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## Seasonal Dynamics Of Ecological Features Of The House Mouse (Rodentia, Muridae) North Caucasus.

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### ABSTRACT

In the conditions of the foothills (700 m above sea-level) and middle mountains of the Caucasus (1800 m above sea-level) seasonal dynamics of number, sexual and age structure of a sinantropic house mouse is studied. Higher and stable number of a specie in the foothills during all seasons of year is shown, than in middle mountains where seasonal fluctuations on are more expressed. Features of reproduction of populations which provide differences in dynamics of number are revealed. The sexual structure the brownie of a mouse does not find correlation communication with a season of year.

**Keywords:** Caucasus, foothills, middle mountains, small mammals, house mouse, season of year, number, reproduction, population, morpho-physiological indicators

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## INTRODUCTION

Small mammals of various landscape zones have specific features of reproduction, age structure and dynamics of populations which represent a complex of adaptations to living conditions (Bolshakov, 1972). The optimum structure of population is one of ecological mechanisms of adaptation of small mammals to specific conditions of the environment of their dwelling (Schwartz, 1967). In ecological researches questions of number and structure of populations are one of the most developed, including, and for a house mouse (A house mouse ..., 1994; Kotenkova, 2000, etc., We et al., 2006; Gomez et al., 2008). However in the Caucasus modern data in this aspect are not enough. It is known that house mouse (*Mus musculus L.*, 1758) is one of sinantropic species of rodents, widespread and mass on number, that number and in the Caucasus. In the North Caucasus the house mouse occupied all plain: a steppe zone and semi-deserts, the specie gets into mountains in different places on different heights (Tembotov, 1972), and in a subalpine belt, she occupies only settlements, i.e. is strictly sinantropic form (Tembotov, 1972; Tembotov, Shkhashamishev, 1984; Tarasov, 1989). Adaptation of a specie to conditions of middle mountains of the Caucasus (subalpine belt) on fabric is caused by the high oxygen capacity of blood that is provided with activity of blood formation of marrow and is followed by higher content of hemoglobin in blood, at the expense of erythrocytes, larger on volume, without increase in their quantity. At the same time, characteristic of mountain populations of widespread types in mountains, increases in the index of heart it is not revealed which high both in the foothills, and in middle mountains (Tembotova, etc., 2006; Emkuzheva, 2013). Features of population structure of a house mouse in mountains of the North Caucasus it is studied poorly (Tarasov, 1989), data on their seasonal variability are absent. In this regard the purpose of work consisted in the analysis of seasonal dynamics of number, population structure of a house mouse in different climatic conditions: meadow steppes (foothills) and subalpine belt (middle mountains) of the Caucasus.

## METHODOLOGY OF CARRYING OUT WORK

Research object - a house mouse (*Mus musculus L.*). Catching of small animals was made in not heated houses and constructions by a standard method of trap-lines (Karasyova, Telitsina, 1996). Recalculation was done for 100 trap-days. In total 3116 trap-days (hp), 1757 - in the foothills, and 1359 - in middle mountains are fulfilled. 360 individuals of a house mouse (137 - in the foothills, 223 are caught - in middle mountains) who were subjected to the morpho-physiological analysis (Schwartz, etc., 1968). The number and gender and age structure of populations is studied. The actual fertility was estimated on the basis of calculation of placental spots and quantity of embryos in uterus horns with recalculation of average value on quantity of the breeding females. Reproduction indicators are calculated:

- The RII - an indicator of intensity of reproduction counting on one female - the work of average of embryos for percent of the breeding females (Okulova, etc., 2009).
- PEI - a conditional indicator of efficiency of population - the work RII on number (number of individuals on 100 hp).

The age of animals was determined on a complex of signs: body weight, condition of generative bodies and degree of molar damage.

