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INFLUENCE OF BODY WEIGHT ON HIBERNATION OF THE COMMON DORMOUSE (MUSCARDINUS AVELLANARIUS)

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The hibernation of 18 wild-caught dormice was studied in the laboratory under constant condition. The animals were supervised and fed continuously during the experiments. For hibernation they were transferred to a refrigerator with controlled temperature of 5±2°C. Mortality was 44% during the hibernation, in contrast to 64–74% in nature. Weight loss tended to be linear and a relationship was found between the initial weight and the slope of the regression line. It is suggested that there is a critical mass relating to mortality in the animals that died. The mean initial body weight of surviving dormice was 18.19±3.50 g and of those that perished it was 15.26±3.16 g. This difference is statistically not significant but since it is close to the conventional 5% individual differences have to be calculated within the two groups, e.g. the body size in comparison with body mass, differences in metabolism, etc. Analysing the fine structure of a weight loss graph, hibernation periods could be detected. These seemed to last 4–26 days, the mean was 11 days. The mean body weight loss was 31.3±5.4%.

Key words: hibernation, weight loss, *Muscardinus avellanarius*

INTRODUCTION

The common dormouse hibernates from November to April. PAJUNEN (1974, 1979) studied the hibernation of the garden dormouse (*Eliomys quercinus*) in laboratory. We can conclude from that study that much smaller common dormouse (*Muscardinus avellanarius*) could behave differently. VOGEL and FREY (1995) studied the hibernation of this species in nature and were able to determine the hypothermic, normothermic and awakened periods. JUŠKAITIS (1999) established that winter mortality was 64–72%, including winter predation. The aim of the present study was to investigate weight loss during hibernation and to establish a relationship between the initial body weight and the slope of weight loss regression line. It was postulated that there is a critical mass determining death or survival and tried to establish this by reference to the mortality rate during hibernation.

MATERIALS AND METHODS

The animals were obtained from two areas of nest boxes : a planted middle-aged oak forest from the lowlands next to Makó, and a young opened oak forest mixed with fruit-trees from the foot of the mountains next to Lőrinci. They were transferred to Szeged for laboratory testing. Before and after hibernation the animals were kept at external temperatures in cages and were fed continuously. There was very mild weather at the and of the autumn and early in the winter, so observations lasted for 108 days, from the 13th December 2000 until 1st April 2001. At the first indication of hibernation starting they were transferred in a special bin to a refrigerator with controlled temperature (5±2°C). An empty bin was used as a blind-sample and measurements were corrected with these data. Body mass was recorded every second day, weighing the animal (to the nearest 0.1 g) together with the bin to prevent disturbance. It was supposed that the weight loss is linear and the regression was tested with one-tailed F-test. Spearmann-rank correlation was used to indicate a connection between the initial body weight and the slope of the regression line and two-sample t-test to compare mean body masses of perished and survived animals. Analysing the fine structure of a weight loss graph hibernation periods could be detected as a distinct segment when the animals were awake.

RESULTS

The mortality during the hibernation was 44%. The results of regression shows that linear tendency could be suggested, and the slopes differ significantly

Table 1. Results of the linear regression for the tested population. The individuals that died are signed with a plus before the number. n: number of measures, m0: initial weight, b: slope of the regression line, r^2: determination coefficient, p: significance level at the actual F-value

Individual	Days	n	m0 (g)	b (g/day)	r^2	F-value	p
14	108	54	26.6	–0.1081	0.9891	4721	<0.001
+1/1	64	32	12.05	–0.0201	0.9263	377	<0.001
+1/2	64	32	11.7	–0.0118	0.9620	760	<0.001
1/3	104	52	17.8	–0.0146	0.9678	1501	<0.001
+12/1	96	48	16.7	–0.0185	0.9815	2439	<0.001
+12/2	104	52	20.7	–0.0223	0.9797	2415	<0.001
12/3	102	51	19.3	–0.0208	0.9410	782	<0.001
12/4	104	52	20.75	–0.0199	0.9810	2578	<0.001
33/1	102	51	14.6	–0.0162	0.9426	805	<0.001
33/2	102	51	14.8	–0.0113	0.9558	1060	<0.001
10/2	102	51	18.05	–0.0165	0.9559	1062	<0.001
+16/1	64	32	14.5	–0.0125	0.9665	865	<0.001
16/2	108	54	16.6	–0.0077	0.9799	2541	<0.001
24/1	102	51	16.85	–0.0156	0.9705	1613	<0.001
+24/2	96	48	14.55	–0.0823	0.9723	1612	<0.001
+6/1	64	32	18.5	–0.0121	0.9408	477	<0.001
+6/2	64	32	13.4	–0.0225	0.9762	1230	<0.001
31	104	52	16.5	–0.0129	0.9886	4327	<0.001

