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INFECTION WITH *TAENIA* SPP. IN RODENTS IN DANISH WOODLANDS

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Abstract

Little is known about the ecology of *Taenia* spp. infection in woodland rodents due to the lack of morphological characteristics in immature cystic stage of different *Taenia* species. It is important to differentially diagnose cysts of *Taenia* spp. and the potentially lethal *E. multilocularis*. In this study rodents of several species were trapped in 8 woodland areas. 32 out of suspected 54 cysts or white spots in various organs were verified as infection with *Taenia* spp. by PCR. *Taenia* infection varied in woodlands from 0-14 infected individuals/locality. The infection rate was higher in woodlands more distant to rural areas and in adult rodents trapped in winter and spring. The infection was detected in three out of seven rodent species; Bank voles (19/296 n/total), Yellow-necked mice (9/91) and Field voles (4/14). The majority of infected Bank voles were found in areas of high rodent trapping rate, in contrast to Yellow-necked mice. This study shows that PCR is a good alternative for the less specific morphologic identification of *Taenia* spp. in wildlife, which facilitates studies into the ecology and epidemiology of this disese in wildlife.

Background

Taenia spp. infection in wildlife develops into hydatid cysts in various tissues of mammal intermediate hosts. It is recognized that the dynamics of *Taenia* infection in woodland rodents is complex and involves different factors that determine the spatial distribution of the disease. The presence of *Taenia* spp. infection in rodents in areas of active public attendance may raise question about risk of spread of similar cestodes e.g. *Echinococcus multilocularis*. In cases of immature and developing Taeniid cysts it is important to have a differential diagnosis of cysts of *Taenia* spp. and the potentially lethal *E. multilocularis*. Improvement in the diagnostic techniques are in continous advancement and the application of such techniques in epidemioogical studies is important for a better understanding of the spread of wildlife infecitons, especially zoonotic infections.

Materials and Methods

Study area: 8 woodland areas were included in this study (Fig. 1). The woodlands were in or around Copenhagen greater manucipality. The woodlands are publickly accessed where roaming foxes and cats are frequently seen.

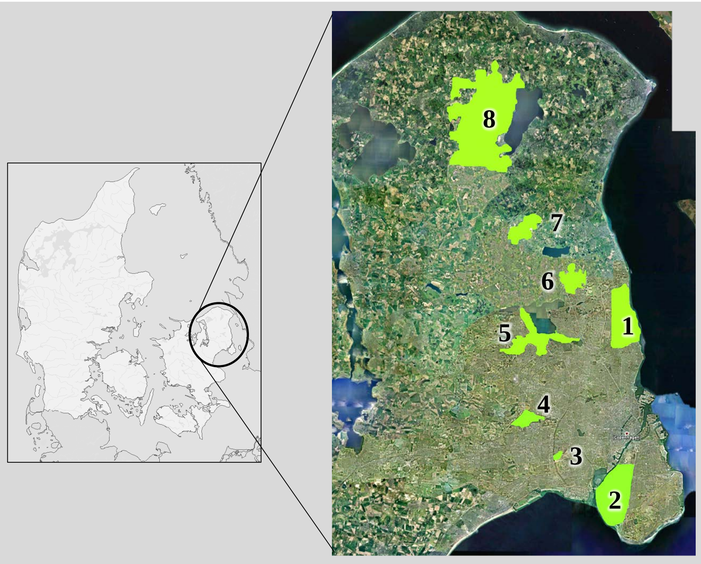


Fig. 1. Map of trapping areas.

1. The animal garden
2. West Amager forest
3. Broendby forest
4. The west forest
5. Bagsvaerd forest
6. Rude forest
7. Tokkekoeb forest
8. Grib forest

Woodlands 1-5 located inside Copenhagen greater area.
Grib forest (8) is the second largest woodland in Denmark and resembles a true forest

Duration of the study: Rodent trapping started in November 2006 and finished in October 2007. Trapping was stopped between December 2006 and March 2007 due to snow and cold/rainy weather. This one year study was divided into two cycles. The first cycle occurs during the low breeding season of the rodents (November – May). In this cycle mature adult rodents are mainly caught. While the low breeding season of the rodents (June – October) occurs during the second cycle of the study. In the second cycle immature young rodents are frequently caught.

Rodent trapping: Three live traps were used; Ugglan-lemmel, Ugglan-special and Sherman traps with rodent pellets as a bait. The traps were distributed in grids of 500m^2. Each grid consisted of five lines 10m apart and in each line ten spots 10m apart were marked. In each of the marked spots one trap of the three kinds of traps was placed, altogether 150 traps/area. The traps were baited and left open for a week then rebaited and closed. The traps were chicked for two days and removed in the second day.

Rodent examiantion: Trapped rodents were euthanized by CO_2. Viescera and connctive tissues were examined and cystes or white spots in the liver and other organs were collected and preserved for identification morphologically[1] (Fig. 2) and by PCR[2].

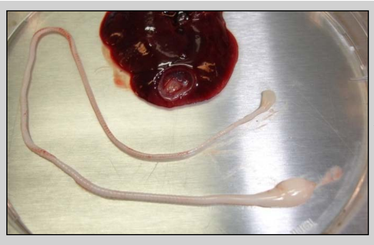
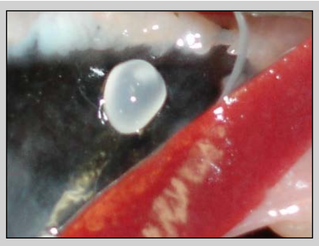


Fig. 2. Cysts isolated from rodent livers:
Taenia taeniaeformis ←

T. polyacantha →



DNA extraction and PCR: from freshly collected cyctes was done using the (tissue method) of a commercial kit (QiAmp DNA mini kit®). Confirmative PCR was done on all isolated cysts and white spots.

