

ECTO- AND ENDOPARASITES IN REMAINING POPULATION OF WILD RABBIT *ORYCTOLAGUS* *CUNICULUS* (L., 1758) IN EAST BOHEMIA

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Received: January 21, 2005

Abstract

BÁDR, V., BORKOVCOVÁ, M.: *Ecto- and endoparasites in remaining population of wild rabbit *Oryctolagus cuniculus* (L., 1758) in east Bohemia*. Acta univ. agric. et silvic. Mendel. Brun., 2005, LIII, No. 4, pp. 7-14

An investigation of ecto- and endoparasites of wild rabbit *Oryctolagus cuniculus* (L., 1758) was made during February and March 2004. Together five species of ectoparasites and seven species of endoparasites was found in five specimens of host. Ectoparasites: acarids *Leporacarus gibbus* (Pagenstecher, 1862), *Psoroptes cuniculi* (Delafond, 1859), and *Cheyletiella parasitivorax* (Mégnin, 1878), flea *Spilopsyllus cuniculi* (Dale, 1878), and louse *Haemodipsus ventricosus* (Denny, 1842). Except of petechial haemorrhagies inside both earlobes of one rabbit neither hyperkeratosis nor scale with any degrees of hairlessness were detected. Higher incidence of flea *Spilopsyllus cuniculi* could be important for spreading of myxomatosis. In one rabbit abnormal damage of incisivi was found, which caused the highest documented incidence of acarids *Cheyletiella parasitivorax* (485 ex.), fleas *Spilopsyllus cuniculi* (65 ex.), and especially enormous amount of louse *Haemodipsus ventricosus* (1840 ex). This finding establish close relation between prevalence and counts of ectoparasites with health of host, because population of ectoparasites from different taxonomic groups are principally affected by effective host's cleanup. Handicapped hosts are not able to make clarify as effective as the healthy ones. Endoparasites: tapeworm *Taenia pisiformis* (Bloch, 1780) – larvae, nematods *Passalurus ambiguus* (Rudolphi, 1819) Rudolphi, 1845; *Graphidium strigosum* (Dujardin, 1845) Railliet and Henry, 1909, *Trichostrongylus retortaeformis* (Zeder, 1800) Loos, 1905 and protozoa *Eimeria piriformis* Kotlan & Pospesch, 1934; *E. media* Kessel, 1929, and *E. perforans* (Leuckart, 1879) Sluiter & Swellengrebel, 1912. All endoparasites were found in very low or middle intensity, which does not seem to be main cause of decreasing number of wild rabbits in monitored areas.

ectoparasites, endoparasites, wild rabbit, *Oryctolagus cuniculus*

Wild rabbit populations in the Czech Republic dropped in so far that this game animal is hunted only exceptionally in the last five years, not in excess of 500 ex. yearly.

The number and spreading of rabbits are influenced by more factors, one of decisive is their health status. Although myxomatosis is generally principal disease of this mammal in this country, parasitoses are of great importance. Ectoparasites in rabbits have not

been globally studied, although they are important vectors of viral and bacterial infections even among stationary ectoparasites. Kotrlá et al. (1984) named only species spectrum that can be taken into account in the host.

In different level attention was payed to endoparasites as well. In the Czech Republic the only study of helminths was made by Tenora and Baruš (1957). Páv et al. (1981), and Kotrlá et al. (1984) presented

overview of species and prevalences of helminths and coccidia. In this paper the species spectrum of ecto- and endoparasites of wild rabbit (*Oryctolagus cuniculus*) in residual population in North Bohemia (Czech Republic) is discussed and analysed.

MATERIAL AND METHODS

This study was performed in the short time period between February and March 2004, the exceptional hunt was made with permission of the Town Council in Hradec Králové.

Two remaining populations of wild rabbits were found in the region of the town Hradec Králové. The first population was documented in the centre of the town in „Šimek gardens“. This population has been reducing yearly, there were only eight rabbits in 2002, three rabbits in 2003 and the last rabbit was hunted down in 2004. The second population of rabbits lives in large grounds of the firm ČKD-Motors at periphery of the town Hradec Králové. Out of the whole number of about 200 rabbits in 1990 only 30 individuals were assessed in 2004. Four rabbits from this population were hunted down.

All five wild rabbits were examined for ecto- and endoparasites – 2♂ (weight 1.84 and 1.63 kilo) and 3♀ (1.65; 1.59 and 1.59 kilo).

