RESEARCHES REGARDING THE BIOLOGIC RESERVE OF THE RODENT *Microtus arvalis* Pall (*Rodentina: Microtidae)* IDURING THE AUTUMN OF 2009 IN THE ORCHARDS IN SIBIU COUNTY

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Abstract:*The weather conditions during the last years were favorable to the growth of the populations of Microtus arvalis in Sibiu County. This pest rodent sheltered within all the agricultural cultures as well as in pastures, hayfields, slopes, the road sides. Its presence grew alarmingly in orchards, too.In order to put into practice correctly the control and warning measures there was necessary to establish the density of this pest. So, in order to determine the number of colonies as well as the percentage of attacked trees there were investigated 929 hectares of orchards. Researches upon the species Microtus arvalis were done by Săvescu, 1960; Manolache and Boguleanu, 1967; Tuţă, 1980; Teodorescu and coworkers, 2003; Paşol and coworkers, 2007, and so on.The investigations were done during 3rd September 2009 – 15th September 2009 in 7 orchard firms in the localities Viile Sibiului, Cisnădie, Şura Mare/Slimnic, Şura Mare (Agnita), Ruja, Miercurea Sibiului (Sibiu County). There was checked the surface of 929 hectares of orchards and there were identified the trees that were attacked by the rodent on the parcel of tree species. In order to determine the number of colonies as well as the percentage of the trees attacked by the mice there done soundings in zigzag as well as on the diagonal of the parcel. In the parcels where the trees were sustained by a sustaining system the sounding was done alongside the tree rows. In the same time there was investigated the dependence of the population of Microtus arvalis on the values of environment factors during 2009.There is considered that the results of the investigations are of a special economic importance, these being used afterwards in appreciating the best moment to put*

Key words*: biological reserve, Microtus arvalis Pall*

INTRODUCTION

Microtus arvalis Pall belonging to the *Microtidae* family, also named field mouse is one of the pest rodent of the young fruit tree plantations and of all young tree plantations. This rodent is spread in the entire steppe and forest steppe area till the altitude of 2000m.

In our country it can be seen in the orchards and forest plantations in the Transylvania Basin, in Banat and Moldavia. It also can be seen in Walachia and Oltenia in the under Carpathians regions alongside with the water rat (TUŢA, 1980).

In the areas where it made a powerful invasion it was of a high economic significance. So during 1965 – 1966 in Batoş orchard in Mureş County it destroyed over 80,000 trees of 2-10 years old, the tree patrimony being of 120 ha intensive orchard (TOMŞA, 2003).

In years with long, warm and rainless autumns the mice can cause great losses especially to the young trees in the new plantations and seed beds (TEODORESCU & coworkers, 2003). The mice gnaw the roots as well as the stem round the base then climbing gnawing up to 25cm height. The gnawing can be shallow but on small areas they can be deep to the wood all around the stem. The attacked trees dry in time (PAŞOL & coworkers, 2007). The greatest damages are produced at the end of winter.

Among the fruit tree species, the apple and the apricot trees, the the plum tree are mostly attacked by *Microtus arvalis* (SĂVESCU, 1960). At the cherry and sour cherry tree as well as for the hazel tree 1-8 years old the attack rate is smaller.

This pest develops very well on a rough soil. It lives in colonies, in underground nests having a lot of galleries, deep to 30-40cm that communicate with the exterior through a variable number of holes from 1 to many more. (MANOLACHE & BOGULEANU, 1967)

The mouse breeds from spring till autumn. A pregnant mouse female can give birth 5-7 times to 5-8 young ones if there are good condition of life like food, warm time and normal humidity. The young generation can breed themselves at the age of 1month and a half. The live time for a mouse is at the average of 18-19 months.

MATERIAL AND METHODS

✓ **The interval the investigations took place:** 03.09.2010 – 15.09.2009;

✓ **The investigation took place in 7 orchards in the following localities**: Viile Sibiului, Cisnădie, Şura Mare/Slimnic, Şura Mare, Veseud (Agnita), Ruja, Miercurea Sibiului.

