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PARASITOCENOSES IN PRODUCTIONAL RODENT BREEDS IN CZECH REPUBLIC

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Abstract

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Aim of this work was to monitor the occurrence of most common parasites of rodents in 13 commercial and hobby breeds. Most often detected protozoans belonged to genera *Giardia*, *Eimeria* and *Cryptosporidium,* tapeworms *Hymenolepis nana* and *H. diminuta*, nematods *Syphacia obvelata* and *Aspiculuris tetraptera* and mites *Ornithonyssus bacoti*, *Laelaps hilaris* and *Notoedres muris.* Diseases broke out mainly during summer months. In animals with clinical signs of illnesses there was an expectation of parasite presence, and most of them were nematods – 80%, tapeworms – 45.2%, protozoans – 41.1% and ectoparasites – 22%. Samples of animals without clinical signs of illnesses contained nematods – 16%, tapeworms – 11%, coccidians – 6% and ectoparasites – 0%. Besides evaluation of all samples, breeding conditions were evaluated as well. Consequently plan was made to remove the causes of parasitoses for each monitored breed. Most dangerous parasites were coccidians of the genus *Cryptosporidium,* which caused high mortality of the young animals. In Czech Republic high percent of breeds are contaminated with parasites, however, there is little experience in how to deal with these illnesses. Results are weak and low-quality breeds, especially of mice and common rats. Important protection is buying animals from well-known and verified breed with no signs of illness and also regular control of excrement samples.

rodent, parasite, commercial breed

Commercial rodent breeding started to develop after the revolution in 1989. Borders were opened and possibility to export rodents especially for feeding purposes came along. Until then usually inbred lines of mice and common rats were bred in sterile laboratories. Today export of rodents for feeding purposes forms 95% of all breeds and every month several millions of rodents are exported from the Czech Republic. Breeders' knowledge were little in the beginning, as there was no literature available. Today breeders know more, but the most important thing – the health status of animals – still evades them. Breeders usually don't do any veterinary checks and don't use common drugs such as helminth control cures. In our work we concentrated on uncovering the main (most often) parasites in selected rodents and sketching the main illnesses and problems in breeds. Observing was done in most often bred rodents: Syrian hamster *Mesocricetus auratus* (Waterhouse, 1839), Dzhungarian hamster *Phodopus sungorus* (Pallas, 1773), Campbell's Russian dwarf hamster *Phodopus campbelli* (Thomas, 1905), Roborovskii's hamster *Phodopus roborovskii* (Saturnin, 1903), White mouse *Mus musculus* ICR and MNRI, White rat *Rattus norvegicus* WISTAR, Multimammate mouse *Mastomys coucha* (Smith, 1834), Mongolian gerbil *Meriones unguiculatus* (Milne-Edwards, 1867) and Degu *Octodon degus* (Molina, 1782).

MATERIAL AND METHODS

Selection of Breeds

Before the monitoring started, 20 bigger breeds from all around the Czech Republic were spoken to. Thirteen of them showed an interest to participate on this prior monitoring by sending samples of excrements or dead animals for dissection. None of these breeders wanted to be named, therefore they are labelled only by letters A-M.

Breeding Facilities

Rodents in all breeds were kept in special plastic containers covered with zinc-coated wire cover with water-basin and feeder. Breeding containers were mostly laid within iron shelves one next to another in several levels. Majority of of breeding containers for different rodent species had size of 280 × 220 × 130 mm, 430 × 280 × 150 mm or 580 × 370 × 200 mm. Water basins were most often made of glass or plastic with aluminium or rustless lid. Fodder was being placed on the top of the containers. Size of feeding granules was in average 13 mm × 15–20 mm. Floors in breeding rooms were made of firm and washable material (pavement, PVC). All species of rodents were kept in groups of 5–40 individuals.

Breeding Method

Majority of breeders used their own methods, more or less different from each other. Methods differed mainly in clean-up frequency and disinfection of breeding containers and breeding rooms. None of the breeding facilities used air filtration, bedding sterilization or autoclaving during cleaning. Venting was done by ventilators.