Examination for ectoparasites

The hunted rabbit was immediately put into PVC bag and laboratory examined within one hour. Initially, each animal was examined visually for skin defects, especially on head. Then the fleas were collected with tweezers – mostly from earlobes, exceptionally were found free in the bag. The rabbit body was repeatedly examined and fleas and lice were sampled by means of tweezers. Then followed proper examination of pinnae and the material was sampled by a swab wetted in clinical gasoline. In order to gain quantitative collection of acariforme mites from both genera *Cheyletiella* and *Leporacarus*, examined rabbit was put back into a sack from PVC with several swabs deeply wetted in diethylether. All arthropods were narcotised for up to 15 minutes; then the rabbit was taken out, repeatedly beaten and combed out above white stiff paper about the size of 1 m². All this gained material was pour down into Petri dishes. Narcotised mites, lice and sporadically also fleas were picked out by the pair of tweezers under stereomicroscope Olympus SZ 60, at a magnification of 10 to 30x.

The ectoparasites were put in 70% ethanol. After one hour of the end of first narcosis, the procedure

with diethylether was repeated and once again after following hour. The assay of narcosis comes from modification of procedure of bird louse sampling (Zlotorzyska, 1972).

The main principle of this method consists in mites and lice that are not stick to the coat and skin of a host during narcosis. Following handling makes it possible to collect the arthropods from the host hair. To gain better results of this method, another two fold repeated procedure is carried out because the mites that were not eliminated, slowly move among hair during one hour, and after the next narcosis they are planished and/or combed out. In the end, the rabbits were hidden and the skin was supervised from inside against light; small dark points indicated heads of sticking louses – method by Broekhuizen (1971).

Collected ectoparasites were processed sequentially: mites and lice without any blood in digestive tract were assembled directly into Liquido de Swane, fleas and lice with visible contents of blood in digestive tract were cleared by O'Mahony method (10% KOH, glacial acetic acid, fenolxylen, xylen) (Rosický, 1957). Smear on the swab from rabbit earlobes was viewed in a dark-field of stereo-microscope Olympus SZ 60 at a magnification of 10 to 50x. The swabs were then mechanically loosened and washed in 70% ethanol through riddle with the mesh size of 1.5mm; the filtrate again was observed in the dark-field of stereomicroscope.

Examination for endoparasites

Digestive tract, lungs and liver were examined for endoparasites, using the methods of Kassai (1999). Helminths founded were fixed in 50% alcohol and later identified following the methods of Tenora and Baruš (1957), and Kassai (1999). Biopsy from gut wall was made to find coccidia. Identification of the *Eimeria* species was made using the methods of Pellérdy (1974), and Chroust et al. (1998).

RESULTS

No changes were seen in any rabbits during external examination that would signalise acute course of skin disease. Small petechial haemorrhagies were observed inside both earlobes in one individual that is presented below as the No. 2. Neither hyperkeratosis nor scale with any degrees of hairlessness were detected. No external manifestation of endoparasitoses were stated. Overview of ectoparasites and endoparasites is in Table I, and Table II, respectively.

I: Ectoparasites

No.	Locality	Sex	Date	<i>Leporacarus gibbus</i>	<i>Cheyletiella parasitivorax</i>	<i>Spilopsyllus cuniculi</i>			<i>Haemodipsus ventricosus</i>			
				without discrimination	without discrimination	♂	♀	Σ	♂	♀	juv.	Σ
1.	HK - Šimek gardens	♂	26.02.04	2	1	-	-	-	6	9	9	24
2.	HK - ČKD Motory areal*	♂	28.02.04	63	485	29	36	65	266	533	1041	1840
3.	HK - ČKD Motory areal	♀	29.02.04	7	-	28	21	49	0	0	2	2
4.	HK - ČKD Motory areal**	♀	29.02.04	401	1	7	32	39	5	9	22	36
5.	HK - ČKD Motory areal	♀	01.03.04	91	-	24	20	44	-	-	-	-
Total				564	487			197				1902

* 6 astigmatic mites and 1 biting louse were founded in addition, both demonstrably from some songbird

** founded 1 ♂ of *Psoroptes cuniculi*

II: Endoparasites

No.	Locality	Sex	Date	<i>Taenia pisiformis</i> larvae	<i>Passalurus ambiguus</i>	<i>Graphidium strigosum</i>	<i>Trichostrongylus retortaeformis</i>	<i>Eimeria piriformis</i>	<i>Eimeria media</i>	<i>Eimeria perforans</i>
1.	HK - Šimek gardens	♂	26.02.04	-	-	-	-	*	*	-
2.	HK - ČKD Motory areal	♂	28.02.04	-	61	128	-	*	**	*
3.	HK - ČKD Motory areal	♀	29.02.04	5	32	2	-	*	*	-
4.	HK - ČKD Motory areal	♀	29.02.04	2	59	-	-	*	**	-
5.	HK - ČKD Motory areal	♀	01.03.04	-	24	-	42	-	*	*
Total				7	176	130	42			

