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BIOENERGETIC CHARACTERISTICS OF TWO SYMPATHRIC HOUSE MICE SPECEIES FROM NORTH BULGARIA

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ABSTRACT. A flow of matter and energy through two mice populations is presented. An estimation of their influence on the production of alfalfa field (*Medicago sativa*, L.) was also done. Two sinthopic mice species from genus Mus - *Mus musculus musculus* (*Linnaeus*, 1758) and *Mus spicilegus* (*Petenyi*, 1882) in Northern Bulgaria are the object of the present work.

KEY WORDS. *Mus musculus musculus, Mus spicilegus,* diet and bioenergetics

INTRODUCTION

Animal eco-physiological mechanisms and their part in the functioning of ecosystem has an important place in the population studies. The food specialization, metabolic rate and energy flow through animal populations depends on the differences of nutrition and energy value of plants, composing their diet.

Two species from the genus *Mus* - *Mus musculus musculus* (*Linnaeus*, 1758) and *Mus spicilegus* (*Petenyi*, 1882) are the object of the present work. The steppe species *M. spicilegus* is completely outdoor, while the semisinantropic *M. m. musculus* spends late spring, summer and early autumn in the field and the rest time of the year in the human settlements.

Alfalfa is a perennial and unhills agriculture. The absence of annual crop rotation allows rodents to inhabit such type of areas more then one year. The absence of migration processes is one of most important factors to select the right place for population and biocenological investigations.

MATERIAL AND METHODS

The annual investigations in 3-4 age-old alfalfa fields were providing in Northern Bulgaria immediate proximity of town Dolni Dabnik.

The population density was calculated by CMR method (Davis 1956).

Species differentiation of the mice from genus Mus was done using discrimination key by Gerasimov et all. (1990).

Method for diet determination of two mice species was by Bomford (1987 II).

To estimate the food preferences animals from the species *M. spicilegus* were caught from hilloks near Pleven and those from *M. m. musculus* nearly the Kostinbrod.

Energy values of food, bodies and feces of mice were determining using bomb calorimeter "KL-10".

Statistic calculations were by Parker (1978).

RESULTS AND DISCUSSION

Results of population dynamics of genus *Mus* for the investigating period (from XI 1991 to IX 1992) are presented on fig. 1. In November the population density amounts 9.5 animal/ha.

Increasing of population density 42.8 animal/ha was established in the spring on the investigated area. The highest density 86.1 animal /ha was note in the summer but it was followed by considerable decreasing in September - 11.5 animal /ha.

The habit of live of *M. spicilegus* (Sokolov et. al., 1990) is a reason this species to be find in the field during all the year. The high catch of animals in the summer probably is a result of the presence of semisinantropic *M. m. musculus* this season in the field.

The representatives from the two investigated mice species *M. spicilegus* and *M. m. musculus* living in Northern Bulgaria were established on the field for the investigating period. During the investigating period in the alfalfa field percentage ratio between two mice species is presented on fig. 2a and 2b.

On the base of the craniometrical results of *M. spicilegus* and *M. m. musculus* all further experiments were provided simultaneously with the two species.

The number of animals and the species differentiation of mice captured for stomach content analysis are presented on table 1.

The dynamic of mice food composition in seasonal and annual aspects is presented on fig. 3.

Statistically reliable differentiations in the food spectrum of mice were established only in summer – time when the two sympatric mice species were caught in the investigated alfalfa field. Comparison between stomach contents by sex the same conclusions were done. Statistically reliable differentiations by sex ($p \leq 0.05$) were fined only in summer when in the diet of males the percentage of green vegetable parts were higher then females. On the other hand in the female diet the part of seeds and animal food were significantly higher. They consists not more then 1/3 from the male's food.

Mice consumptions (C) of three weed plant species included in the experiments for food preferences are presented in table 2.

Data concerning consumption (C), digestion (D) and assimilation (A), as well as the excretory products (F and U) for steppe and synantropyc mice species are present on table 3.

The results show that about 20% from the total amount of food excretes with feces and urine and the rest 80% from the consumption take part in the assimilation. This quantity consists of metabolically energy, expended on respiration (R) and maintenance.

The calorimetric measurements of main assay of the food, food reminds of weed seeds are presented on table 4a and 4b.

Daily energy amount of food with 2.77 ± 0.76 g is 61.6 kJ/day for *Mus spicilegus* and 61.5 kJ/day for 2.88 ± 0.35 g seeds for *Mus m. musculus*. For 1.0 g body mass it was 4.0 kJ/g/day.

Between the daily energy consumption by the two investigated mice species there are not statistically significant differences

Calorimetric measurements based on average samples of the body and feces also were done. The results are presented on table 5.