Gathering of Samples

Samples were taken the way to ensure, that at least four samples a year (quarterly) will be taken from each rodent species in each breed (Table I). Excrements for analysing were chosen randomly either from healthy animals – without any clinical signs of illness or from animals with clinical symptoms of illness. Dead animals were dissected randomly. Apart from microscopic analyzing of excrements and dissections in laboratory, animals were also directly checked in breeding facilities. Mainly following attributes were monitored: sanitary conditions, fodder and technical status of breeding.

Parasites founded were determined after Kassai (1999), Chroust (1998), and Pellérdy (1974).

RESULTS

From October 2003 to March 2008 730 samples were checked. Out of these 649 were excrements examined by flotation and 81 specimen of rodents were dissected. 226 (31%) samples were taken from breeding containers with clinically healthy animals. 504 (69%) from breeding containers with clinically ill animals. Prevalence of parasitoses is shown in Table II.

Illnesses in clinically ill animals were caused mainly by prevalence of oxyurids (80%), tapeworms (45.2%) and coccidians (41,1%). In mice and common rats intestine parasites were often accompanied by coccidians. They were detected together with pinworms in 53% of clinically ill animals and together with tapeworms in 63% of clinically ill animals. Intensity of infection was low to very high.

In apparently healthy animals no ectoparasites were detected. Infestation by other parasites was always of very low intensity.

Annual Dynamic

Occurrence of parasite groups differed in all rodent species of all breeds through the years, especially in genera *Eimeria* and *Cryptosporidium*. While in 2004 coccidians were detected only from March to September, in 2005 they were present during the whole year. Similarly fluctuating results were noted in following years. Ectoparasites were usually detected in October, February and July. Pinworms and tapeworms were present all year round.

Ectoparasites

Samples were analyzed were by excrements examination or dissection. Detected species were Rat mite *Ornithonyssus bacoti* (Hirst, 1913), *Laelaps hilaris* (C. L. Koch, 1836) and Rat ear itch mite *Notoedres muris* (Mégnin, 1877).

Ornithonyssus bacoti was detected on the body grain of common rats only 2×, and in the same breed. Inter-

I: *Rodents´ species and number of samples taken from breeds A–M*

		Breeds													Total number of samples
	Rodent	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	
1	*M. auratus*		18						18	22					58
2	*P. sungorus*	18							21			18			57
3	*P. campbelli*	19										25		18	62
4	*P. roborovskii*	18								18	18				54
5	*M. musculus*	18	18		20	18	22		18	18			19		151
6	*R. norvegicus*	21	24	18				18	18			18		18	135
7	*M. coucha*	18								21			18	20	77
8	*M. unguiculatus*	18							18	18	20				74
9	*O. degus*	21							20				21		62
	Total number of samples	151	60	18	20	18	22	18	113	97	38	61	58	56	730

II: *Comparison of parasitoses prevalence in clinically ill and clinically healthy animals*

	Clinically ill animals		Clinically healthy animals	
	Number of samples	%	Number of samples	%
Total	504	100	226	100
Ektoparasites	**111**	**22**	**-**	**-**
O. bacoti	2	0.4	-	-
L. hilaris	3	0.6	-	-
N. muris	106	21	-	-
Nematods	**403**	**80**	**36**	**15.9**
S. obvelata	320	63.5	26	11.5
A. tetraptera	98	19.4	15	6.6
Tapeworms	**228**	**45.2**	**25**	**11.1**
H. diminuta	176	34.9	18	8.0
H. nana	52	10.3	7	3.1
Protozoans	**207**	**41.1**	**14**	**6.2**
Eimeria spp.	146	29	12	5.3
Cryptosporidium sp.	40	7.9	7	3.1
G. muris	85	16.9	-	-

val between first and second finding was two years. First finding was in May 2004, second in April 2006. After sucking the blood of host females were visible to the naked eye. Mostly the young in the nests and nursing mothers were attacked.

Laelaps hilaris was discovered only in one breed, in species *Phodopus sungorus, P. campbelli* a *P. roborovskii*, which were bred in one room. The breed showed only very little visible signs of infestation – small bites on the body.