A) Ectoparasites:

1. Acarina

Leporacarus gibbus (Pagenstecher, 1862)*Cheyletiella parasitivorax* (Mégnin, 1878)*Psoroptes cuniculi* (Delafond, 1859)

We have found only one specimen (♂) of the mites from genus *Psoroptes* that morphologically coincides with *Psoroptes cuniculi*. But the feature consists in that this mite was gained during narcotise method and all examination of earlobes was negative.

We have not observed mites from the genuses *Sarcoptes*, *Notoedres*, *Chorioptes* and *Demodex*. Ticks from the genus *Ixodes* have not been observed in any examined animal which coincides with the season of performed study.

2. Siphonaptera

Spilopsyllus cuniculi (Dale, 1878)

3. Anoplura

Haemodipsus ventricosus (Denny, 1842)B) Endoparasites:

1. Cestoidea

Taenia pisiformis (Bloch, 1780)

Spherical to slightly subspherical larvocysts localised on large intestine measured 6x3–6 mm.

2. Nematoda

Passalurus ambiguus (Rudolphi, 1819) Rudolphi, 1845

These frequent, 3–11 mm long nematods parasite in large intestine and caecum. In our study was found in caecum of 4 rabbits from ČKD – firm areal.

Graphidium strigosum (Dujardin, 1845) Railliet & Henry, 1909

Nematoda were found both free in stomach content and adherent in the wall of stomach. There were small petechie in the places of adherent.

Trichostrongylus retortaeformis (Zeder, 1800) Loos, 1905

3. Coccidia

Eimeria piriformis Kotlan & Pospesch, 1934*Eimeria media* Kessel, 1929*Eimeria perforans* (Leuckart, 1879) Sluiter & Swelengrebel, 1912

Mucosa in the place of parasitation were modified, but the changes did not signalise marked disadvantage of hosts health.

DISCUSSION

Mite *Leporacarus gibbus* is a specific parasite of wild rabbit and brown hare. In this country it was

firstly described by Král (1943) as a very extended and numerous ectoparasite in rabbit coat. From this host was also sampled by Zapletal (1960). Dusbábek and Beron (1975) took this information and joined another locality. Kadulski and Dobryńczuk (1976) and Dubinina (1983) make a mention of skin preference on the back next to tail basis and body flanks of both wild rabbit and brown hare.

Mite *Leporacarus gibbus* can cause listroforosis (leporacarosis). The course of this disease described Zavadil (1962) in brown hare. Population characteristics of the mite *Leporacarus gibbus* in brown hare was studied by Wasylík (1965) in Poland. In comparison with this work, our narcotise assay was unambiguously more effective. Rate of infestation of wild rabbits was documented by various authors in the laboratory and natural conditions. Enormous number of mites was often found in the lab – even 100 u./cm² per skin (Deoras and Patel, 1960). Shepherd and Edmonds (1977) located the mite *L. gibbus* firstly on the skin of 50-day-old rabbits at maximal number of 83 and in half-year rabbits 4.248 mites in wild population of rabbit in Australia. In the literature, *Psoroptes cuniculi* is known as *Psoroptes equi* var. *cuniculi*. Validity of the species *Psoroptes cuniculi* has already been corroborated by Sweatman (1958). This species is known as a parasite of domestic rabbits in the Czech Republic. Vaněk and Nováková (1959) described pathological findings of the genus *Psoroptes* in wild mammals – brown hares; they also observed some morphological differences from *Psoroptes cuniculi* (and called it *Psoroptes equi* var. *cuniculi*) and the hare's mite named *Psoroptes equi* var. *leporis*.

Skin defects – petechial haemorrhages – were found in one rabbit earlobes (No. 2) only. This rabbit was attacked by the highest number of the mites *Cheyletiella parasitivorax* that could to cause mentioned damage. In the treatises devoted to game diseases (Kotrlá et al., 1984; Páv et al., 1981), there is mentioned false notion – harmlessness of mite for a host, respectively his benefit by hunting the species *Leporacarus gibbus*. Mykityowycz (1957) and Taylor (1969) have documented that both species feed on skin excretion and skin scales. Active biting of host skin and suckling of skin cells, lymph and tissue humour described Dusbábek (1980). Direct infestation in domestic rabbits was documented in the work of Clark and Hyong-Sun (1976).

