Parasites of stray and client-owned domestic cats in urban areas in Russia during 2000-2015 years

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Abstract. Cats are commonly infected by many species of parasites that includes helminths, protozoan parasites, mites and fleas. Parasites affect the health of cats and cause morbidity and mortality, especially in young and old animals. Some species such as Ancylostoma spp., Opisthorchis felineus and Echinococcus spp. are well-known zoonotic parasites worldwide, that high public health risks. Currently of available data on prevalence of feline parasites in Russia, and published studies provide incomplete information regarding the period of parasitological study, number of cats examined, origin, gender and life condition of examined animals. There are no official veterinary guidelines on parasitological examination available. Moreover low quality of veterinary monitoring and inadequate preventive measures has lead to the high rates of environmental contamination by infested cats' feces containing helminths eggs and protozoan cysts. This paper reviews the knowledge on feline parasites fauna and the prevalence in Russia. Practical aspects related to diagnosis, treatment, and controls of parasitic diseases of cats in Russia are discussed.

INTRODUCTION

Cats and dogs are the most popular domestic animals worldwide. Pet population is rapidly increasing every year and reached critical indices. Statistical data shows that in the last decade, cat and dog population has increased 1.4 times whereas human population increased by 1.2 times. Currently, there are no clear statistical representation of cat population in Russia. However, every third family keeps a cat, therefore, the total number of cat population is estimated to be at least 37.5 million. According to statistical data, Russia occupies the fifth country in the world (after USA, Brazil, China and Japan) and leading country in Europe to have the most number of cats (Davtyan, 2016). So cats are one of the most popular animals, which live in close contact with humans. Due to this fact, cats are of major economic, social, medical and veterinary importance. Cats can be infected by a large number of parasites; some of which have zoonotic potential. Parasites such as Ancylostoma spp., Echinococcus sp., Opisthorchis felineus, Ancylostoma spp. are common parasites of cats that can also affect humans worldwide, these helminths are of major medical importance and can cause morbidity and mortality in human populations (Setasuban et al., 1976; Riberton & Tompson, 2002; Bowman et al., 2010; Deplazes et al., 2011; Petney et al., 2013). The growing number of owned cats has also been accompanied by a substantial increase in free-roaming cat population. Free-roaming animals do not receive veterinary attention and anti-parasitic treatments. The prevalence rates of parasites are significantly higher in free-roaming cats, than in household cats, and as a result, the free-roaming cat population are the major source of parasites infection especially in urban ecosystems.
(Dabritz et al., 2006; Gerhold & Gessup, 2013; Hoopes et al., 2015). Free-roaming cat populations are also increasing in Russia (Davtyan, 2016). Knowledge on the prevalence of cat parasite fauna and distribution, methods of diagnosis and treatment are essential for control and prevention of parasites infections in pet and human populations.

This review summarizes data on the endoparasites and ectoparasites in domestic cats in Russia, with a focus on zoonotic parasites.

**Cats parasites in Russian Federation**

There is a lack of data on the fauna of parasites of domestic cats in Russia. In present review data were summarized from published studies conducted between the years 2000 to 2015. A Total of 5 long-term studies are provided (Tables 2-4), and most of the study were conducted during one year. The total number of animals examined was significantly different in published reports; it fluctuates between 18 to 4280 numbers of examined cats (Tables 2, 3, 4). There is a lack of data on the origin of the cats examined in the published study, however reports frequently included both stray and client owned animals. There is absence of clear data on number of client-owned and stray animals; parasites prevalence in stray and client-owned animals is also not distinguished (Tables 2-4). Most of the studies were conducted in Central Federal District (Aleksandrova & Safiullin, 2010; Puzenko & Malyshева, 2010; Kurnosova & Uspensky, 2011; Romasheva & Romashev, 2015; Saprykina, 2016) follow to Volga Federal district (Sidorkin et al., 2013; Suleymanova, 2014; Sivkova & Sogrina, 2015; Timerbaeva & Ilyashenko, 2014) and Siberian federal district (Bortsova, 2013; Domazcii, 2013; Luneva & Ponamarev, 2014; Rubin et al., 2015). Sporadically reports were published from Northwestern (Gavrilova, 2013), North Caucasian (Zaychenko, 2012), Ural, South (Maslova et al., 2015; Stolbova et al., 2015) (Table 1).

