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Characteristics of Migrants in a Free-Living Population of the House Mouse [1]

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Walkowa W., Adamczyk K. & Chełkowska H., 1989: Characteristics of migrants in a free-living population of the house mouse. Acta theriol., 34, 21: 305—313 [With 3 Tables & 2 Figs.]

To characterize the migrants of *Mus musculus* Linnaeus, 1758 we examined population in an outdoor enclosure and in the areas surrounding it (lawns with shrubs, gardens, crop fields, buildings). Mice had the possibility to go out of the enclosure and to move between its different parts. The animals were caught in live traps and then they were marked and released in the place of capture (except for the mice caught inside the buildings; they were removed). Among mice living in the enclosure two groups of migrants were distinguished: inside and outside the enclosure. A negative correlation was found between numbers of these two groups ($r = -0.65$). The total number of migrants inside the enclosure was smaller than the total number of emigrants from the enclosure. Seasonal differences in the number of migrants inside the enclosure were smaller than in the number of emigrants from the enclosure. Migrants within the enclosure were heavier and they had a longer residency period from the first capture until the emigration than the emigrants from enclosure to other habitats. The average body weight of emigrants from open areas was similar to the average body weight of migrants of the enclosure. However, the average residency period from the first capture till the emigration was much shorter for the emigrants from open areas than for emigrants of the enclosure. The possible reasons of the differences in the characteristics of migrants were discussed.

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1. INTRODUCTION

The problem of rodent dispersal is widely discussed by ecologists (Lidicker, 1975, Gaines & McClenaghan, 1980, Tamarin, 1980, and others). However, there are relatively few investigations directly concerning this problem. It is caused by methodical difficulties especially in relation to the species associated with man. Presence of man in the areas inhabited by the house mouse and the inclination to exterminate this species make

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the studies of dispersal movements very difficult. Therefore, there is not much evidence relating to migrants and dispersal of this species. The aim of this work was to characterize migrants in a population of the house mouse with respect to their sex, body weight, residency period from the moment of marking till emigration, and seasonal character of migration.

2. METHODS

The study was conducted at Dziekanów Leśny, north of Warsaw, in various habitats: in an outdoor enclosure, in open areas surrounding it (lawns with shrubs, gardens, crop fields), and in nearby dwelling houses and farm buildings. The farthest trapping station was about 300 meters in the straight line from the enclosure. The enclosure itself had 600 m², and it was divided into 4 compartments (pens) by brick walls 80 cm high and 60 cm deep into the ground. The lower part of the external sides of the enclosure was also lined with brick in the same way as the inner divisions, and the upper part of the sides was made of a wire-mesh. From the top the enclosure was also covered with a wiremesh. The ground was covered with grass and bushes. The enclosure was spontaneously colonized by mice from surrounding areas as the enclosure was not mouseproof.

The capture of the rodents was made regularly with the use of 617 live traps baited with oats. In the enclosure the quantity of oat was constant (8 kg) in the time of trapping and there were bread rolls given beside the traps in the time

Table 1

Trapping design.

Trapping site	Number of traps	Duration of trapping series	Interval between trapping series	Period of trapping	Method
Outdoor enclosure	192	5 days	9 days	whole year	CMR
Open areas (gardens, fields, lawns)	235	5 days	9 days	April—Dec.	CMR
Lawns with shrubs around the enclosure	90	continuous	0 days	whole year	CMR
Buildings	100	continuous	0 days	whole year	removal

between trappings. The basic method was catch-mark-release whereas mice caught in the buildings were removed (Table 1). In the open areas last rodents were caught in November, thus trapping was stopped at the end of this month. In spring traps were set in April to observe the moment of the appearance of mice in the open areas. Around the enclosure, the traps were set all the year round because occasionally mice emigrated from the enclosure also in winter. The study was started in spring 1985. The information about migrants presented in this paper is from the period from March 1986 till February 1988. Estimates of the average body weight of migrants were based on the weight of mice at the last capture before emigration.

3. RESULTS

3.1. Characteristics of Migrants

Migrants consisted of individuals marked in one of the habitats (enclosure, crop field, garden *etc.*) and recaptured in another habitat. Mice moving from one pen of the enclosure to another were also called migrants. Migrating individuals could change their habitats (*e.g.* they could go from the enclosure to the field) or they could move through a different habitat to the same habitat type (*e.g.* from one crop field through a lawn to another crop field). All migrants were divided into two groups: (2) emigrants from the open areas. It was found that mice immigrated to all the habitats examined, including crop fields, lawns, gardens, and all the habitats examined, including crop fields, lawns, gardens, and buildings; two individuals immigrated to the enclosure.