At the same time, the rabbit No. 2 was infected with the highest number of fleas *Spilopsyllus cuniculi* that are also typical of sucking on the earlobes. This flea is a specific for rabbits with its narrow binding of development on a climate of rabbit burrow. This parasite does not appear in domestic rabbits, due to quite different route of rearing. The rabbit flea *Spilopsyllus cuniculi* is the only member of aphanipterium (syn.

siphonapterium) of wild rabbit (Rosický 1950, 1957). The first locality was documented by Grulich (1949) in this country with the rate of infestation up to 40 ectoparasites per a host. Grulich (1949) and Rosický (1957) described veterinary meanings of this flea species in the transmission of myxomatosis, infections caused by staphylococcus, pasteurelloses and trypanosomoses. The specific sites for flea bittings are earlobes. The rate of gender of collected fleas should be by Grulich (1949) markedly inclined in favour of females; male: female about 1 : 2. The flea species is known throughout Europe. The rabbit flea is considered to be the main vector of myxomatosis in Great Britain.

The mites were not found in the swabs and the next scrapings from haemorrhagic loci which does not rule out their contribution on the occurrence of pathological changes, but indicates that these haemorrhagies were more probably caused by flea bittings. The fleas were sampled on all animals mostly on the earlobes.

Early quantitative fleas collection made possible to assign the structure of population of adults with the ratio male : female – 1 : 1.2. The distinction of number of individuals between both gender is not so emphatic as Grulich (1949) wrote. There are two explanations of this: a) representation of both gender of fleas in the hosts very varied; b) Grulich did not define if he sampled the fleas short time after host death as we did because there is generally known (Rosický, 1957) that flea male leave the dead host earlier than females – they react more sensitively on temperature decreasing. Consequently higher ratio of females can be found in the collection. Elimination of the mites as the cause of skin defects supports also negative findings of hyperkeratosis changes of the skin nor small crusts or less haired locuses on the host body. Attack of several hundreds of *Cheyletiella parasitivorax* mites did not evidently present higher stress for a host. But quite other situation was in louse *Haemodipsus ventricosus*. This species is specific parasite of wild rabbit. It should belong to the rare parasites by Kotrlá et al. (1984), but with its host has been spread worldwide. To the predilection sites of parasite belong rabbit flanks and teats with fine coat. Smetana (1965) also mentioned its cosmopolitan distribution even in domestic rabbits. He sampled this species from rabbits at only one locality in Moravia (Lednice). Černý (1977) knew no information in his checklist on this parasite from Bohemia. Francis and Lake (1921) confirmed the transmission of tularaemia of lice *Haemodipsus ventricosus* among rabbits. Correct comparison of transmission possibilities

by means of vectors from the species Ixodida and Anoplura was published before (Bádr, 2002).

This species was found in four out of five rabbits; one rabbit had two juvenile stadium of the parasite only. Extent of infestation in two rabbits was moderately heavy (10–50 lice) as stated Broekhuizen (1971) in brown hares by attack of louse *Haemodipsus setoni*. By far there is no exacerbation of host health status caused by lice infestation and their direct blood sucking.

Broekhuizen (1971) proved narrow relationship between the number of ectoparasites and the occurrence of other pathogens including the endoparasites of various taxonomic groups in the same animal. Murray (1961) has already formed laws of the correlation on the base of intensity comparison of the louse *Polypylax serrata* infestation and its host – mouse *Mus musculus* behaviour. The main findings consisted in ectoparasites abundance that is mostly influenced by time that the host spend by effective cleaning of the own body. This time is detectable lower in diseased individuals. We also found higher intensity of infestation in somatically affected individuals who could not actively influent the fauna of their ectoparasites. Enormous occurrence of the louse *Haemodipsus ventricosus* (in total 1840 pieces!) was detected in the rabbit No. 2. The structure of population – 56.5% of juvenile forms – does not only prove intensive breeding of this louse in winter, which also supports presentation of juvenile forms in others, lice positive individuals.

The intensity invasion of lice *H. ventricosus* coincides with the findings of Murray (1961) and with already cited Broekhuizen (1971) but in the world literature was absolutely exceptional and in wild rabbits never documented in such number. Abnormal state of the teeth was found in the rabbit No. 2 (Fig. 1); from the central incisors in the upper jaw remained only radices in the jaw-bone, both incisors were snapped and crest of edges indicated injury that happened long time ago. On the contrary, incisors in the lower jaw were overgrowth to the elephant teeth. These defects were not only the cause of lower feed income, but also eliminated body cleaning. Similar case was documented in the brown hare by Broekhuizen (1971), when examined one hare knocked down by traffic with overgrowth left upper incisor. The hare was middle heavily infected according to the number of infestation by the lice *H. setoni* (10–50 ectoparasites) but completely healthy. Alike, high link of ectoparasites occurrence on the health status is repeatedly cited in the other groups of ectoparasites – e.g. in biting louse (Mallophaga).