The literature data on the parasites fauna of domestic cats include 25 ectoparasites species (Table 1, 3), 6 ectoparasites species; and 1 species of *Demodex* mites. Ectoparasites fauna includes mites *Notoedres cati*, *Sarcoptes scabiei*, *Otodectes cynotis*, *Cheyletiela yasguri*, fleas *Ctenocephalides felis*; lice *Felicola subrostratus* (Table 1, 4). Feline endoparasites fauna includes protozoan, roundworms, tapeworms and flatworms. Protozoan fauna includes 5 species. There are 6 species of tapeworms, 4 species of flatworms and and 10 species of roundworms (Table 1, 2, 3).

Species such as *Toxocara cati*, *Toxascaris leonina* and *Dipylidium caninum* are frequently found in cats from different districts. Helminths such as *Capillaria putorii*, C. feliscati, *Pseudamphistomum truncatum* and *Dirofilaria* spp. have been sporadically reported in cats from Russia. There is also a lack of data on the prevalence and distribution of *E. granulosus* and *Trichinella* spp. in cats as both the species are of major medical importance (Kodym et al., 2007; Pavlova et al., 2016).

Through analysis of the results obtained according to geographical districts, it was found that most of the endoparasites species were found in cats from Central Federal District, follow North Caucasian District (Table 1).

There are no information on the prevalence of ectoparasite and distribution in cats of different ages groups and gender, clinical signs and pathogenicity of ectoparasites infestations. Cats in Russia are frequently found infested with mites (*N. cati*, *O. cynotis*) fleas (*C. felis felis*), and less frequently infested with ticks and lice (Table 4). Fauna of ticks in Russia are large; and the information is lacking regarding wildlife species wildlife species such as *Amblioma* on cats.

**Prevalence of parasites**

Prevalence rates vary broadly in different regions; the total prevalence of endoparasites varies from 13.3% to 42.8% (Table 2). Whereas real prevalence rates of endoparasites are underestimated, mainly because most studies carried out in this country are based on the detection and identification of eggs and oocysts in fecal samples using ordinary
Table 1. Helminth fauna of domestic cat in Russia

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Class</th>
<th>Order</th>
<th>Family</th>
<th>Species</th>
<th>Method</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platyhelminthes</td>
<td>Trematoda</td>
<td>Plagiorchiida</td>
<td>Opisthorchiida</td>
<td>Methorchis bilis</td>
<td>AU</td>
<td>North Caucasian Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Opisthorchis felineus</td>
<td>AU, CE</td>
<td>Central Federal District, Siberian Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pseudamphistomum truncatum</td>
<td>AU</td>
<td>Central Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dicrocoeliida</td>
<td>Dicrocoelium lanceatum</td>
<td>CE</td>
<td>Central Federal District</td>
</tr>
<tr>
<td>Cestoda</td>
<td>Cyclophillidea</td>
<td></td>
<td>Dipyliidae</td>
<td>Dipylicium caninum</td>
<td>CE</td>
<td>Central Federal District, Siberian Federal District, Volga Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Echinococcus granulosus</td>
<td>AU</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mesocestoidida</td>
<td>Mesocestoides lineatus</td>
<td>AU</td>
<td>North Caucasian F.D.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hydatigera taeniaformis</td>
<td>AU, CE</td>
<td>North Caucasian F.D., Central F.D., Siberian F.D., Kazakhstan; Volga F.D.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Taenia spp.</td>
<td>CE</td>
<td>North Caucasian F.D.</td>
</tr>
<tr>
<td>Nematoda</td>
<td>Secernentea</td>
<td>Ascaridida</td>
<td>Ascaridida</td>
<td>Toxocara mystax</td>
<td>CE</td>
<td>Central F.D., North Caucasian F.D., North-West F.D., Volga F.D., Siberian F.D., Far East F., Urals F.D.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Toxascaris leonina</td>
<td>CE</td>
<td>North Caucasian F.D., Central F.D., Siberian F.D., Volga F.D., Ural F.D., Far East F.</td>
</tr>
<tr>
<td>Strongylida</td>
<td>Ancylostomatidae</td>
<td></td>
<td>Ancylostoma sp.</td>
<td>CE</td>
<td>Siberian F.D., North-Caucasian F.D.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Uncinaria stenocephala</td>
<td>Volga F.D., North-Caucasian F.D., Central F.D., Siberian F.D.</td>
<td></td>
</tr>
<tr>
<td>Trichurida</td>
<td>Trichurida</td>
<td></td>
<td></td>
<td>Trichurus vulpis (syn Trychocephalus vulpis)</td>
<td>CE</td>
<td>Central F.D.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Capillaria feliscati</td>
<td>CE</td>
<td>North-Caucasian Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aonchoteca putorii (Capillaria putorii)</td>
<td>CE</td>
<td>North-Caucasian Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Eucoleus aerophilus</td>
<td>AU</td>
<td>South Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dirofilaria immitis</td>
<td>AU</td>
<td>South Federal District</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D. repens</td>
<td>AU</td>
<td>Central Federal District</td>
</tr>
</tbody>
</table>

