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HELMINTHS OF WILD PREDATORY MAMMALS OF UKRAINE. NEMATODES

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Helminths of Wild Predatory Mammals of Ukraine. Nematodes. Varodi, E. I., Malega, A. M., Kuzmin, Y. I., Kornyushin, V. V. — The article summarizes information on the nematodes parasitic in wild Carnivora of Ukraine. Totally, 50 species of nematodes are known to parasitise carnivorans in the country, 30 species were registered in the present study. Nematodes were found in 14 species of examined hosts from the families Canidae, Mustelidae and Felidae. Maximum diversity of nematodes of carnivorans was observed in Polissia (forest zone in the north of the country) and in Kherson Region in the south. Hosts from the family Canidae harboured 19 nematode species; studied species of the Mustelidae were infected with 15 nematode species, 6 of them were also found in Canidae. The wildcat (*Felis silvestris* Schreber) and the lynx (*Lynx lynx* Linnaeus) harboured only two species of nematodes, both are specific parasites of these hosts. The most comprehensive information concerns the nematode communities of the red fox (*Vulpes vulpes* Linnaeus) and the wolf (*Canis lupus* Linnaeus), with 19 and 9 nematode species found, correspondingly. From 1 to 6 nematode species were found in other species of carnivorans.
Key words: wild Carnivora, canids, mustelids, felids, nematodes, Ukraine.

Introduction

Special investigations of helminths parasitic in wild carnivorans on the territory of Ukraine were first initiated by A. N. Kadenatsii in 1939 in Crimea. Among various domestic and wild mammals studied by the author, 146 carnivorans, including 110 red foxes (*Vulpes vulpes* Linnaeus) and 36 mustelids of 3 species (badger, steppe polecat and stone marten), were examined. Results of the investigations supplemented with the data previously obtained by Rukhliadev (1948) were summarized in a monograph by Kadenatsii (1957). The book reports on 26 species of nematodes parasitic in wild carnivorans in Crimea.

Results of the extensive helminthological studies in 6 regions of central Ukraine in 1947–1958 were published by Korneyev and Koval (1958). The results covered information on 172 specimens of carnivorans in total: 145 specimens of the red fox, 18 wolves (*Canis lupus* Linnaeus), and 9 raccoon dogs (*Nyctereutes procyonoides* Gray). Five species of nematodes were recorded, including *Dioctophyme renale* (Goeze, 1782), a rare species found by the authors in the wolf in Kyiv Region.

Later on, during next several decades, no special studies on helminths of wild carnivorans have been performed in Ukraine. Some published records dealt with particular groups of helminths in separate regions. Those were mostly the results of ecological studies of predatory mammals with some information on their parasites (e. g., Turianin, 1959; Abelentsev, 1968). Some data on helminths of wild carnivorans are presented in the reports of medical parasitologists, who investigated the distribution of dangerous parasitic diseases and their agents in Ukraine, including the transmission of *Diphyllobothrium latum* Linnaeus, 1757, *Echinococcus granulosus* Batsch, 1786, *Alveococcus* (= *Echinococcus*) *multilocularis* Leuckart, 1863, *Opistorchis felineus* (Rivolta, 1884), *Trichinella spiralis* (Owen, 1835), and *Dirofilaria repens* Railliet et Henry, 1911 in natural foci (Britov and Boyev, 1972; Bessonov, 1978; Padchenko and Lokteva, 1990; Yemets, 2003).

All relevant information on helminths of carnivorans from the former USSR was summarized in two monographs published in 1969 and 1977. The book by Kontrimavichus (1969) deals with helminths of Mustelidae only. In this monograph, 14 species of nematodes are mentioned as occurring on the territory of Ukraine based on the data previously published by Rukhliadev (1948), Petrov (1941), and Kadenatsii (1957).

Kharchenko and Tkach (1992) reported on the nematodes of the genus *Strongyloides* from mustelids in Ukraine and recorded the occurrence of *Str. mustelorum* Cameron et Parnell, 1933 in the country. The authors considered *Str. martis* Petrow, 1940 as a synonym of *Str. mustelorum*. In a survey by Zvegintseva (2003), the results of helminthological studies in «Askania-Nova» Biosphere Reserve were summarized, with information on helminths of carnivorans included.

Among the helminths of carnivorans reported in the book by Kozlov (1977), the distribution of 30 species of nematodes in Ukraine is directly or indirectly (based solely on the references) indicated. Unfortunately, the hosts can be identified not for all of them.

A number of publications deal with the distribution and identification of *Trichinella* spp. in Ukraine. Bessonov (1978) reviewed information on the distribution of trichinellosis in the country and reported on the occurrence of *Trichinella* sp. in the red fox in Crimea, in the raccoon dog (locality unknown), in the wolf in Transcarpathian region, and in the weasel (*Mustela nivalis* Linnaeus) in Ternopil and Odesa Regions. The species identified as *Tr. spiralis* has been repeatedly reported on the territory of Ukraine in the red fox, the pine marten (*Martes martes* Linnaeus) and the steppe polecat (*Mustela eversmani* Lesson) from Ternopil and Odesa Regions (Kulikova, 1963, 1965), in the wolf, the red fox and the steppe polecat from Zakarpattia Region (Korneyev, 1960), in the wolf and the red fox from Kharkiv Region (Nosik et al., 1959), in the wolf, the red fox, and the raccoon dog in Chernihiv Region (Savchenko, 1962a, b), in the red fox from Vinnytsia and Chernihiv Regions, and in the wolf from all over the Ukraine (Melnik and Bulgakov, 1975) (after Britov, 1982).

Later *Tr. spiralis* was recognized as a complex of sibling species: *Tr. spiralis* s. str., *Tr. nativa*, *Tr. nelsoni*, *Tr. pseudospiralis* (Britov and Boyev, 1972; Garkavi, 1972). Not less than 7–9 nominal species are presently included into the genus (Pozio et al., 2009; Koniayev et al., 2012; Korhonen et al., 2015). Britov (1982) reported on two species of the genus occurring in Ukraine: *Tr. spiralis* from humans, pigs and wild boars (*Sus scrofa* Linnaeus), and synanthropic rodents all over the country, and *Tr. nelsoni* from the red fox in Odesa Region. Shelemba (1999) summarised the results of trichinelloscopy of game animals in 1984–1997 in Zakarpattia Region and reported on the presence of the nematodes identified as *Tr. nativa* in the wolf, the red fox, the brown bear (*Ursus arctos* Linnaeus), the badger and the wildcat, as well as in the wild boar.

Didyk (2007) found three species of *Trichinella* in Ukraine: *Tr. britovi* in the wolf from Zhytomyr Region, the red fox from Zhytomyr and Zakarpattia Regions, the stone marten (*Martes foina* Erxleben) from Zakarpattia Region; *Tr. spiralis* in the pig from Zhytomyr and Chernihiv Regions; *Trichinella* sp. from the brown bear in Zakarpattia Region. The latter species was later identified as *Tr. nativa* (Akimov and Didyk, 2009). Further studies demonstrated that *Tr. spiralis* was able to parasitize the wolf and the red fox as well. The wolf from southern Ukraine appeared to be mix-infected with *Tr. britovi* and *Tr. spiralis* (Didyk, 2013). *Tr. britovi* was also found in the raccoon dog, the lynx, the badger and the stone marten in Ukrainian Carpathians (Didyk, 2013; Didyk et al., 2013). *Tr. pseudospiralis* known from wild carnivorans in Poland (Moskwa et al., 2013) has never been found in Ukraine yet.