Notoedres muris was most often discovered of all ectoparasites. In each species of rodents it caused wound in different parts of their bodies. In mice itch manifested itself by scratched ears and inner aerophone. Very rarely moulting on back occurred. In common rats outgrowth occurred on ears and nose. The rest of rodent species usually had wounds on whole body and was moulted.

Protozoa

Protozoa were detected in excrements of rodents. Detected species were *Giardia muris* (Friend 1966) and coccidians of the genera *Eimeria* and *Cryptosporidium*.

Eimeria spp.

Coccidians were detected in almost all rodents, except Syrian hamster, Dzhungarian hamster, Campbell's Russian dwarf hamster, Roborovskii's hamster and Degu. Total prevalence of all analyses of ill animals was 29%, this of healthy ones 5.3%. In infested breeds dying of the young happened, usually 1–2 days after weaning. When serious infestation occurred in breeds, even adults died. Before death they were bony and apatic with fuzzy fur.

Giardia muris

Giardia muris was discovered only in ill animals, with prevalence 16.9%. It was most often detected in Multimammate mouse *Mastomys coucha*. From the total number of 77 samples 54 were positive, i.e. prevalence 70.2%. Second most heavily infected rodent was Syrian hamster *Mesocricetus auratus*. From the total number of 58 samples 18 were positive, i.e. prevalence 31%. Disease caused flatulency and death in youngsters of the age 10–20 days. The young were stained with urine and bedding was moist. Adults suffered with diarrhoea. *G. muris* was also solely detected in White rat *Rattus norvegicus var. alba* (1/135), i.e. prevalence 0.7%.

Cryptosporidium sp.

Prevalence was only 3.1% in clinical healthy animals and 7.9% in the ill ones, but infected breeds were 100% infected as well as in the case of coccidians of the genus *Eimeria*. Each case of *Cryptosporidium* infection in category of ill animals was serious with fatal progression especially in the young mice and common rat after weaning. Category of clinical healthy animals had no bigger problems.

Tapeworms

Detected tapeworms were of two species – *Hymenolepis diminuta* (Rudolphi, 1819) Weinland, 1858, and *H. nana* (*Vampirolepis nana* (Siebold, 1852) Spasskii, 1954 (= *Hymenolepis nana*). They were founded in 45.2% samples of ill animals and in 11.1% of the healthy ones. From the total number of 228 positive samples in category of ill animals, 176 (77.2%) belonged

to *H. diminuta*. Tapeworms were detected mainly in mice and common rats. They were not found in Multimammate mouse *Mastomys coucha,* Mongolian gerbil *Meriones unguiculatus*, and Degu *Octodon degus.*

Nematoda

Only two species detected were *Syphacia* spp. (Rudolphi, 1802) a *Aspiculuris tetraptera* (Nitzsch, 1821) Schulz, 1924. In samples from ill animals prevalence was 80%, in healthy animals 15.9%. Pinworms were unambiguously the most often present parasites. Also intensity of infection was usually high to very high. They were not detected in samples from Degu *Octodon degus*. Most often infected animals were mice, Dzhungarian hamster and Mongolian gerbil.

DISCUSSION

Mice, common rats and rabbits used in laboratories can be hosts of many viral, bacterial and fungal diseases, although these illnesses don't cause any apparent symptoms. However, presence of parasites in laboratory can be a limiting factor for planned experiments (Pinto et al., 1994). Situation is similar in case of laboratory hamster and another rodents (Higgins et al., 1990; Perec and Okulewicz, 2006). Moreover, many parasitic agens of laboratory rodents have zoonotic potential (Pinto et al., 2001a). In our monitoring we studied the situation in commercial breeds, but as well as in laboratory breeds the success of breed depends on the health status of animals. Parasitic infections, especially subclinical parasitoses, can affect immune system of rodents (Sato et al., 1995; Perec and Okulewicz, 2006). Results of our work confirm – by the discovery of parasites with zoonotic potential – the necessity to observe not only laboratorial but also productional breeds.

