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The Effect of Introduced Males on Spatial Patterns of Initially Introduced Red-Backed Voles

WPŁYW INTRODUKOWANYCH SAMCÓW NA ROZMIESZCZENIE PRZESTRZENNE OSIADŁYCH OSOBNIKÓW *CLETHRIONOMYS RUFOCANUS*

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We conducted an experiment using the red-backed vole (*Clethrionomys rufocanus bedfordiae*) in field enclosures and examined the effect of experimentally introduced males on spatial patterns of initially introduced voles. The home ranges of voles were estimated by using radiotelemetry. Interaction between the initially introduced males (RS) and the additionally introduced males (AD) were examined. In seven of ten AD males were restricted to a confined area, and overlapped with each other. Home ranges of six AD males did not overlap with any range of females, and only two AD males could approach females within 10 m. The results indicated that RS males were behaviorally dominant over AD males.

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1. INTRODUCTION

Examining the effect of immigrant males on a resident population (or a previously established population) is important in theories concerning dispersal and reproductive behaviour in small rodents. A substantial part of adult microtine male rodents disperse at the beginning of the breeding season (Beacham, 1981). An increase in the number of dispersers creates the situation in which resident voles interact with immigrant voles for space and mates. Behavioural interaction between immigrants and residents can affect their space use and reproductive success, and relative reproductive success between residents and immigrants is related to evolutionary significance of dispersal (Johnson & Gaines, 1985).

We conducted an experiment using the red-backed vole (*Clethrionomys*

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rufocanus bedfordiae) in field enclosures and examined the effect of experimentally introduced males on spatial patterns of residents (initially introduced voles).

2. MATERIALS AND METHODS

This experiment was conducted in July 1987 in the Tomakomai Experimental Forest of Hokkaido University located in the south-central part of Hokkaido, Japan. Two 1-ha enclosures (A and B) were used. The vegetation and the detailed description of the enclosures has been shown elsewhere (Saitoh, 1981). The animals used in this experiment were nulliparous young born in the laboratory. Their mothers, which were pregnant at their capture, were collected from the wind shelterbelt in the Ishikari Plain north-east of Sapporo. The females were 39—52 days old ($\bar{X}$=44.5) and the males 36—52 days old ($\bar{X}$=46.6) at the beginning of the experiment. Their body weights were 20—35 g ($\bar{X}$=25.0) in the females and 21—48 g ($\bar{X}$=33.4) in the males. All the females had perforated vaginas and all the males had scrotal testis.

On 10 July 1987, 14 females were introduced into each enclosure. Two days later 10 males (RM) were introduced into each enclosure. Twelve July 1987 was set as day 1 and on day 11, 10 additional males (AD) were introduced into one of the enclosures (B). There was no significant difference in body weight between RM and AD (Mann-Whitney U test, U=39, p>0.05). On day 13, the initially introduced males were removed from the enclosures. On day 20—21, all the voles were removed, and the females were kept in isolated cages to check the dates of parturition.

All voles were radiotracked. Implants and tracking technique were applied according to Madison *et al.* (1985). During four periods (days 3—4, 10—11, 12—13, and 16—17), four persons radiotracked all the voles every 3h throughout 24h period. Other than these periods, the voles were located twice a day, morning and night. We analyzed home ranges by using a minimum convex polygon of the location points for each vole.

3. RESULTS

From day 7 until the day of removal, most females in both enclosures had exclusive or slightly overlapping home ranges with other females, although the home ranges of three females extensively overlapped with those of the neighboring females. During the same period, seven of 10 males in enclosure A had home ranges overlapping with those of other males. Eight of 10 males in enclosure B also had overlapping home ranges with those of other males from day 7 to the day of removal (day 13). During the experiment, seven males in enclosure A and four in enclosure B were predated by snakes and three in enclosure A and two in enclosure B died from unknown causes. Snake predation could be identified by several characteristics; (i) a signal from a transmitter indicated snake

movements and (ii) about a week after predation the transmitter could be found when a vole carcass was completely digested.

The ranges of the initially introduced males (RM) and the additionally introduced males (AD) on days 12—13 are shown in Fig. 1. In seven of ten ADs, the ranges were restricted to a confined area, and overlapped with each other. Home ranges of six AD males did not overlap with any range of females, whereas four AD males overlapped with females. However, at the same time of location, only two ADs could ap-

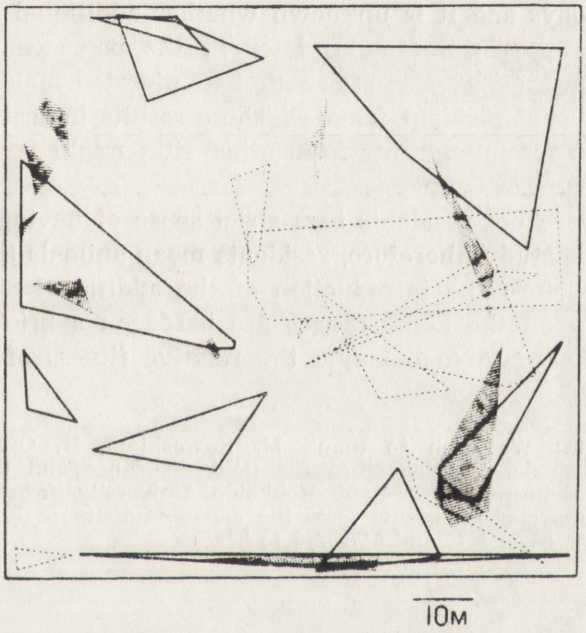

Fig. 1. Minimum convex polygons representing the home ranges on days 12—13 in enclosure B. The straight lines indicate the area of the initially introduced males (RM) and the dashed lines indicate those of the additionally introduced males (AD). Shadowed area indicate the range of females. The voles were radiotracked every 3h from 12:30 on day 12 to 8:00 on day 13.

proach females within 10 m, and there was only one case in which the distance between an AD and a female was less than 5 m, although RMs often could approach females within 5 m. After the removal of RMs, ADs could approach females. In enclosure A, the home range pattern was stable from day 7.

After the field experiment, 19 females were removed from the enclosures. Only one female gave birth to young in a cage. This result is in contrast to the experiments in the wind shelterbelt, in which most of the introduced young females gave birth to young (Kawata, 1987). The

reason for the low reproduction is unclear. This might be due to differences in vegetation, unsuitable manipulation, and/or quality of voles.

4. DISCUSSION

The results of home range patterns in Fig. 1 indicate that RMs were behaviorally dominant over ADs. RMs might deter ADs from females. Immigrant males from other sites might be less successful to copulate with females. In this experiment behavioural interactions were examined only for two days and it is unknown whether additional males had the opportunity to approach females later in the presence of RM voles. However, Kawata (1988) also stated that immigrated males were unable to sire offspring of resident females. These results indicated that reproductive success for immigrants from other sites might be less than that of residents.

RS males were not residents in a strict sense of having been born in an area. In this study, therefore, residents mean animals that established home ranges before the introduction of the additional males. Furthermore, the data on the home ranges are based on a brief period. Thus we need further data to examine the relative fitness of residents and dispersers.

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