The studied selections came from the central part of the North Caucasus. According to A.K. Tembotov's typification (Sokolov, Tembotov, 1989), points of collecting material, belong to the Elbrus option of zonation which is characterized by continental climate due to penetration of dry air streams from Caspian Depression. Places of catching of animals are located at the different high-rise levels: the foothills (the surrounding village of Psynadakha, 700 m above sea-level, a belt of meadow steppes, GPS of coordinate - 43°51' NL, 43°14' EL, average annual temperature is 8,6 °C, an average annual amount of precipitation of 630 mm), middle mountains (the surrounding settlement Elbrus, 1800 m above sea-level, a subalpine belt, GPS of coordinate - 43°15' NL, 42°33' EL, average annual temperature is 3,8 °C, an average annual amount of precipitation of 917 mm). Researches were conducted from 2003 to 2012. Material is processed statistically by methods of the dispersive analysis (Puzachenko, 2004). For all statistical tests the significance value is accepted by 5%.

RESEARCH RESULTS

On materials of 2007 the relative number of a house mouse in constructions and houses in the conditions of the foothills of a belt of meadow steppes of the North Caucasus (the village of Psynadakha, 700 m above sea-level) is quite stable within a year (fig. 1.). Recession of number is noted in the spring (8,34 wasps. on 100 hp). At the same time in separate years we noted both considerable rises, and recessions. So in the winter of 2003 it reached 25 wasps. on 100 hp, and in the same season of 2006 - 4,20 wasps. on 100 hp. According to literary data the mouse brownie in different regions varies number from in considerable limits from 1-2 to 25% of hit (A house mouse ..., 1994).

It should be noted that during the summer period house mice in the foothills are marked out as natural station, and in constructions. We believe that it is caused by seasonal migrations: in the spring - from dwellings of the person in field station, in the fall - back, characteristic for the sake of appearances in the majority of places of dwellings (Kucheruk, 1988; House mouse ..., 1994, etc.).

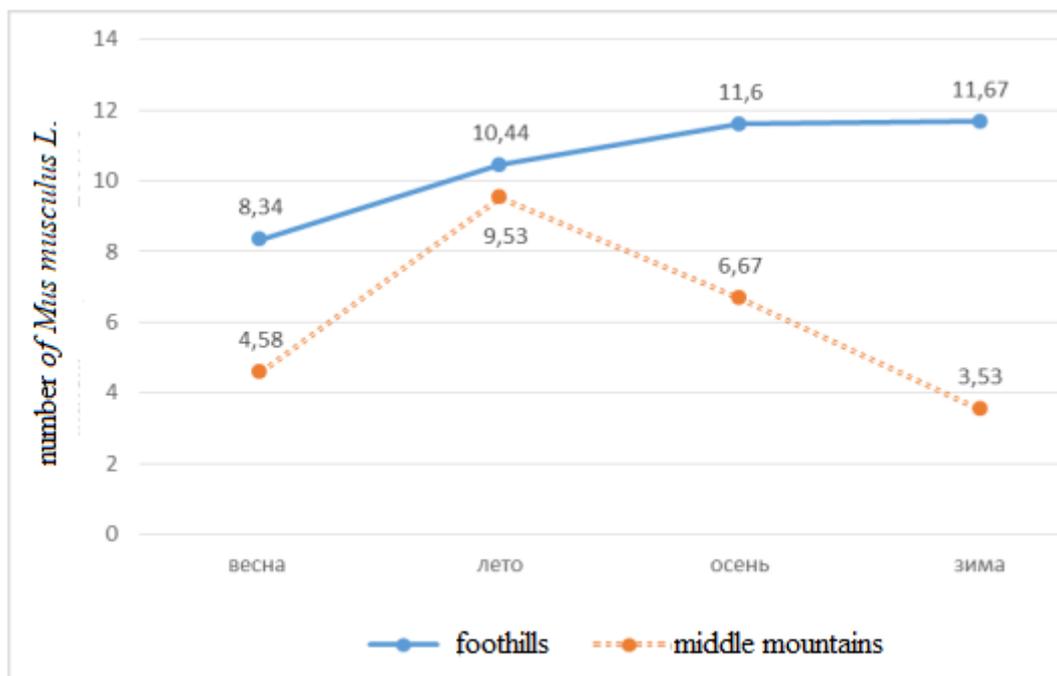


Fig. 1. Changes of number of *Mus musculus L.* during different seasons of year in the foothills and middle mountains of the North Caucasus

