PARASITES OF *MYOCASTOR COYPUS* – A COMPARISON IN FARM ANIMALS AND THEIR FERAL COUNTERPARTS*

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The parasitic status in the coypus (nutrias) *Myocastor coypus,* both farm-bred or free-living on river banks in the Czech Republic, was determined. Faecal samples were collected from 200 coypus originating from 11 farms (farm-bred animals) and from 20 individuals living at 14 natural localities (feral animals). Faeces were examined for nematode eggs and coccidian oocysts using the McMaster method. The evaluation of faeces from farm-bred coypus indicated infection with the following parasites: *Trichuris* sp., *Strongyloides* sp., *Trichostrongylus* sp., *Eimeria seidelli*, *Eimeria nutriae, Eimeria coypi,* and *Eimeria myopotami*. Free-living feral rodents harboured *Eimeria nutriae, E. coypi, Strongyloides* sp. and in one case also *Trichuris* sp. An additional visceral examination of 20 coypus originating from five farms revealed two nematode species in the gastrointestinal tracts, namely *Trichuris myocastoris* and *Strongyloides myopotami.* The study indicated that feral coypus are far less parasitized than their captive counterparts.

coypu, nutria, nematodes, *Trichuris myocastoris*, *Strongyloides myopotami,* cocccidia, *Eimeria*

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INTRODUCTION

Myocastor coypus (Molina, 1782) is named either coypu (name used in Europe and Latin America) or nutria (used in North America, Asia, and the former Soviet Union (see https://www.nwrc.usgs.gov/special/nutria/). The rodent is a large, semi-aquatic, invasive animal native to South America (Woods et al., 1992). The coypu has been introduced around the world for fur farming (Carter, Leonard, 2002), but it has also been released as a game animal and a means to control aquatic vegetation (Bounds, Carowan, 2000). Coypus were first imported to the Czech Republic in 1924 and became very popular due to their high quality coats and meat. Since the 1990s, numbers of farm-bred animals have been declining, yet they remain a favourite source of healthy meat in some regions (Tumova et al., 2015).

However, today the coypu is considered one of the worst invasive species (Lowe *et al*., 2000; Bertolino, Viterbi, 2010). This is due to the widespread damage it causes to ecosystems, including its effects on crops, riverine vegetation and riverbanks through grazing and burrowing (Carter, Leonard, 2002; Vila *et al*., 2010). We can see a similar situation in the Czech Republic, where numbers of coypus managed to escape from farms and began spreading in the feral during the 1970s. Currently, the number

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Table 1. Results of faecal samples (n = 200 per each parasite) examination of farm-bred coypus (*Myocastor coypus*)

Parasite	Prevalence (%)	EPG/OPG			
		mean	SD	min	max
Nematoda					
Trichuris sp.	57.0	416.3	901.5	20	6 000
Strongyloides sp.	11.5	8.3	35.5	20	300
Trichostrongylus sp.	4.0	2.3	11.8	20	80
Coccidia					
Eimeria seideli	26.0	674.4	3 664.7	20	28 800
Eimeria myopotami	5.0	9.4	34.8	20	220
Eimeria coypi	37.0	1 325.7	3 264.9	20	18 040
Eimeria nutriae	23.0	274.9	1 007.0	20	8 980

EPG = eggs per g of faeces, OPG = oocysts per g of faeces, SD = standard deviation

of these rodents in free nature is increasing. They do not have any enemy in Central Europe and occur here in little isolated areas (Kristofik, Danko, 2012).

Like other animals, *M. coypus* suffers from many diseases and parasitic infections. However, studies dealing with its parasites are sporadic and focus mainly on wild populations from the Americas. Babero, Lee (1961) found various helminths, namely 11 species of trematodes (including *Echinostoma revolutum*, *Heterobilharzia americana*, and *Psilostomum* sp.), 21 species of cestodes (including *Anoplocephala* sp.), one acanthocephalan (*Neoechinorhynchus* sp.), and 31 species of nematodes (including *Trichostrongylus sigmondontis*, *Longistriata maldonadoi*, *Strongyloides myopotami,* and *Trichuris myocastoris*) in coypus from Luisiana. Martino et al. (2012) examined the endoparasites of wild coypus from their native region in South America. The rodents were infected with Nematoda (82.0%), Trematoda (33.3%), Cestoda (12.8%), and various unicellular parasites (*Eimeria, Cryptosporidium, Giardia*) (46.1%). Monoxenic coccidia *Eimeria myopotami* and *Eimeria nutriae* (phylum Apicomplexa), and nematodes *Strongyloides myopotami* and *Trichuris myocastoris* were the most prevalent parasites. El-Kouba et al. (2009) examined coprologically 16 animals from a protected area in Curitiba, Brazil. The overall prevalence rates were 56.25% for trematode eggs, 87.50% for cestode eggs, 56.25% for Strongyloidea nematodes eggs, and 50% for coccidia (Eimeriidae) oocysts.