✓ **There was checked a surface of 929 ha of orchards** finding out the invaded surfaces and the degree of the attack (the density of the colonies/ha)

✓ **There were identified the trees that were attacked** by the rodent on areas and fruit trees species;

✓ **The investigation of the dependence of the number of the population *Microtus arvalis* to the values of the environment:** temperature, rain in 2009;

✓ **The investigation method:** in order to determine the number of colonies as well as the percentage of trees attacked by the mice there were done drills in zigzag and on the diagonal of the area. In the areas where the trees had sustaining systems the drills were done alongside the row of trees.

RESULTS AND DISCUSSIONS

1. Finding out the Invaded Areas and Establishing the Degree of the Attack (the density of the colonies/ha)

The weather condition during the last years was favorable for the growth of the populations of *Microtus arvalis* in Sibiu County. This pest rodent settled in all the agricultural cultures as well as in pastures, hay field, slopes, the side of the roads and its presence also grew alarmingly in the orchards, too.

In order to apply correctly the warning and control measures there was necessary to establish the density of the pest. In this respect in order to determine the number of colonies as well as the percentage of the attacked trees there were investigated 929 ha of orchards (Table 1).

Table 1

The surface and the type of orchards investigated in the Sibiu County

The number of the total Investigated ha	**The orchard type**		
	Super intensively over 3,000 trees/ha	**Intensively 500-2000 trees/ha**	**Classical 200-500 trees/ha**
929 ha	66 ha	299 ha	564 ha
% of the total of orchards	7,1%	32,2%	60,7%

During 03.09.2009 – 15.09.2009 there were investigated 929 ha of orchards in the Sibiu County from which: 66 ha of orchard super intensively (over 3,000 trees/ha), representing 7.1% of the surface; 299ha of orchard in an intensively way (500-200 trees/ha),

representing 32.2% of the total and 567ha. Classical orchard (200 – 500 trees/ha) representing 60.7% of the investigated area.

Out of those 929ha of the investigated orchards in 2009 825ha (respectively 88.8%) were found out having the pest rodent (Table 2).

Table 2

The attacked areas and the density of the rodent (colonies/ha) in the Sibiu County 2009

The controlled surface From a sanitary Point of view	No attack	With attack	**Invaded surfaces and the density (the degree of the attack) of the rodent *Microtus arvalis* (colonies/ha)**				
			Weak 1-5 col. /ha	Medium 6-10 col./ha	Big 11-25 col./ha	Very big 26-100 col./ha	*General Attack* 101-200 col./ha
926 ha	104 ha	825 ha	94 ha	97 ha	205 ha	125 ha	304 ha
%	11,2 %	88,8%	11,39%	11,78%	24,84%	15,15%	36,84%

Out of the 825ha, 94ha presented a weak density of the attack (11.39% of the attacked surface), on the 97ha the density was a medium one (11.28%), on 205ha the degree of the attack of the pest was a big one (24.84%) and on 127 ha the degree of the attack was a very big one (15.15%) and on 304ha (36.84%) there was a general attack.

2. The Analysis of the Attack of the Rodent Against the Fruit Trees in the Controlled Orchards

Besides the number of the colonies/ha there was also investigated the number of the fruit trees attacked by *Microtus arvalis* (Table 3).

As a result of the analysis of the table 3 we can draw the following conclusions:

- On those 148ha of orchard there were found 15,707 samples pf fruit trees that suffered an attack of *Microtus arvalis.* Out of these 1,027 samples suffered a weak attack, 2,649 suffered a medium attack, 7,419 samples a strong attack and 4,612 samples a very strong attack.

- We must draw the attention that the result of the attacked trees by the rodent was during 2007 – 2009

- The biggest damages were registered in young orchards, of intensively type having 1,100trees/ha.