Note: AU – postmortem examination; CE – coprological examination; n/a – not available.
coprological techniques. Only a few studies were presented using postmortem examination. This emphasizes the need for additional diagnostic methods (e.g. coproantigen tests, PCR tests) if we are to understand the actual diversity and prevalence of endoparasites of cats in Russia. Most published studies were focused particularly on helminths, so it is not difficult to estimate frequency of helminth infections in cats in Russia.

Prevalence rates of helminths vary in cats of different age groups. Kittens between up 1 month to 1 year of age are the most exposed to helminth infections, followed by young animals 3-5 years of age. Cats older than 5 years are less frequently infected by helminths. This is due to the immature immune system of young animals (Domazcii et al., 2013; Sidorkin et al., 2013). There is also lack of data on helminth prevalence in cats in relation to gender. According to Pohodina, there is no significant difference between the prevalence rates of males and females cats, which were 41.4%, and 38.1% respectively.

Toxocara cati (syn. T. mystax) is the most frequently found species in cats in Russia. Its prevalence rates varies, and it fluctuates from 4.8 to 65-100% (Table 2). The high prevalence of T. cati (100%) was found in kittens aged 1-12 months. This species is not transmitted by transmammary or transplacentary methods and is the opposite to T. canis, parasitizing in dogs. High infestation rates of T. cati in neonatal cats are reported as the immune system is unable to generate long-term immunity to the parasites (Deplazes et al., 2011). Toxascaris leonina is also frequently found in cats, with infection rates fluctuating between 4.8% and 46% respectively. Capillaria feliscati and Aonchoteca putorii (syn. Capillaria putorii) are rare in cats, A. putorii was found in North-Caucasian Federal District (Pyatigorsk) with prevalence rate of 5.6%, C. feliscati was found in Voronezh with a prevalence rate of 11.7% and one case was registered in Moscow (Zaychenko, 2012; Panova et al., 2015; Davyolova & Shemyakov, 2015). Lungworm Eucoleus aerophilus was reported from Voronezh region with a prevalence rate of 5.8% (Kulesov & Romashov, 2016). There are no published reports for lungworms such as Aelurostrongylus abstrusus, Ostlerus rostratus and Troglostrongylus brevior (Traversa et al., 2013) infestation in cats from Russia. The most frequently reported cestodes were D. caninum and Hydatigera taeniaeformis (syn. Taenia taeniaeformis) with prevalence rates ranging between 1% and 50% and 1.1% and 15.4% respectively (Table 2). Mesocestoides lineatus and Diphyllolobothrium latum are also rare in cats (Table 1). Metorchis bilis was reported from the North-Caucasian Federal District (Pyatigorsk) and Central Federal District (Voronezh) (Zaychenko, 2012; Romasheva & Romashev, 2014), with prevalence rates varying between 3.7% and 0.91%–33.3% respectively. That species was found in Volga Federal district (Perm) with prevalence of less than 1% (Sivkova & Sogrina, 2015). Mesocestoides lineatus was found in cats from Pyatigorsk (North-caucasian Federal District) and Voronezh (central Federal District) with prevalence of 3.7% and 5.8% (Zaychenko, 2012; Romasheva & Romashev, 2014). The most frequently reported trematodes of cats were O. felineus (Table 2). The prevalence rates of O. felineus from Altay region and Kursk were 83% and 12.5% respectively (Puzenko & Malysheva, 2010; Luneva & Ponamarev, 2014). Pseudamphistomum truncatum was detected during postmortem examination in Voronezh region, with a prevalence rate of 66.7% (Romasheva & Romashev, 2014). Trichuris vulpis and Dicrocoelium lanceatum are reported in cats; but both species were reported from Voronezh with a prevalence of 0.98% (Panova et al., 2015). Only few sporadic reports of feline Dirofilaria sp. infection have been published in the last several years. Dirofilaria spp. were found in cats in Krasnodar, Barnaul, Rostov-on-Don and Kirovskii Region with min and max prevalence of 0.15% and 20% respectively (Kravchenko & Gnenenko, 2007; Krivorotova, 2014; Krivorotova & Nagorny, 2015; Luneva & Ponomarev, 2014; Vinokurova, 2011). Recent data show (Krivorotova, 2014) that the infection rates in cats between one and three years old and