Information regarding parasites in captive-bred coypus is scarce. Frequently occurring parasites in breeds are monoxenic coccidia. According to Mertin et al. (2005), coccidiosis is the most dangerous parasitic disease in coypus and can cause considerable losses in young offspring. Scheuring (1990) determined six species of the genus *Eimeria* in 19.5% of coypus from farms in Poland, these animals were further infected with nematodes (28.5%), comprising mostly *T. myocastoris* and *S. myopotami,* and rarely one case of *Trichostrongylus* sp.

Similarly, surveys of gastrointestinal parasites of feral coypus in Europe are scarce. Lewis, Ball (1984) revealed exclusively coccidia in feral coypus from England; however, recent study by Zanzani et al. (2016) detected much wider spectrum of feral coypu parasites in England which included *S. myopotami*, *Trichostrongylus duretteae*, *Eimeria coypi,* and *Eimeria seideli*.

However, the coypu is also capable of spreading zoonotic agents such as *Toxoplasma gondi*, *Fasciola hepatica, Echinococcus granulosus, Echinococcus multilocularis, Taenia* metacestodes, *Capillaria hepatica*, and several others (e.g. Babero, Lee, 1961; Bollo et al., 2003; Gayo et al., 2011; Nordoni et al., 2011; Umhang et al., 2013; Zanzani et al., 2016).

The aim of the present work was to determine the parasitic status in Czech farm coypus in order to evaluate the potential risk of the spread of parasitic diseases, which may pose a danger to both animals and humans. Another equally important goal was to compare the degree of parasitization of farm and feral coypu populations in the Czech Republic.

MATERIAL AND METHODS

Faecal samples were collected from *M. coypus* individuals originating from 11 farms (farm-bred animals) and 14 natural localities (feral animals) of the Czech Republic. The faecal samples were stored in plastic tubes at 4°C for a week prior to analysis. All samples were examined individually for gastrointestinal nematode eggs (faecal egg counts, FEC) and coccidial oocysts (faecal oocyst counts, FOC) using the McMaster method (Vadlejch et al., 2013).

Table 2. Results of faecal samples (n = 20 per each parasite) examination of feral coypus (*Myocastor coypus*)

Parasite	Prevalence (%)	EPG/OPG			
		mean	SD	min	max
Nematoda					
Trichuris sp.	5.0	3.0	13.4	60	60
Strongyloides sp.	30.0	71.0	179.4	20	740
Coccidia					
Eimeria coypi	60.0	197.0	354.7	40	1 280
Eimeria nutriae	45.0	1 577.0	6 038.5	60	27 160

EPG = eggs per g of faeces, OPG = oocysts per g of faeces, SD = standard deviation

Table 3. Results of necropsy examinations of farm-bred coypus (*Myocastor coypus*)

Parasite	Coypus n	Prevalence (%)	Intensity of infection			
			mean	SD	min	max
Trichuris myocastoris	20	40	11.3	19.9	4	66
Strongyloides myopotami	20	25	5.2	10.9	1	23

SD = standard deviation

Eimeria oocysts were determined using descriptions from Prasad (1960), Lewis, Ball (1984), and Scheuring (1990).

The viscera (abomasum, small intestines, colon, and caecum) of coypus originating from five Czech farms were collected and processed for worm recovery. The worms were separated according to sex and rinsed in a physiological saline solution (0.9 w/v NaCl) in order to remove contaminants, and stored in 70% ethanol. Parasites were identified according to Skrjabin et al. (1957), Sato et al. (2008), and Rylkova et al. (2015).

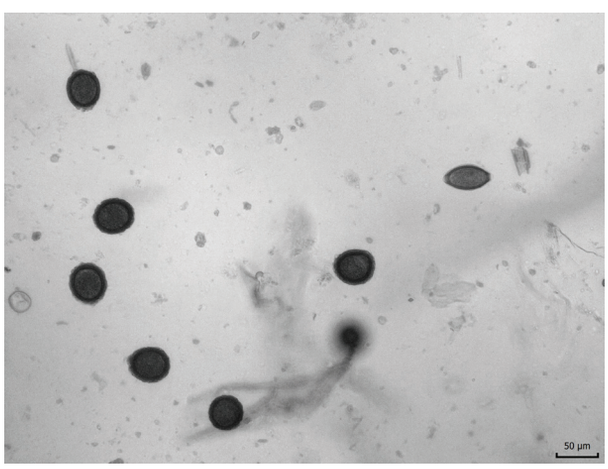

Fig. 1. Oocysts of *Eimeria seideli* and an egg of *Trichuris* sp.