Table 3

The number of the attacked trees from the total of the controlled orchards

Controlled Orchard Surface ha	**Without tree attack**	**With the tree attack**	**The attacked trees**				
			Weak 3%	Medium 3-10%	Strong 10-30%	Very strong 30-60%	Extremely strong over 60%
926 ha	781 ha	148 ha	46 ha	46 ha	42 ha	14 ha	-
% of the total surface	84%	16%	5%	5%	4.5%	1.5%	-
The Total of the attacked trees	-	**15,707**	**1,027**	**2,649**	**7,419**	**4,612**	-

Table 4 leads to the following conclusions:

- Out of those 148 ha of fruit trees attacked by *Microtus arvalis* 116 ha were cultivated intensively, 4 ha were cultivated super intensively and 28 ha classical. There were affected 12,031 trees out of 15,707. There was established that the most of the attacked trees were in young orchards, the intensively type(over 1,000trees/ha);

- On 46 ha there were attacked 1,027 trees , this being a weak attack (1-3%); on another 46 ha there were attacked 2,649 trees, this being a medium attack (3-10%); on 42 ha there were attacked 7,419 trees, this being a strong attack (10-30%); on 14 ha the pest attacked 4,612 trees, this being an extremely strong attack (30-60%);

Table 4

The Situation of the Attacks Considering the Types of Orchards in Sibiu County

Locality/ Society	Trees attacked	The total of the hectares attacked			The number of the trees attacked – the kind of attack (ha)					
		Intensively	Super Intensively	Classical	Weak 1-3%	Medium 3-10%	Strong 10-30%	Very Strong 30-60%	Extremely Strong > 60 %	The total of the attacked trees
Viile Sibiului S.C. Horticola Internațional SRL	Apple tree	35 ha	-	-	12 ha/ 396 trees	6 ha/ 660 trees	17 ha/ 3,366 trees	-	-	4,422
	Apple tree	-	-	5 ha	-	5 ha / 175 trees	-	-	-	175
	Plum tree	-	-	5 ha	-	5 ha / 225 trees	-	-	-	225
	Cherry tree	-	-	10 ha	-	-	-	10 ha / 2,500 trees	-	2,500
	Sour cherry tree	15 ha	-	-	5 ha/ 165 trees	-	10 ha / 1,210 trees	-	-	1,375
Cisnădie S.C. Prod Fruct	Plum tree	-	-	7 ha	7 ha / 84 trees	-	-	-	-	84
Șura Mare/Slimnic Person	Apple tree	10 ha	-	-	-	2 ha / 88 trees	4 ha / 880 trees	4 ha / 2,112 trees	-	3,080
	Cherry tree	-	-	1 ha	-	-	1 ha/ 115 trees	-	-	115
Șura Mare Person	Apple tree	1 ha	-	-	1 ha / 2 pomi	-	-	-	-	2
Veseud (Agnita) S.C. Duo Comp SRL	Apple tree	37 ha	-	-	11 ha / 302 trees	25 ha / 1,237 trees	1 ha / 330 trees	-	-	1,869
Ruja S.C. Conelt SRL	Apple tree	17 ha	-	-	6 ha / 66 trees	3 ha/ 264 trees	8 ha / 1,320 trees	-	-	1,650
	Plum tree	1 ha	-	-	-	-	1 ha / 198 trees	-	-	198
Miercurea Sibiului S.C. Deko Rame SRL	Apple tree	-	4 ha	-	4 ha / 12 trees	-	-	-	-	12
Total		116 ha	4 ha	28 ha	46 ha / 2,649 trees	46 ha 7 2,649 trees	42 ha / 4,612 trees	14 ha / 4,612 trees	-	15,707

- In Viile Sibiului there were attacked 4,597 apple trees, 2,500 cherry trees, 1,375 sour cherry and only 225 plum trees. Although in the literature of specialty there is mentioned that the cherry tree and the sour cherry tree can be attacked by *Microtus arvalis* in a smaller proportion there was established that on the investigated agricultural eco system the number of the samples of sour cherry trees and the cherry trees was much higher than those of the attacked plum trees.

