

**DATA CONCERNING THE DIVERSITY OF SCARABEOID LARVAE  
(COLEOPTERA: SCARABEOIDEA:  
MELOLONTHIDAE, RUTELIDAE AND CETONIIDAE)  
IN FOREST NURSERIES FROM COVASNA COUNTY, ROMANIA**

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**Abstract.** The researches regarding the diversity of scarabeoid larvae in the forest nurseries from Covasna County were made in October, 2013. The material (477 larvae) was collected from the soil (121 samples of 1 m x 1 m x 0.5 m); systematically, it belongs to three families: Melolonthidae, Rutelidae and Cetoniidae; three subfamilies: Melolonthinae, Rutelinae and Cetoniinae, 6 genera and 6 species. The dominant species was *Protaetia (Netocia) cuprea* (Fabricius 1775) – 312 individuals (in 52 samples) identified for three forest nurseries: Dârnău, Iancău and Păpăuți. It was followed by: *Melolontha melolontha* (Linnaeus 1758) with 52 individuals collected from 10 forest nurseries (106 samples); *Rhizotrogus aestivus* (Olivier 1789) with 40 individuals (in 2 forest nurseries – 17 samples); *Amphimallon solstitiale* (Linnaeus 1758) – 35 individuals from 3 forest nurseries (22 samples). The authors analysed the densities of the species in correlation with the types of forest, types of soil, types of stations, altitude. Regarding the infestation level, very high infestations were identified for Oituz, Turia and Comandău forest nurseries. Low infestations were registered for Dârnău and Păpăuți.

**Keywords:** scarabeoids, larvae, forest nurseries, infestation, Covasna County, Romania.

**Rezumat. Date privind diversitatea larvelor de scarabeoidee (Coleoptera: Scarabeoidea: Melolonthidae, Rutelidae și Cetoniidae) în pepiniere din județul Covasna, România.** Cercetările privind diversitatea larvelor de scarabeoidee în pepiniere din județul Covasna au fost realizate în octombrie, 2013. Materialul biologic (477 de larve) a fost colectat din sol (121 de sondaje de sol: 1 m x 1 m x 0,5 m); din punct de vedere sistematic, acesta aparține la trei familii: Melolonthidae, Rutelidae și Cetoniidae; trei subfamilii: Melolonthinae, Rutelinae și Cetoniinae, 6 genuri și 6 specii. Specia dominantă a fost *Protaetia (Netocia) cuprea* (Fabricius 1775) – 312 indivizi (în 52 de sondaje) identificați în trei pepiniere: Dârnău, Iancău și Păpăuți. Această specie a fost urmată de: *Melolontha melolontha* (Linnaeus 1758) cu 52 de indivizi colectați din zece pepiniere (106 sondaje); *Rhizotrogus aestivus* (Olivier 1789) cu 40 de indivizi (în două pepiniere – 17 sondaje); *Amphimallon solstitiale* (Linnaeus 1758) – 35 de indivizi în trei pepiniere (22 de sondaje). De asemenea, au fost analizate densitățile speciilor în corelație cu tipurile de pădure, tipurile de sol, tipurile de stațiune, altitudine. Referitor la gradul de infestare, s-a constatat faptul că infestări foarte puternice s-au înregistrat pentru pepinierele: Oituz, Turia și Comandău. Infestări slabe au prezentat pepinierele Dârnău și Păpăuți.

**Cuvinte cheie:** scarabeoidee, larve, pepiniere, infestare, județul Covasna.

## INTRODUCTION

Nowadays, in Romania, in the forest nurseries and plantations, the root feeders represent the main disturbing biotic agents. Among them, the scarabeoids (Melolonthidae and Rutelidae Families) cause important losses in forest cultures (CIORNEI et al., 2011). Therefore, it is very important to investigate the presence of the root feeders in the soil (soil samples). All the material found in the samples was identified, analysed and then the specialists evaluated the infestation level. The aim of this paper is to present some contributions to the knowledge of the diversity of scarabeoids, by analysing the populations of larvae present in the soil, in different forest nurseries from Covasna County.