RESULTS

Results of coprological examinations are summarized in Tables 1, 2. Evaluation of faecal samples from farm-bred coypus indicated infection with unidentified species of three nematode genera (*Trichuris* sp., *Strongyloides* sp., and *Trichostrongylus* sp.) and four coccidian species (*Eimeria seideli, Eimeria myopotami, Eimeria coypi*, and *Eimeria nutriae*) (Table 1, Fig. 1). The most prevalent and frequent parasites were *Trichuris* sp., *E. coypi, E. seideli*, and partially *E. nutriae*. In 11 farms, all examined rodents were infected with *Trichuris* sp.

Faecal samples from feral coypus, collected from 14 natural localities, contained eggs of only two nematode genera (*Trichuris* and *Strongyloides*) and two coccidian species (*E. nutriae* and *E. coypi*) (Table 2). Here, *Strongyloides* sp., *E. nutriae,* and *E. coypi* were the most frequent parasites.

Two nematode species were also identified in the gastrointestinal tracts of 20 animals, namely *Trichuris myocastoris* (8 positive cases, P = 40%) and *Strongyloides myopotami* (5 positive cases, P = 25%). The number of whipworms *T. myocastoris* varied slightly from 4 to 66, the mean intensity of infection (II) was 19.9 (Table 3). The number of *S. myopotami* roundworms varied from 1 to 23 and the mean II was 5.2 (Table 3). No other nematode species was revealed in the gastrointestinal tract of examined animals, despite the fact that the *Trichostrongylus duretteae* could be hypothetically expected here (Zanzani et al., 2016).

DISCUSSION

This study has shown that the feral coypus are far less parasitized than their captive counterparts, although we examined fewer faecal samples of feral coypus than of the farm-bred animals. The free living coypus defecate mostly in water, which makes obtaining the faecal samples difficult. The narrower spectrum of their parasites is largely due to the unlimited environment of the feral coypus on the river banks. Contrariwise, farmed animals are kept in groups in concrete tanks, where the only water source is a water feeder. These conditions facilitate the spread of parasites, especially those having part of their life cycle in the environment and needing no intermediate hosts.

Our results dealing with parasitic load of farm coypu are comparable to those of studies from neighbouring Poland (S c h e u r i n g , 1990). In the both countries, farm coypus are parasitized by nematodes *S. myopotami, T. myocastoris,* and *Trichostrongylus* sp.*,* and a series of coccidian species. In the Czech Republic, however, there is a higher incidence of *Trichuris* nematodes, which can reach an average egg prevalence of 57%. Moreover, on certain Czech farms all animals became infected with this parasite. In Poland, S c h e u r i n g (1990) reported prevalences of *T. myocastoris* from 7.2% in August to 34.2% in December. Prevalences of another nematode, *Strongyloides myopotami*, ranged from 6% in April to 25% in December. Our study showed a similar infection rate for this nematode: 11.5% (coprological examination) and 25% (necropsy examination). *Trichostrongylus* nematodes were only diagnosed using the coprological method; none of these nematodes were detected in the digestive tract of necropsied animals.

In the present study, four *Eimeria* species were discovered: *E. seideli, E. nutriae, E. coypi,* and *E. myopotami* and the prevalences on the Czech farms were much higher (in some cases 100%) then on the Polish farms (9–31.6%); there, however, also *E. fluviatilis* was detected (S c h e u r i n g , 1990).

In feral coypus from the Czech Republic, mainly coccidia were detected, most often *E. coypi* and *E. nutriae*. *Trichuris* sp. was revealed in only one sample; *Strongyloides* sp. occurred more frequently in feral coypus than in their farm counterparts.

The feral coypu population has increased in the Czech Republic in recent years. This increase is partially due to mild winters and to the fact that local people have developed a habit of feeding these animals. Feral coypus in the Czech Republic do not pose a threat to other animals or humans from a parasitic point of view. Nevertheless, coypu breeders should put more effort into monitoring their animals for parasitic infection. Young animals can be especially susceptible to the effects of parasitic infection, which are reflected in growth rates and fur quality.

CONCLUSION

Evaluation of faecal samples from farm-bred animals indicated infection with the coccidia, *Trichuris* sp., *Strongyloides* sp., and *Trichostrongylus* sp. Feral coypus harboured mainly coccidia and *Strongyloides* sp., in one case also *Trichuris* sp. Two nematode species of parasites (*Trichuris myocastoris* and *Strongyloides myopotami*) were identified in the gastrointestinal tracts of 20 animals. The study revealed that feral coypus are far less parasitized than their captive counterparts. Feral coypus in the Czech Republic do not, at least from a parasitic point of view, pose a threat to other animals or humans.

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