Endoparasitoses of the Eurasian collared dove (Streptopelia decaocto) on the northern Black Sea coast of Ukraine

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One of the main tasks of ecological parasitology at the present stage is to determine patterns of spread of invasive diseases of poultry in the environment through a thorough epidemiological examination, as well as to determine the main directions and factors of spread of parasites in Ukraine. Some pigeon health problems can affect their populations, but parasitic infections play an important role. Our research found that 83.3% of Eurasian collared doves examined (Streptopelia decaocto) were affected by endoparasites. The commonest helminths were Raillietina spp. with the average invasion intensity of 4.9 ± 1.3 specimens/ind., Baruscapillaria spp. and Ascaridia columbae with an invasion intensity of 4.6 ± 1.5 and 3.7 ± 2.1 specimens/ind., respectively. The commonest cestodes were Raillietina spp. with the extent of invasion of 52.2% and Davainea progottiana – 6.7%. The Amoebotaenia cuneata cestodes were recorded in 3 (3.3%) doves, and Echinoplois cariosa – only in 2 (2.2%) doves. Six doves (6.7%) were infected with the nematode Ascaridia columbae and 5 (5.6%) – Baruscapillaria spp. Eimerian oocysts were found in 9 (10%) collared doves, and Trichomonas gallinae was recorded in 15 (16.7%) birds. According to the results of helminthological autopsy and identification of the isolated pathogens, 8 varieties of mixed infections were identified. In association with the Rayetins, there were the protozoa Eimeria spp. and Trichomonas gallinae and the nematode Ascaridia columbae. Two-component invasions were registered in 78.6% of doves, three-component infestations in 14.3% and four-component infestations in 7.1% of birds. Mixed infection with Raillietina spp. + Ascaridia columbae was found in the small intestine of Streptopelia decaocto, which was also pathomorphologically observed to have catarrhal-hemorrhagic enteritis, which was accompanied by the formation of a large number of spotted hemorrhages on the mucous membrane, and in the places of attachment of cestodes - necrotic-caseous areas. Temperature and other weather conditions such as humidity, precipitation, etc. of the northern Black Sea coast affect the population size of intermediate host cestodes. Continuous monitoring of invasive diseases of pigeons of different species will help to take the necessary preventive measures against endoparasitoses of birds.

Keywords: pigeons; cestodes; nematodes; eimeriosis; trichomonosis; distribution; epidemiology.

Introduction

Pigeons of the genus Columbiformes are birds that can be found almost all over the world. Those who observe these birds cannot even imagine how harmful their disorderly reproduction can be and how many risks they are exposed to. They are the main source of a number of infections and pathogens (Bled et al., 2011; Orlova & Orlov, 2019). The Eurasian collared dove Streptopelia decaocto Frivaldszky (1838) (Columbiformes: Columbidae) is a common resident bird in many countries, mainly in villages and cities (Dinevich et al., 2003; Scheidt & Hurlbert, 2014; Bagi et al., 2018). Cities and suburbs are home to a large number of pigeons, which are permanent residents of parks, playgrounds, markets and other facilities and can serve as distributors of the commonest intestinal nematodes (Vaz et al., 2017; El-Dakhly et al., 2019). Streptopelia decaocto, since the 1930s, has spread from West Asia and the Balkans to all of Europe and Central Asia, and continues to expand its range. The first birds in Ukraine appeared in Uzhgorod in 1944. Three years later it was already nesting in Mukachevo and Chop. Soon it flew through the Carpathian Mountains to Lviv region. Then it gradually inhabited Volyn, Rivne, Zhytomyr. In 1955, this species was first observed in Kyiv, in 1960 – in Sarny. Then there was the settlement of Southern Ukraine. Currently, the Eurasian collared dove is a common species in Ukraine. It lives exclusively in settlements – both in small villages and large cities. It inhabits areas with well-developed woody vegetation. It nests more often in old parks, cemeteries, areas of old residential buildings with courtyards, street avenues. In summer and autumn, it occurs in agricultural lands (Talpash, 2019). On the territory of Kharkiv, absolute surveys of the Eurasian collared dove with mapping elements in squares with an area of 0.25 km² were conducted (40 squares were surveyed). Then the number of collared doves in the following habitats was determined by extrapolation: multi-storey buildings, private buildings, industrial zone, forest zone, park zone, wastelands (including undeveloped areas, etc.). The average nesting density of the species within the city of Kharkiv was 6 pairs/km² in the zone of private development, 4.6 pairs/km² – in areas with multi-storey buildings, 3 pairs/km² – in the industrial zone, 2 pairs/km² – in the park zone, 0.4 pairs/km² – in wastelands and other undeveloped areas. The estimate of the size of the nesting population of the collared dove, taking into account the areas of these habitats within the city, was slightly more than 850 pairs (Breznugova et al., 2017).