Ectoparasites

Pets and domestic animals can suffer from very high number of mites, which cause problems not only to animals but also to their breeders (Beck, 2006). The tropical rat mite (*Ornithonyssus bacoti*) is quite a big ectoparasite living in the nests of rodents. In our study it was found in breed of common rats, where it attacked the young in the nest and nursing female. Beck (2008) states, that this haematophagous mite species may also cause dermatitis in man. This was confirmed in our study, because this mite often attacked breeders. *Laelaps hilaris* looks like red mite. It is smaller but also visible to the naked eye. From the nests of rodents, where it lives, it got on the breeders during manipulation with excrements and bedding. Researches showed that this mite can be carrier of *Francisella tularensis* (Lysý et al., 1979); therefore its presence in breeds is potentially dangerous for breeders.

Notoedres muris was most often detected ectoparasite of rodent breeds in our study. Injuries of hosts were deep and of large-scale. Animals suffered from severe itching, therefore they scratch themselves and nuzzled themselves up things. Sometimes they even bit off their tail or other parts of their bodies. Itch most often occurred in mice, where it started from inner ear. Mice were very restless and ears finally became totally useless. Common rats suffered from rash and impetigo on ears, nose and tail, but on the contrary to mice they did not scratch themselves as much. In the rest of rodents *N. muris* was present on the whole body, mainly on the tail root and back. Animals had big incrustations and bit off their fur. In majority of cases, treatment was done using Neocidol (active component Diazinon). Specimen attacked by higher number of ectoparasites lost their libido and stopped to reproduce. Wounds made by moves and sucking of the mites on the skin were also secondary infected. Breeders always found the infection disturbing and bothering. Most ectoparasites were not imported to breeds by purchase of new rodents, but by breeder, air, bedding and fodder. The mites were often found on people who visited the breeds, but surely didn't touch neither animals nor the accessories in breeds.

Huge numbers of stored product mites, which procreated on badly stored fodder or bedding, occurred in some breeds, especially productional. They did not hurt rodents, but disturbed and bothered them. It was also an unpleasant problem for breeders, considering the smell and economic loss caused by uselessness of contaminated material.

Protozoa

Diseases caused by intestinal protozoa has always been very serious and often deadly, especially in the young stressed by weaning. Infection by coccidians is often very swift. Interval from the first symptoms to death was usually only few hours. Animals were bristled, bony and apathic. In such cases immediate adding of the cure into water was necessary. However, the problem in general is small water consumption. Moreover, rodents are very sensitive to flavored water, they don't like to drink it, and cures for coccidiosis are very bitter. Coccidiostatics were being applied for three days, after it animals were slightly dehydrated. After application of these cures, some of the weakest animals died. During our study it turned out right to give the animals anthelmintics at first. Coccidiostatics destroy whole micro flora and therefore even more weaken already ill animals.

The young left with mothers for longer time died on smaller scale. Species of the genera *Cryptosporidium* belong to zoonotic species (Webster and MacDonald, 1995). Considering the fact, that on big farms wild brown rats are common, the danger of spreading disease is higher.

Protozoa *Giardia muris* was during our study detected mainly in Multimammate mouse (*Mastomys coucha*) and Syrian hamster (*Mesocricetus auratus*). Infected animals suffered from enteric gassiness and flatulency, along with diarrhea and severe urinating. Bedding of these animals was quite wet. The young were not taken care of and were stained by excrements and urine. Usually youngsters between 10–20

days of age were dying. Adults suffered from diarrhea, but survived. *Giardia muris* can also attack other species of rodents, for example mice, where prevalence can be up to 46.2% (Bicalho et al., 2007). DaSilva et al. (2008) carried out a study to evaluate efficiency of several cures for mice attacked by this protozoon. Results of efficacy were 97.05% for metronidazole, 98.30% for fenbendazole and 100% for secnidazole. Apart from cure itself, precaution and hygiene are also important, because bad manipulation with excrements can lead to epidemic (Totková et al., 2004).

