

Prevalence and seasonal variation in ticks on *Muscardinus avellanarius* from Germany (Rodentia: Gliridae)

Prevalence a sezonní proměnlivost klíšťat na plšíku lískovém (*Muscardinus avellanarius*) v Německu (Rodentia: Gliridae)

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Abstract. We sampled ticks infesting hazel dormice (*Muscardinus avellanarius*) between May 2017 and September 2017 at seven locations in Germany. Of a total of 221 dormice examined, 19% were infested by ticks, but the prevalence of infestation varied strongly between sites and months. The highest prevalence at one site was noted in September (55%) while the lowest was in July (0%). In June, prevalence differed between sites from 0% to 47%. Most frequently, dormice were infested by one tick. The maximum number of ticks found on one animal was 12. All ticks were detected on the head of the animals, where the most common feeding sites were ears, nose and the area around the eyes.

Key words. Hazel dormouse, ectoparasites, *Ixodes ricinus*, parasites, mammal host.

INTRODUCTION

Parasites live in or on hosts from which they derive resources for their own growth, survival and reproduction (PRICE 1980). Although restricted to the host's first line of defence against environmental conditions (the integument, away from vital organs), ectoparasites can have a pronounced impact on their host's fitness (LEHMANN 1993). They can for example increase the metabolic rate (KHOKHLOVA et al. 2006), slow the rate of growth (VAN VUREN 1996), decrease litter size (NEUHAUS 2003), enhance morbidity (PFÄFFLE et al. 2009) and reduce survival (LEHMANN 1992, VAN VUREN 1996) of their mammalian hosts.

Ectoparasite infestation is not only relevant for the host itself. In some cases, hosts can play a significant role in enzootic cycles of ectoparasite-borne pathogens. For example, small rodents serve as important reservoir hosts for the spirochaetes that cause tick-borne Lyme disease. In Central Europe, hazel dormice (*Muscardinus avellanarius*), garden dormice (*Eliomys quercinus*) and edible dormice (*Glis glis*) seem to support this pathogen more efficiently than do mice or

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Table 1. Numbers of hazel dormice examined for ticks at different sites and during different months
 Tab. 1. Počty plšíků lískových vyšetřených na přítomnost klíšťat na různých lokalitách a v různých obdobích roku

site number / číslo lokality	site name / lokalita	federal state / spolková země	number of dormice examined / počet vyšetřených plšíků	month/s / měsíc/e
1	Highway A44	Hesse / Hesensko	175	V–IX
2	Affoldern	Hesse / Hesensko	5	VI
3	Braunau	Hesse / Hesensko	5	VI
4	Graburg	Hesse / Hesensko	17	VI
5	Hainleite	Thuringia / Duryňsko	5	VI
6	Rhön	Thuringia / Duryňsko	9	VI
7	Spitzberg	Saxony / Sasko	5	VI

voles (RICHTER & MATUSCHKA 2012). Reservoir competence and the number of ticks feeding on a host are crucial variables determining the prevalence of infection in the rodent and tick populations.

As part of a long-term study on tick infestation of hazel dormice, we investigated the prevalence of tick infestation at different sites and in one site during the whole season of activity of these dormice. We also recorded the most common feeding sites for ticks on the dormouse body.

MATERIAL AND METHODS

We sampled ticks infesting hazel dormice between May and September 2017 at seven different locations in Germany (Table 1). Dormice were examined in the course of checking nest boxes and nest tubes for regular monitoring projects (BÜCHNER et al. 2010) and during mitigation measures (LANG et al. 2018). Six sites were sampled only in June, whereas site 1 at highway A44 was sampled every two weeks. Every dormouse encountered was weighed, aged and sexed, except for juveniles <10 g, and carefully examined for ticks. Numbers of ticks found may be underestimated because larval ticks during their early feeding may have gone undetected. Even though larval and nymphal ticks can easily be distinguished by the number of legs, developmental stages were not determined in order to minimise handling time of the dormice. Whenever possible, ticks were carefully removed and stored for further examination.