There were not statistically significant differences between energy values of the body and feces by the two investigated mice species. It's possible to be calculated that the energy value for body mass of 15.4±1.7g amounts about 338.8 kJ/animals/day for the body and 0.9 kJ/ animals/day for the feces of *Mus spicilegus*. Respectively for *Mus m. musculus* with average body mass 15.3±1.6 g this values were 344.3 kJ/day and 0.9 kJ/ animals/day.

Daily energy budget in the body of the investigated mice is presented on table 6.

Therefore 97% of the food energy utilizes as metabolizable energy in the body. All experimental animals were adults, in unisexual activity period and with constant body mass. Therefore the total amount of metabolized energy utilizes for respiration.

The energy flows between the two investigated mice species are very similar and this is a reason to present them as a joint scheme – fig.2.

On the base of the obtained result the annual amount of consumption is possible to be calculate. It was 36.8 kg/ha or in energetic units - 855 058.5 kJ/ha. Energy losses with feces were about 3% from the total consumption - 7.4 kg/ha or 23 133.3 kJ/ha per year. 17.5% from all the energy flow through the *M. m. musculus* population. About 6.6% from assimilated energy (A) or 2.1 kg/ha per year (55 063.1 kJ/ha) were utilized for biomass formation.

In the annual energy flow between two mice populations there were not established statistically significant differences. Similar metabolic values for the investigated species are the result of close temperature preferences in the winter (Metcheva & Gerasimov, 1994).

CONCLUSIONS

The stomach contents analysis show sameness in the food spectrum by the two investigated species. In spite, that alfalfa is a perennial, unhill agriculture and suitable mice habitat it's not a preferred as a food except in a case when a most prefered food absent.

The results from the annual energy consumption gives a possibility to conclude that the two sympatric mice species utilized less then 1% from the total primary

production of the alfalfa field. Therefore for such population density the mice influence on the energy circulation in the biocenosis is near to negligible.

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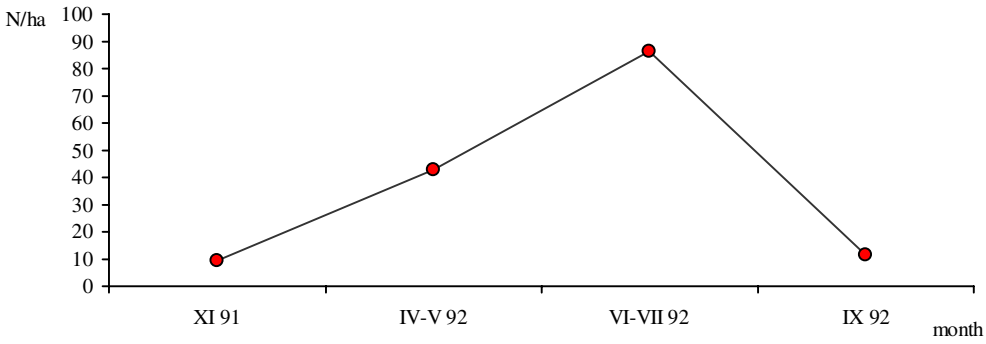

fig. 1. Ppulation density of *Mus sp* .

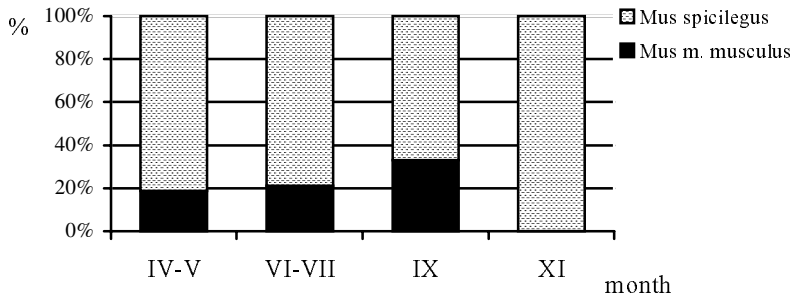

fig. 2 a.Percentage participation of two mice specis in the field for 1991

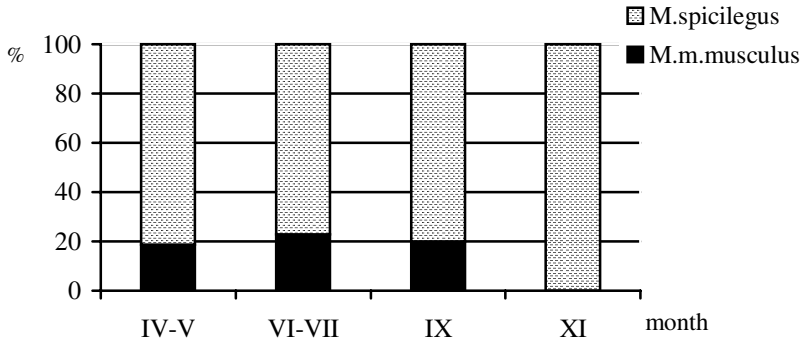

fig. 2 b.Percentage participation of two mice specis in the field for 1992.

