

Institute of General and Experimental Biology, Mongolian Academy of Sciences;
Ministry of Nature, Environment, and Tourism of Mongolia;
Ministry of Education, Culture, Science, and Sports of Mongolia;
Commission on Marmot Investigation of the Theriological Society at the Russian Academy of Sciences
Mammalian Ecological Society of Mongolia;
Joint Russian–Mongolian Complex Biological Expedition of RAS and MAS



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on the Genus *Marmota*
Marmots of the
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MARMOTS ADAPTATION IN CAGE CONDITIONS

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Introduction

We obtain from marmots their pelts, edible meat and healing medicinal fat. All those products are in high demand. For 5-8 months a year marmots are dormant, and need neither food provision for winter, nor care in that season. The base of their nutrition is vegetable foods. Marmots are large sized: the body length of adult animals is 40 to 70 cm, the weight, 3.5 - 10 kg. In nature marmots spend 9/10 of their life span in burrows. Estrus occurs in April-May, and pregnancy lasts 30-35 days. They whelp 4-6 kits on the average. Lactation lasts 35-50 days (Bibikov, 1989).

Material and methods

The subjects of the study were steppe marmots (n=280) of a European subspecies (*Marmota bobak bobak* Müller, 1776) (Figure 1) and black-capped marmots (n=26) of a Kamchatka subspecies (*Marmota camtschatica camtschatica* Pallas, 1811) (Figure 2).

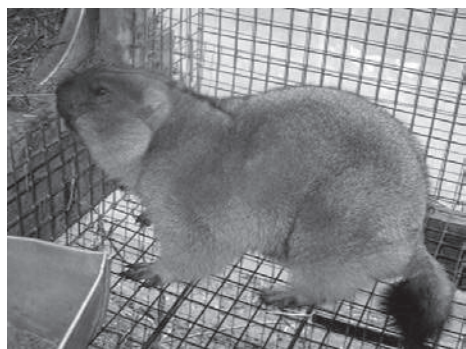


Figure 1. The steppe marmot (photo M.V. Plugina).



Figure 2. The black-capped marmot.

Several housing types for keeping marmots were tested: warm houses of squared beams and bricks; wooden 4-row barn-shed 7 x 68 meters (Figure 3); the common 2-row open shed (Figure 4); and an open 2-row shed with underground houses. The animals also were housed in cages under a lean-to and in corrals. For winter hibernation, separately placed cages in which houses were covered with snow for better warmth, were employed.

Мир
животных
и человека



Figure 3. *Wooden 4-row barn-shed.*



Figure 4. *2-row open-shed.*



Figure 5. *Cages for marmots.*

The cages were those used for industrial breeding of red foxes and polar foxes, with open air, galvanized, welded wire-mesh and a wooden house. We lined the house with wire-mesh from inside. The distance between the wooden and wire-mesh bottoms in the house was increased up to 10 cm to make a thicker stratum of warming material for winter keeping of the marmots (Figure 5).

When keeping marmots in a shed with underground houses we installed, on both sides along the shed, concrete trays, which we dug into the earth 1.5 meters deep. We covered the shed with concrete and filled earth to the landscape level. Inside the trays we made brick partitions. We connected the underground houses with the open air sites with a tubular passage.

The temperature of the air in the cages recorded at M-16 thermograph. The body weight of animals was measured once a month on electronic scales. Statistical analysis was performed using Microsoft Excel 2010.

Results and discussion

There were considerable differences in temperature conditions for winter hibernation between shed and barn housing. Both steppe and black-capped marmots kept in cages can readily endure severe winters with temperatures as low as -30 to -35°C (Plotnikov & Zabolotskikh, 2000). During winter hibernation, which lasts from October to the beginning of April in the temperature zone of Russia, marmots reduced body weight by 30-45%. Black-capped marmots had a 3-4% lower weight decrease than did the steppe variety. Grown individuals of both species lose 5-6% more weight than did the young. When kept in cages



with insulated houses in a closed shed marmot body weight is reduced 30-33%, while the average for animals kept in a shed with open sides was 37%. The weight reduction percent in marmots wintering in cages under snow cover was greater. Keeping marmots in closed, non-heated premises, provides a better temperature regime than in an open shed. Degree of illumination of outside rows of cages on a sunny day is 80-850 lx. With 4-row sheds, reduced natural lighting to the inside rows of cages was noted (1-29 lx).

Open shed techniques have the advantage of lower building expenses but do not suit areas with severe winters. Making shed side walls of removable screens allows their use in various climatic zones. In southern regions where summer temperature is more than +35°C, the simple shed version is also not recommendable. For that zone, sheds with underground houses suit marmots better. Keeping marmots in winter in premises with artificial heating did not give good results. Under such conditions hibernation was interrupted, and moult and growth cycles are disrupted.