<table>
<thead>
<tr>
<th>Parasite / Region</th>
<th>Period</th>
<th>Origin</th>
<th>n</th>
<th>Method</th>
<th><em>Toxascaris myersi</em></th>
<th><em>Toxascaris leonina</em></th>
<th><em>Uncinaria stenocephala</em></th>
<th><em>Anyclostoma sp.</em></th>
<th><em>Ditylidium caninum</em></th>
<th><em>Hydatigera taeniaformis</em></th>
<th><em>Taenia sp.</em></th>
<th><em>Mesocestoides lineatus</em></th>
<th><em>Opisthorchis felineus</em></th>
<th><em>Metorchis butis</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Saratov (Sidorkin et al., 2013)</td>
<td>one year</td>
<td>n/a</td>
<td>530</td>
<td>Pulleborn</td>
<td>19.7</td>
<td>12.4</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kursk (Puzenko &amp; Malysheva, 2010)</td>
<td>2006–2009</td>
<td>stray + client owned</td>
<td>26</td>
<td>AU</td>
<td>42.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15.4</td>
<td>-</td>
<td>-</td>
<td>3.8</td>
<td>-</td>
</tr>
<tr>
<td>Pyatigorsk (Zaychenko, 2012)</td>
<td>2009</td>
<td>client owned</td>
<td>107</td>
<td>MacMaster</td>
<td>24.3</td>
<td>7.5</td>
<td>6.6</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>3.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Altay (Luneva &amp; Ponomarev, 2014)</td>
<td>one year</td>
<td>stray + client owned</td>
<td>402</td>
<td>Kotelnikov-Chrenov, Kotelnikov-Varenichev</td>
<td>46</td>
<td>37.8</td>
<td>5.2</td>
<td>3.9</td>
<td>-</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>83</td>
<td>-</td>
</tr>
<tr>
<td>Kazan (Timerbaeva &amp; Ilyashenko, 2014)</td>
<td>n/a</td>
<td>n/a</td>
<td>-</td>
<td>-</td>
<td>4.8</td>
<td>5.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Voronezh (Volgina &amp; Gaponov, 2006)</td>
<td>one year</td>
<td>n/a</td>
<td>293</td>
<td>-</td>
<td>31.4</td>
<td>7.8</td>
<td>0.9</td>
<td>-</td>
<td>24.5</td>
<td>2.9</td>
<td>0.9</td>
<td>1.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Novosibirsk (Bortsova, 2013)</td>
<td>n/a</td>
<td>shelters</td>
<td>18</td>
<td>Floatation</td>
<td>32</td>
<td>3.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Perm (Sirkova &amp; Sogmina, 2015)</td>
<td>n/a</td>
<td>client owned</td>
<td>637</td>
<td>Kotelnikov-Chrenov</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>&gt;1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bashkortostan (Suleymanova, 2014)</td>
<td>n/a</td>
<td>n/a</td>
<td>37</td>
<td>Pulleborn + AU</td>
<td>29.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>29.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Western Siberia (Domazcii et al., 2013)</td>
<td>one year</td>
<td>client owned + shelters</td>
<td>400</td>
<td>CE</td>
<td>26.7–30.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Voronezh (Romashova &amp; Romashov, 2014)</td>
<td>2000–2013</td>
<td>n/a</td>
<td>54</td>
<td>AU</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>33.3</td>
<td>33.3</td>
<td>-</td>
</tr>
<tr>
<td>Zelenograd (Aleksandrova &amp; Safirullin, 2010)</td>
<td>2008–2009</td>
<td>client owned</td>
<td>-</td>
<td>Pulleborn</td>
<td>14.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>29</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Saint-Petersburg (Gavrilova, 2013)</td>
<td>September 2012 – December 2012</td>
<td>stray</td>
<td>20</td>
<td>CE</td>
<td>35</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Moscow (Panova et al., 2015)</td>
<td>n/a</td>
<td>client owned + stray</td>
<td>44</td>
<td>Pulleborn-Kotelnikov-Chrenov</td>
<td>31.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: AU – postmortem examination; CE – coprological examination; n/a – not available.
older than nine years was lower than in cats between four and eight years of ages; showed a prevalence was 7.6–14.4% and 18.8–22.5%, respectively. Same prevalence was found among female and male cats – infestation rates were 14.4 and 15.4%, respectively. In another study (Luneva & Ponomarev, 2014) D. immitis was found in cats older than 3 years of age, female cats were less frequently infected with D. immitis.