The present survey summarizes the results of our investigations on the nematodes from wild carnivorans in Ukraine. The study supplements previously published surveys on trematodes and cestodes parasitic in this host group in the country (Kornyushin et al., 2011; Korol et al., 2016).

Material and methods

All helminths, including nematodes, were collected during complete or partial helminthological investigations of 260 individuals of wild carnivorans belonging to 14 species. Most host specimens were collected and examined by E. Varodi and O. Malega in 1998–2010. We also examined the animals collected and granted by other researchers, parasitologists and theriologists: L. Shevchenko, V. Domnych, O. Yemets, N. Zvegintsova, M. Golovushkin, M. Klestov, and others. Part of these studies concerning mainly trematodes and cestodes has been already published (Zvegintseva et al., 2007; Kornyusin et al., 2011; Korol et al., 2016). Additionally, helminth specimens from previously collected material stored in the helminthological collection of the I. I. Schmalhausen Institute of Zoology (Kyiv, Ukraine) were studied. The nematodes were identified using identification keys and descriptions published by Kozlov (1977) and Kontrimavichus (1969) and other publications on the particular nematode taxa. Taxonomy of Capillariidae Neveu-Lemaire, 1936 follows the system suggested by Moravec (1982).

Table 1 shows the list of studied host species and the rates of nematode infection in the studied hosts.

Results and discussion

Thirty species of nematodes were found in 14 species of wild Carnivora in Ukraine. Some nematodes were identified to generic level only. Listed below are the nematode species and their hosts recorded in the present investigation. The infection parameters [prevalence (P), intensity (I) as mean value and range in parentheses, and abundance (A)] and the localities are indicated for each host species.

Table 1. Studied species of wild carnivorans and prevalence of their infection with nematodes

#	Host species	Number of specimens studied	Number of specimens infected	Prevalence of infection, %
	Canidae			
1.	Wolf (*Canis lupus* Linnaeus)	32	21	65.6
2.	Golden jackal (*Canis aureus* Linnaeus)	1	1	100
3.	Red fox (*Vulpes vulpes* Linnaeus)	166	134	81.5
4.	Raccoon dog (*Nyctereutes procyonoides* Gray)	14	9	64.3
	Mustelidae			
5.	American mink (*Neovison vison* Schreber)	13	6	46.1
6.	Stone marten (*Martes foina* Erxleben)	7	7	100
7.	Pine marten (*Martes martes* Linnaeus)	4	4	100
8.	Weasel (*Mustela nivalis* Linnaeus)	6	6	100
9.	Steppe polecat (*Mustela eversmani* Lesson)	2	2	100
10.	Stoat (*Mustela erminea* Linnaeus)	2	2	100
11.	Eurasian otter (*Lutra lutra* Linnaeus)	3	2	100
12.	European badger (*Meles meles* Linnaeus)	3	3	100
	Felidae			
13.	Eurasian lynx (*Lynx lynx* Linnaeus)	1	1	100
14	Wildcat (*Felis silvestris* Schreber)	6	6	100
	Total:	260	204	78.4

Family Capillariidae Neveu-Lemaire, 1936

1. *Pearsonema plica* (Rudolphi, 1819)
Site of infection: bladder.
Hosts: red fox (P = 13.2 %; I = 12.9 (1–80); A = 1.7) in Zhytomyr, Kyiv, Cherkasy, and Chernihiv Regions; wolf (P = 9.4 %; I = 7.0 (4–10); A = 0.7) in Zhytomyr and Kyiv Regions.

2. *Pearsonema mucronata* (Molin, 1858)
Site of infection: bladder.
Hosts: pine marten (P = 100 % (4/4); I = 1 (1–1); A = 1) in Zhytomyr, Kyiv and Chernihiv Regions; stone marten (P = 71.4 %; I = 1.4 (1–2); A = 1.0) in Kyiv and Poltava Regions; American mink (P = 38.5 %; I=22.0 (7–61); A = 8.5) in Kyiv Region.

3. *Aonchotheca putorii* (Rudolphi, 1819)
Site of infection: stomach, intestine.
Hosts: pine marten (P = 25 % (1/4); I = 31; A = 7.7) in Zhytomyr Region; stone marten (P = 14.3 % (1/7); I = 1; A = 0.14) in Kyiv Region; american mink (P = 23.1 %; I = 52.0 (32–75); A = 12.0) in Kyiv and Chernihiv Regions; weasel (P = 16.7 % (1/6); I = 1; A = 0.17) in Sumy and Kyiv Regions; stoat (P = 100 % (2/2); I = 2.0; A = 2.0) in Zakarpattia and Volynska Regions; steppe polecat (P = 50 % (1/2); I = 47; A = 23.5) in Kyiv Region; red fox (P = 0.6 %; I = 1; A = 0.05) in Kyiv Region.

4. *Eucoleus aerophilus* (Creplin, 1839)
Site of infection: trachea, bronchi.
Hosts: red fox (P = 12.0 %; I = 10.9 (2–50); A = 1.3) in Zhytomyr, Kyiv, Chernihiv and Cherkasy Regions; wolf (P = 9.4 %; I = 2.7 (1–4); A = 0.2) in Zhytomyr and Kyiv Regions; pine marten (P = 25 % (1/4); I = 4; A = 1.0) in Kyiv region; stone marten (P = 14.3 % (1/7); I = 1; A = 0.14) in Kyiv Region.

5. *Capillaria* sp.
Site of infection: stomach.
Host: red fox (P = 1.2 %; I = 2.5 (2–3); A = 0.03) in Zhytomyr Region.

Family Trichuridae Ransom, 1911
6. *Trichuris vulpis* (Froelich, 1789)
Site of infection: caecum and large intestine.
Hosts: red fox (P = 4.8 %; I = 8.0 (1–38); A = 0.05) in Rivne, Zhytomyr, Kyiv and Kherson Regions; wolf (P = 18.8 %; I = 14.5 (2–30); A = 2.4) in Kherson and Zaporizhzhia Regions; raccoon dog (P = 7.14 %; I = 1; A = 0.07) in Kyiv Region.

Family Trichinellidae Ward, 1907
7. *Trichinlla* cf. *spiralis* (Owen, 1935)
Host: red fox (P = 0.6 %; I = 2; A = 0.6). Two adult female nematodes were found in the intestine of one fox in Zhytomyr Region.

Family Strongyloididae Chitwood et Mclntosh, 1934
8. *Srtongyloides lutrae* Little, 1966
Site of infection: intestine.
Host: Eurasian otter (P = 66.7 % (2/3); I = 43.5 (2–85); A = 17.4) in Kyiv Region.

9. *Strongyloides mustelorum* Cameron et Parnell, 1933
Site of infection: intestine.
Host: weasel (P = 16.7 % (1/6); I = 4; A = 0.6) in Kyiv Region.