The marmots' feeding period lasts approximately 6.5 months, from April to October. During this period, intensive growth of the young is observed and the restoration of body mass in adults. Fat accumulation, compressing energy resource storage for wintering and early spring is underway. Before entering hibernation, marmots must have body weight not less than the following indices: adult steppe marmots: 5.2-5.8 kg, yearlings: 2.7-3.2 kg; adult black-capped marmots: 4.4-5.0 kg, yearlings: 1.4-1.8 kg (Plotnikov, 2012).

In captivity, marmots eat a variety of foods. They may be fed with: mangel-wurzel, carrots and other roots; boiled potatoes, cabbages, pumpkins and other vegetables, alfalfa, clover, various grasses, soaked with water or vapour combined foods, roots and oil-cake, milk and whey, bread and meal scraps and waste. It is impossible to satisfy the nutrient requirements of marmots without concentrated foods. Cereals without preliminary cooking and dry, loose combined foods are highly suitable for marmots. We recommend that marmots be fed granulated combined foods with granules 4.8-10 mm made for rabbits, nutrias, laboratory animals, pond fish and swine (Figure 6).



Figure 6. Granulated feed.



Figure 7. Bunker feeder KKB-1M.

Steppe marmots eat 300 g of granulated food per day (Mukhamedyanov et al., 2009). Unlike steppe marmot the black-capped variety eats 42-52% less dry combined foods, but both species similarly consume root vegetables and other succulent foods. The requirement of steppe marmots in nutrients on 1 MJ exchange energy makes (g): solid - 82,5; protein - 15,2; fat - 1,9; cellulose - 2,8; an azotic extractives - 31,6. On 1 kg of weight of a body it is required to marmots (g): 9,1 protein; 1,1 fat; 1,7 cellulose; 18,9 an azotic extractives; 0,9 calcium and 0,5 phosphorus. The requirement for all nutrients increases by 1 kg of live weight in the spring, and decreases on 23-30 % in the autumn.

At the cellular contents it is possible to provide need of marmots for nutrients with feeding by the granulated compound feed according to the developed recipes. It is established that when using in feeding of marmots of the granulated compound feed KKB – 1M, feeding trough, applied to rabbits is most technological (Figure 7).

Marmots, eating the granulated compound feed, try to take it paws. The part of a forage inevitably falls under a cage. For decrease in losses of a forage on a bottom under a bunker feeding trough it is necessary to attach in addition a shelf from sheet iron. As a result of this device the dropped – out forage fails not at once under a cage and steals up marmots.

Conditions of the cellular contents and technology of feeding of marmots cause level of need of marmots in water. Especially big need for water when feeding by dry compound feeds and at high surrounding temperatures. The general consumption of water in hot days of summer reaches on a marmots farm 500 g on the head per day. Feed marmots 2 times a day – in the morning and in the evening.

Fat storage at high levels in marmots before entering hibernation is of the key importance to their successive reproduction. Young female animals and those in a poor nutritive state in spring have incomplete estrous cycles as the heat and ovulation are absent. In vaginal smears mainly basal, parabasal, intermediate and a few surface epithelial cells are present (Figure 8, 9). This is the evidence for insufficient estrogens in the bodies of such females, as indicated in other studies (Rymalov, 1996).

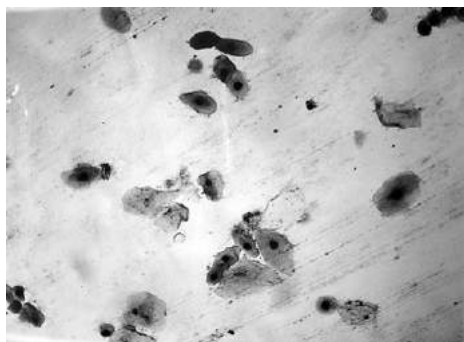


Figure 8. Stage of proestrus 2.

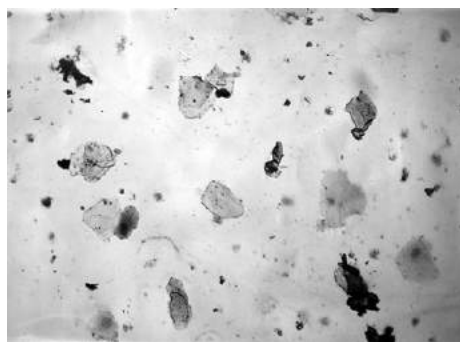


Figure 9. Estrus stage.

Marmots have a long reproductive period (7-10 years) and because they are a good model for a monitoring of different population parameters during long period of time. The first problem was providing of whelping. Even slight intervention in a liter life provoked a great female stress. Later, in domestication process, female had become calmer. Inspection at the day of whelping and moving whelps from one female to another were feasible.

Marmots are born without hair cover with smooth pink skin. Body mass of a newborn marmot is about 35 g, body length is about 10 cm. Eyes and ears are tightly closed; there are no teeth. The teeth emerge and the eyes open after 20 days of age. The weaning of the young is at the age of 45 days (Figure 10).



Figure 10. Young marmots.

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