In middle mountains of the North Caucasus on the periphery of an area (1800 m above sea-level) where on change of climatic conditions it is imposed and the lowered partial pressure of oxygen, number of a house mouse it is subject to seasonal variability (fig. 1.), what is characteristic of widespread types in mountains (Bolshakov, 1972). The number peak in studied fell 2007 on a summer season (9,53 copies on 100 hp). Apparently from fig. 1., specie number is low in both selections in the spring, by summer it increases, in middle mountains reaching an annual maximum and in the fall again decreases, and in the foothills - continues to grow.

We did not register in middle mountains the mass migrations in natural biotops that are characteristic for house mice during the warm period for all the time of conducting observations from 2004 to 2012. The number of a specie reaches a minimum during the cold winter period - up to 3,53 copies on 100 hp. It is known (Putin, 2006) that negative ambient temperatures - the major limiting factor of distribution of a house mouse in natural biotopes and open antropocenosis. The specie is warm-loving and migrative, which is (Ladygina, 1954; Kalabukhov, 1969; Stolkakova, 1978) caused by poorly developed physical thermal control (accumulation of

fatty stocks, growth of a fur cover in the fall) owing to what protection against cooling occurs in energetically unprofitable way - sharp increase of level of a metabolism and heat production at fall of temperature. In cold the period of year at a house mouse in middle mountains of the Caucasus is observed activation of immune processes (Tembotova, etc., 2011).

In general, the received results demonstrate that in middle mountains number the brownie of a mouse is lower in relation to the foothills during all seasons of year. The reasons can be a little. The first - historical - rather recent penetration of specie into middle mountains of Central Caucasus Mountains. According to A.K. Tembotov's data (1957) a house mouse - young dwellers of a subalpika of Central Caucasus Mountains, respectively, the periphery of an area. The second - physiological - poorly developed thermal control of specie in lower temperatures of the environment of middle mountains.

To the main to the reasons of various dynamics of number of small mammals in mountains features of reproduction of population, the speed of puberty of various generation, fertility belong (Bolshakov, 1972). The ratio of floors in population is established as under genetic laws (the signs linked to a floor often define significant differences in physiology, ecology and behavior of males and females) but also, to a certain extent, under the influence of Wednesday (Bolshakov, Kubantsev, 1987). The data obtained by us demonstrate that a ratio of floors the brownie of a mouse does not find out correlation (scale correlation) communication with a season of year that is characteristic as in the conditions of the foothills (0,05), and middle mountains (0,07). In the spring, in the summer and in the fall in the foothills in the ratio of males and females, judging by the caught animals, the shift in favor of males (tab. 1) is observed, in the winter - females prevail.

**Table 1. Features of population structure of a house mouse during different seasons of year in the foothills of the North Caucasus**

Indicators	winter	spring	summer	fall
Sexual structure	1:1,42	1,55:1	1:1,52	1:1,20
Reproduction:				
% pregnancy and lactation	11,11	0	20,00	27,28
Quantity of embryos	5-8	0	5-6	8-9
Actual fertility	6,55	-	5,57	7,50
RII	72,77	0	113,40	227,24
PEI	856,50	0	1183,89	2635,98

In middle mountains in the winter and in the summer the ratio of floors is close to 1:1, in the spring and in the fall small shift in favor of males (tab. 2).

**Table 2. Features of population structure of a house mouse during different seasons of year in middle mountains of the North Caucasus**

Indicators	winter	spring	summer	fall
Sexual structure	1:1,01	1,30:1	1,15:1	1,30:1
Reproduction:				
% pregnancy and lactation	16,67	54,54	37,50	3,45
Quantity of embryos	4-7	5-7	2-9	6
Actual fertility	5,33	7,00	5,89	6,00
RII	88,85	381,99	220,88	20,70
PEI	313,60	1749,51	2104,99	138,10

Age structure of a house mouse in the North Caucasus a labile both in seasonal, and in high-rise aspect. The population basis in the foothills and middle mountains is made by adult animals whose share during different seasons of year varies, in the foothills maximum - in the summer (92.50%), minimum - in the winter (75.00%). In middle mountains, on the contrary, the maximum share - in the winter (100%), minimum - in the summer (71.92%).