Table 1. Species distribution of the number of caught animals for stomach content analysis.

year	1990	1991				1992			
month	XI	IV-V	VI-VII	IX	XI	IV-V	VI-VII	IX	total
M.spicilegus	31	12	17	8	13	10	8	11	110
M.m.musculus	0	3	4	5	0	2	2	5	21
total	31	15	21	13	13	12	10	16	131

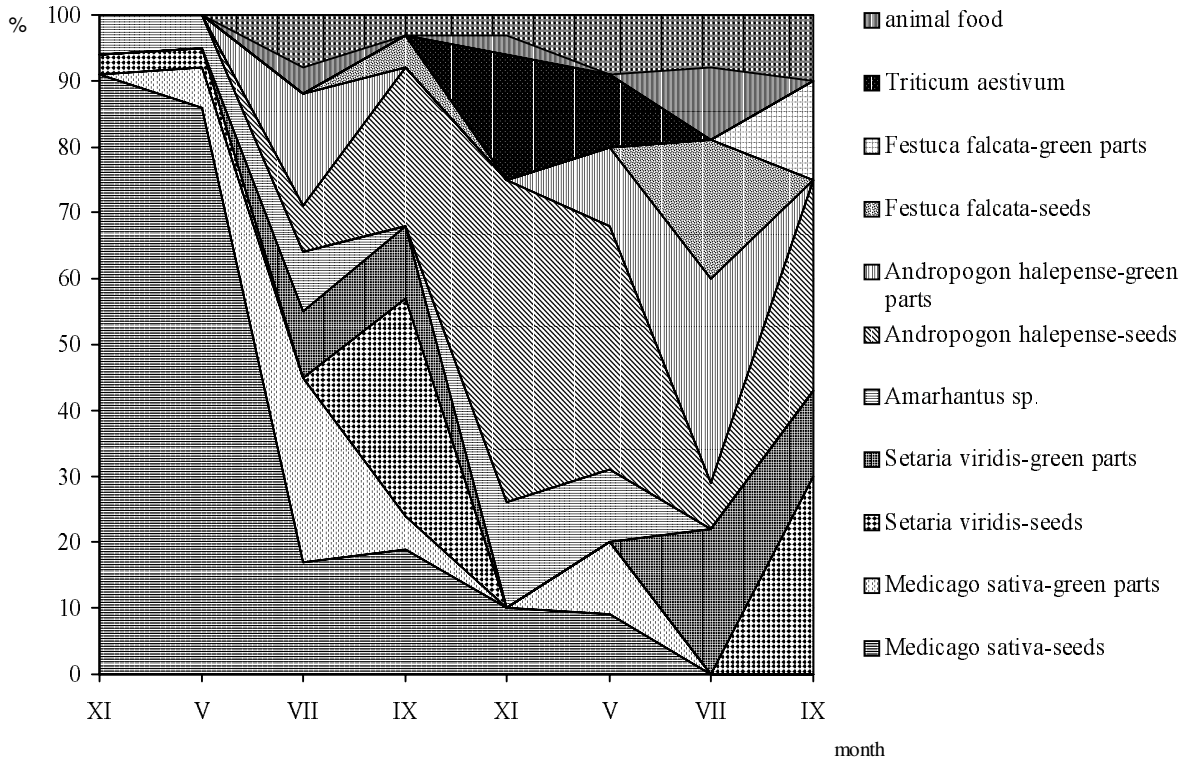

Fig. 3. Annual dinamic of food composition for the two investigated mice species

Table 2. The means (x ± Sd) of consumption in g/animal/day for *M. spicilegus* and *M. m. musculus*

species		*Andropogon halepense*	***Setaria viridis***	*Amaranthus sp.*	total
Mus spici-	x	1.01	0.88	0.89	2.77
legus	±Sd	0.18	0.32	0.59	0.76
n=91	min	0.25	0.03	0	1.53
	max	1.75	1.37	2.47	4.30
Mus mus-	x	1.07	0.93	0.87	2.87
culus	±Sd	0.19	0.20	0.35	0.35
n=77	min	0.88	0.64	0.48	2.35
	max	1.65	1.15	1.27	3.24

Table 3. The means (x ± Sd) of consumption, digestion, assimilation food, feces and urine in g/animal/day for *M. spicilegus* and *M. m. musculus*

species		Init. weight	Final weight	C	F	D	U*	A
Mus	x	15.4	15.4	2.77	0.49	2.28	0.05	2.23
spici-	±Sd	1.7	1.4	0.76	0.15	0.21	-	0.13
legus	min			1.53	0.23	1.26	-	1.16
n=91	max			4.30	0.78	3.71	-	2.39
Mus	x	15.3	15.5	2.87	0.49	2.38	0.05	2.33
mus-	±Sd	1.6	1.8	0.35	0.06	0.26	-	0.34
culus	min			2.34	0.41	1.76	-	1.66
n=77	max			3.24	0.56	2.99	-	2.87

- Urine was calculated by Drozdz (1968).