10. *Strongyloides erschowi* Popowa, 1938
Site of infection: intestine.
Hosts: raccoon dog (P = 21.4 %; I = 2.3 (1–4); A = 0.5) in Kyiv Region; red fox (P = 0.6 %; I = 95; A = 0.6) in Kyiv Region.

Family Crenosomatidae Schulz, 1951
11. *Crenosoma vulpis* (Rudolphi, 1819)
Site of infection: bronchi, bronchioles.
Hosts: red fox (P = 2.4 %; I = 16.2 (2–53); A = 0.39) in Zhytomyr and Kyiv Regions; wolf (P = 6.2 %; I = 2.5 (2–3); A = 0.2) in Zhytomyr and Kyiv Regions; badger (P = 1.3 %; I = 2; A = 0.7) in Chernihiv Ragion.

12. *Skrjabingylus nasicola* (Leuckart, 1842)
Site of infection: frontal sinuses.
Host: steppe polecat (P = 50 % (1/2); I = 13; A = 6.5) in Kyiv Region.

13. *Skrjabingylus petrovi* Bajenov, 1936
Site of infection: frontal sinuses.
Host: pine marten (P = 25 % (1/4); I = 145; A = 36.2) in Chernihiv Region.

Family Trichostrongylidae Leiper, 1912
14. *Molineus patens* (Dujardin, 1845)
Site of infection: intestine.
Hosts: weasel (P = 50 % (3/6); I = 8.7 (2–16); A = 4.3) in Volynska, Zhytomyr, Kyiv and Sumy Regions; steppe polecat (P = 50 % (1/2); I = 12; A = 6) in Kyiv Region; badger (P = 33.3 % (1/3); I = 2; A = 0.6) in Sumy Region; red fox (P = 3.6 %; I = 2.0 (1–4); A = 0.07) in Zhytomyr and Lviv Regions.

Family Ancylostomatidae Looss, 1905
15. *Ancylostoma caninum* (Ercolani, 1859)
Site of infection: intestine.

Host: wolf (P = 6.2 %; I = 2.0 (1–3); A = 0.12) in Zakarpattia and Chernihiv Regions; red fox (P = 0.6 %; I = 1.0; A = 0.6) in Kherson Region.

16. *Ancylostoma tubaeforme* (Zeder, 1800)
Site of infection: intestine.
Host: wildcat (P = 33.3 % (2/6); I = 5.5 (4–7); A = 1.8) in Zakarpattia and Kyrovograd Regions.

17. *Uncinaria stenocephala* (Railliet, 1884)
Site of infection: intestine.
Hosts: red fox (P = 27.1 %; I = 10.2 (1–82); A = 2.8) in Volynska, Lviv, Rivne, Zhytomyr, Kyiv, Chernihiv, Sumy, Cherkasy, Kherson, Zaporizhzhia Regions, and in Crimea; wolf (P = 65.6 %; I = 40.2 (1–98); A = 26.4) in Zakarpattia, Volynska, Zhytomyr, Kyiv, Chernihiv, Kherson and Zaporizhzhia Regions; golden jackal (P = 100 % (1/1); I = 17; A = 17) in Odesa Region; raccoon dog (P = 64.3 %; I = 42.1 (9–105); A = 27.1) in Kyiv Region; pine marten (P = 25 % (1/4); I = 1; A = 0.25) in Kyiv Region; badger (P = 66.7 % (2/3); I = 22.0 (12–32); A = 14.7) in Chernihiv and Sumy regions.

Family Ascarididae Baird, 1853
18. *Toxocara canis* (Werner, 1782)
Site of infection: intestine.
Hosts: red fox (P = 22.9 %; I = 10.2 (1–103); A = 2.3) in Lviv, Volynska, Rivne, Chernihiv, Sumy, Cherkasy, Kherson, Zaporizhzhia Regions and Crimea; wolf (P = 15.6 %; I = 3.0 (1–6); A = 0.47) in Zhytomyr, Kyiv, Kherson and Zaporizhzhia Regions.

19. *Toxocara mystax* (Zeder, 1800)
Site of infection: intestine.
Hosts: wildcat (P = 66.7 % (4/6); I = 33.0 (7–52); A = 22.0) in Zakarpattia and Kirovograd Regions; lynx (P = 100 % (1/1); I = 2; A = 2) in Zhytomyr Region.

20. *Toxascaris leonina* (Linstow, 1902)
Site of infection: intestine.
Hosts: red fox (P = 39.2 %; I = 19.0 (1–197); A = 7.4) in Volynska, Zhytomyr, Kyiv, Sumy, Chernihiv, Cherkasy, Poltava, Dnipropetrovsk, Kherson, Zaporizhzhia Regions and Crimea; wolf (P = 15.6 %; I = 3.3 (1–18); A = 1.03) in Kherson and Zaporizhzhia Regions.

Family Physalopteridae Leiper, 1908
21. *Physaloptera sibirica* Petrow et Gorbunow, 1931
Site of infection: stomach, intestine.
Host: badger (P = 33.3 % (1/3); I = 10; A = 3.3) in Kherson Region.

Family Spiruridae Oerley, 1885
22. *Spirocerca arctica* Petrow, 1927
Site of infection: nodules on stomach wall.
Hosts: red fox (P = 0.6 %; I = 23.0 (1–197); A = 0.14) in Crimea; stone marten (P = 14.3 % (1/7); I = 1; A = 0.14) in Kyiv Region.

23. *Spirocerca lupi* (Rudolphi, 1809)
Site of infection: nodules on stomach and oesophagus walls.
Host: red fox (P = 0.6 %; I = 1; A = 0.05) in Kherson Region.

Family Rictulariidae Railliet, 1916
24. *Pterygodermatites affinis* (Jagerskiold, 1904)
Site of infection: intestine.
Hosts: red fox (P = 5.4 %; I = 16.9 (1–51); A = 0.9) in Zakarpattia, Kyiv and Kherson Regions; wolf (P = 3.1 %; I = 16.9 (1–51); A = 0.03) in Kherson Region.

Family Filariidae (Weinland, 1858)
25. *Filaria martis* Gmelin, 1790
Site of infection: subcutaneous tissue.
Host: pine marten (P = 25 % (1/4); I = 1; A = 0.25) in Kyiv Region.

Family Oxyuridae Cobbold, 1864
26. *Syphacia agraria* Sharpilo, 1973
Site of infection: intestine.
Host: red fox (P = 0.6 %; I = 1; A = 0.05) in Kyiv Region.

27. *Syphacia arvicola* Sharpilo, 1973
Site of infection: intestine.
Host: weasel (P = 33.3 % (2/6); I = 6.5 (6–7); A = 1.7) in Zakarpattia Region.

Family Heligmosomidae Cram, 1927
28. *Heligmosomum costellatum* (Dujardin, 1845)
Site of infection: intestine.
Host: red fox (P = 0.6 %; I = 9; A = 0.05) in Kherson Region.

29. *Heligmosomum* sp.
Site of infection: intestine.
Host: red fox (P = 0.6 %; I = 1; A = 0.06) in Kyiv Region.

30. *Heligmosomoides* sp.
Site of infection: intestine.
Host: weasel (P = 16.7 % (1/6); I = 10; A = 1.67) in Zakarpattia Region.

