

**CAN LARGE HOME RANGES BE DUE TO SOCIAL DOMINANCE IN *APODEMUS FLAVICOLLIS*?**

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In this paper, as a follow-up to a previous study (Vukićević-Radić et al., 2006), we attempted to infer the existence of social dominance with data obtained from a CMR (capture, mark, release) monitoring study of population dynamics in *A. flavicollis* by relating correlates of dominance to home range size.

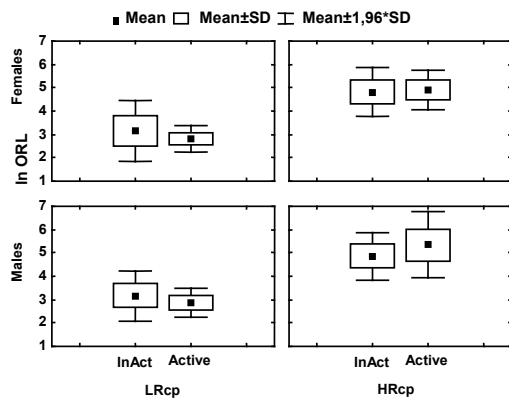
The study was carried out in an oak community stand (*Orno-Quercetum petraeae* Borr., 1955) on Avala Mountain (44° 45' E, 18° 10' N; alt.: 384 m), which is located near Belgrade, Serbia. Small rodents were studied over a three year period as part of a CMR monitoring study on a 400 point square trapping grid (10 by 10 m), with a Longworth trap at each point (Vukićević-Radić et al., 2006). The following attributes were recorded for each animal: individual number, trap location, sex, weight, length and reproductive status. Population densities were estimated by the Jolly-Seber method (Jolly, 1965; Seber, 1965). Here we present results obtained from a 1-ha sample of the study area where habitat conditions were favorable for the yellow-necked mouse. The sample consisted of capture data for 54 animals captured two times (LRcp - low level of recapture) and 35 animals captured at least six times during the entire study period (HRcp - high level of recapture). Home range area (HR) was estimated by the inclusive boundary strip method (Stickel, 1954). As an index of home range, the maximum distance between traps where an individual was captured (observed range length = ORL) was calculated (Mazurkiewicz and Rajska-Jurgiel, 1998). Two-way factorial ANOVA designs were created to test differences of HR size in comparison to sexual activity for individuals with low and high levels of recapture. HR and ORL values were transformed (ln+1) and standardized to achieve normality. 2x2  $\chi^2$ -tests were used to test for differences in the proportion of HRcp and LRcp individuals in periods of high vs. low density, and for differences in the proportions of sexual activity between HRcp and LRcp individuals. All statistical analyses were done using the Statistica 5.1. package (STATSOFT 1998).

During the 3-year period on the 1 ha subplot of the study area, we marked 245 individuals of *A. flavicollis* - 39% were individuals trapped only once, 22% were captured two times, and 14% were individuals that were captured at least six times (5-14 recaptures). For both parameters of home range, males had slightly larger home ranges and greater variability than females

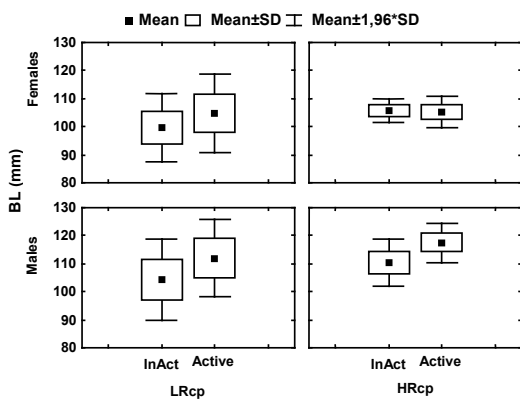
(the differences were non-significant — ORL:  $F_{(1,87)}=0.05$ ,  $p=0.81$ ; HR:  $F_{(1,87)}=0.01$ ,  $p=0.92$ ). ORL in different trapping sessions varied from 10 to 70.7 m for LRcp individuals and from 44 to 348.8 m for HRcp individuals. HR varied from 100 to 1514 m<sup>2</sup> for LRcp individuals and from 500 to 3950 m<sup>2</sup> for HRcp individuals. The abundance of *A. flavicollis* varied markedly over the period of study. Maximum population densities peaked twice, once in June of 1997 (104 ind/ha) and once in June of 1998 (54 ind/ha), while lowest density was registered in January of 1999 (4 ind/ha), giving a variation amplitude of 26-fold. Our results showed that the change of resident number in low and high density periods (22%) is significantly smaller than the change (53%) of non-resident number ( $\chi^2=17.854$ ,  $df=2$ ,  $p<0.001$ ). We note that the proportion of residents vs. non-residents across density also varies from being approximately equal (54% LRcp / 46% HRcp - low density) to highly disproportionate (86% LRcp / 14% HRcp -high density), showing a marked increase in “surplus” animals in periods of high density.