3.1.1. Migrants from the Enclosure

The size of population in the enclosure showed large changes but it tended to increase during several years (Fig. 1). From April 1987, females were more abundant than males ($p<0.05$).

In the study period, there were 954 mice in the enclosure, including 100 migrants (10.5%). In the enclosure fewer individuals migrated from one pen to another (38 animals — 4% of all mice in the enclosure) than emigrated from the enclosure to another habitat (62 animals — 6.5%).

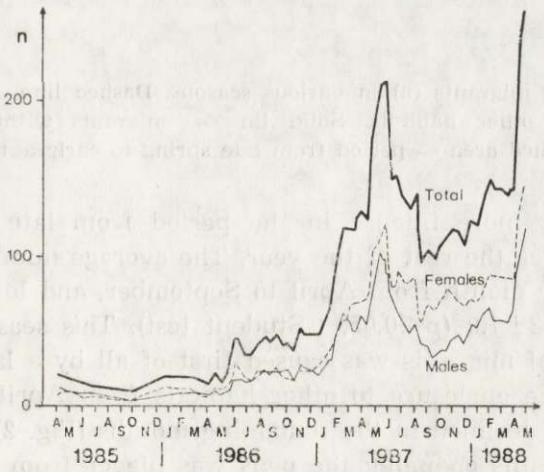

Fig. 1. Changes in numbers (n) of the house mouse in the enclosure.

The majority of emigrants from the enclosure never returned to it. Only 9 mice returned, of which 8 came back to the pen from which they went out. Of 46 mice which changed the pen (for more then 2 years in this case) 5 animals came back to the same pen from which they emigrated. The majority of within-enclosure migrants (93%) moved only between two pens. Only 2 mice moved from one pen to another before they emigrated from the enclosure to another habitat.

Most emigrants were represented by young individuals both sexually mature and immature (72% of the emigrants weighed less than 13g). Also old animals (weighing 17—19g) and staying for a long time in the enclosure (up to 62 weeks), sexually active and inactive, and even pregnant females belonged to migrants. The numbers of emigrating females and males were similar (51 males and 49 females), and their proportion was similar to the sex ratio of recruits, that is mice caught for the first time.

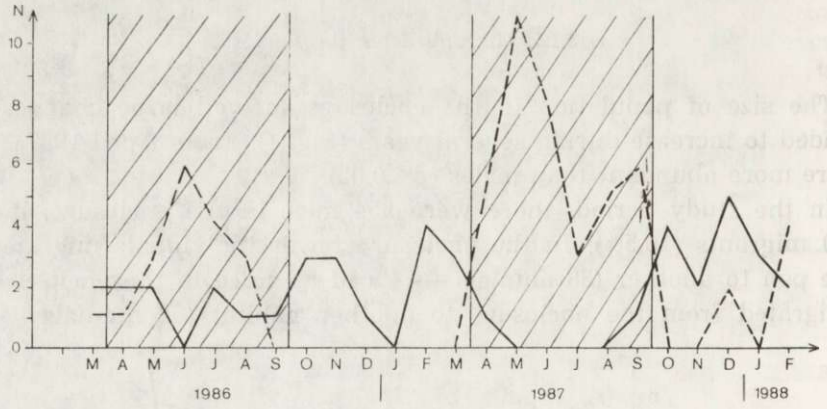

Fig. 2. Number of migrants (n) in various seasons. Dashed line — emigrants from the enclosure to other habitats. Solid line — migrants within the enclosure. Hatched area — period from late spring to early autumn.

Dispersal was more intense in the period from late spring to late autumn than over the rest of the year. The average number of migrants was 4.9 ± 1.8 per month from April to September, and lower from October to March 3.2 ± 1.9 ($p < 0.05$, t-Student test). This seasonal difference in the number of migrants was caused first of all by a large emigration of mice from the enclosure to other habitats from April to September. This emigration declined in the remaining months (Fig. 2). However, the number of migrants changing the pens was bigger from late autumn to early spring than over the rest of the year ($p < 0.05$, t-Student test). The

number of emigrants from the enclosure to another habitat was negatively correlated with the number of migrants changing the pens ($r=-0.65$, $n=24$, $y=2.7-0.3x$; $p<0.01$).