There is lack data on protozoan infections in cats in Russia. The most frequently reported protozoan parasites were Coccidia, including Cystoisospora rivolta and C. felis; the prevalence rates varying between 4.9% and 1.24%. Giardia spp. was found in Kazan and Moscow with a prevalence rate of 0.56% and 5.39% respectively. Sarcocystis spp. is rarely found in cats, it was reported from Moscow and Perm with prevalence of 0.82% and 0.16%. There is also a lack of information on Toxoplasma sp. The following prevalence was reported from Moscow (33.8%) Voronezh with prevalence rate of 17.65% and Kazan with prevalence rate of 0.4% (Table 3).

In total, six reports on ectoparasites in cats were published in the last decade. The most frequently found ectoparasite was O. cynotis with maximum prevalence rate of 68.7%, followed by N. cati with 8.8%. Demodex cati was registered sporadically with low prevalence rates between 0.1 and 2.8%. There is no published data on other feline Demodex mites such as D. gatoi and third unnamed molecular distinguished species (Frank et al., 2013). Mites C. yasguri and Sarcoptes scabiei were observed in Ob,Tymen (Table 4). There is also lack of data on fleas and lice’s species and their prevalence in cats.

Table 3. Prevalence of Protozoa in cats from Russia

<table>
<thead>
<tr>
<th>Region</th>
<th>Period</th>
<th>Origin</th>
<th>n</th>
<th>Method</th>
<th>Toxoplasma gondii</th>
<th>Coccidia</th>
<th>Cystoisospora felis</th>
<th>Cystoisospora rivolta</th>
<th>Sarcocystis spp.</th>
<th>Giardia spp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voronezh</td>
<td>one year</td>
<td>client-owned</td>
<td>293</td>
<td>Flotation</td>
<td>17.6</td>
<td>4.9</td>
<td>1.96</td>
<td>1.96</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Perm</td>
<td>n/a</td>
<td>client-owned</td>
<td>637</td>
<td>Ketelnikov-Chrenov</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kazan</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Moscow</td>
<td>241</td>
<td>Fulleborn-Chrenov</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.8</td>
<td>5.4</td>
</tr>
</tbody>
</table>