Our results indicate that the proportion of sexually active individuals was significantly different, depending on resident status ( $\chi^2=6.34$ ,  $df=2$ ,  $p=0.04$ ). The proportion of reproductively active individuals was 28.6% for HRcp compared to 14.8% for LRcp individuals. The differences of ORL and sexual activity for both sexes were highly significant at different levels of recapture ( $F_{(7,81)}=41.9$ ,  $p<0.001$ ). The highest mean value of ORL (210.6 m) was observed for sexually active males with a high level of recapture, while the corresponding value for sexually inactive males was 38% lower (129.7 m) (Fig. 1). Sexual activity was not accompanied by larger home ranges for LRcp individuals. For females sexual activity did not lead to larger territories, while it did so for males. This pattern was also observed for HR: a highly significant difference of HR between levels of recapture ( $F_{(7,81)}=10.9$ ,  $p<0.001$ ). Sexually active females and males with low recapture rates had similar HR values (mean of 403 m<sup>2</sup> for females and 457 m<sup>2</sup> for males), while the highest HR was recorded for sexually active HRcp males (mean of 1867 m<sup>2</sup>). The mean HR value for sexually active HRcp females was 1263 m<sup>2</sup>, while for sexually inactive HRcp females the mean value was 4.3% lower.

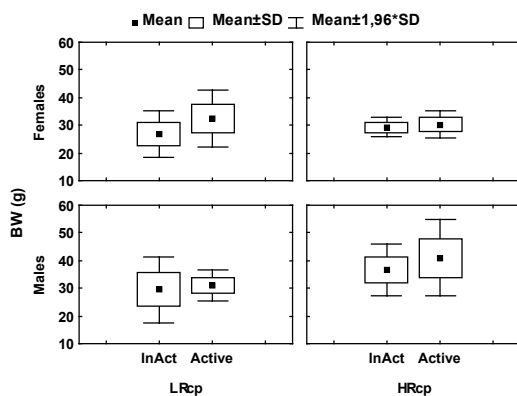
When data on body length (BL) were tested for differences in sexual activity, both sexes showed highly significant differences between individuals with high and low levels of recapture



**Fig. 1.** Differences of home range size (ln ORL) in relation to sexual activity and levels of recapture (LRcp - low level of recapture, HRcp - high level of recapture) in males and females.



**Fig. 2.** Differences of body length (BL) in relation to sexual activity and levels of recapture (LRcp - low level of recapture, HRcp - high level of recapture) in males and females.



**Fig. 3.** Differences of body weight (BW) in relation to sexual activity and levels of recapture (LRcp - low level of recapture, HRcp - high level of recapture)

( $F_{(7,81)}=33.1$ ,  $p<0.001$ ). Generally, sexually active individuals of both sexes were larger. The same holds for the contrast of LRcp with HRcp, with individuals having high capture rates being larger than LRcp individuals (Fig. 2). When data on body weight (BW) were tested for differences in sexual activity, both sexes showed highly significant differences between individuals with high and low levels of recapture ( $F_{(7,81)}=6.9$ ,  $p<0.001$ ). Generally, sexually active individuals of both sexes attained greater weights (Fig. 3).

We showed that the magnitude of change in the number and proportion of residents vs. non-residents was different during periods of low and high population density. A significant part of the population was not reproductively active and the proportion of sexually active individuals was different, depending on their residence status. The greatest home range size was observed in sexually active resident males, while for resident females sexual activity did not imply larger territories. Resident individuals of both sexes which were sexually active were larger and attained greater weights than non-resident animals. These results can be seen as supporting the view that social interactions do play a visible and important role in mouse population dynamics. Coupled with our previous results (Vukićević-Radić et al., 2006), the present findings indicate that in a structured and variable population, social dominance be neither disregarded nor overemphasized.

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