Tapeworms and Ascarids (Nematoda)

Tapeworms (*Hymenolepis nana* and *H. diminuta*) and nematods (*Syphacia* spp. and *Aspiculuris tetraptera*) belong to species very commonly found in rodents (Pinto et al., 1994; Goncalves at al., 1998; Pinto et al., 2001a, 2003; Bazzano et al., 2002; Perec and Okulewicz, 2006; Bicalho et al., 2007). During our study it was not very obvious, that animals have these parasites. However, animals were prematurely excluded, they were slowly getting thin and dehydrated. This led to lower lactation of females and dwarfed young. Tapeworm *H. nana* also belong to parasites with zoonotic potential (Epstein and Awakian, 1937). Once again it is necessary to mention the possibility of spreading this parasite through freely living common rats.

Oxyurids (pinworms) were in our study detected mainly in mice, Dzhungarian hamster and Mongolian gerbil. They can also attack other rodents, such as brown rats, where they can also cause an illness (Pinto et al., 2001b). Wightman et al. (1978) states in his study that *Syphacia obvelata* can be transmitted from gerbil to gerbil, gerbil to mouse, and mouse to gerbil. Thus, as it has already been mentioned, hygiene in breed is one of the elemental factors for successful animal breeding. In acute cases, hygiene must be accompanied with suitable cure. Several medicaments are sued for curing small rodents infected with nematods (Katyiar et al., 1987; Huerkamp, 1993; Kozan et al., 2007). Coghlan et al. (1993) presents fenbendazol, as a highly efficacious broad-spectrum anthelmintic with adulticidal, larvicidal, and ovicidal actions and this treatment in combination with environmental control measures against pinworm eggs, is capable of eliminating *S. muris*. Zenner (1998) presents similar way of successful curing of pinworms. Although he used piperazin and ivermectin, he also recommends nowadays very strict sanitary measurements such as a complete cage change, thorough disinfections and cleaning of the rooms associated with the treatment.

It is well known, that gastrointestinal parasites are an important cause of reduced production of meat, milk and wool in domestic livestock. It is generally believed that problems caused by these parasites have increased owing to the intensification of animal husbandry (Kloosterman et al., 1992). With new possibilities given in market animals' production, in our case breeding of small rodents as food, it is necessary to transform this long time known experience to this category of animals. Problems were usually solved by serving pharmaceuticals until nowadays. However, results of several studies proved, that it is always necessary to take wide spectrum of breeding circumstances into account. Nutrition can be god example. Nutritionists have long understood that intestinal nematode parasites have deleterious effects on host nutritional status, but only recently has the importance of malnutrition as a predisposing factor to intestinal nematods been recognized (Koski and Scott, 2001). So it is impossible to insufficiently or inconveniently feed animals, which will be used as food for other animals, as our study also proved. Breed hygiene is also very important. Bicalho et al. (2007) states in his study, that the majority of the animal houses of mice and rats had neither proper physical environment nor protection barriers to prevent the transmission of infections. It is also known, that insufficient hygiene and incapability to interrupt parasites' life cycle can lead to fast spreading of parasites (Totková et al., 2005 a, b). In our study it was found out that especially disinfections of breeding containers was done insufficiently. But this fact was usually discovered afterwards, when trying to reveal the cause of parasitic infection and checking the breeders' work. Other reasons of worsen animals' health or their deaths are inappropriate fodder, overdosing by vitamins and amino acids or improper crossbreeding.