Table 4. Prevalence of ectoparasites and Demodex cati in cats from Russia

<table>
<thead>
<tr>
<th>Region</th>
<th>Period</th>
<th>Origin</th>
<th>n</th>
<th>Otodectes cynotis</th>
<th>Sarcoptes scabiei</th>
<th>Notoedres cati</th>
<th>Cheyletiella yasguri</th>
<th>Clenocephalides felis</th>
<th>Demodex cati</th>
<th>Aphiidae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ob (Rabin et al., 2015)</td>
<td>2006-2013</td>
<td>client-owned</td>
<td>n= 263</td>
<td>68.7</td>
<td>20.4</td>
<td>8.8</td>
<td>0.4</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tymen (Stolbova et al. 2015)</td>
<td>2010-2015</td>
<td>n/a</td>
<td>n=1452</td>
<td>14.8</td>
<td>6.55</td>
<td>5.4</td>
<td>1.2</td>
<td>0.1</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Saint-Petersburg (n=20) (Gavrilo, 2013)</td>
<td>September-december 2012</td>
<td>n/a</td>
<td>n=20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kazan (Timerbaeva &amp; Byashenko, 2014)</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
<td>10.2</td>
<td></td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td>16.6</td>
</tr>
<tr>
<td>Zelenograd (Aleksandrova &amp; Safinullin, 2010)</td>
<td>2008-2009</td>
<td>client-owned</td>
<td></td>
<td>59.4</td>
<td></td>
<td>5.8</td>
<td></td>
<td></td>
<td></td>
<td>17.4</td>
</tr>
</tbody>
</table>

n/a – not available
MATERIALS AND METHODS

Fecal Sample collection
Fresh fecal samples that were collected were placed in individual tubes or jars with a label containing information regarding the cat’s age, gender and data of sample collection. All samples were examined one day after collection. Skin scrapings and cerumen samples were investigated one day after collection.

Laboratory diagnostic procedures
The diagnosis of parasitic diseases affecting cats in Russia is still predominantly made by traditional methods. For instance, gastrointestinal parasites are usually detected by ordinary coprological techniques such as Fulleborn (flotation in saturated sodium chloride solution); this method has low sensitivity for Cestoda and Trematoda eggs (Polowski et al., 2006; Becker et al., 2016). Other original flotation sedimentation techniques such Kotelnikov-Nahrenov(ZnCl₂ SG 1.82), Kotelnikov-Varenich (NH₄NO₃ SG 1.28) methods using saturated solutions have high sensitivity for most intestinal parasites due to high gravity of the solutions (Lutfiullin et al., 2010; Dolbin et al., 2011; Timerbaeva et al., 2014). However, direct morphological identification of helminths eggs such as Taenia spp., Ancylostoma spp. and protozoan cysts cannot normally be differentiated by light microscopy. The multiple polimerase chain reaction (PCR) is high sensitive method, using for detection indistinguishable Tenia spp. and Ancylostoma spp. eggs and protozoan cysts (Orlandi & Lampel, 2000; Traub et al., 2004; Trachsel et al., 2007). Unfortunately this method is not used by veterinarian’s practitioners in Russia. Different methods are used for Toxoplasma identification – such as direct microscopy of fecal samples, and different serological tests. Serological analyses include IFA, CFT and immune chromatography (Kodym et al., 2007; Bazhibina, 2011; Bespalova & Katkov, 2015).

TREATMENT
Efficacy of anthelminthic therapy presents major significance for prevention and control of helminths infections among companion animals (Dryden & Payne, 2004). Praziquantel, pyrantel, ivermectine and albendazol are frequently used in anthelminthic in Russia (Arkhipov & Smirnov, 2006; Prohorova, 2010; Smirnova & Arisov, 2015). These compounds are highly effective against most parasites of animals are toxic and have heavy side effects (Epe & Kaminsky, 2013). New synthetic drugs combined with praziquantel is commercially available; that have high efficacy and low toxicity compared with praziquantel (Epe & Kaminsky, 2013). Among the new anthelminthic compounds, only emodepside (Profender) is available in Russia (Arkhipov et al., 2007). Ivermectin is often used against ectoparasites suc as N. cati, O. cynotis, fleas and lice (Prohorova, 2010). There are only a few known published reports on feline demodicosis treatment. In a report published by Yastreb, 2016 cat’s demodicosis was successfully treated using Bravecto – insectoacaricide a new class of izoxasolines used against ectoparasites (Avdienko, 2008; Yastreb, 2016). In other report combined scheme for localized and generalized demodicosis accompanied with Staphylococcusiss treatment was presented, and it includes anatoxin, antibiotics, vitamin B12, immunoparasitan, gipchlofos.

