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Contest Competition between Wood Mice and Bank Voles: Is There a Winner?

KONKURENCJA MIĘDZY NORNICĄRUDĄ A MYSZĄ LEŚNĄ: CZY JEST ZWYCIĘZCA?

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Bank voles *Clethrionomys glareolus* and wood mice *Apodemus sylvaticus* coexist in many areas although they potentially compete for food and micro-habitat. We report the observation of their behavioural interactions at a bait point. No clear behavioural relationship was found. This might be an important factor promoting their coexistence.

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1. INTRODUCTION

Little information is available about competitive interactions between bank voles *Clethrionomys glareolus* (Schreber, 1780) and wood mice *Apodemus sylvaticus* (Linné, 1758). These two species potentially compete for food (*i.e.* Hansson, 1985) and habitat (Geuse & Bauchau, 1985; Gurnell, 1985) but Geuse & Bauchau (1985) were unable to detect any effect of the abundance of one species on the other in 27 woodlots in Central Belgium (see also Gurnell, 1985, Table 3). They concluded that factors other than interspecific competition have an overwhelming effect on the population density of these species. No study investigating the effect of one species on the demography of the other using experimental removal has been conducted. However, Gliwicz (1981) demonstrated a combined negative effect of *Apodemus flavicollis* (Melchior, 1834) and *C. glareolus* on the survival, use of space, and reproduction of

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Apodemus agrarius (Pallas, 1771), a species similar in size to *A. sylvaticus*.

Studies of microhabitat use by *A. sylvaticus* and *C. glareolus* (Bergstedt; 1982; Geuse, 1985) as well as analysis of multiple capture data (Montgomery, 1979; Verhagen & Verheyen, 1982; Geuse & Bauchau, 1985; Lambin *et al.* in prep), consistently indicate a strong interspecific segregation on a microspatial scale. Moreover, some authors claim that activity rhythms of the bank vole are influenced by the presence of wood mice (Miller, 1955; Brown, 1966; Greenwood, 1978). The bank vole is more diurnal when co-occurring with *Apodemus* spp. (*e.g.* Andrzejewski & Olszewski, 1963; Greenwood, 1978). Such an adjustment of activity rhythms would reflect the existence of interference competition between wood mice and bank voles. Andrzejewski & Olszewski (1963) provide evidences of a clear hierarchical relationship between the larger (*A. flavicollis* and *C. glareolus*. The former species vigourously attacked bank voles, and restricted their access to a feeding station. At high density, *C. glareolus* reduces its activity level when *A. flavicollis* is active (Wójcik & Wołk, 1985).

Despite the assertion of Gurnell (1985) that *Apodemus* spp. are behaviourally dominant over *C. glareolus*, there are no field data on the hierarchical relationship existing between *A. sylvaticus* and *C. glareolus*. Because *A. sylvaticus* is significantly smaller than *A. flavicollis*, it is likely that the hierarchical relationship between *A. sylvaticus* and *C. glareolus* is less clear-cut than between the latter and *A. flavicollis*. Data on the existence of a dominance hierarchy between wood mice and bank voles should be known in order to differentiate between the interaction model IIIA (coexistence, both species suppressed) and the model IIIB (coexistence, one species unaffected, the other suppressed) of Gurnell (1985).

In this note, we describe 19 encounters between wood mice and bank voles observed in natural condition by means of a night vision camera. We discuss the factors influencing the outcome of these interspecific interactions.

2. MATERIAL AND METHODS

The observations were conducted in a woodlot in central Belgium (50°37'N, 4°31'E) between October 1985 and June 1986 and from November 1986 to May 1987. A highly sensitive surveillance video camera (tube Newvicon, sensitivity 1 lux) was used for the observations. The position, magnification, and focusing system were controlled remotely from a building 100 m from a bait point. The size of the area observed varied from 1.5 to 6 m^2, depending on the magnification used.

A video tape recorder with variable recording speed allowed the filming of 16 consecutive hours. The filmed behaviours could be viewed in slow motion or frame by frame. The date and the time were continuously recorded and overprinted on the video screen. A dim light was provided by a 15 watt electric light covered by a red plastic filter. This illumination was sufficient for the filming and rodents do not readily detect this color (Finley, 1959; Flowerdew, 1974). The bait point was supplied daily with rolled oats and peanut butter. Monthly trapping sessions around the bait point captured most of the rodents observed on the bait point. Each rodent captured was sexed, weighet, examined for reproductive condition and ear-tagged using numbered surgical clips. Fur clipping (of shoulder, flank, leg or back) allowed for individual identification of most of the rodents observed around the bait point.

For each interspecific encounter, the following information was recorded: date and time, species observed at the feeding station before the encounter, identity of the protagonists (when possible), weight of both individuals (from trapping data), outcome of the encounter (attack, withdrawal of one of the rodents, occurrence of simultaneous feeding). Based on these elements we classified the encounters as: *Apodemus* winning, *Clethrionomys* winning or no winner.