RESULTS

A total of 221 hazel dormice were examined and 125 ticks were found on 41 of them. The overall prevalence of tick infestation in hazel dormice was 19%, varying strongly between sites and months (Figs. 1 and 2). In June, their occurrence differed between sites from 0% to 47% (Fig. 1). At the site where nest boxes and nest tubes were checked every two weeks (site 1 in Table 1), the highest occurrence (55%) was reported in September while the lowest (0%) was found in July (Fig. 2). Most frequently, dormice were infested by one tick (Fig. 3). The maximum number of ticks found on one animal was 12. All ticks detected were feeding on the head of the animal. The most common feeding sites were ears, nose and the area around the eyes (Fig. 4). First examination of the ticks collected revealed that the majority were *Ixodes ricinus*. Other tick species have not yet been determined to species level.

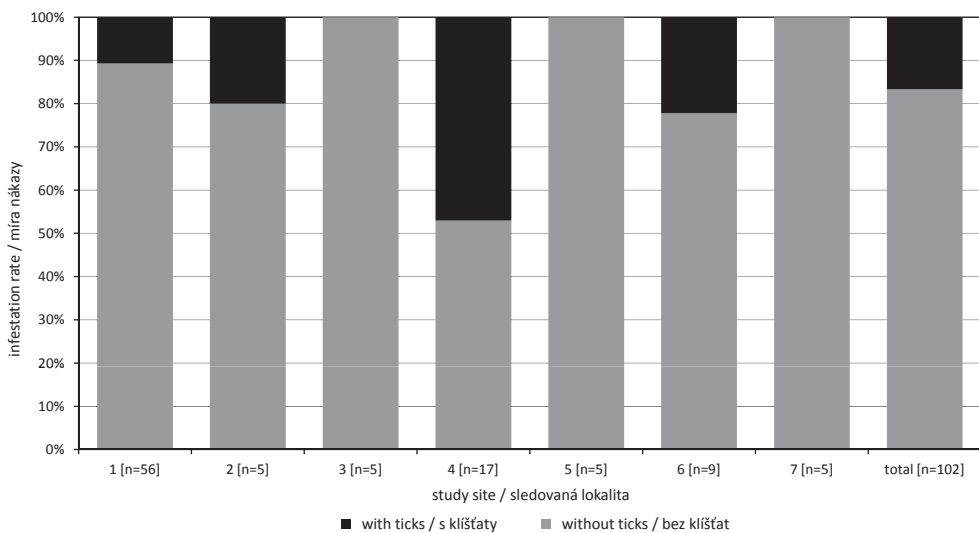


Fig. 1. Prevalence of infestation of hazel dormice with ticks in June 2017 at seven sites in Germany.
 Obr. 1. Prevalence nákazy plšíků lískových klíšťaty v červnu 2017 na sedmi lokalitách v Německu.

