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Dispersion of the Woodmouse in Deciduous Woodland

STRUKTURA PRZESTRZENNA POPULACJI *APODEMUS SYLVATICUS* W LESIE LIŚCIASTYM

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Montgomery W. I. & Bell D. V., 1981: Dispersion of the woodmouse in deciduous woodland. Acta theriol., 26, 7: 107—112 [With 2 Tables & 1 Fig.].

Dispersion of a population of *Apodemus sylvaticus* (Linnaeus, 1758) was studied by analysis of the distribution of captures in live traps and recovery of faecal pellets in open milk cartons. Captures of both males and females were clumped and during the period immediately preceding the breeding season, males and females were segregated. Both methods gave similar results when dispersion was analysed with respect to habitat heterogeneity; activity of *A. sylvaticus* was concentrated in areas where cover was dense and within 2 m of the ground. A review suggests that when *A. sylvaticus* shares woodland with *Clethrionomys glareolus*, the former has no discernible preference for any cover type whereas the latter is restricted to dense vegetation close to the ground. However, in the absence of this potential competitor captures of *A. sylvaticus* are concentrated in vegetation providing ground and field cover.

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INTRODUCTION

Southern and Lowe (1968) have presented good evidence suggesting that unlike the Bank vole, *Clethrionomys glareolus*, *Apodemus sylvaticus* is dispersed independently of cover density. Random dispersion of *A. sylvaticus* populations in deciduous woodland is commonly accepted (Flowerdew, 1977) but some authors, for example Corke (1971) and Fairley (1967), have noted a disproportional concentration of captures of this species in dense field cover. Studies of small mammal dispersion usually rely on data from live trapping programs. This suffers from the disadvantage of curtailing normal activity and it may be that the spatial distribution of captures which are dependent on many extrinsic and intrinsic variables such as weather and social behaviour does not correspond to the true dispersion of the population. Here dispersion in a woodland population of *A. sylvaticus* is examined not only through live trapping but also by a faecal tracking technique similar to that used by Holišova (1968) and Randolph (197). This method has the considerable advantage that it does not limit the movement of mice; also data can be collected quickly and cheaply and the study area can be

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greatly enlarged. Dispersion of *A. sylvaticus* is also examined with respect to cover in woodland. The study was carried out in the north of Ireland where *A. sylvaticus* is present in the absence of *C. glareolus*.

STUDY AREA AND METHODS

All field work was carried out in the grounds of Stranmillis College and Riddel Hall, Belfast, Northern Ireland. The study area, covering approximately 1.65 ha, consisted mainly of seminatural deciduous woodland with a small strip of ungrazed grassland, in the north east corner. The wood stands on a steep slope but along the south western edge there is a low-lying, flat, marshy area. It is dominated by *Fagus, Acer, Fraxinus, Quercus, Castanea* and *Alnus* with an undergrowth of *Ilex, Salix, Betula, Rubus* and *Prunus*. The grid consisted of 13 rows, each 10 m apart, with 13 points at 10 m intervals along each row. All points were used in tracking though four points had to be abandoned during the course of the study. Only the central 9 points of the inner 9 rows were used in trapping. Two Longworth live traps (Chitty & Kempson, 1949) were set at each of these inner 81 points for five consecutive nights at two week intervals in January and February, 1978. The traps contained dry bedding and wheat grain. Captives were inspected and released during morning trap rounds. On the fifth day of trapping, traps were lifted and two open milk cartons were placed at each point of the whole grid. These were used to collect mouse faeces (Brown, 1969; Randolph, 1977) and provided protection from rain thus preventing disintegration of pellets. Cartons were set on one side and contained a strip of blotting paper and a few grams of wheat. The cartons were secured by metal skewers and were left undisturbed for three consecutive nights. On the final morning of each session of trapping and tracking, the cartons were lifted and the number of pellets recorded for each point of the grid.

An attempt was made to relate the distribution of mouse captures and faecal pellets to four types of plant cover; high canopy (more than 7 m high), low canopy (2—7 m high), field cover (15 cm—2 m high) and ground cover (up to 15 cm high). Each square of the entire grid was mapped and the percentage cover in each class of vegetation assessed.