## MATERIAL AND METHODS

The material analysed in this paper was collected in October 2013. Twelve forest nurseries were investigated: Brețcu, Oituz, Ojdula, Turia (Brețcu Forest District), Comandău, Dârnău, Iancău, Păpăuți (Comandău Forest District), Ghelința (Covasna Forest District), Ozunca Băi, Szalkas and Vârghiș (Tălișoara Forest District). All of them belong to the Romanian National Forest Administration, Covasna Forest Direction (geographically – Covasna County – Fig. 1).

The characteristics of the twelve forest nurseries are presented in Table 1.

For this study, the scarabeoid larvae were collected from the soil – samples of 1 m x 1 m x 0.5 m. All the larvae were preserved in alcohol. The material was identified using the keys by PANIN (1955, 1957) and KLAUSNITZER (1978).

The number of samples was established for each forest nurseries according to their surface (1 sample / ha). Thus, for analysing the data, it was necessary to establish the density of the larvae (no. larvae / m<sup>2</sup>).

Also, for establishing the level of infestation, for all the species that were identified, it was necessary to calculate the average number of *Melolontha melolontha* (Linnaeus 1758) in the third larval instar, using the critical number of larvae / m<sup>2</sup> established for each species (SIMIONESCU et al., 2000 – Table 2).

The taxonomy and nomenclature used in this paper is in accordance with Fauna Europaea (<http://www.faunaeur.org>).