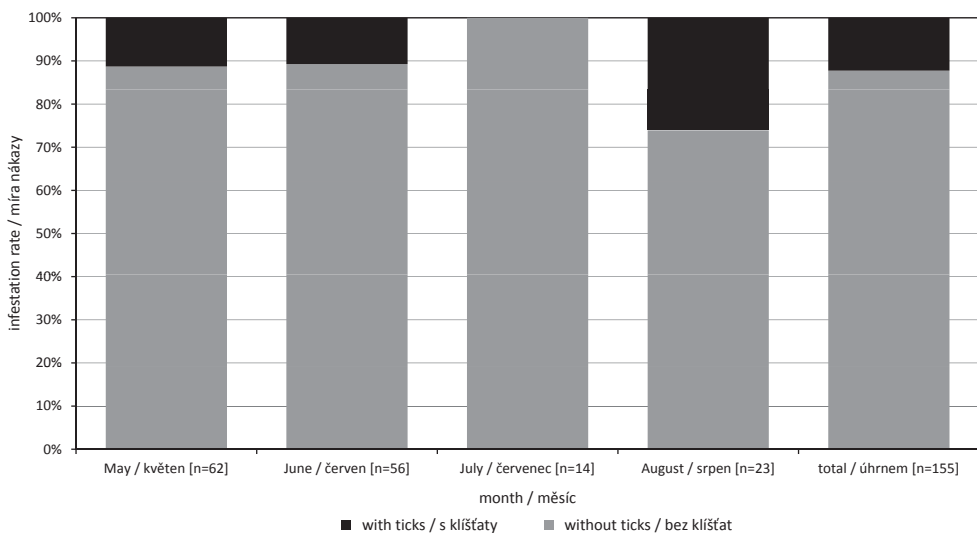


Fig. 2. Monthly prevalence of infestation of hazel dormice with ticks between May and September 2017 at site 1 at highway A 44 (the federal state of Hesse, Germany).
 Obr. 2. Měsíční prevalence nákazy plšíků lískových klíšťaty mezi květnem a zářím 2017 na lokalitě 1 u dálnice A44 (spolková země Hesensko, Německo).

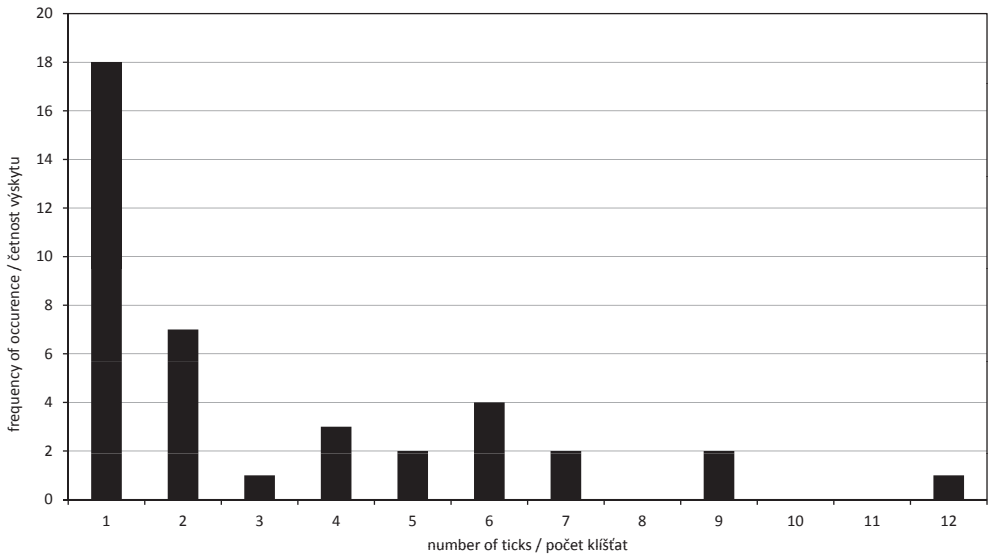


Fig. 3. Frequency of tick numbers on tick-infested hazel dormice in Germany.
 Obr. 3. Početnost klíšťat na klíšťaty nakažených plšících lískových v Německu.

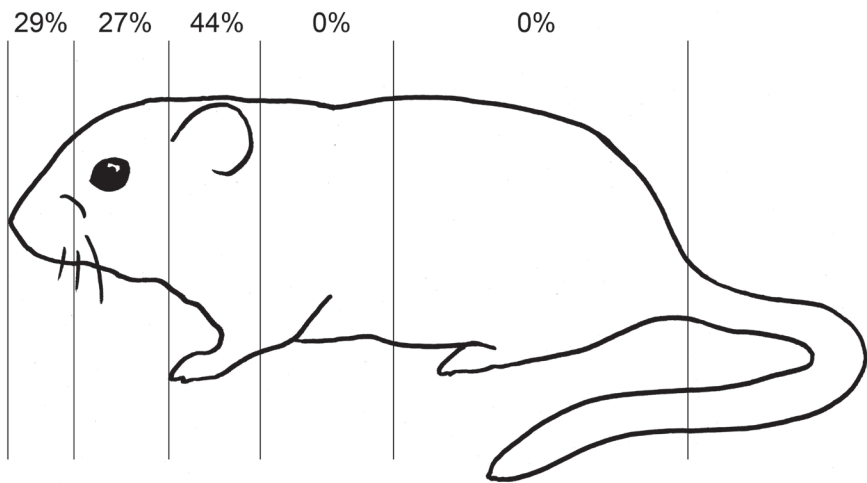


Fig. 4. Relative abundance of ticks feeding at specific sites on the hazel dormouse body.
 Obr. 4. Relativní hojnost klíšťat sajících na určitých místech těla plšíka lískového.