Tabl. 4a. Main values (x ± Sd) of food energy (kJ/g) from the weed seeds

Weed species	*Andropogon halepense*	***Setaria viridis***	*Amarhantus sp.*
food	18.3 ± 0.03	18.3 ± 1.2	18.6 ± 0.2
Mus spicilegus			
Food reminds	16.1 ± 0.08	17.1 ± 0.4	16.9 ± 0.2
Consumption	22.6 ± 0.6	21.2 ± 0.4	22.6 ± 0.2
Mus m. musculus			
Food reminds	15.4 ± 0.06	17.5 ± 0.6	17.1 ± 0.2
Consumption	23.5 ± 0.5	18.2 ± 0.9	22.3 ± 0.2

Tabl. 4b. Main values (x ± Sd) of food energy (kJ) from the weed seeds

Weed species	*Andropogon halepense*	***Setaria viridis***	*Amarhantus sp.*
food	54.9 ± 0.04	54.9 ± 1.2	55.8 ± 0.5
Mus spicilegus			
Food reminds	32 .0± 0.08	36.3 ± 0.4	35.7 ± 0.4
consumption	22.9 ± 0.6	18.6 ± 0.5	20.1 ± 0.3
Mus m. musculus			
Food reminds	29.7 ± 0.06	37.9 ± 0.7	36.4 ± 0.2
consumption	25.2 ± 0.5	16.9 ± 0.9	19.4 ± 0.2

Tabl.5. Energy values (x ± Sd) of the body and feces in kJ/g.

Species	***Mus spicilegus***	***Mus m. musculus***
body	22.0 ± 0.40	22.5 ± 0.50
feces	1.8± 0.04	1.8± 0.04

Tabl. 6. Daily energy budget in the body of *Mus spicilegus* и *Mus m. musculus* (x ± Sd), in kJ/animal/day.

Species	W (g)	C (g)	C	F	D	U*	A
Mus spicilegus n = 135	15.4 ± 1.5	2.77 ± 0.76	61.6 ±1.6	0.8 ± 0.1	60.8 ± 0.4	0.86	59.9 ± 0.3
Mus m. musculus n = 77	15.6 ± 1.4	2.88 ± 0.54	61.5 ± 1.3	0.8 ± 0.1	60.7 ± 1.1	0.86	59.8 ± 0.9

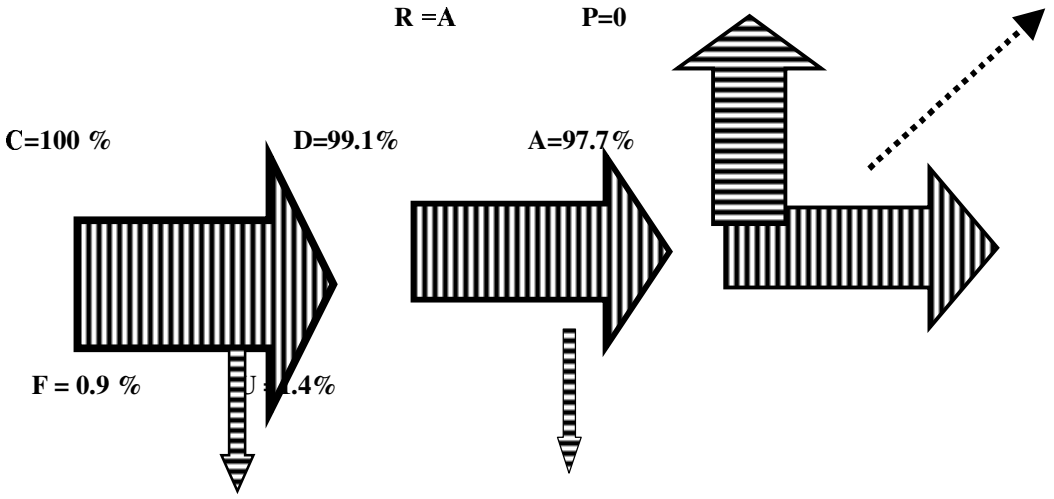

Fig 2. Energy flow trough the body of *Mus sp.*