1: Abnormal state of the teeth in the rabbit No. 2

Endoparasites were found in lower number of species when compared with study Tenora and Baruš (1957). All parasites founded had low intensity that, according to the same authors, is not stressed for its host too much. Adults of *Taenia pisiformis* attack Canidae, Felidae, and Mustelidae species. Parasitised carnivora moving around the rabbits burrow are sources of infections for rabbits, because they distribute proglottids with eggs. When larvocysts are present in a great number, they could be the reason of weakening and death of rabbits (Tenora and Baruš, 1957). Tenora and Baruš (1957) described prevalence 47.5%, average number of larvocyst in one rabbit 10–16 individuals and maximal number 42 individuals in one host. This larval stage of taenia found Foronda et al. (2003), and Haupt and Hartung (1984), as well with prevalence from 8.7% to 30.4% and 8.19%, respectively.

Passalurus ambiguus is a parasite of rabbits and hare. After Skrjabin (1949: in Tenora and Baruš,

1957) total amount of only 500 individuals in one host has harmful effects. Tenora and Baruš (1957) found 2.100 individuals, Haupt and Hartung (1984) even 17.400 in one host. Prevalence and intensity of *Graphidium strigosum* in our study correspond with results Evans (1940), who found low prevalence and intensity of invasion in autumn and winter months as well. *Trichostrongylus retortaeformis* is regularly found in recent and former studies (Tenora a Baruš, 1957; Haupt and Hartung 1984; Foronda et al., 2003, and others) and is regularly distributed (Foronda et al., 2003). Coccidiosis is usually associated with mortality of rabbits, especially of young ones. In our study we had only adult specimens, of which the mortality is caused *E. perforans* and *E. stiedai* (Hobbs et al., 1999). We detected only *E. perforans* and in very low number of oocysts, which could be due to seasonal examination.

SOUHRN

Ekto- a endoparazité u zbytkové populace králíka divokého *Oryctolagus cuniculus* (L., 1758) ve východních Čechách

Komplexním parazitologickým vyšetřením pěti králíků bylo nalezeno pět druhů ektoparazitů: roztoči *Leporacarus gibbus*, *Psoroptes cuniculi* a *Cheyletiella parasitivorax*, blecha *Spilopsyllus cuniculi* a veš *Haemodipsus ventricosus*. Vyjma petechiálních krvácenin v ušních boltcích jednoho králíka nebylo

shledáno žádných kožních onemocnění. Pro šíření virového onemocnění myxomatózy může mít velký význam vyšší výskyt blechy *Spilopsyllus cuniculi*. U jednoho králíka bylo zjištěno abnormální poškození chrupu, jež se stalo příčinou nejvyššího zaznamenaného výskytu roztočů *Cheyletiella parasitivorax* (485 ks), blech *Spilopsyllus cuniculi* (65 ks) a zejména enormního množství vši druhu *Haemodipsus ventricosus* (1840 ks). Nález dokládá úzký vztah výskytu a intenzity invaze ektoparazitů se zdravotním stavem hostitele, neboť populace ektoparazitů různých taxonomických skupin jsou zásadním způsobem ovlivňovány efektivní očistou těla ze strany hostitele. Postižení jedinci nejsou schopni provádět očistu ve stejné míře jako jedinci zdraví.

Dále bylo nalezeno sedm druhů endoparazitů: tasemnice *Taenia pisiformis* – larvocysty, hlístice *Passalurus ambiguus*, *Graphidium strigosum*, *Trichostrongylus retortaeformis* a prvoci *Eimeria piriformis*, *Eimeria media*, *Eimeria perforans*. Endoparazité byli zjištěni s nízkou nebo střední intenzitou, jež se nejeví být hlavní příčinou úbytku králíků ve sledovaných lokalitách.

ektoparazité, endoparazité, králík divoký, *Oryctolagus cuniculus*

ACKNOWLEDGEMENT

We would like to thank above all to the Department of Environment of the Town Council in Hradec Králové for conferment of exception for hunting of wild rabbits both on non-hunting lands and beyond statutory period. We also would like to thank for help to Ing. Trpák and Mr. Dolanský from neighbour hunting districts.

This work was supported by grant of MSM AF MZLU No. 4321 00001.

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