Table 2. Results of the Spearmann-rank correlation. n: number of individuals, rs: Spearmann-rank correlation coefficient, p: significance level for rs

Group	n	rs	p
Whole population	18	–0.265	>0.25
Surviving individuals	10	–0.758	<0.05
Perished individuals	8	–0.190	>0.5

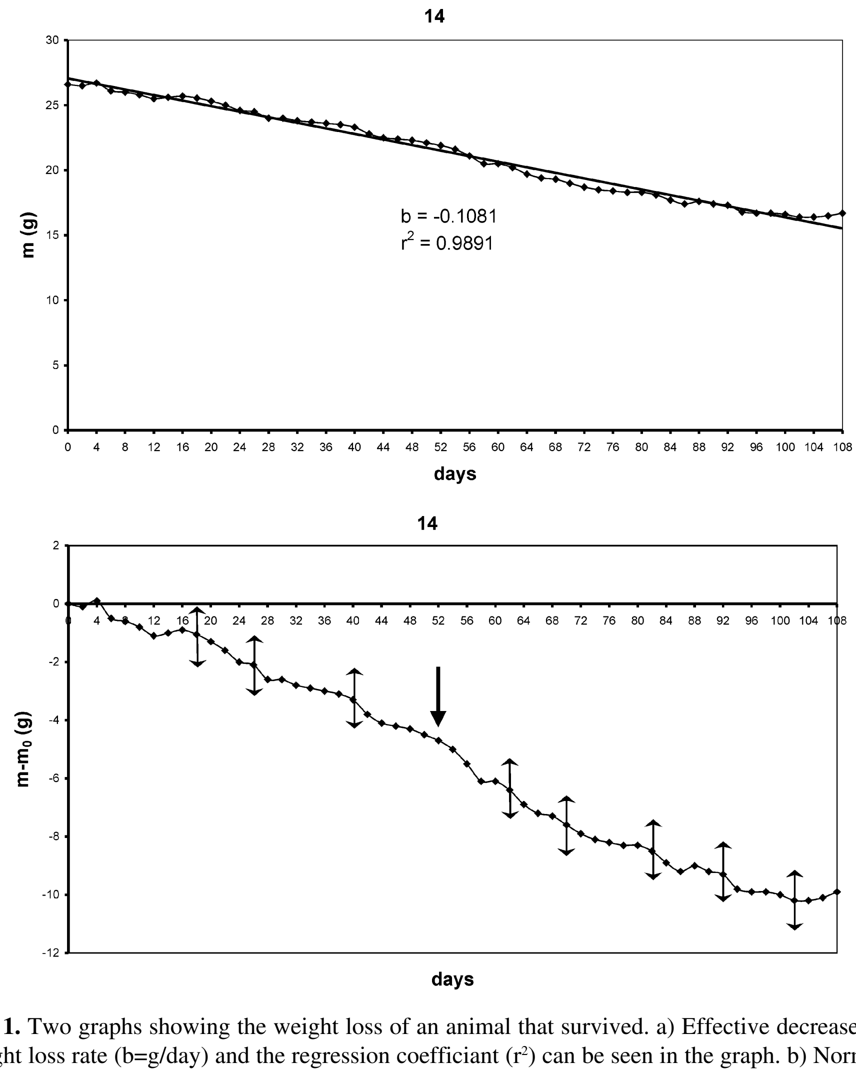

Fig. 1. Two graphs showing the weight loss of an animal that survived. a) Effective decrease. The weight loss rate (b=g/day) and the regression coefficiant (r^2) can be seen in the graph. b) Normated decrease. The simple arrow-head shows the observed awakening and the twin arrow-head shows the presumed awakening

Table 3. The two sampled t-test for the survived and perished individuals. n: number of individuals, ma: the mean of body mass, df: degrees of freedom, p: significance level for the actual t-value and degrees of freedom

Group	n	ma (g)	Standard error (g)	t-value	df	p
Survived individuals	10	18.19	1.11	1.837	16	0.085
Perished individuals	8	15.26	1.12			