PREVENTION
Veterinarian practitioners, cat owners do not have a native source of information for parasite epidemiology, life cycles or control measures in Russia (Makarov, 2004). Currently, prevention include regular deworming of infected cats, control of food quality and pet diets also help to prevent parasite infections. For example, to prevent O. felineus infestation it is recommend to avoid the feeding of fresh cyprinid fishes (Aunpromma et al., 2016)

Many cat owners cannot afford preventive measures and act only when there is a life-threatening problem affecting their animals. Furthermore, there are a large number of free-roaming cats in the Russian cities. Government is not able to manage these animals due to the lack of adequate infrastructure and trained personnel to
conduct an effective long-term population control program. As a result, pet dogs and cats are endangered by a wide range of parasites that may cause disease to them and eventually to their human owners.

PARASITES WITH ZOONOTIC POTENTIAL

O. felineus, M. bilis, D. lanceolatum are major zoonotic parasites (Azizova, 1987; Ilynskikh et al., 2006; Petney et al., 2013). D. caninum and T. mystax can affect humans (Molina et al., 2003; Fisher, 2003; Szwaja et al., 2011). Larvae Toxocara cati and T. canis can cause larval migrans syndrome, including ocular larval migrans and visceral larval migrans (Fisher, 2003). Adult T. cati can also parasitize human intestine. However, in opposition to T. canis, T. cati is an underestimated zoonotic agent (Fisher, 2003). Incidence of T. canis was high in humans with a total 3310 cases of toxocariasis registered in 2011 and 3325 cases registered in 2012 in Russia (Maksimova & Maniya, 2014). The main source of T. cati infection is environment contaminated by helminths eggs passed by infected cats. Studies on the contamination of geohelminths eggs in soil shows a high contamination levels of Toxocara spp. eggs, the prevalence of Toxocara spp. eggs in soil varies between 1–3% and 50–60% with a mean intensity of 1–10 eggs per 100 gr (Malyshева et al., 2013). However in single report, Toxocara eggs were identified as T. cati – in Vitebsk with prevalence rate of 30.2% (Bekish, 2006). Seasonal prevalence of T. cati in cats are high during the year, with peak of infection rates in autumn period. Free-roaming cats are also frequently infected with T. cati than cats without free access to outdoors.

Toxoplasmosis is an important zoonotic parasitic disease in humans and many species of birds and mammals, which is caused by the opportunistic protozoan Toxoplasma gondii (Dubey, 2010). As the definitive hosts for T. gondii, infested cats pass oocysts in their feces leading to contamination with T. gondii oocysts in soil (Elmore et al., 2010). Serological assays show that seroprevalence of Toxoplasma in kittens was lower than in adult cats; female cats are frequently infected with Toxoplasma than males with a prevalence 27.1% and 12.2% respectively (Berezina et al., 2011). A total of 10090 cases of toxoplasmosis in human population were registered from the year 2000–2011 in Russia. The regions with the highest incident rate were Arkhangelsk Oblast (714 cases per 100 000) and Yakutia (306 cases per 100 000) (Dubarev et al., 2013).

Liver flukes O. felineus and M. bilis are the main humans’ parasites in Russia (Mordvinov et al., 2012). Life cycle of both species includes two intermediate hosts: fist intermediate hosts are freshwater snails; second intermediate hosts are Cyprinidae fishes. The final hosts of both species can be various species of fish-eating mammals the largest parasite-endemic area is in western Siberia, namely the Ob and Irtysh River valleys and their tributaries (Skarednov et al., 1986; Filatov et al., 1989; Zelia et al., 1990). In the central part of this area, the Tyumen and Tomsk Districts, the mean prevalence of human infection is 40%–95%. The prevalence of 65% were reported in the Komi-Permiak national district. Other districts and territories where opisthorchiasis is endemic include Voronezh District (Chubirko et al., 1997), Yekaterinburg District (Tsybina, 1994) Altai territory (Chubirko et al., 1997), Volga River valley ((Kazadaeva & Kastranova, 2015) and Archangelsk District (Zelia & Gerasimov, 1992). M. bilis is also found in Western Siberia. Seroprevalence of this species is 4.9–8.4% (Ilynskikh et al., 2006; Mordvinov et al., 2012).

CONCLUSIONS

The close contact between domestic cats and humans may unintentionally represent hazard for humans. Therefore, to avoid the potential risks associated with owning a pet, it is fundamental to maintain pets in good health and protect them from zoonotic pathogens.

Therefore, veterinary practitioners and medical physicians should work together towards improving the well-being and general health of both animals and humans.
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