RESULTS

41 male and 38 female *A. sylvaticus* were captured a total of 254 and 213 times respectively. In January, sessions I and II, only 14.7% of males had well developed scrotal testes but this proportion rose to 52.6% during February, sessions III and IV. Only two females in reproductive condition were handled such that this study reports spatial distribution in an *A. sylvaticus* population during the period immediately prior to breeding. Dispersion was analysed using Morisita's Index of Dispersion (Morisita, 1962). Captures of all mice were significantly contagious ($I_\delta = 1.42$; $F_0 = 3.48$, $P < 0.01$) as were captures of either sex; for males $I_\delta = 1.79$; $F_0 = 3.08$, $P < 0.01$; for females $I_\delta = 1.84$; $F_0 = 3.64$, $P < 0.01$. With each trapping session there were negative correlations between the distributions of male and female captures, though these were significant only in sessions III and IV (Table 1). Grid squares in which *A. sylvaticus* was not captured were omitted from these correlation tests. Dispersion of faecal pellets was also significantly clumped;

$I_\delta = 2,35$; $F_0 = 11.16$, $P < 0.01$. In the inner part of the grid, where traps were set, there was a strong positive correlation between the number of captures in traps and the number of faecal pellets deposited in milk cartons ($r = 0.42$, $P < 0.001$).

Although mice were captured in all vegetation types other than the rough grassland, the mean numbers of captures in grid squares with 50% or more ground and field cover were greater than in those with

Table 1

Correlation coefficients for the relationship between the numbers of male and female captures in squares in which *A. sylvaticus* was captured during sessions I, II, III and IV.

Session		Corr. coef.	Deg. of free.	% male reproductive
Jan.	I	−0.14	46 $P > 0.1$	
	II	−0.10	58 $P > 0.1$	14.7 n=34
Feb.	III	−0.48	46 $P < 0.001$	
	IV	−0.41	58 $P < 0.001$	52.6 n=38

Table 2

Mean numbers of captures and faecal pellets recovered from squares of specified vegetation types.

	50% or more cover				50% or more cover predominantly	
	Ground cover	Field cover	Low canopy	High canopy	Ground and field cover	Low and high canopy
Captures						
n	33	3	11	9	31	23
$\bar{x}$	7.03	7.33	4.09	5.00	6.94	4.61
s.d.	4.67	2.08	3.42	3.43	4.76	4.76
Faecal pellets						
n	56	15	15	14	66	31
$\bar{x}$	9.23	11.60	5.00	6.00	11.36	4.74
s.d.	9.20	9.88	5.37	6.50	10.92	4.58

dense vegetation at low and high canopy levels (Table 2). This preference was also apparent in the recovery of faecal pellets. The mean number of pellets recovered from squares with cover predominantly between 0 and 2 m was significantly greater than the mean number of pellets recovered from squares where cover was chiefly above 2 m ($t = 4.20$; $P < 0.001$). Similarly the mean incidence of captures of *A. sylvaticus* was greater, though not significantly, in the former cover type ($t = 1.95$; $P < 0.1$). The number of faecal pellets recovered from any square was associated positively with the density of low vegetation, that is ground and field levels, and negatively with the density of high vegetation, that is high and low canopies (Fig. 1). Analysis of variance indicates that, in the former instance, variation between percentage

cover classes was significantly greater than within class variation ($F = 6.15$; $P < 0.01$), but in the latter case, variation between percentage cover classes was not significantly greater than within class variation ($F = 1.42$; $P > 0.05$). However, the mean number of pellets recovered in squares with 40% or less cover at high level was significantly greater than the mean number of pellets recovered in squares with more dense high cover ($t = 2.53$; $P < 0.02$) and the mean number of pellets recovered from squares with 40% or less low cover was significantly less than
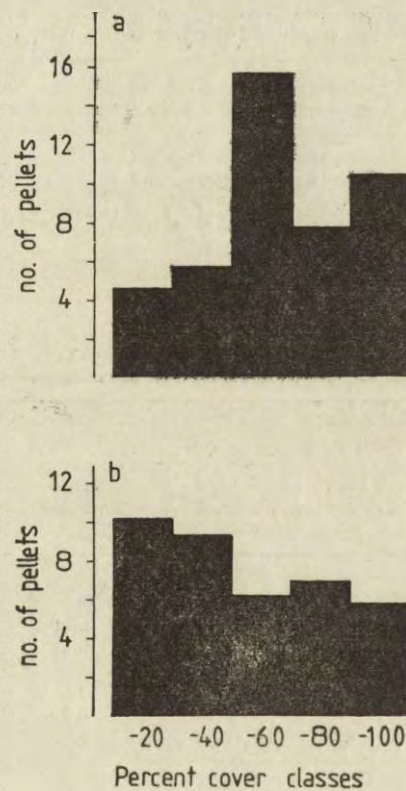