DISCUSSION

Data on ectoparasites of the hazel dormouse are comparatively scarce but it is well known that they carry, at least occasionally, fleas, mites and ticks (JUŠKAITIS & BÜCHNER 2013). Ticks have been found frequently on hazel dormice from Belgium, France, Germany and Lithuania (RICHTER et al. 2004, JUŠKAITIS & BÜCHNER 2013, JUŠKAITIS 2014, G. VERBEYLEN pers. comm.). The majority of ticks feeding on hazel dormice, as for other rodents, were immature stages (CULL et al. 2017). *Ixodes ricinus*, frequently found in this study, is the most common tick in Central Europe and is the primary vector of many pathogens (ALKISHE et al. 2017).

As ticks feed on their host for a few days, overall as well as seasonal prevalence of infestation depend on the frequency of encounters. The overall prevalence we recorded on hazel dormice is lower than found on most ground-dwelling rodents and on other dormice (MATUSCHKA et al. 1999, RICHTER & MATUSCHKA 2012, FIETZ et al. 2016, CULL et al. 2017 and references therein). The fact that the prevalence of infestation was considerably lower in July may result from climatic differences. Ticks live lower on vegetation during dry and warm weather when the risk for them of desiccation is high (RANDOLPH & STOREY 1999, PÉREZ et al. 2012). Arboreal rodents, such as hazel dormice, usually live in shrubs or trees and avoid moving on the ground (BRIGHT & MORRIS 1991, 1992). This may explain the lower prevalence of infestation during the hottest summer months. This resembles the highest prevalence in ground-dwelling rodents occurring in Germany from May to July (MATUSCHKA et al. 1990) and in the UK in August (CULL et al. 2017 and other references therein). Abundance of questing ticks also differs with landscape features and plant communities (SCHWARZ et al. 2009, PEREZ et al. 2016). This point has to be taken into account for future investigations and comparisons between sites.

Numerous factors might influence the observed pattern of ticks on the dormouse body. Their preference for the head region and especially the ears (Fig. 4) is in line with observations in most other mammals (e.g. RANDOLPH 1975, KIFFNER et al. 2011, FIETZ et al. 2016). It may result from different grooming behaviours of the hosts (RANDOLPH 1975).

Due to the preliminary nature of this paper and the small sample size, we were not able to address relevant topics, such as the influence of sex, size, weight or age of the hosts on the prevalence of their ticks (SOLIMAN et al. 2001, MORAND et al. 2004, CHRISTE et al. 2007, HARRISON et al. 2010). These parameters will be addressed when the sample size allows for statistical analysis.

SOUHRN

Na sedmi místech v Německu jsme v květnu až září 2017 odebírali klíšťata z plšíků lískových (*Muscardinus avellanarius*). Z celkového počtu 221 vyšetřených plšíků jich bylo 19 % napadeno klíšťaty, ale míra nákazy se mezi lokalitami a měsíci výrazně lišila. Nejvyšší prevalence klíšťat na jednom místě byla zaznamenána v září (55 %), zatímco nejnižší v červenci (0 %). V červnu se prevalence mezi jednotlivými lokalitami pohybovala v rozmezí 0–47 %. Plšíci byli nakaženi nejčastěji jedním klíštětem, maximální počet klíšťat zjištěných u jednoho zvířete byl 12. Všechna klíšťata byla nalezena na hlavě plšíků, kde nejčastějšími místy přisátí byly uši, čenich a oblasti kolem očí.

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