These two groups of migrants displayed differences also in other features:

(a) Seasonal changes in the number of emigrants from the enclosure were bigger than those in the number of within-enclosure migrants: the average number per month of the former in the period from April to September was almost 8 times that noted from October to March, while only three times for the second group.

(b) The average body weight of the emigrants from the enclosure to other habitats was lower than that of the migrants within the enclosure (Table 2).

(c) The average residency period from the first to the last capture before emigration from the enclosure was 5 weeks, and it was shorter by half than for the mice migrating within the enclosure (Table 3).

No statistically significant differences were found in the sex ratio between the two groups of migrants (55% males among the emigrants from the enclosure and 43% among the migrants within the enclosure).

Table 2

Average body weight (in grams) of mice before emigration. Differences between *a* and *b*, *c* and *d*, *a* and *c* are statistically significant at $p<0.05$ (*t*-Student test).

Sex	Direction of dispersal		
	from enclosure to another habitat	within enclosure	from open area to another habitat
Males	10.5 ± 3.3^a	14.0 ± 4.1^b	11.6 ± 1.3
Females	7.9 ± 3.1^c	13.6 ± 6.0^d	12.2 ± 8.5
Total	9.3 ± 3.4^e	13.8 ± 5.2^f	11.8 ± 5.2

Table 3

Average residency time (in weeks) of mice from the time of marking until emigration. Differences between *a* and *b*, and *c* and *d*, *e* and *f*, *b* and *g*, *c* and *h*, *d* and *h*, are statistically significant at $p<0.05$ (*t*-Student test).

Sex	Direction of dispersal		
	from enclosure to another habitat	within enclosure	from open area to another habitat
Males	6.3 ± 12.2	10.2 ± 9.2^e	1.1 ± 0.4^f
Females	3.4 ± 5.7^a	10.8 ± 15.2^b	1.4 ± 0.9^g
Total	5.0 ± 9.8^c	10.6 ± 12.7^d	1.3 ± 0.6^h

3.1.2. Migrants from the Open Areas

The number of mice in the open areas was low and seasonally variable. A total of 198 animals were caught there (including 111 males), from which 12 (7 males and 5 females) were migrants, that is, they changed their habitat. Like in the enclosure, migrants were mostly young individuals, as indicated by their average body weight (Table 2). Only two animals weighed more than 12g, including one pregnant female. The average residency period of these migrants in the habitat before emigration was short (Table 3) and much shorter than in the enclosure.

4. DISCUSSION

House mice usually show a high degree of site tenacity and only a small proportion of the population migrates (Petrusewicz & Andrzejewski, 1962; Adamczyk & Petrusewicz, 1966; Vlček, 1984; Pennyciuk *et al.*, 1986, and others). Also in this study most animals inhabiting the enclosure were sedentary. Typically the animals moved to new places relatively quickly, as indicated by the fact that: (a) out of 62 emigrating from the enclosure to another habitat, only two at first moved from one pen of the enclosure to another, (b) emigrants from the enclosure which moved to more distant habitats were not caught in the immediate vicinity of the enclosure, although many traps were set there every day.

Migration in both the enclosure and the open areas was seasonal, which was also noted by other authors working on the house mouse in the open areas (*e.g.* Khokhlova & Krasnov, 1986). On the other hand, Pennyciuk *et al.* (1986) did not found seasonal changes in migrations of mice in an outdoor enclosure. This could have been related to the fact that the enclosure was mouseproof.

Two groups of migrants distinguished in the enclosure (migrants moving from one pen to another and migrants moving outside) differed in the period of intensification of migrations (Fig. 2), in the number of migrants between the periods from spring to autumn and from autumn to spring, in the average body weight and in the average residency period from the time of marking to the start of emigration (Tables 2, 3). A correlation coefficient between abundance of these two groups of migrants provides evidence that migrations within the enclosure and from the enclosure to different habitats are interrelated.