Some species of nematodes were not found in the present study; however, they had been recorded as parasites of carnivorans in Ukraine by other authors. Eight of such species were reported by Kadenatsii (1957) in Crimea: *Baylisascaris* (= *Ascaris*) *columnaris*, *Filaroides martis, Perostrongylus falciformis*, *Dirofilaria immitis*, *D. repens*, *Strongyloides stercoralis*, *Spirura rytipleuritis*, *Gnathostoma spinigerum*. The latter species was also mentioned by Petrov (1941) as occurring in Ukraine. Besides, Rukhliadev (1948) reported on the parasitism of *Filaroides bronchialis* in the stone marten from Crimea.

Additionally, we studied more than 80 specimens of domestic dogs and found 8 nematode species; 6 of them occurred also in wild canids. In 10 domestic cats four nematode species were found, all of them parasitized wild felids and/or canids as well. The nematodes *Dirofilaria repens* (in dogs and cats) and *D. immitis* (in dogs) were found only in domestic carnivorans. These species had been collected by veterinary surgeons and passed for identification to the authors. *Dirofilaria immitis* was recently collected from the wolf and the red fox in Kyiv Region (Y. Yakovlev, unpublished personal communication).

The species *U. stenocephala* appeared to have the widest distribution in Ukraine. It was found in 11 administrative regions and in Crimea, i. e. in almost all studied localities. Besides, the species has the widest range of hosts; it parasitizes all four canid species occurring in Ukraine, and two species of mustelids. *Toxascaris leonina* is another wide-spread species occurring in 10 regions and in Crimea, though it is parasitic in the red fox and the wolf only. The both species are also common in domestic dogs and cats in Ukraine.

Aonchotheca putorii has rather diverse host range. It was found in 6 species of mustelids and in one canid host in 6 regions of Ukraine. The host range of *E. aerophilus* includes two species of Canidae and two mustelid hosts. *Molineus patens* also occurs in both canids (one species) and mustelids (three species), however, it is rather rare in the red fox, similarly to *Ao. putorii*. On the other hand, *Cr. vulpis* is common in the red fox and rarely infects the badger.

Wild felids appeared to be parasitized with only specific nematodes: *Tc. mystax* and *An. tubaeforme*. However, we can not exclude the possibility of the wildcat infection with the nematode species commonly occurring in domestic dogs and cats: *Tx. leonina*, *Tc. canis*, *U. stenocerhala*, and *An. caninum*, especially in the localities where the wildcats may contact the domestic cats and dogs.

Our studies were not evenly detailed on the whole territory of Ukraine. Rather comprehensive information was obtained mostly from northern and western parts of the country. The richest nematode fauna in the studied host group was observed in the region of Polissia — the forest zone. There we found 16 nematode species. Significant data were obtained in Kyiv Region (9 host species examined, 14 species of nematodes found), and Zhytomyr Region (5 host species examined, 13 nematode species found). Lesser number of hosts (6 species) was studied in Chernihiv Region, where we found 7 species of nematodes. In other parts of Polissia, Volynska, Rivne and Sumy Regions, we examined only the red foxes and found 2–3 most common species of parasitic nematodes. In Zakarpattia Region, three species of carnivorans were examined, and three nematode species were found. Three species of nematodes were found in the red fox in Lviv Region.

In central part of Ukraine, 5 nematode species were found in the red fox in Cherkasy Region, 2 species parasitized this host in Poltava and Dnipropetrovsk Regions. In southern Ukraine, three species of nematodes were collected from the red fox and the wolf in Zaporizhzhia Region and Crimea. In Kherson Region, the studies were more detailed; 8 species of nematodes were found in 5 species of hosts.

Nematodes appeared to be the most common group of helminths parasitizing wild carnivorans in Ukraine. In total, the prevalence of nematode infection reached 78.4 %, with 30 species found. Cestodes and trematodes were less common: 65.4 % and 17 species, and 39.6 % and 11 species, correspondingly (Kornyushin et al., 2011; Korol et al., 2016).

The co-occurrence of several nematode species in the same host individual was quite commonly observed. In the largest host species (wolf and red fox), up to 4–5 nematode species were found simultaneously parasitizing an individual host. The nematode parasites were often accompanied with cestodes and/or trematodes. In most cases, the nematode communities included *U. stenocerhala*, *Tc. canis* and *Tx. leonina*. In the present study, we observed three kinds of communities consisting of 5 nematode species: *Tc. canis* + *U. stenocerhala* + *Cr. vulpis* + *E. aerophilus* + *P. plica* (found twice); *Tx. leonina* + *U. stenocerhala* + *Tr. vulpis* + *E. aerophilus* + *P. plica*; *Tx. leonina* + *U. stenocerhala* + *Cr. vulpis* + *E. aerophilus* + *P. plica*. Nematode communities consisting of four species were even more common; we found 7 kinds of such communities: *Tc. canis* + *U. stenocerhala* + *Tr. vulpis* +*M. patens*; *Tc. canis* + *U. stenocerhala* + *E. aerophilus* + *P. plica*; *Tc. canis* + *Tx. leonina* + *Tr. vulpis* + *R. acus*; *Tc. canis* + *Cr. vulpis* + *E. aerophilus* + *P. plica*; *Tx. leonina* + *U. stenocerhala* + *Tricichinella sp.* + *E. aerophilus*; *Tx. leonina* + *U. stenocerhala* + *M. patens* + *E. aerophilus*; *Tx. leonina* + *U. stenocerhala* + *E. aerophilus* + *P. plica*.

One or two nematode species were usually found in each specimen of mustelid hosts. Only in the pine marten, three nematode species were twice observed simultaneously parasitizing the same host individual: *Ao. putorii* + *P. mucronata* + *E. aerophilus* and *P. mucronata* + *E. aerophilus* + *Sk. petrovi*.

Nematodes parasitic in the red fox were studied comprehensively. We obtained information on the helminths of this host from 13 administrative regions of Ukraine, including Crimea, and found 19 species of nematodes. The diversity of nematodes parasitizing the

red fox may be related to the wide trophic spectrum of this predator. Taxonomic structure of the nematode communities of the red fox consists of several distinct groups of species differing by their prevalence and intensity of infection (fig. 1, A). *Toxascaris leonina*, one of the most common species in the region, is predominating in the community. Two species, *U. stenocerhala* and *Tc. canis*, compose a group of sub-dominants. The group of common species also consists of two species, *P. plica* and *E. aerophilus*. Thereby, the core of the nematode community in the red fox is composed of 5 species with the prevalence of infection larger than 10% and the mean intensity of 10 or more specimens per host. Five more species, *R. afinis*, *Tr. vulpis*, *M. patens*, *C. vulpis*, and *Capillaria* sp., are assigned to the group of rare species, with prevalence of infection less than 10 % and variable intensity of infection. Four of them are typical parasites of the red fox; the status of *Capillaria* sp. can be hardly determined.