SOUHRN

Parazitocenózy v produkčních chovech hlodavců v České republice

Cílem práce bylo sledování výskytu nejčastějších parazitů u hlodavců ve 13 produkčních a zájmových chovech. Nejčastěji byli zachyceni prvoci rodu *Giardia*, *Eimeria* a *Cryptosporidium*, tasemnice *Hymenolepis nana* (*Vampirolepis nana* (Siebold, 1852) Spasskii, 1954 a *Hymenolepis diminuta* (Rudolphi, 1819) Weinland, 1858, roupi *Syphacia* spp. a *Aspiculuris tetraptera* (Nitzsch, 1821) Schulz, 1924, a dále roztoči čmelíkovec krysí *Ornithonyssus bacoti* (Hirst, 1913), savenka hraboší *Laelaps hilaris* (C. L. Koch, 1836) a *Notoedres muris* (Mégnin, 1877). Celkem bylo od října 2003 do března 2008 vyšetřeno 730 vzorků, z toho 649 vzorků trusu flotací a 81 kusů různých druhů hlodavců bylo propitváno. 226 (31 %) vzorků bylo odebráno z chovných klecí klinicky zdravých zvířat, 504 (69 %) z chovných klecí klinicky nemocných zvířat. U nemocných zvířat bylo onemocnění způsobeno převážně přítomností roupů (80 %), tasemnic (45,2 %) a kokcidií (41,1 %). U myší a potkanů kokcidie často provázely střevní červy – společně s roupy byly kokcidie zachyceny u 53 % klinicky nemocných zvířat a společně s tasemnicemi do-

konce u 63 %. Intenzita infekce byla nízká až velmi vysoká. U klinicky zdravých zvířat nebyli zachyceni žádní ektoparazité. V případě infekce ostatními druhy parazitů byla intenzita infekce ve všech případech velmi nízká. Výskyt jednotlivých skupin parazitů u všech sledovaných druhů hlodavců všech chovů v jednotlivých letech značně kolísal, a to zejména u rodu *Eimeria* a *Cryptosporidium*. Zatímco v roce 2004 byly kokcidie zachycovány pouze od března do září, v roce 2005 byly zachyceny celoročně. Podobně rozkolísané výsledky byly zaznamenány i v dalších letech. Vnější parazité byli nacházeni obvykle v říjnu, únoru a červenci, roupi a tasemnice se vyskytovali celoročně. Nejnebezpečnějšími parazity byly kokcidie rodu *Cryptosporidium*, které způsobovaly vysoké úhyny mláďat zejména bezprostředně po odstavu. Společně s vyhodnocením vzorků byl hodnocen i chov a následně vytvořen plán pro odstranění příčin parazitóz u jednotlivých chovatelů. Kromě nálezu ekto- a endoparazitů bylo totiž zjištěno, že výskyt parazitů není jediným ukazatelem při posouzení kvality chovu. Kromě nevhodného složení a kvality krmiva to byly především špatné hygienické a chovatelské podmínky, způsobující sníženou imunitu zvířat, neplodnost a celkově zhoršený zdravotní stav. Při výskytu helmintů se zvyšoval výskyt především velmi nebezpečných kokcidióz. V chovech, kde v jedné místnosti bylo chováno více druhů hlodavců, neprobíhala parazitární infekce stejně u jednotlivých druhů, a proto bylo chovatelům doporučováno léčit pouze druh s výraznými projevy nemoci a nikoliv druhy všechny, jak byla léčba obvykle prováděna. Dalším jednoznačným doporučením všem chovatelům bylo preventivní zjišťování parazitů na odborných pracovištích tak, aby případná léčba či jiný zásah mohly být provedeny včas a nikoliv až po propuknutí nákazy. Při zjištění vysokého napadení se ukázalo jako nejvhodnější řešení provést likvidaci celého chovu. V ČR je vysoké procento zamořených chovů parazity a malá zkušenost s bojem proti těmto nemocem. Výsledkem jsou slabé a nekvalitní odchovy, zejména myší a potkanů. Důležitou ochranou je tedy nákup zvířat ze známých a prověřených chovů, nejevících žádné známky onemocnění a preventivně vyšetřených na parazity. V naší republice jsou desítky chovů a miliony zvířat, která jsou exportována do států Evropské unie. Z hlodavců určených na krmení se postupně stává významná exportní komodita, která může chovatelům při dodržení optimálních podmínek chovu, a tedy vysokému počtu odchovaných kvalitních zvířat, přinést výrazné ekonomické zisky. Nedílnou součástí kvalitních chovů je také dodržování potřebných hygienických norem s ohledem na zoonotický potenciál některých parazitů hlodavců.

hlodavec, parazitocenóza, produkční chov

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