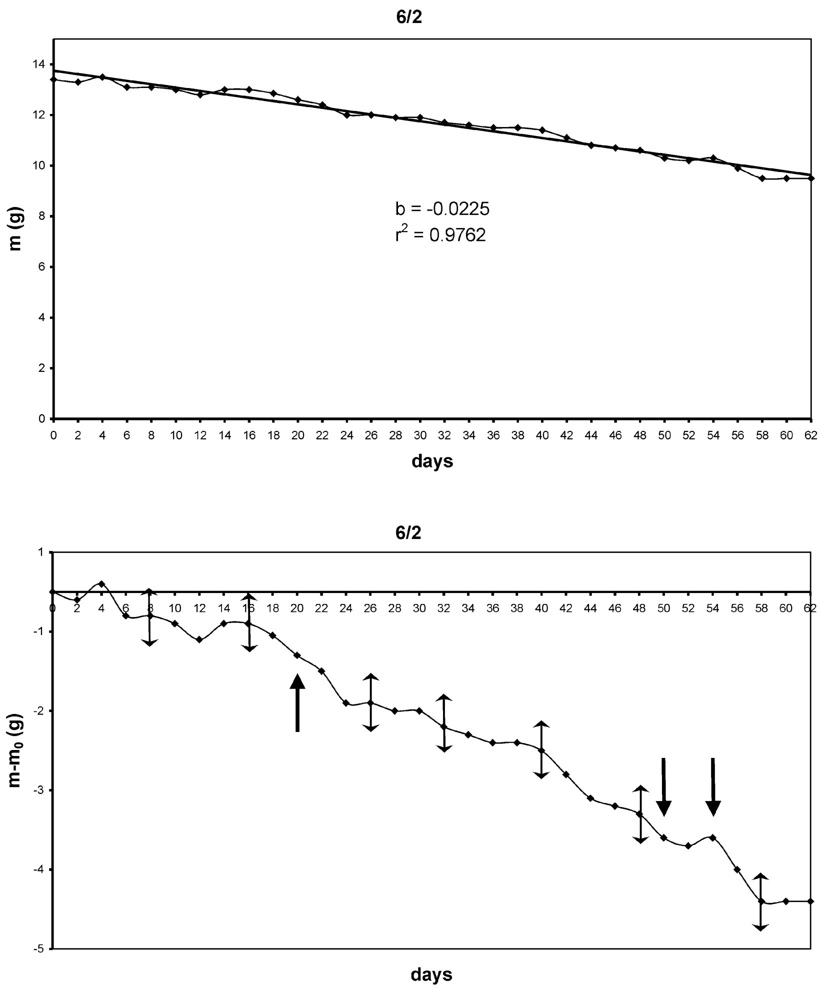

Fig. 2. Two graphs showing the weight loss of an animal that died. a) Effective decrease. The weight loss rate (b=g/day) and the regression coefficiant (r^2) can be seen in the graph. b) Normated decrease. The simple arrow-head shows the observed awakening and the twin arrow-head shows the presumed awakening

from zero (Table 1, Figs 1*a* & 2*a*). The Spearmann-rank correlation indicated a connection between initial body weight and the slope of the regression line in the case of the survived animals, while the animals that died showed no connection. (Table 2). The two-sample t-test showed that there was not significant difference between the mean body masses of the two groups (Table 3). The periods of wakefulness seemed to last for 4–26 days and the mean duration was 11 days (Fig. 1*b* & 2*b*). The mean body weight loss was 29±7% for the whole population and 31.3±5.4% for the animals that survived.

DISCUSSION

Animals that survived used their reserve energy more smoothly during the hibernation in comparison with those that died or the population as a whole. The rank-correlation and the comparison of initial weights suggests that the initial weight is not an exclusive factor causing mortality. Differences in age groups (FRENCH 1990, JUŠKAITIS 1999, PAJUNEN 1974), body size in comparison with body mass or individual differences in metabolism must be calculated. Winter predation was excluded, so mortality was due to intrinsic factors. The observed periods of awaking are in good accordance with information from the literature for *Muscardinus avellanarius* (VOGEL & FREY 1995). The proportional body weight loss is very similar in the garden dormouse (PAJUNEN 1974, PAJUNEN 1979).

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REFERENCES

FRENCH, A. R. (1990) Age-class differences in the pattern of hibernation in yellow-bellied marmots, Marmota flaviventris. *Ecologia* **82**: 93–96.

JUŠKAITIS, R. (1999) Winter mortality of the common dormouse (Muscardinus avellanarius in Lithuania. *Folia Zoologica* **48**: 11–16.

PAJUNEN, I. (1974) Body temperature, heart rate, breathing pattern, weight loss and periodicity of hibernation in the French garden dormouse, Eliomys quercinus L., at 4.2±0.5°C. *Ann. Zool. Fennici* **11**: 107–119.

PAJUNEN, I. (1979) Effect of transfer from 4° to 0°C during midwinter on hibernation in the garden dormouse, Eliomys quercinus L. *Ann. Zool. Fennici* **16**: 201–204.

VOGEL, P. & FREY, H. (1995) L'hibernation du muscardin Muscardinus avellanarius (Gliridae, Rodentia) en nature: nids, fréquence des réveils et température corporelle. *Bull. Soc. vaud. Sc.* **83** (3): 217–230.

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