Each of other 7 species was found in the red fox only once. Five of them are occasional parasites of the host, though their status is different. *Spirocerca arctica* is rare in Ukraine, it was previously found once in Crimea (Kadenatsii, 1957). *Spirocerca lupi* has not been reported from Ukraine yet, and *Trichinella* cf. *spiralis* was not exactly identified in the present study, since we examined the morphology of only 2 adult females from the host intestine and did not study the host muscles in search for the larval stages. However, the occurrence of *Trichinella* sp. larvae in the muscles of the red fox is commonly reported in Ukraine. As for *Srt. erschowi*, in Ukraine it parasitizes mostly the raccoon dog and occasionally infects the red fox. *Aonchotheca putorii* is a specific parasite of mustelids; its presence in the red fox is accidental. Two species, *S. agraria* and *Heligmosomum* sp., are the common parasites of rodents. Their occurrence in the red fox may be explained by the ability to post-cyclic parasitism. A considerable part of rare species found in the red fox in the present study confirms the completeness of knowledge on the nematode communities of this host in the region.

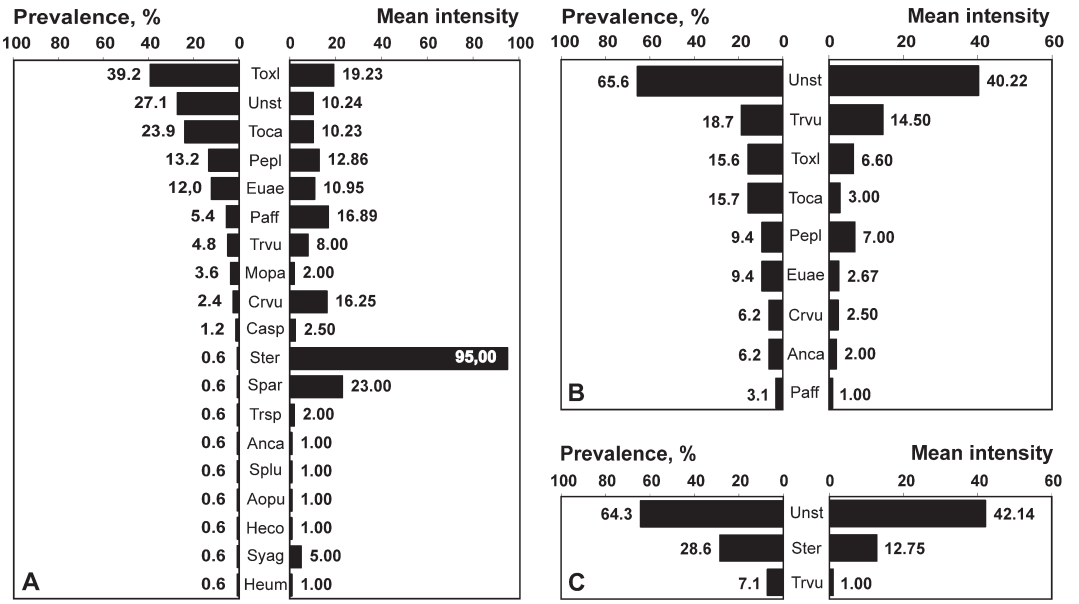

Fig. 1. Structure of nematode communities in carnivorans of the family Canidae in Ukraine (based on original data). A — red fox; B — wolf; C — raccoon dog. Toxe — *Toxascaris leonina*; Unst — *Uncinaria stenocerhala*; Toca — *Toxocara canis*; Pepl — *Pearsonema plica*; Euae — *Eucoleus aeropilus*; Paff — *Pterygodermatites affinis*; Trvu — *Trichuris vulpis*; Mopa — *Molineus patens*; Crvu — *Crenosoma vulpis*; Casp — *Capillaria* sp.; Ster — *Strongyliodes erschowi*; Spar — *Spirocerca artica*; Splu — *S. lupi*; Trsp — *Trichinella* cf. *spiralis*; Aopu — *Aonchotheca putorii*; Syag — *Sy. agraria*; Heum — *Heligmosomum* sp.; Anca — *Ancylostoma caninum*.

Nematode communities of the wolf were studied less comprehensively. Thirty-two specimens of this host from 6 regions were examined, and 9 species of nematodes were found. The core of the nematode community is composed of 6 species (fig. 1, B). *Uncinaria stenocephala* is strongly predominating, with the highest prevalence and intensity of infection. Three species, *Tr. vulpis*, *Tx. leonina* and *Tc. canis*, are sub-dominant. Two species, *P. plica* and *Eu. aerophilus*, are common for this host. Two more species, *Cr. vulpi* and *An. caninum*, are rare parasites of the wolf, each of them was found twice in this host. *P. affinis* was once found in the wolf is rare or occasional species. All nematodes found in the wolf are specific parasites of canids. Eight of them were more or less common in the red fox as well.

We examined only 14 specimens of the raccoon dogs, mostly from Kyiv Region. In total, the prevalence of the nematode infection was rather high — 65.6 %, however, only three nematode species were found in this host (fig. 1, C). *Uncinaria stenocephala* was predominating, *Str. ershovi* was sub-dominant. The third species, *Tr. vulpis*, is a rare parasite of the raccoon dog, it was found only once in our studies. This species, as well as *U. stenocephala*, is a common parasite of the wolf and the red fox in Ukraine, whereas *Str. ershovi* is more specific to the raccoon dog.

Wild felids, wildcat and the lynx, harboured only the parasites specific to Felidae, namely, *Tc. mystax* and *An. tubaeforme*. The former one appeared to be more common.

According to our data and information from literature, 30 species of nematodes parasitize wild Canidae in Ukraine. Helminth community of the red fox appeared to be the most diverse: 27 species of 15 families. Sixteen species of nine families are known to parasitize the wolf. Lesser number of species is known from the raccoon dog (5 species) and the golden jackal (1 species).

Wild felids were found to harbour 4 nematode species; the brown bear is parasitized with only two species from different families (table 2).

Species of the Mustelidae were less numerous in the studied material. Mostly single specimens of some species were examined, excepting comparatively larger sample of the American mink, 13 specimens. This species was originally introduced for cage keeping in Ukraine, and its nematode community is depauperated. However, the overall nematode infection was rather high in the studied sample. Two nematode species were found: *P. mucronata* and *Ao. putorii*, with prevalence of infection 38.5 % and 23.1 %, correspondingly. Both nematodes are common parasites of mustelids in Ukraine. The former one was found in two species of martens, the latter one was found in 5 mustelid species and in the red fox.

