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The effect of temperature on the life activity of spermophilus pygmaeus distributed in the southern regions of Uzbekistan

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Abstract: This article is dedicated to an in-depth study of the effect of temperature on the species Spermophilus Pygmaeus in the field of rodentology. Existing studies show that temperature has a great influence on the number of small ground squirrels, their life activity, nest drying, and the development of young ground squirrels. This requires better study of the species and demonstration of new approaches based on ecological research. In studies conducted in the southern regions of Uzbekistan in 2023, a systematic analysis was conducted of how the nests, colonies, and population dynamics of these species changed depending on the temperature. To support scientific achievements in the field of rodents, it is necessary to develop new methods and test them in practice. Moreover, these studies demonstrate the importance of preserving the biodiversity of rodents and ensuring the sustainability of ecosystems.

Keywords: Spermophilus Pygmaeus, rodent, burrow, ethology of the species, synanthropus, landscape, temperature.

Introduction: Today, the animal world is being widely studied, in particular, the distribution of rodents of the genus Rodentia, their life activity, role in nature and human life, and the role of representatives of the genus as carriers of infectious diseases. These works require a broader theoretical and practical study of representatives of the genus and are of great practical importance. The occupation of new territories by species and the emergence of new adaptive adaptations to changes in nature are increasing. The migration of rodents for food and habitat is increasing as a result of anthropogenic impact. This situation leads to the fact that species cause more epidemiological situations. That is, the migration of rodents and their approach to residential areas, their ectoparasites, which are carriers of infectious diseases, is accompanied by an increase in the number of various infectious diseases in humans. In addition, the calculation of indicators of the density and annual activity of rodent species is of great importance, and when calculating these indicators, relative indicators are often used, but these indicators do not give a clear picture of their actual number and state. In the scientific works of Varshavskiy and Kalabukhov, data are presented on the seasonal changes in the life activity of rodents, various adaptations, and seasonal changes in the number of species [1;2;3;4]. The relationship between the annual number of rodents, the spread of various diseases, and the periods of activity of the species is presented in Rall's works [8;9]. Optimization of conditions for rodents, that is, an increase in temperature, influences the intensification of various chemical reactions and life activity. However, if heat exchange is deviated from the optimal norm, the main factor can become the ambient temperature, which directly affects the ethological, ecological, physiological, and even biochemical reactions of rodents [5;6;7]. The rise in temperature is a factor that determines the food of rodents, their reproduction, the expansion of the range of species, the number and viability of young individuals. Temperature also affects how rodents build shelters and construct nests. The increase or decrease in ambient temperature also affects the temperature of the rodent's nest. Heat also affects the body temperature of small ground squirrels, the development of their physical thermoregulation,

and the conditioned reflex mechanisms of heat regulation [10]. In some rodents, when the ambient temperature changes by 25° (5 - 30°), the body temperature changes by 0.6-1.2° [11]. In rodents distributed in mountainous areas, changes in ambient temperature contribute to an increase of an average of 0.8° [12]. At the beginning of spring, the body temperature of newborn rodents differs by 1°, while in summer-born rodents it differs by 0.3° from the ambient temperature [13]. We also focused our research on such issues as the influence of ambient temperature on small ground squirrels and the change in the number of species depending on temperature.

METHODS

In April 2023, special observations were conducted to determine the number of small ground squirrels (Spermophilus pygmaeus) distributed in the natural and cultural landscapes of the Nishon district of Kashkadarya region, which is considered the southern territory of Uzbekistan. A total of 532 small ground squirrels were caught using various traps between 10:00-14:00 in the warmest part of the day and between 18:00-20:00 in the second part of the day. 50 traps were used to catch small ground squirrels. Thermometers were used to measure the temperature.

RESULTS AND DISCUSSION

Our research is also aimed at studying the vital activity of representatives of the genus Rodentia in the southern regions of Uzbekistan, their numbers, the influence of seasonal changes, and migration to agricultural lands. The research work examined the temperature-dependent changes in the number of small ground squirrels (Spermophilus pygmaeus) distributed in the natural and cultural landscapes of the Nishan district of Kashkadarya region, which is considered the southern territory of Uzbekistan. The awakening of Spermophilus pygmaeus from winter sleep occurs at the beginning of hot days, that is, in the middle of March. In the southern regions of Uzbekistan, spring comes early, and the temperature begins to rise from the beginning of March. In spring, an increase in the temperature leads to an increase in the intensity of movement of small ground squirrels. In the evening and at night, in any season of the year, the activity of small ground squirrels is practically zero. Nevertheless, the level of animal activity does not directly affect their actual population.