The Eurasian collared dove is considered a pest of crops, as it usually feeds on large flocks, grains, fruits and can spoil them. It also feeds on beetles and butterflies (Olimpi et al., 2020). This species hosts a large number of endoparasites, such as cestodes, nematodes and unicellular protozoa (Mushi et al., 2000; Sentí et al., 2005).

One of the main tasks of ecological parasitology at the present stage is to establish patterns of spread of invasive diseases of poultry in the environment through careful epizootological examination, as well as to determine the main directions and factors of parasitism in Ukraine (Nakao et al., 2019; Paliy et al., 2020). Researchers believe that intestinal parasit-
sis is primarily a sanitary problem, and its prevention should be based on sanitary-parasitological monitoring (Harlin & Wade, 2009; Ahmed et al., 2019). Some health problems of doves can affect their populations, but parasitic infections play an important role (Mohammed et al., 2019).

However, there are no data on the prevalence of S. decacto parasites on the northern Black Sea coast of Ukraine. The population of wild pigeons is growing every year. They infect private poultry, thus spreading the invasion to synanthropic and domestic pigeons. Therefore, finding out the spread of parasitic diseases will help prevent the infection of the population of domestic and wild pigeons in the region.

Materials and methods

The research was conducted in the period from August to November 2019 and 2021 on the northern Black Sea coast of Ukraine (Odessa, Mykolaiv, Kherson regions). A total of 90 S. decacto individuals seized during sport hunting were studied: 30 in Berezovsky, Odessa and Belgorod-Dniestrovsk districts of Odessa region, 30 in Bashtansky and Mykolayiv districts of Mykolayiv region, 30 in Skadovsk and Kherson districts of Kherson region. The experiments performed on the animals did not contradict the current legislation of Ukraine (Article 26 of the Law of Ukraine 5456-VI of 16.10.2012 “On protection of animals from cruel treatment”), adopted by the First National Congress of Bioethics (Kyiv, 2001) and international bioethical standards (materials of the IV European Conference for the Protection of Vertebrate Animals Used for Experimental and Other Purposes, Strasbourg, 1985) (Simmonds, 2018; Kabene & Baadel, 2019). The research program was reviewed and approved by the Bioethics Commission of the National Research Center the Institute of Experimental and Clinical Veterinary Medicine.

To diagnose trichomonosmosis of pigeons, fresh wet smears were taken from the mucous membrane of the oral cavity and throats of the birds, which were examined in the laboratory of epizootology and parasitology of the Odessa research station NSC “IEKVM” by staining according to the method of Romanowsky-Giemsa using light microscope ×400 (Anderson et al., 2009). Trichomonas was identified by signs of mobility and the presence of flagella (Dove et al., 2004).

Species of helminths were identified morphologically – nematodes were identified after clearing in lactic acid with glycercin, and cestodes – after staining with lactic acid carmine. Differentiation of cestode oncospheres (naiet, davenni) was performed by staining eggs with diamond green in the dilution of 1:100000 and then the capsules were examined in Petri dishes. Oncospheres of Davainea proglottina were stained with light green in 3–5 minutes, and oncospheres of Raillietina spp. during this time were not stained (Ukrainian patent for utility model No. 78451).

To diagnose eimeriosis, pigeon feces were examined by the standardized Fuleborn method. Microscopic examinations were performed at low magnification of the microscope (8 × 10) with subsequent determination of the average rates of invasion extent (EI, %) and invasion intensity (II, the number of oocysts in 1 g of feces) (Bakulin, 2006).

Results

Both helminths of the classes of cestodes and nematodes, and protozoa, were recorded in the intestinal canal of the collared dove. It was found that 83.3% of the examined collared doves S. decacto were infected by endoparasites. The commonest of the cestodes were Raillietina spp. (Molin, 1858; Megnin, 1880) with the invasion extent of 33.3% and Davainea proglottina (Davainea, 1860) – 6.7%. The cestode Anchoebotria carnea (von Linstow, 1872) was recorded in 3 doves with the invasion extent of 3.3%, and Echinolepis carinata (Magalhaes, 1898) in only 2 (2.2%) doves.

According to the results of research, 6 doves (6.7%) were infected with the nematode Ascaridia columbae (Gmelin, 1799) and 5 (5.6%) doves – Barasacapillaria spp. (Madsen, 1945; Monorec, 1982). Eimeriosis oocysts of Eimeria columbae (Nieschulz, 1935), E. tabbsana (Labbe, 1896; Pinto, 1928), E. columba (Mirra and Das Gupta, 1937) were found in 9 (10%) doves, and Trichomonas gallinae (Rivolta, 1878) was recorded in 15 (16.7%).