Since most nematodes parasitic in Mustelidae are not strictly specific to their hosts and occur in several species of the family, we analysed the structure of nematode communities in Mustelidae in

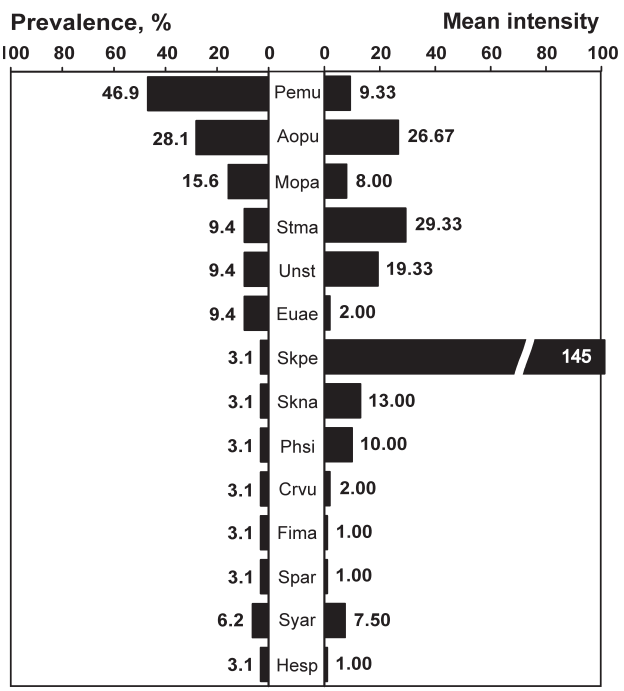

Fig. 2. Structure of nematode communities of Mustelidae in Ukraine (based on summarized original data on seven studied species): Pemu — *Pearsonema mucronata*; Aopu — *Aonchotheca putorii*; Mopa — *Molineus patens*; Stma — *Strongyloides lutrae* + *St. mustelorum*; Unst — *Uncinaria stenocerhala*; Euae — *E. aeropilus*; Skpe — *Skrjabingylus petrovi*; Skna — *S. nasicola*; Phsi — *Physaloptera sibirica*; Crvu — *Crenosoma vulpis*; Fima — *Filaria martis*; Spar — *Spirocerca artica*; Syar — *Syphacia arvicola*; Hesp — *Heligmosomoides* sp.

Table 2. Nematodes parasitic in Canidae, Felidae, and Ursidae in Ukraine (based on original studies and information from literature)

#	Nematode species	Wolf	Red fox	Raccoon dog	Golden jackal	Wildcat	Lynx	Brown bear
1.	*Pearsonema plica*	+	+					
2.	*Aonchotheca putorii*		+					
3.	*Eucoleus aerophilus*	+	+					
4.	*Trichuris vulpis*	+	+	+				
5.	*Trichinella spiralis* s. l.	+	+	+				
6.	*Tr. spiralis* s. str.	+	+			+		
7.	*Tr. nelsoni*		+					
8.	*Tr. britivi*	+	+	+			+	
9.	*Tr. nativa*	+	+			+	+	+
10.	*Dioctophyme renale*	+						
11.	*Srtongyloides stercoralis*		+					
12.	*Str. ershovi*		+	+				
13.	*Ancylostoma caninum*	+	+					
14.	*An. tubaeforme*					+		
15.	*Uncinaria stenocephala*	+	+	+	+			
16.	*Crenosoma vulpis*	+	+					
17.	*Molineus patens*		+					
18.	*Toxascaris leonina*	+	+					
19.	*Toxocara canis*	+	+					
20.	*Tc. mystax*					+	+	+
21.	*Spirura rytipleurites*		+					
22.	*Spirocerca arctica*		+					
23.	*Sp. lupi*		+					
24.	*Pterygodermatites affinis*	+	+					
25.	*Physaloptera sibirica*		+					
26.	*Dirofilaria immitis*	+	+					
27.	*D. repens*	+	+					
28.	*Dirofilaria* sp.	+						
29.	*Heligmosomum costellatum*		+					
30.	*Heligmosomum* sp.		+					
31.	*Syphacia agraria*		+					

general (fig. 2). We found 15 species of nematodes in this host group. Six of them also occurred in the red fox. Interestingly, 3 species, namely, *U. stenocerhala*, *Cr. vulpis*, and *M. pastens*, are common in the red fox and in the badger. The possible explanation to this is the fact that the fox often uses the badger's borrows for living.

The nematode community of mustelids, similarly to that of canids, consists of 5 main groups. *Pearsonema mucronata* found in three host species is predominating with the prevalence of 46.9 %. Sub-dominant group consists of *Ao. putorii* (P = 28.1 %) from 6 host species and *M. patens* (P = 15.6 %) from three hosts. The group of common species includes three species with prevalence about 10 %: *E. aerophilus*, found in two host species, *Str. mustelorum, Str. lutrae* found in one host species each and *U. stenocephala* from the badger. Thus, the core of the nematode community in mustelids is composed of 6 species. Six more species fall into the category of rare species. Their prevalence of infection is about 3%, each of them was found only once in the present study. In this group, *Skr. petrovi* showed the highest intensity of infection (I = 145 in pine marten); the infection intensity of *Skr. nasicola* and *Ph. sibirica* was also rather high (13 and 10 in steppe polecat and in badger, correspondingly). Each of three other rare species was found with infection intensity of 1 or 2 specimens. *Filaroides martis* and *Sp. arctica* are specific parasites of mustelids. *Crenosoma vulpis* is specific to canids, though quite commonly infects mustelids. Therefore, all three species can not be considered as occasional parasites of Mustelidae. The remaining two species, namely, *Sy. arvicola* and *Heligmosomoides* sp., are normally parasitic in rodents; their occurrence in mustelid hosts is considered as post-cyclic parasitism. The presence of nematodes of rodents in the

digestive tract of mustelids is commonly reported in parasitological studies of this host group. For example, Turianin (1959) found *Protospirura* sp. simultaneously parasitizing voles and the weasel in Transcarpathian region.

Among the studied species, the pine marten had the richest fauna of nematode parasites: 6 species, including *U. stenocerhala* acquired from canids. Rather diverse community of nematodes was observed in the weasel: 5 species, including 2 post-cyclic parasites acquired from rodents. The stone marten and the badger each harboured 4 nematode species, the steppe polecat was infected with 3 species, the stoat and the otter were parasitized with 1 nematode species each.

According to our data and information from literature, Mustelidae in Ukraine harbour quite a diverse fauna of nematodes: 31 species from 17 families (table 3). Twelve species are common for both Mustelidae and Canidae, 10 of them were found in the badger. In this host, 19 nematode species were registered — more than in other mustelids. Rather numerous nematode species were found in the stone marten (12 species) and the pine marten (10 species), as well as in the steppe polecat and the weasel (8 nematode species in each host). From 2 to 4 species of nematodes are known to parasitize the stoat, the European and American minks and in the otter in Ukraine (table 3).

Table 3. Nematodes parasitic in mustelid hosts in Ukraine (based on original studies and information from literature)

#	Nematode species	Pine marten	Stone marten	European polecat	Steppe polecat	Weasel	Stoat	European mink	American mink	Otter	Badger
1.	*Pearsonema mucronata*	+	+	+	+				+		+
2.	*P. plica*	+	+								+
3.	*Aonchotheca putorii*	+	+	+	+	+	+		+		+
4.	*Eucoleus aerofilus*	+	+								+
5.	*Eu. perforans*	+									+
6.	*Trichinella spiralis* s. l.	+	+	+	+	+		+			+
7.	*Tr. nativa*										+
8.	*Tr. britovi*		+							+	+
9.	*Strongyloides mustelorum*					+	+				
10.	*Str. lutrae*									+	
11.	*Crenosoma vulpis*										+
12.	*Cr. tajga*		+								
13.	*Filaroides martis*	+	+	+	+						+
14.	*Fi. bronchialis*										+
15.	*Perostrongylus falciformis*										+
16.	*Skrjabingylus nasicola*				+	+			+		
17.	*Skr. petrovi*	+	+								
18.	*Molineus patens*		+	+	+	+	+		+		+
19.	*Uncinaria stenocephala*	+									+
20.	*Ancylostoma caninum*				+						
21.	*Baylisascaris columnaris*				+						+
22.	*B. devosi*										
23.	*Toxascaris melis*										+
24.	*Physaloptera sibirica*										+
25.	*Spirocerca arctica*		+								
26.	*Spiroptera hamulosa*	+									+
27.	*Gnathostoma spinigerum*							+			
28.	*Filaria martis*		+								+
29.	*Protospirura* sp.					+					
30.	*Syphacia arvicola*					+					
31.	*Heligmosomoides* sp.					+					

The nematodes found in separate species of carnivorans in the present study are listed below.