Table 1. Number of Spermophilus pygmaeus in the study area in relation to temperature.

Day	Time 10:00-14:00		Time 18:00-20:00	
	Temperature	number of species	Temperature	number of species
1	21 ^{0}C	21	15 ^{0}C	3
2	23 ^{0}C	29	17 ^{0}C	5
3	28 ^{0}C	37	20 ^{0}C	11
4	30 ^{0}C	43	21 ^{0}C	19
5	29 ^{0}C	40	21 ^{0}C	17
6	30 ^{0}C	41	21 ^{0}C	15
7	31 ^{0}C	41	22 ^{0}C	18
8	32 ^{0}C	43	23 ^{0}C	20
9	33 ^{0}C	42	21 ^{0}C	21
10	35 ^{0}C	47	24 ^{0}C	19
total		384		148

On April 9, we placed 50 traps in areas where small ground squirrels were widespread. We placed traps between 10:00 and 14:00 and caught 21 small ground squirrels, during which the temperature was 21°C. The condition of the traps and the presence of rodents in them were monitored hourly. By the second half of the day, from 18:00 to 20:00, traps were placed again, and 3 small ground squirrels were caught, during which the temperature was 15°C. The same work was repeated for 5 days, and the data presented in Table 1 were obtained. On April 20, 50 traps were placed in the study area, and 29 small ground squirrels were caught, and when checking the temperature, it was found that it rose to 23°C. In the second half of the day, the temperature reached 17°C, and 5 small ground squirrels were caught in traps. On May 1, between 10:00 and 14:00, 37 small ground squirrels were caught at 28°C, 43 on May 10 at 30°C, and 40 on May 26 at 29°C, 11 on May 1 at 20°C, 19 on May 10 at 21°C, and 40 on May 26 at 17°C. The average temperature between April 9 and May 26 was 22.5°C. Traps were set daily and checked twice during the specified time interval. A total of 225 small ground squirrels were caught between the days of the experiment, and depending on the temperature, 62 ground squirrels were caught on the 3rd day of the experiment (May 10), which is the highest indicator. On the 1st day (April 9), 24 small ground squirrels were caught, which is the

smallest number. From the above data and the number of rodents caught, it can be said that the most active period of small ground squirrels occurs during hot periods of the day. On hot summer days, small ground squirrels become less active with sunset. Thus, depending on environmental conditions, mainly the temperature factor, small ground squirrels increase or decrease their activity. Increasing the temperature increases the activity of small ground squirrels. A significant increase in the number of ground squirrels was observed when the ambient temperature changed from 21°C to 30°C. This increase in activity occurs due to the following reasons: Increased metabolic rate - in ground squirrels, metabolism accelerates with higher temperatures, which increases their likelihood of faster digestion and searching for more food. Increased activity - a rise in temperature in small ground squirrels increases their physical activity and begins to actively respond to external stimuli.

CONCLUSION

Based on the above data, it can be concluded that if relative methods are used to calculate the number of rodents (for example, using traps), the obtained data will reflect not the number of animals, but their dynamic density. The increase in temperature increases the activity of small ground squirrels, accelerating the processes of searching for food and feeding. On the other hand, a decrease in temperature, especially in the evening and morning, reduces their activity. This can probably be shown as an adaptive reaction of small ground squirrels to temperature changes. With a decrease in temperature, the number of ground squirrels outside the nest decreased significantly. At low temperatures in the evening, their activity decreases, and we characterized this by the following. With the cooling of the air in the evening and at night, organisms quickly lose heat. Therefore, their activity level decreases. On April 9 (21°C) and April 20 (23°C), the number of small ground squirrels reached 21 and 29 individuals. This change was observed due to the increase in temperature. On May 1 (28°C) and May 10 (30°C), the number of ground squirrels increased to 37 and 43 units. Temperature sensitivity helps organisms adapt to environmental conditions. Small ground squirrels undoubtedly have the ability to adapt to environmental conditions, such as changes in temperature, food sources, and the search for shelter. At low temperatures, their activity decreases and they hide more or spend time in shelters. Low temperatures also affect the development of the younger generation. Temperature changes also affect the mites' reaction to the environment and their adaptation to their habitat. There are four ecological factors necessary for the life of warm-blooded animals, including rodents. Temperature comes first. All life processes associated with temperature are important for any living organism. The temperature factor is especially important for rodents, as their small size leads to high heat loss. In conditions close to optimal conditions, the temperature factor may not be involved in determining the specific reactions of animals. However, if heat exchange deviates from the optimal norm, the ambient temperature can become the main factor, which directly affects the ethological, ecological, physiological, and even biochemical reactions of rodents.

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