The commonest helminths of Raillietina spp. were detected by pathological autopsy in the intestines of birds, with the average invasion intensity of 4.9 ± 1.3 specimens/ind. Barasacapillaria spp. and Ascaridia columbae with the invasion intensity of 4.6 ± 1.5 specimens/ind. and 3.7 ± 2.1 specimens/ind., respectively (Table 1).

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Helminthes detected</th>
<th>Invasion intensity</th>
<th>Invasion specific</th>
<th>Min–max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raillietina spp.</td>
<td>234</td>
<td>4.9 ± 1.3</td>
<td>1–5</td>
<td></td>
</tr>
<tr>
<td>Davainea proglottina</td>
<td>18</td>
<td>3.0 ± 0.9</td>
<td>1–3</td>
<td></td>
</tr>
<tr>
<td>Echinolepis carinata</td>
<td>3</td>
<td>1.5 ± 0.2</td>
<td>1–2</td>
<td></td>
</tr>
<tr>
<td>Anchoebotria carnea</td>
<td>17</td>
<td>5.7 ± 0.2</td>
<td>2–4</td>
<td></td>
</tr>
<tr>
<td>Ascaridia columbae</td>
<td>22</td>
<td>3.7 ± 2.1</td>
<td>1–4</td>
<td></td>
</tr>
<tr>
<td>Barasacapillaria spp.</td>
<td>23</td>
<td>4.6 ± 1.5</td>
<td>3–6</td>
<td></td>
</tr>
<tr>
<td>Eimeria spp.</td>
<td>–</td>
<td>227.5 ± 22.1’</td>
<td>175–281</td>
<td></td>
</tr>
<tr>
<td>Trichomonas gallinae</td>
<td>–</td>
<td>12.6 ± 0.2’</td>
<td>9–16</td>
<td></td>
</tr>
</tbody>
</table>

Note: * – oocysts in 1 g of feces; ** – trichomonosis in the field of view of the microscope.

The pathological changes of eimeriosis in the doves were characterized by slightly disheveled dull feathers, and the back of the body around the cloaca was contaminated with fecal masses. The goiter was half-empty, and the muscular stomach contained the residuals of a small amount of fodder. The intestine retained its characteristic tubular shape, the walls of the duodenum and jejunum were thickened in places, the lumen of the intestine was uneven, narrowed in some areas, without feed content (empty). The cecum had a normal shape and volume, greyish on the outside, the relief of their mucous membrane was partially smoothed. The rectum was balloon-like dilated, with much thinner walls, contained semi-liquid watery, poorly formed fecal masses in the lumen. The intensity of lesions was from 175 to 281 oocysts in 1 g of feces (Fig. 1).

Fig. 1. Oocystes Eimeria spp. in S. decacto

In the fecal masses of infected collared doves in the field of view of the microscope single eggs of Barasacapillaria spp. were recorded, although the intensity of the invasion was high (Fig. 2).

Fig. 2. Egg Barasacapillaria spp. in S. decacto

One dove from Skadovsk district of Kherson region and another from Belgorod-Dniester district of Odessa region had a high degree of intensity of Raillietina spp. and Ascaridia columbae (Figs. 3, 4). According to the results of helminthological autopsies of the doves, it was found that mono-invasion was more often recorded in the collared dove (EI – 67.8%; 81.3% – from sick doves). Mixed invasions were less frequently recorded (EI – 15.6%; 18.7% – of infected doves).
Discussion

According to the results of our research, it is necessary to conduct additional research on the northern Black Sea coast of Ukraine on pigeons of different species and especially the collared dove, which makes dispersive movements and at the same time settles near towns and villages and comes into contact with other poultry species – chickens, turkeys and domestic pigeons.

The operation of agricultural enterprises is accompanied by feeding of wild birds, a large number of which can lead to significant economic losses and pose epizootiological threats (Chaplygina et al., 2019; Ferenczi et al., 2021; Velkers et al., 2021). The commonest of these bird species are domestic pigeons.

Almost all birds are infected with various types of endoparasites, both in the form of mono- and mixed infection. The endoparasites recorded in our studies are of great veterinary importance and therefore require de-
tailed study (Al-Quaraishy et al., 2021). The high prevalence of monoinfection in doves, compared to double and triple infections, leads to competition in which nutrients are shared by endoparasites and leads to the development of mono- or mixed infections. This may also indicate an innate systemic strategy of endoparasites to avoid competition (Santos et al., 2020).