Fig. 1. The relationships between the mean number of faecal pellets collected and the density of low vegetation and the density of high vegetation.

the mean number of pellets found in squares with more dense low cover ($t = 3.57$; $P < 0.001$). Fewer pellets were recovered from squares where low cover was complete or nearly so, than were found in squares with moderate amounts of such cover; the mean number of pellets recovered in squares with 41—60% low cover was greater, though not significantly, than the mean number recovered from squares with more than 60% low cover ($t = 1.74$; $P < 0.1$).

DISCUSSION

Dispersion in small mammal populations is difficult to assess directly, since it is rare to know the whereabouts of all individuals at a given moment, and it is more usual to employ the spatial distribution of trapping success. Only Evans (1942) has analysed dispersion in a population of *A. sylvaticus* in its own right; most authors, for example Miller (1958), Fairley (1967) and Southern & Lowe (1968), have analysed dispersion with respect to habitat heterogeneity. The present report concurs with Evans' finding that captures of *A. sylvaticus* are clumped which suggests that the spatial distribution of activity is also aggregated. In this analysis of dispersion no distinction has been made as to whether this aggregation of activity is due to the presence of a number of individuals or the consistent presence of a single individual. However, it is clear that the aggregation of captures was not due to an association of males and females. On the contrary, captures of either sex were aggregated and there was some indication that during the period immediately preceeding breeding, females and males were segregated (c.f. Randolph, 1977).

There are several theoretical objections to the use of trap data to analyse dispersion of small mammal populations; not only is movement curtailed but trappability is subject to a variety of factors (Kikkawa, 1964; Gurnell, 1976; Montgomery, 1979). Therefore it is imperative that the relationship between the distributions of captures and animals be understood. In this study, dispersion has been analysed with respect to the distribution of faecal pellets deposited in open containers set out in a regular grid. The assertion that dispersion can be so analysed depends on two assumptions; firstly, the number of faecal pellets in containers is assumed to be proportional to the amount of activity in the grid square in which they are set. Secondly, it is assumed that defecation occurs randomly during surface activity in *A. sylvaticus* and that faecal pellets do not serve a territorial or marking function. If these assumptions are warranted and the distribution of faecal pellets is indeed a good indication of mouse dispersion, then the strong positive correlation between the distributions of pellets and captures indicates that trap data is also a fair reflection of *A. sylvaticus* dispersion in woodland.

Evans (1942), Miller (1958), Kikkawa (1964) and Southern & Lowe (1968), working on *A. sylvaticus* and *C. glareolus* populations in southern England, found that the distribution of *A. sylvaticus* captures was unrelated to any type of vegetation, while captures of *C. glareolus* were in close association with dense field or ground cover. Only Corke (1971) and Montgomery (1977) working on populations of *A. sylvaticus*, *A. flavicollis* and *C. glareolus* in southern England, report an association of *A. sylvaticus* captures with dense low level vegetation. Later Corke (1974) noted a decline in the number of *A. sylvaticus* captures in former areas of predominance when numbers of *C. glareolus* increased. In Ireland *A. sylvaticus* is usually found in woodland in the absence of potential competitors. Hence dispersion of *A. sylvaticus* in Irish woodland is of considerable interest. Here, dispersion of *A. sylvaticus*, as suggested by the distribution of faecal pellets, was associated with cover at ground

and field levels. This is in general agreement with Fairley (1967), also working in the north of Ireland. Where *C. glareolus* is found with *A. sylvaticus* in Ireland, *A. sylvaticus* usually favours more open habitat, while *C. glareolus* is almost wholly restricted to dense cover (Fairley & Jones, 1976). This situation is very similar to that seen in most rodent communities in southern Britain. These studies suggest that the spatial distribution of *A. sylvaticus* in deciduous or mixed woodland is dictated by competition with other species in the rodent community. In the absence of potential competitors *A. sylvaticus* may exploit preferentially areas of thick cover at or just above ground level. In the presence of substantial numbers of *C. glareolus*, captures of *A. sylvaticus* may be distributed randomly with respect to cover type or density. This apparent competitive relationship can only be analysed more fully by experimental manipulation of sympatric populations of *C. glareolus* and *A. sylvaticus*.

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