1. Canidae

Wolf: 1. *Pearsonema plica*; 2. *Eucoleus aerophilus*; 3. *Trichuris vulpis*; 4. *Crenosoma vulpis*; 5. *Ancylostoma caninum*; 6. *Uncinaria stenocephala*; 7. *Toxocara canis*; 8. *Toxascaris leonina*; 9. *Pterygodermatites affinis*.

Golden jackal: 1. *Uncinaria stenocephala.*

Red fox: 1. *Pearsonema plica*; 2. *Aonchotheca putorii*; 3. *Capillaria* sp.; 4. *Eucoleus aerophilus*; 5. *Trichuris vulpis*; 6. *Trichinella* cf. *spiralis*; 7. *Strongyloides erschowi*; 8. *Crenosoma vulpis*; 9. *Molineus patens*; 10. *Uncinaria stenocephala*; 11. *Ancylostoma caninum*; 12. *Toxocara canis*; 13. *Toxascaris leonina*; 14. *Spirocerca arctica*; 15. *Sp. lupi*; 16. *Pterygodermatites affinis*; 17. *Syphacia agraria*; 18. *Heligmosomum castellatum*; 19. *Heligmosomum* sp.

Raccoon dog: 1. *Strongyloides erschowi*; 2. *Trichuris vulpis*; 3. *Uncinaria stenocephala*.

2. Felidae

Wildcat: 1. *Ancylostoma tubaeforme*; 2. *Toxocara mystax*.

Lynx: 1. *Toxocara mystax*.

3. Mustelidae

Pine marten: 1. *Pearsonema mucronata*; 2. *Aonchotheca putorii*; 3. *Eucoleus aerophilus*; 4. *Skrjabingylus petrovi*; 5. *Uncinaria stenocephala*; 6. *Filaria martis*.

Stone marten: 1. *Pearsonema mucronata*; 2. *Aonchotheca putorii*; 3. *Eucoleus aerophilus*; 4. *Spirocerca arctica*.

Weasel: 1. *Aonchotheca putorii*; 2. *Strongyloides mustelorum*; 3. *Molineus patens*; 4. *Syphacia arvicola*; 5. *Heligmosomoides* sp.

Stoat: 1. *Aonchotheca putorii*.

Steppe polecat: 1. *Pearsonema mucronata*; 2. *Skrjabingylus nasicola*.

American mink: 1. *Pearsonema mucronata*; 2. *Aonchotheca putorii*; 3. *Molineus patens*.

Badger: 1. *Crenosoma vulpis*; 2. *Molineus patens*; 3. *Uncinaria stenocephala*; 4. *Physaloptera sibirica*.

Otter: 1. *Strongyloides lutrae*.

Nematodes with complex life-cycles (biohelminths) generally predominated in the nematode communities of carnivorans in Ukraine, representing 11 of 17 families: Capillariidae, Dioctophymidae, Crenosomatidae, Filaroididae, Spiruridae, Physalopteridae, Gnathostomatidae, Rictulariidae, Filariidae, Onchocercidae, and Trichinellidae.

The intermediate hosts of these nematodes are terrestrial gastropods, insects (mostly beetles), and earthworms (Anderson, 2000). These animals are common items and quite often a substantial part of the diet of most carnivorans. Less commonly the nematode larvae develop in aquatic invertebrates, crustaceans and oligochaetes, and the final hosts are infected passively with water drunk from natural water bodies. Dipteran insects are the intermediate hosts and vectors for the species of Filariidae and Onchocercidae.

Trichinellids have a particular type of life-cycle. They may exploit the same host individual as the final host (adult nematodes dwell in the host intestine) and the intermediate host (larval nematodes migrate in blood circulatory system and settle in muscles).

Nematodes with simple life-cycles (geohelminths) belong to five families: Trichuridae, Strongyloididae, Ancylostomatidae, Trichostrongylidae, and Ascarididae. Species of the latter family perform a complex migration in the final host, the larvae travel through the portal vein and the lung artery to the lungs. These nematodes may use rodents as the paratenic hosts. The geohelminths compose a core of nematode communities in large carnivorans: the wolf, the red fox and the raccoon dog.

According to previously published information and our data, up to 50 nematode species parasitize wild predatory mammals in Ukraine. Such a diverse nematode fauna identified for this host group indicates, in our opinion, that the knowledge on the nematode communities in Ukrainian carnivorans is quite comprehensive.

In the neighbouring countries, particularly in Belarus and Moldova, the nematodes of carnivorans were also well-studied. In the catalogue published by Merkusheva and Bobkova (1981), 23 species of nematodes are reported from wild carnivorans in Belarus. There, the nematodes of some host groups, particularly of Mustelidae, were studied more comprehensively than in Ukraine. *Aonchothaeca mustelorum* was not found in Ukraine, whereas it was reported from the pine marten and the American mink in Belarus. Ten species of nematodes, mostly common parasites of mustelids, were reported from the European polecat in Belarus, and only three species were found in this host in Ukraine. In the raccoon dog in Belarus, 10 nematode species were found, whereas only 5 species are known in Ukraine (3 species are common for both countries). In Ukraine, such widely distributed species as *Tx. leonina*, *Tc. canis*, *P. plica*, *Ao. putorii*, *E. aerophilus* have not been found in this host yet.

Twelve nematode species were found in the lynx in Belarus, and only 3 species are reported from this host in Ukraine. *Toxocara mystax* is common for both countries. *Pearsonema* (= *Capillaria*) *feliscati* was reported from the lynx in Belarus, whereas in Ukraine it is known only from the domestic cat. Other nematodes are common parasites of various carnivorans.

Nematode communities in the brown bear have not been studied in Ukraine yet. There are only records of *Trichinella britovi* from this host. In Belarus, this species was apparently identified as *Tr. spirallis* s. l. Three more species were reported from the brown bear in Belarus: *Baylisascaris (= Toxascaris) transfuga* (Rudolphi, 1819), *U. stenocerhala* and *Tc. canis*. The former one is specific to the bear, whereas the two latter ones are widely distributed parasites of carnivorans. Presumably, these nematodes may infect the brown bear, the lynx and the raccoon dog in Ukraine as well, at least in the northern part of the country (Polissia).