The prevalence of pigeon endoparasites was studied in the Canary Islands, where elmeria oocysts were recorded in 50%, cestodes of the species Raillietina microcarnaca (Fidmann, 1990) Lópiz Neyra, 1947 – in 44% and Ascaridia columbae – in 40% of cases (Foronda et al., 2004). In the study of Minas Gerais in Southeastern Brazil, a study of wild feral pigeons (C. livia domestica) showed that all pigeons were infected with Eimeria spp. The causative agent of A. columbae was detected in 4% of pigeons, and in 3.2% – a mixed invasion caused by A. columbae and Raillietina spp. (Olivera et al., 2000). In the Zaría region of northern Nigeria, pigeon infestation caused by a single pathogen was more common (37.5%) than double (14.0%) and triple (0.8%) (Adang et al., 2008). According to a number of researchers, in Central Ethiopia, a higher number of infected pigeons – 27% – had a monoinfection, compared with those who had a mixed invasion – 1% caused by R. echinobothrida + R. cesticillus and 1% R. echinobothrida + R. tetragona in absence of triple infection (Ashenafi & Eshutu, 2004).

Among pigeon nematodes, ascariasis is one of the most frequently reported infestations (Bahlarmi et al., 2013). Gupta et al. (2011) indicate that pigeons may play the role of intermediate host for certain helminth species. Despite the widespread population of S. decaocto in Iraq, only a few relatively recent articles have been published on their parasites. Al-Bakery (2009) reported the simplest Trichomonas gallinae. In the survey of 250 – Columbia oenas, 200 – C. livia and 40 – S. decaocto, the prevalence was 22.0%, 17.5% and 10.0%, respectively. Mehrwood et al. (2019) isolated cestodes: Aporina defodi, Cotugnia digynoeca, Raillietina echinobothrida, R. serrata and R. tetragona. The infestation of pigeons was 63% at the intensity of 5.3 specimens/bird.

In a study of wild pigeons in Santiago, Chile, Trichomonas gallinae was detected in 11% of cases without any clinical signs and pathological changes at autopsy. Seven species of nematodes were identified: Tetrameres spp. (14%), Capillaria annulata (1%), C. columbae (11%), C. obtusa (11%), Ascaridia columbae (5%), Diaparynis spiralis (2%) and Gonylostoma ingluvica (2%). The Cestoda class found in a single pigeon was represented by Aporina defodi (Torro et al., 1999). Al-Rammahi et al. (2013) reported the spread of protozoa Trichomonas spp. in 13.3% of pigeons and three species of cestodes: Raillietina spp. (64.2%), Aporina spp. (18.6%) and Cotugnia spp. (17.1%). In a study of 63 Eurasian collared doves S. decaocto from Florida, nine species of helminths (5 nematodes, 2 cestodes and 2 trematodes) were identified. The most common were Ascaridia columbae (73.0%) and Baruscapillaria obsignata (11.1%) (Bean et al., 2005). The data from this study suggest that the environment in which doves live and the food search strategies of each host species are the driving force behind the helminth component communities.

In various studies, differences in the prevalence of endoparasitoses are predicted by many factors that influence the onset of the disease, such as host resistance to infection, eating habits, climatic conditions, geographical differences, and living conditions. Adult birds can remain infected for a year or more and are a constant source of infection for their chicks (Radfar et al., 2012). Monitoring of invasive diseases of pigeons of different species will help the necessary preventive measures to be taken against endoparasites of birds (Boyko & Brygadyrenko, 2019). Along with parasitic diseases, pigeon lesions and bacterial microflora are noted (Teske et al., 2013; Han et al., 2021).

Pigeons, due to their close interaction with humans and other domestic and wild birds, serve as a potential reservoir of zoonotic parasites (Adang et al., 2008). Both domestic and wild pigeons are not harmless birds, they can serve as hidden potential reservoirs of too many human diseases, and can transmit parasitic diseases to animals and poultry (Piasheck, 2006). The authors report that wild pigeons and domestic pigeons are usually infected by internal and external parasites through a common food source (Ali et al., 2020). Both domestic and wild pigeons feed mainly on grain, but consume beetles, snails, earthworms, and ants, which can be carriers of invasive stages of helminths (Boyko et al., 2009; Bogach et al., 2020). The prevalence and level of infestation of birds varies depending on the type of parasite, the physiological condition of the infested individual, as well as the geographical location of the natural and climatic zone (Onyie et al., 2000).

Conclusion

According to the results of helminthological dissections of the collared dove S. decaocto, raitension in the form of monoinfection was recorded most often (44% of sick pigeons, EI – 36.7%). Raitension was also recorded in mixed invasions (18.7% of infected doves, EI – 15.6%) with pathogens Trichomonas gallinae, Eimeria spp., Ascaridia columbae, Davainea progloffita and Baruscapillaria spp. Pathomorphological changes in the small intestine of S. decaocto were characterized by the development of catarrhal-hemorrhagic enteritis and dystrophic-necrotic changes in the liver, which occurred due to mechanical toxic and immunosuppressive action of cestodes.

References