- There can't be done a direct correlation of the number of the colonies/ha and the number of the attacked trees/ha due to the agricultural and technical works as well as the control measures that were applied differently on the areas by the producers.

3. The Investigation of the Dependence of the Number of the Population of *Mictotus arvalis* to the Values of the Environment: Temperature and Rain during 2009

The year 2009 was from the temperature point of view over the yearly average temperature in many years. This being, for the Sibiu Depression of 8.9^0 C and in 2009 the average temperature was 10.3^0C.

During 2009 there was registered quite a growth of the average temperature of the air with 1.4^0C.

Usually July is the hottest month of the year and January the coldest one. 2009 was between the normal limits regarding the temperature. There was registered 20.9^{0}C in July that is a value close to that registered in many years for this month and - 2.8^{0}C in January, this value being also close to the normal one. December and February, generally cold months were mild in 2009, with temperature above the average ones So, the average temperature in February was of only – 0.6^{0}C, and in December the average temperature was even higher of 1.7^{0}C. During the invasions of arctic or marine polar air the researched area can be covered by masses of cold air, being mostly exposed to the severe cold the valleys and the depression zone.

During the year the number of the days when there is registered an average temperature higher than 0^{0}C is of 293 and the number of the days with an average temperature over 10^{0}C is of 179.

The average data of the first frost is situated in the second decade of October. The danger of frost can last till May but it generally disappears from the third decade of April. Due to the invasions of masses of cold air yearly in autumn and late in spring the frost can be present sometimes within a period of 2 to 4 weeks comparing to the average data.

The number of frost days is of 124. The variation of the air temperature in 2009 can be seen in Figure 1.

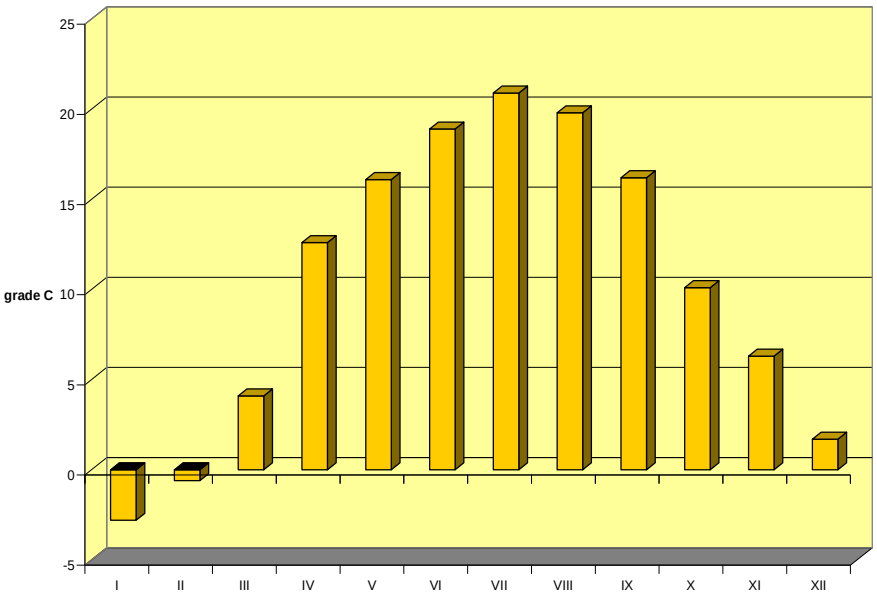

Figure 1: The Variation of the Average Monthly Temperature during 2009

Having as a background the growth of the temperature and in normal conditions of rain the number of the pests grew alarmingly.

The average relative wetness of the air registers values of 75% (average yearly value). In the depression area of Sibiu the difference registered between the warm and cold season is quite high (18%).

The yearly value of the relative wetness of the air in the depression area presents a continuous diminution till the beginning of summer and than a growth till the end of the year.