In the different Areas of Caucasus varies both duration, and number of peaks of reproduction of specie (Alekperov, 1966; Ryabtseva, 1978; Eygili, 1980). In city population of a house mouse (Nalchik, 500 m above sea-level) the period of reproduction is extended, the peak falls on a summer season (Tembotova, etc., 2007) and comes to the end in the fall. In foothill population, on the obtained data, a bit different picture: the greatest percent of pregnant females comes across in the summer and in the fall (more than 20%). During the winter period the single making multiple copies females (3.45%) meet, us the litter nest with three cubs in a haystack in February is revealed. Reproduction is interrupted in the spring (0%).

In the conditions of middle mountains longer period of reproduction with coverage of all seasons of year is characteristic of a house mouse, judging by the females who are taking part in reproduction. The peak of reproduction is noted during the warm spring and summer period (54,54% and 37,50% in the summer of females were pregnant in the spring). In January we caught a pregnant female who brought 5 quite created cubs on the same day, with the body weight of 820-920 mg.

It is also necessary to note that in the spring and in the summer females with post-placental spots of pregnancy were observed (18,18% and 6,67% respectively). Recession of reproduction is noted in the fall (3,45% of pregnant women). The brood size, judging by quantity of embryos, with area height ( $t=1,13$  at  $p < 0.269$ ) does not change. This indicator in the foothills varies from 5 to 9, in middle mountains from 2 to 9 that will be coordinated with data of other authors (Eygili, 1980; House mouse ..., 1994). The average of embryos on a pregnant female in both populations on seasons is also relatively stable (at paired comparison on seasons in the foothills of  $p < 0.151$  -  $p < 0.258$ ; in middle mountains -  $p < 0.312$  -  $p < 0.909$ ).

Apparently from the obtained data, dwelling the mouse brownie in middle mountains of Central Caucasus Mountains is followed by increase in intensity of reproduction during all seasons of year that is characteristic of widespread type's mountains (Bolshakov, 1972). At the same time characteristic increase in fertility with height is not observed:  $6.60 \pm 0.26$  embr. - in the foothills,  $6.00 \pm 0.54$  embr. - in middle mountains.

The Indicator of Intensity of Reproduction (IIR) the mouse brownie during the winter period is low both in the foothills and in middle mountains, regardless of number. The analysis of dynamics of an indicator of efficiency of population (PEI) showed that in the foothills the house mouse produces the maximum number of young people in the fall. The limit reproductive effort of females in an annual cycle (high values of IIR) brings in middle mountains in the spring at increase of total of efficiency of population (PEI) which reaches the maximum values only by summer.

## CONCLUSION

In the foothills (700 m over Ur. I) and middle mountains (1800 m over Ur. I) the central part of the North Caucasus of the loudspeaker of relative number of a house mouse it is various: in the foothills it is high and stable during all seasons of year, in relation to middle mountains where the peak of number is observed in the summer, and recession - in the winter. At the same time during the cold winter period the basis of populations of a house mouse in the North Caucasus is made by adult mature individuals both in the foothills and in middle mountains. The breeding females meet also in the foothills in the winter, but in their middle mountains much more. Dynamics of reproduction of specie at different heights is various: more individuals participate in mountains in reproduction and the reproduction period is longer.

The high intensity of reproduction in mountains in comparison with the foothills with a small number allows assuming smaller life expectancy of a house mouse in middle mountains of the central part of the North Caucasus. Above told allows to come to a conclusion about wellbeing of foothill population during all seasons of year, and turning on of compensation mechanisms (a reproduction intensification) for maintenance of stability of population of a house mouse in middle mountains of the central part of the North Caucasus.

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