Fifteen species of nematodes parasitic in wild carnivorans of Moldova are reported in the monograph by Andreiko (1973). The nematode communities of the red fox were comprehensively studied; 7 nematodes species were found. All of them are known to parasitize the red fox in Ukraine. One nematode species, *An. caninum*, was reported from the raccoon dog in Moldova. The wildcat harboured 4 nematode species, three of them (*A. tubaeformis*, *Tc. mystax*, and *Tr. spiralis*) are known from this host in Ukraine, whereas *E. aerophilus* was found in a number of other hosts in the country. Four species of nematodes were reported from the badger in Moldova. One of them, *Cr. schulzi*, has been never found in Ukraine. Each of other mustelid species (pine marten, stone marten, weasel) harboured one nematode species; all of them are known from these hosts in Ukraine. Information on the helminths fauna of carnivorans from the regions of Russia adjacent to Ukraine is summarized in several recent publications. Itin (2015) in the dissertation on parasites of Carnivora from North-Western Caucasus listed 51 helminth species, including 25 nematodes. Three of those species have not been recorded in Ukraine: *Eu. bohmi* from the red fox, *Cr. petrowi* from the pine and stone martens and the American mink, and *Petrowispirura petrowi* from the wildcat.

Information on the helminths of the red fox in the studies of Itin (2015) is comprehensive; it is based on examination of 127 host specimens. Seventeen species of nematodes were found. Some of those species were not registered in Ukraine, such as *Eu. bohmi*, or were found in hosts other than the red fox: *Tc. mystax*, *G. spinigerum*, and *D. renale*. The latter species appeared to be quite common in the red fox in Kuban region.

In a rather large material collected by Itin (2015) from the raccoon dog (56 specimens examined), 14 species of nematodes were found; whereas only 5 species are known from this host in Ukraine. Two species, *Tr. spiralis* s. l. and *U. stenocephala* appeared to be common parasites of this host in both regions; other nematodes parasitize different carnivoran hosts in Ukraine. Helminth fauna of the jackal was also well-studied due to examination of 60 host specimens. Thirteen nematode species were found, all typical for other canids, whereas in Ukraine it was only *U. stenocephala* that was collected from a single jackal examined. In

9 specimens of the wolf, 7 nematodes were identified, all known in Ukraine as well. Four mustelid species were parasitologically examined in Krasnodar Krai; helminths of the badger were more comprehensively studied based on 60 specimens of the host. Only 10 nematode species were found in the badger in this region, whereas in Ukraine we have identified 18 species; 8 species were common for both regions. *An. caninum* and *D. repens* have not yet been reported from the badger in Ukraine; the latter species rarely parasitizes mustelids. Of other nematodes infecting mustelid hosts in Krasnodar Krai, the infection of the American mink by *Cr. petrowi* and martens by *A. columnaris* is yet unknown in Ukraine.

Information on the parasites of the wildcat in Krasnodar Krai is based on examination of 12 host specimens; 9 nematode species were found. All of those, excepting *P. petrowi*, are known from Ukraine as well. However, only two species, *Tc. mystax* and *Tr. spiralis* s. l., were found to parasitize this host in Ukraine. Five more species were reported from domestic cats; *Ao. putorii* normally infects mustelids. Author's information on the parasites of the coon (*Procyon lotor*) is of greatest interest, since this host has been introduced into the region. In 26 studied coons, 7 species of nematodes were found. All of them are common parasites of European carnivorans. In Ukraine, this mammal is rare and its parasites are unknown.

The most comprehensive information on the nematode communities of carnivorans from other neighbouring countries (Poland, Czech Republic, Slovakia, Hungary, Romania) concerns the parasites of Canidae, mostly the wolf and the red fox.

Information on the helminths of carnivorans in Poland is summarized in the review by Pojmańska et al. (2007). Twenty-five species of nematodes are reported in the review. Thirteen of them are parasitic in Canidae, 9 in Mustelidae, 3 in Felidae. One species is reported from the brown bear. Majority of the nematodes registered in Polish carnivorans are widely distributed and common parasites of these animals; most of them are known from Ukraine as well. Eight nematode species occurring in Poland, however, have not been found in Ukraine yet, namely, *Baylisascaris transfuga* from the brown bear; *Aelurostrongylus obstrusus*, *Ollulanus tricuspis*, and *Tc. cati* parasitic in felids; *Trichuris nitzshi*, *U. criniformis*, and *Ao. mustelorum* from mustelids; and *Eu. boehmi* from the red fox.

Nematodes of the golden jackal were recently studied in Hungary (Takacs et. al., 2014); 20 host specimens were examined. Under the environmental conditions favourable for this host, it is parasitized by 16 species of helminths, including 9 nematode species. *An. caninum*, *U. stenocephala* and *P. plica* predominated in the nematode communities, with the prevalence of 40–45 % and comparatively high intensity, 65–166 parasite specimens per host. All nematodes reported from the jackal in Hungary are common parasites of wild canids and the domestic dog in Ukraine, excepting *Angiostrongylus vasorum* (Raillet, 1866). The latter species is known as a widely distributed parasite of canids, occurring also along the lower part of the Don River and in Caucasian region. Presumably, this species may parasitize the golden jackal in Ukraine.

Previously we have reported on 19 species of nematodes parasitic in domestic dogs and cats in Ukraine (Kornyushin and Varodi, 2010; Kornyushin et al., 2013). All of them parasitize wild carnivorans in the country. A number of these species have epizootological and epidemiological significance.

Trichinae are the most dangerous; they may cause human disease often diagnosed as mass "intestinal infection". Wrong diagnostics and inappropriate treatment may lead to death. Previously the synanthropic foci of *Tr. spiralis* in domestic pigs were considered as existing independently from the natural foci. Other species of *Trichinella* were believed to form the latter type of foci, namely, *Tr. nativa* and *Tr. britovi* in Ukraine. They infect wild carnivorans: the wolf, the red fox, the raccoon dog, the brown bear, and a number of mustelid species, as well as the wild boar. The latter species is used as game animal, and people may acquire infection from its meat. However, *Tr. spiralis* appeared to infect the wolf and the red fox in natural habitats (Didyk, 2012, 2013; Didyk et al., 2013). This fact confirms a possibility of exchange between natural and synanthropic foci of trichinellosis.

Human dirofilariosis is an emerging and fast-spreading disease in Ukraine. It is caused by *D. repens* and related mostly to synanthropic regions, where the dogs are the primary hosts of the nematode (Pavlikovska et al., 2014). On the other hand, wild canids may bear the infection, and the contacts between the natural and synanthropic foci are quite possible due to the participation of blood-sucking mosquitoes (Culicidae) as vectors in the nematode transmission. Besides, the stray dogs in vicinities of human settlements may closely contact wild canids.

Human toxocarosis is caused by *visceral larvae migrans* of *Tc. canis*, a common parasite of domestic and wild carnivorans. Migrating larvae may settle in human lungs causing subacute pneumonia and bronchitis. Red foxes and wolfs support the existence of toxocarosis foci in Ukraine.

The risk of spread of nematodoses from wild carnivorans in natural habitats to urbanized territories is increased due to the existence of stray dog packs, which may migrate to natural ecosystems and return to human settlements. By doing this, they form and support a constant exchange channel for parasitic nematodes and other disease agents. The other threat is related to the continuing urbanization of the red fox and its occurrence in the outskirts of cities in Ukraine, similarly to other European countries. This exchange of diseases between natural and synanthropic populations is an important reason for constant monitoring of helminthoses of wild and domestic predatory mammals.

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