PARASITOCENOSES IN PRODUCTIONAL RODENT BREEDS IN CZECH REPUBLIC

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Abstract


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 tetragona 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 parasitic 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 helmint 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), Dzungarian 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 natalensis (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 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 hila ris* (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-

<table>
<thead>
<tr>
<th>Rodent</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>Total number of samples</th>
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</thead>
<tbody>
<tr>
<td>1 <em>M. auratus</em></td>
<td>18</td>
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<td>58</td>
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<td>3 <em>P. campbelli</em></td>
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<tr>
<td>4 <em>P. roborovskii</em></td>
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<tr>
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<td>20</td>
<td>18</td>
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<td>18</td>
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<tr>
<td>7 <em>M. coucha</em></td>
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<td>77</td>
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<tr>
<td>8 <em>M. unguiculatus</em></td>
<td>18</td>
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<td>74</td>
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<tr>
<td>9 <em>O. degus</em></td>
<td>21</td>
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<td>Total number of samples</td>
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<td>60</td>
<td>18</td>
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<td>18</td>
<td>113</td>
<td>97</td>
<td>38</td>
<td>61</td>
<td>58</td>
<td>56</td>
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</table>
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 aero- phone. 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 moulting.

**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, Dzungarian 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* (*Vamiprolepis nana* (Siebold, 1852) Spasskii, 1954 (=*Hymenolepis nana*). They were found 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

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

<table>
<thead>
<tr>
<th></th>
<th>Clinically ill animals</th>
<th>Clinically healthy animals</th>
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<tbody>
<tr>
<td></td>
<td>Number of samples</td>
<td>%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>504</td>
<td>100</td>
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<tr>
<td><strong>Ektoparasites</strong></td>
<td></td>
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</tr>
<tr>
<td><em>O. bacoti</em></td>
<td>2</td>
<td>0.4</td>
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<tr>
<td><em>L. hilaris</em></td>
<td>3</td>
<td>0.6</td>
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<tr>
<td><em>N. muris</em></td>
<td>106</td>
<td>21</td>
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<tr>
<td><strong>Nematods</strong></td>
<td>403</td>
<td>80</td>
</tr>
<tr>
<td><em>S. obelata</em></td>
<td>320</td>
<td>63.5</td>
</tr>
<tr>
<td><em>A. tetraptera</em></td>
<td>98</td>
<td>19.4</td>
</tr>
<tr>
<td><strong>Tapeworms</strong></td>
<td>228</td>
<td>45.2</td>
</tr>
<tr>
<td><em>H. diminuta</em></td>
<td>176</td>
<td>34.9</td>
</tr>
<tr>
<td><em>H. nana</em></td>
<td>52</td>
<td>10.3</td>
</tr>
<tr>
<td><strong>Protozoans</strong></td>
<td>207</td>
<td>41.1</td>
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<tr>
<td><em>Eimeria</em> spp.</td>
<td>146</td>
<td>29</td>
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<tr>
<td><em>Cryptosporidium</em> sp.</td>
<td>40</td>
<td>7.9</td>
</tr>
<tr>
<td><em>G. muris</em></td>
<td>85</td>
<td>16.9</td>
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</table>
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) and *Thelazia callipaeda* (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, Dzungarian 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 agents 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., 1993; 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 nursed. Infection by coccidiosis are very bitter. Coccidiostatics were being applied for three days, after it animals were 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. 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.

**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 smell and economic loss caused by uselessness of contaminated material.
days of age were dying. Adults suffered from diarrhoea, but survived. *Giardia murs* 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 (Toktová 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 et 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 medications 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 ovi- cidal 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 (Toktová 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

Čílem práce bylo sledování výskytu nejčastějších parazitů u hlodavců ve 13 produkčních a zájmových chovech. Nejčastěji byli zachyceni prvoci rodu *Gliateria*, *Eimeria a Cryptosporidium*, tasemnice *Hymenolepis nana* (*Vampirodeles nana* Siebold, 1852) Spasskii, 1934 a *Hymenolepis diminuta* (Rudolph, 1819) Weiland, 1858, roupi *Syphacia* spp. a *Aspiculuris tetraptera* (*Nitzsch, 1821*) Schulz, 1924, a dále roztočitý čmelíkovec krysí *Ornithonyssus bacoti* (Hirst, 1913), savenka hraboší (*Hesperum tunica*) (C. L. Koch, 1836) a *Notodactis 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 (41,3 %). U myší a potkanů kokeidí často provázely střevní červy – společně s roupy byly kokeidí zachyceny u 53 % klinicky nemocných zvířat a společně s tasemnicemi do-

In confection of a concomitant schistosome infection. In *Mus musculus* naturally infected. *Veterinary Protozoology*.