Statistics: Summary statistics were done using Windows Excel®. Prevalence differences were comapered by the $\chi 2$ test and differences in infection intensity were compared by the Mann-Whitney U-test. Multiple regression analysis was carried out using SAS 9.1 version®.

Results

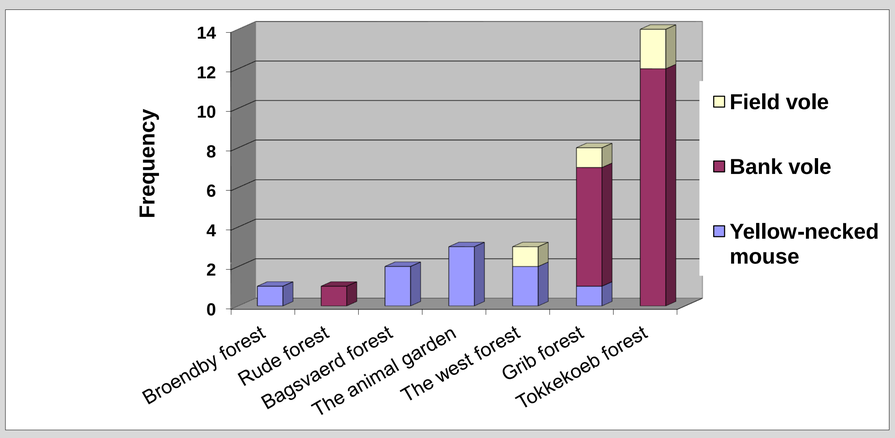
7 species of rodents were caught (Table 1). The species composite varied depending on season of the year which also influenced age composition of the individual species. Yellow-necked mice were more predominant at winter and spring while Bank voles were more captured at summer and autumn. Ugglan-lemmml trap was the most successful in traping rodents of various sizes and species.

Table 1: Rodent species caught during the two cycles of the study

Animal species	Cycle1	Cycle 2	Total
Bank vole	126	170	296
Yellow-necked mouse	64	27	91
Common shrew	2	15	17
Field vole	8	6	14
Pygmy shrew	3	5	8
Water shrew	-	5	5
Wood mouse	1	-	1
Total	**204**	**228**	**432**

Out of 54 suspected cysts or white spots, PCR confirmed infection with *Teania* spp. in only 32 cases. *Teania* spp. were detected in Bank voles (19/296 n/total), Yellow-necked mice (9/91) and Field voles (4/14). The majority of infected Bank voles were found in areas of high rodent trapping rate, in contrast to Yellow-necked mice. Infected Bank voles and Yellow-necked mice were not co-captured in the same area in all but one of the woodlands. *Taenia* spp. infection varied in woodlands from 0-14 infected individuals/locality. No infection with *Taenia* spp. was recorded in West Amager forest. Also no infection was recorded in any of the Water shrews, Common shrews and Pygmy shrews (n=31 totally), nor in Wood mouse. The infection rate was not affected by the used live-trap even though the majority of the caught rodents (young mice, voles and shrews) were trapped by the two kinds of Ugglan traps.

Fig. 3: Frequency of *Taenia* spp infection in three rodents in the screened woodlands



The infection was highly prevalent in adult rodents trapped in winter and spring, cycle one (Fig. 3). During these seasons mature rodents are frequently caught. Also infection prevalence was positively correlated with rincreased body length. On the other hand, the infection rate was more frequently observed in woodlands more distant to rural areas. Surprisingly, the overall infection rate in small woodlands (9%) was equall to that of the big woodlands. Woodland area, included in this study, and rodent capture rates were not determinant factors in the spread of *Taenia* infection in rodents.

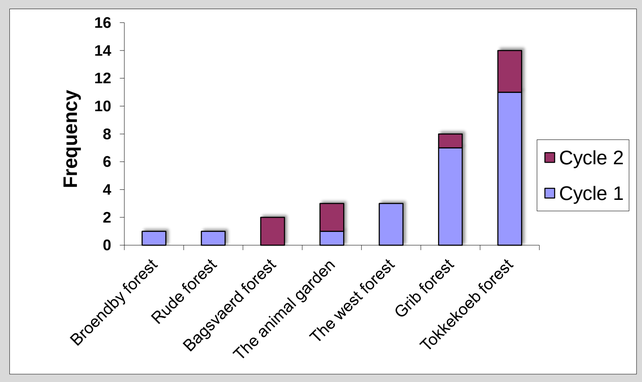


Fig. 3: Frequency of Taenia infection in woodlands in relation to the season of the year.
Cycle 1: winter – spring season.
Cycle 2: summer – autumn season .

Conclusions

This study shows that the life cycle of *Taenia* spp. is established in rodents in woodlands in and around Copenhagen greater area (with an overall infection rate of 8% in three rodent species). *Taenia* infection in rodents is seasonal when adult rodents are more aboundant during winter and spring. Woodland area and rodent aboundance are not determinant factors in the spread of the infection, while rodent speacies and age are concidered the key factors for the spread of the infection. PCR proved to be a reliable alternative for the less specific morphologic identification of Taeniid cysts in infected rodents, which facilitates studies into the ecology and epidemiology of this group of diseases in wildlife.

References

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