As regarding the rain the smallest quantities of rain are during the cold season, when there is collected only a quarter of the quantity of water during summer.

In February the average monthly quantities of water varies from 18-30mm. In 2009 February was a wet month with a quantity of 51.2mm.

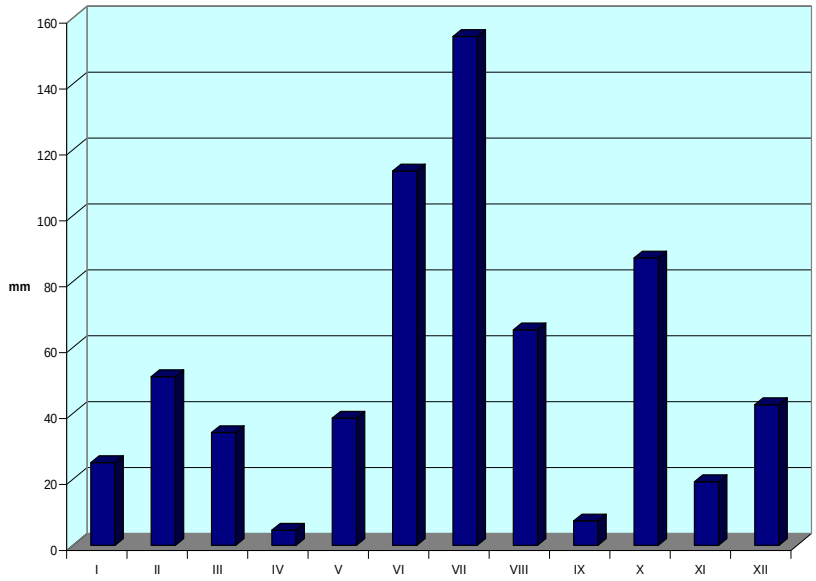

Figure 2: The Variation of the Monthly Quantity of Rain in Sibiu during 2009

Generally June is the month with the highest quantities of water out of the entire year these quantities vary round 90mm. In 2009 was also registered quite a growth of the quantity of rain comparing to the normal one almost the entire summer time: 113.6mm in June and 154.4mm in July. May, generally a rainy month was poor in showers – only 38.6mm.

As an assembly the quantity of rain was within the normal limits (Figure2) but with atypical values for February (more than normal 51.2mm) and April (less than normal with 4.6mm)

CONCLUSIONS

- Out of those 929 ha of orchards investigated in 2009 in the Sibiu County, 825ha (respectively 88.8%) were found with pest rodent. Among these 94 ha presented a weak density of the attack, 97 ha a medium one, 205 ha a high attack degree, 127 ha in a very high attack degree and on 304 ha the attack was generalized;
- There were attacked by *Microtus arvalis* a number of 15,707 fruit tress out of which 1,027 samples suffered a weak attack, 2,649 a medium one, 7,419 a strong attack and 4,612 samples a very strong attack;
- Out of those 15.707 fruit trees 11,210 were apple trees, 507 were plum trees, 2,615 cherry trees and 1,375 sour cherry trees;
- The attacked trees are the result of the attacks during 2007 -2009;

- In Viile Sibiului there were attacked 4,597 apple trees, 2,500 cherry trees, 1,375 sour cherry trees and only 225 plum trees. Although in the literature of specialty there is mentioned that the cherry tree and the sour cherry tree can be attacked by *Microtus arvalis* in a smaller proportion there was established that on the investigated agricultural eco system the number of the samples of sour cherry trees and the cherry trees was much higher than those of the attacked plum trees;
- On the background of the growth of the temperature and in normal conditions of rain during 2009 the number of the pest rodents grew alarmingly in the Sibiu County;
- There was established that on the areas where were done mechanical and agricultural and technical works of the soil as well as the weed killer was used on the row of trees the attack of *Microtus arvalis* was weaker;
- The growth of the attack of pests in some agricultural systems is sometimes due to the lack of the mechanical, agricultural and technical works as well as to the lack of sanitary treatments.

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