The following explanation can be proposed for explaining differences between the two groups of migrants. Each individual in the population is under the social pressure from the animals with which it coexists, from the members of neighbouring subpopulations, and under the in-

fluence of environmental factors (temperature, rain, food, shelters, *etc.*). After leaving their nests young animals are exposed to increasing stress of their neighbours and some of them try to change their place. In the season of good weather conditions (from spring to autumn) a migrant is likely to find a suitable, not overcrowded habitat, so this would promote emigration from the enclosure. As a result, the number of mice emigrating from the enclosure to other habitats was higher than the number of migrants inside it (Fig. 2). When deteriorating weather conditions make dispersal to open areas difficult or even impossible, an individual withstands the social pressure of its immediate associates longer (Table 3). This may explain the longer stay in the enclosure and the bigger body weight of the migrants inside the enclosure as compared with those of the animals leaving the enclosure. It can also be suggested that individuals which cannot stand the increasing social pressure of their immediate neighbours move to the area of another subpopulation, that is, to another pen of the enclosure.

Some authors observed that more males than females migrated (Pennyciuk *et al.*, 1986; Rowe *et al.*, 1987). In this study similar numbers of males and females emigrated from the enclosure. These were mostly young animals (sexually mature and immature) but old ones and even pregnant females were also present among emigrants, this being reported by other authors as well (*e.g.* Penyciuk *et al.*, 1986).

It was found that the average body weight of emigrants from the enclosures and open areas was similar (Table 2) which can indicate their similar age. However, the period from the first capture to emigration was considerably shorter for mice living in the open areas as compared with those in the enclosure (Table 3). This suggest that a large proportion of mice caught for the first time in the open areas alredy started migration. This was not the case in the enclosure, where the fates of migrants were observed from their emergence from the nests.

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CHARAKTERYSTYKA MIGRANTÓW W WOLNOŻYJĄCEJ POPULACJI MYSZY DOMOWEJ

Streszczenie

Badania populacji myszy domowej, *Mus musculus* Linnaeus, 1758 przeprowadzono w Dziekanowie Leśnym koło Warszawy, w wolierze i na terenach ją otaczających (trawniki, ogrody przydomowe, pola, budynki mieszkalne i gospodarcze). Myszy łowiono w pułapki żywołowne, znakowano i wypuszczano w miejscu złowienia — metoda CMR i tylko w budynkach złowione myszy zabierano. Częstość połowów była stała (Tabela 1). Woliera o powierzchni 600 m² była podzielona murowanymi przegrodami na 4 równe części. Myszy miały możność wychodzenia z woliery jak i przemieszczania się w jej obrębie. Analiza migrantów obejmuje okres dwóch lat.

Za migrantów uznano te osobniki, które zmieniły środowisko lub przeszły przez inne do takiego samego, oraz te, które przeszły z jednej ogrodzonej części woliery do drugiej.

Stwierdzono, że myszy imigrowały do wszystkich badanych środowisk. Udział samców i samic wśród migrantów był podobny. Większość migrantów stanowiły osobniki młode.

Spośród migrantów woliery wyróżniono 2 grupy: migrujące wewnątrz i na zewnątrz woliery. Ogólna liczba migrantów w obrębie woliery była mniejsza niż emigrantów na zewnątrz woliery. Nasilenie migracji w obrębie woliery występowało w okresie jesienno-zimowym a emigracji na zewnątrz woliery w okresie od kwietnia do września (Ryc. 2). Migranty wewnątrz woliery miały większy średni ciężar ciała tuż przed migracją (Tabela 2) i dłuższy czas przebywania od pierw-

szego złowienia do emigracji niż emigranty na zewnątrz (Tabela 3). Średni ciężar ciała emigrantów ze środowisk otwartych był podobny do średniego ciężaru ciała migrantów woliery natomiast średni czas przebywania od pierwszego złowienia do momentu migracji był znacznie krótszy.

Przedstawiono możliwe przyczyny zaobserwowanych różnic w charakterystyce migrantów. U migrantów wewnątrz i na zewnątrz woliery mogą one być spowodowane zmianami warunków pogodowych i oddziaływaniami socjalnymi.

Migracyjność myszy na terenach otwartych jest prawdopodobnie większa niż myszy z wolier i być może znaczna część myszy złowionych po raz pierwszy na terenach otwartych była już w trakcie migracji. Tym można wyjaśnić krótszy czas przebywania migrantów od chwili znakowania do emigracji na terenach otwartych w porównaniu z migrantami z woliery, gdzie losy migrantów śledzono od momentu ich wyjścia z gniazda.