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THE INFLUENCE OF THE SIZE OF THE CAGE ON THE NUMBERS AND DENSITY OF A SELF-RANGING POPULATION OF WHITE MICE*

The numbers of an enclosed, self-ranging population of mice increase with an increase in the area of the breeding cages, but this numerical increase is smaller than the increase in living space; thus the density of the mice decreases with an increase in cage size. The decrease is more marked in cages smaller than 1 m², and later is only inconsiderably reduced. The smallest cages have therefore the greatest productivity.

METHODS AND MATERIALS

The mice were kept in six types of cage, with different bottom area (Tab. I)

Size of cages, number of replications (populations) and average of the population duration

Tab. I

Type of cage	Size of cages			Numbers of population	Mean time (months)
	cm	m²	relative		
A	38 × 15	0.057	1*x*	12	13.0
M	38 × 30	0.114	2*x*	12	13.0
Q	38 × 60	0.228	4*x*	12	13.0
Z	80 × 80	0.640	11*x*	61	25.1
B	80 × 160	1.280	22*x*	6	29.2
H	–	6.000	105*x*	4	43.6

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In all the cultures a constant abundance of water and full-value food was maintained. After a certain number of mice had been placed in a cage, not even a single individual was added or removed. The mice reproduced freely, their numbers being limited only by the intrapopulation processes, since all the populations were kept in uniform conditions (constant abundance of food, constant temperature, lighting and humidity). No mass diseases were observed during the experiment. The only variable was the size of the living space. Only the data concerning the number of mice leading lives outside the nest were used for calculations, i.e. concerning the mice over three weeks old. The variations in numbers in each culture took a slightly different course, and therefore attention was concentrated only on certain elements which made it possible to estimate the numbers and density of the population, omitting the actual course taken by variations in numbers. The following were analysed:

1) mean numbers – the arithmetical mean of the number of mice calculated for the whole duration of all cultures of a defined type,

2) average density – mean number of individuals per m^2,

3) relative density – the percentage formed by the mean density in a given type of cage in comparison with the density in type *A* cage (the smallest cage, the size of which was taken as $1x$).

COMPARISON OF RESULTS

The mean number of mice exhibits a close connection with the size of the breeding cage. An increase in the area of the cage causes – as was foreseen – an increase in the numbers of the animals in the culture; the increase in population numbers, however, is slower than the increase in the area of the cage (size of habitat); hence the density – number of individuals per unit of area – of a self-ranging population decreases with an increase in the size of the habitat (Tab. II). This phenomenon can be seen particularly clearly when considering relative density. When the area is doubled, the density of the mice falls by 33% (Tab. II), further increase in the area causes an even greater decrease in population density, and with cultures in cages of 6 m^2 the density of the mice is only 7% of that which is observed in cultures with the smallest living space. This decrease is more rapid in cages with an area of less than 1 m^2, with further increase in size the decrease becomes inconsiderable (Fig. 1).

DISCUSSION OF RESULTS

The external conditions in which the populations under observation lived were uniform. Hence the level of numbers – and therefore also of density –

Average number (N), density(number per m^2 - D), and relative density (RD i.e. density in percent of the density in cage A)

Tab. II

Type of cage	Relative size of cage	$\bar{N}$	$\bar{D}$	RD (percent)
A	1*x*	12.1	212	100
M	2*x*	16.0	140	66
Q	4*x*	16.7	73	35
Z	11*x*	30.5	48	23
B	22*x*	34.1	27	12
H	105*x*	92.5	15	7

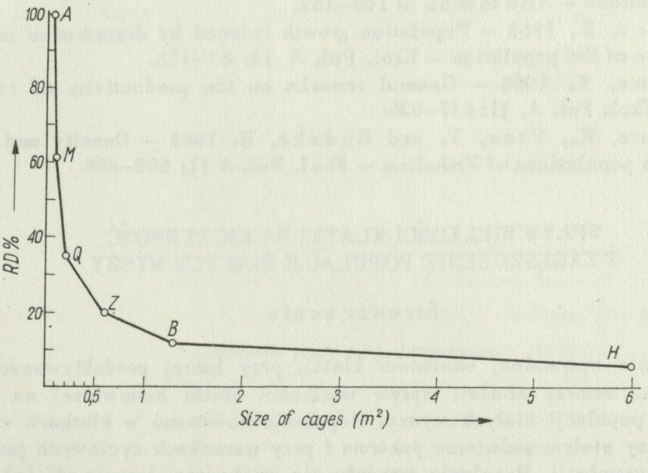

Fig. 1. Relative density in cages of different sizes

could not be the result of the influences of the external habitat. In the same way it was not density *per se* that was the factor determining numbers, since density was formed differently in cages of different size. In considering the causes of one particular density, and not another, being attained, the hypothesis put forward by one of the co-authors in a previous study (Petrusewicz 1958, 1963) may be suggested, i.e. that the density governing factor is here the ecological structure of the population – the relations and connections as a whole between the components of the population, which are formed differently in cages of different size. It may be imagined – this being an assumption only – that in habitats of small dimensions for the given species a mouse can traverse even the largest cage – 6 m², in a few seconds), the number and perhaps also the character of the contacts depend not only on density but also on the absolute number of individuals in the population.

The mean numbers do not fully correspond to that which hydrobiologists mean by the term net production; but the mean numbers from such frequent (daily) measurements are to a certain degree the expression of net production. It may therefore be stated that the productivity of a self-ranging population of mice – with other conditions constant – decreases with an increase in the size of the living space.

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WPŁYW WIELKOŚCI KLATKI NA LICZEBNOŚĆ I ZAGĘSZCZENIE POPULACJI BIAŁYCH MYSZY

Streszczenie

Dla określenia optymalnej wielkości klatki, przy której produktywność populacji jest największa, autorzy zbadali wpływ wielkości klatki hodowlanej na liczebność i zagęszczenie populacji białych myszy. Populacje hodowano w klatkach różnej wielkości (Tab.I) przy stałym nadmiarze pokarmu i przy warunkach życiowych jednakowych dla wszystkich populacji. Populacje mnożyły sie swobodnie, liczebność ich była ograniczana jedynie przez samą populację.

Przy zwiększaniu wielkości klatki hodowlanej liczba myszy wzrasta nieznacznie, nieproporcjonalnie do wielkości powierzchni. Wobec tego zagęszczenie myszy na 1 m² spada przy zwiększaniu powierzchni dna klatki, szczególnie na odcinku od 0,057 do 1 m² (Tab. II). Dalsze zwiększanie powierzchni klatki powoduje nieznaczny spadek zagęszczenia (Fig. 1).

Przeprowadzone badania wskazują, że największą produktywność wykazują klatki o najmniejszej powierzchni dna.

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