3. RESULTS

A total of 1425 hours have been recorded. Rodents have been observed on 1552 occasions (see Lambin, 1986, Baucy, 1987 for details). Out of 209 encounters between two or more small mammals, 19 involved a wood mouse and a bank vole, 181 involved two or more wood mice, and only 6 involved two bank voles.

All the interspecific encounters occurred at night since wood mice were rarely observed in daylight. On five occasions wood mice and bank voles attacked each other but, among these, in only one instance was fighting observed (Table 1). In four other cases, the approach or a jump of one of the rodents was sufficient to induce the flight of the other. Out of the 19 encounters, 15 resulted in the flight of one of the animals. In seven instances, a wood mouse fled from a vole; six of these followed an aggressive movement of a vole. In contrast, only two of eight flights of a vole from a mouse were triggered by an aggressive move by the mouse. In three cases, mice and voles showed no apparent reaction to the presence of an heterospecific rodent, and were observed feeding side by side. However, one of these encounters involved two mice actively interacting with each other when a vole approached the feeding station. One encounter was ambiguous, as after a brief aggressive bout, rodents of both species were observed feeding side by side.

The relative weight of the rodents were known for 10 encounters. In the three cases where the vole was heavier than the wood mouse, the

latter ran away from its heavier opponent. In all three cases where both rodents were of approximately equal size, the bank vole actively avoided the wood mouse. In two out of the three cases where the mouse was known to be heavier than the vole with which it was interacting, simultaneous feeding was observed. In one instance, a vole withdrew from the feeding site upon the arrival of a mouse. A last encounter involved four juveniles *Apodemus* preventing access to the feeding site by an adult vole.

Table 1

Outcome of encounters between wood mice and bank vole. Age classes are given for encounters in wich only the relative weights of the rodents are known.

Encounter number	Weight of *Apodemus* (g)	Relative Weight	Weight of *Clethrionomys* (g)	Behaviours
1	juvenile	<	17	*As* flight
2	17	=	17	*Cg* flight
3	adult	=	adult	*As* attack, *Cg* flight
4	11	<	24	*Cg* attack, *As* flight
5	adults	=	24	2 *As* show no reaction, *Cg* stays
6	subadult	<	24	*As Cg* fight, *As* flight
7	15	=	15	*Cg* flight
8	18	=	15	No reaction
9	20	>	adult	*Cg* flight
10	juveniles	<	adult	4 *As*, *Cg* flight
11	?		?	*As* attack, *Cg* flight
12	?		?	*Cg* flight
13	?		?	*As* attack, *Cg* stays
14	?		?	*Cg* flight
15	?		?	*As* flight
16	?		?	*As* flight
17	?		?	*As* flight
18	?		?	*As* flight
19	?		?	No reaction

4. DISCUSSION

Most of the interspecific encounters observed on the feeding station were intolerant. In only four out of 19 cases did both rodent species feed together for some length of time. In contrast, wood mice showed a high degree of intraspecific tolerance during winter, and aggression was observed only between adults and subadults during the breeding season (Lambin, 1988). Bank voles, on the other hand, were rarely seen but alone; bank voles were more likely to encounter a wood mouse than another bank vole at our bait points. It is possible that encounters between bank voles occur mainly during daytime. However, no encounters were observed during occasional diurnal observation. The scarcity

of encounters between voles is attributed to the low density around our feeding stations but also to their lower sociability. Low levels of encounters between bank voles at the bait point can be compared with the low rate of multiple capture in this spacies (*e.g.* Geuse & Bauchau, 1985).

There is no clear evidence of a hierarchical relationship between wood mice and bank voles. Although the weight of the interacting rodents was not known for all the encounters, their relative weight seems to be a good predictor of the outcome of the interaction. Such relationship has been previously reported by Grant (1972), and summarized by Schoener (1983), for other rodent species. However, despite our small sample size, it seems that when there is no size difference, wood mice have a slight advantage over bank voles.

The encounters we describe here occurred around a feeding station that might have represented a focal point for interindividual aggression. The frequency of interspecific encounters in natural conditions is unknown and extremely difficult to assess. However, as pointed out by Montgomery and Gurnell (1985) and by Lambin (1986), it is likely that natural focal points for interspecific behavioural interactions exist, like burrows or localized food resources.

The lack of clear cut behavioural hierarchy between *A. sylvaticus* and *C. glareolus* might be an important factor allowing the coexistence of these species. It may also explain the absence of effect of one species on the numbers of the other in natural situations (Geuse & Bauchau, 1985; Gurnell, 1985). However, even though descriptive data may not show evidence for competition, experimental manipulations may reveal interspecific interactions (Schoener, 1983). If resources are shared by wood mice and bank voles, we suggest that their interaction is of type IIIA (resource limited, species compete, neither species dominate over the other; pattern of interaction: coexistence, both species suppressed [Gurnell, 1985]). Larger mice are most often slightly dominant over bank voles, but bank voles seem to be able to exclude wood mice from their own preferred habitat (Montgomery & Bell, 1972; Geuse, 1985). We therefore predict that experimental manipulations of the abundances of these species will show that both wood mice and bank voles are suppressed by their heterospecific competitor.

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