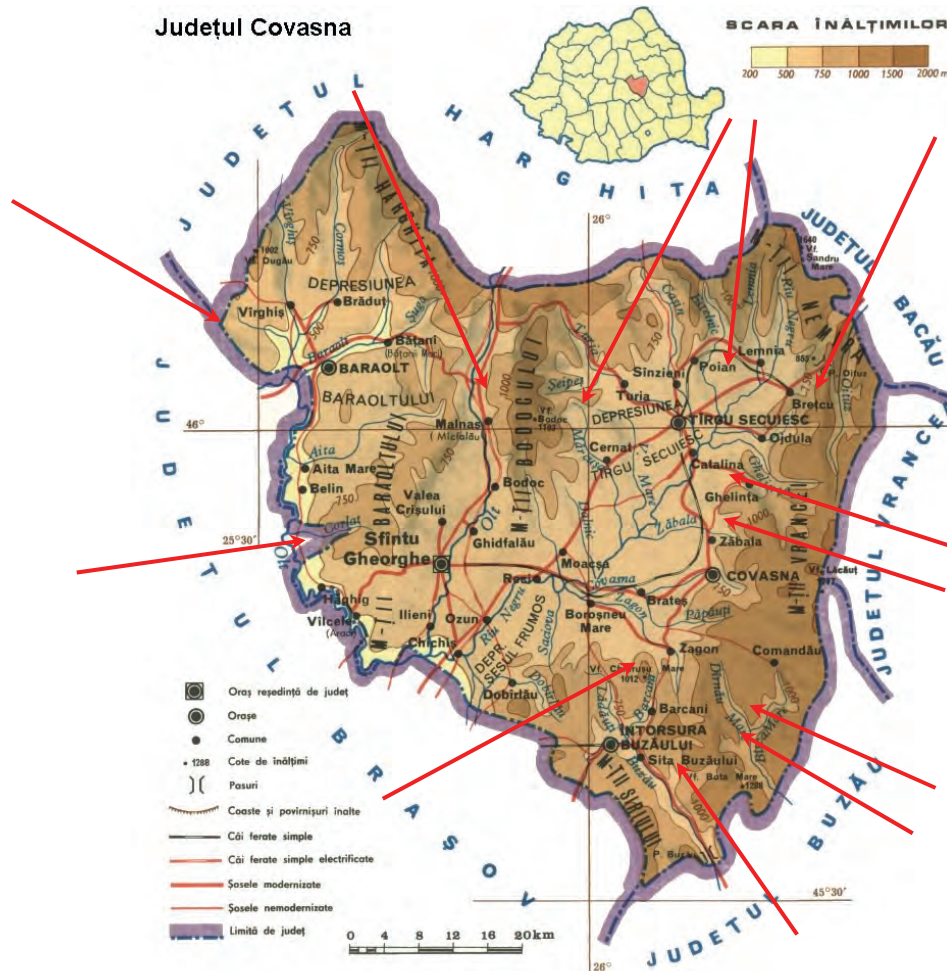


Figure 1. Map of Covasna County, Romania (the studied forest nurseries) (<http://www.pe-harta.ro/covasna/>).

Table 2. The critical number of larvae for the scarabeoid species identified for the forest nurseries from Covasna County – October 2013 (SIMIONESCU et al., 2000).

	The species					
	<i>Melolontha melolontha</i> (Linnaeus 1758)			<i>Amphimallon solstitiale</i> (Linnaeus 1758) <i>Rhizotrogus aestivus</i> (Olivier 1789) <i>Anomala</i> sp. <i>Phyllopertha horticola</i> (Linnaeus 1758)		
The larval instar	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>
The critical number of larvae / m <sup>2</sup>	5	3	1	10	6	3
The formula for calculating the average number of <i>Melolontha melolontha</i> (Linnaeus 1758) in the third larval instar	$L_1 \times 1/5 + L_2 \times 1/3 + L_3$			$L_1 \times 1/10 + L_2 \times 1/6 + L_3 \times 1/3$		

## RESULTS AND DISCUSSIONS

For studying the diversity of scarabeoids by analysing the populations of larvae present in the soil, 121 samples (1 m x 1 m x 0.5 m) from different forest nurseries were analysed. The biological material (477 larvae) was studied for identifying the species and the larval instar. Systematically, the 477 larvae belonged to three families: Melolonthidae, Rutelidae and Cetoniidae; three subfamilies: Melolonthinae, Rutelinae and Cetoniinae, 6 genera and 6 species (Table 3).

According to the results presented in table 3, the dominant species was *Protaetia (Netocia) cuprea* (Fabricius 1775) – 312 individuals (in 52 samples) identified for 3 forest nurseries (Dârnău – in 12 samples, Iancău – 5 samples and Păpăuți – 35 samples). It is necessary to mention that this species does not attack the roots of the plant (it is not a disturbing biotic agent). It was followed by: *Melolontha melolontha* (Linnaeus 1758) with 52 individuals collected from the 10 forest nurseries (106 samples): Brețcu (14 samples), Oituz (7 samples), Ojduța (12 samples), Turia (5 samples), Comandău (5 samples), Dârnău (12 samples), Păpăuți (35 samples), Ozunca Băi (2 samples), Szalkas (2 samples) and Vârghiș (12 samples); *Rhizotrogus aestivus* (Olivier 1789) with 40 individuals (in 2 forest

nurseries – 17 samples: Ojdula – 12 samples and Turia – 5 samples); *Amphimallon solstitiale* (Linnaeus 1758) – 35 individuals from 4 forest nurseries (36 samples): Ojdula (12 samples), Turia (5 samples) and Comandău (5 samples).

The largest number of individuals was collected from Păpăuți forest nursery (244 individuals in 35 samples). The material was also well represented in: Dârnău (53 individuals in 12 samples), Ojdula (49 individuals in 12 samples) and Turia (35 individuals in 5 samples).

Also, the largest number of species was registered for Turia forest nursery (4 species). For three forest nurseries (Oituz, Ojdula and Comandău), there were identified three species. From other three forest nurseries (Brețcu, Dârnău and Păpăuți) there have been collected 2 species. Only one species was identified for four forest nurseries: Iancău, Ozunca Băi, Szalkas and Vârghiș.

In one single forest nursery (Ghelnița) 10 samples have been investigated, but no larva was found.

For comparing the data, it was necessary to calculate the density (no. larvae / m<sup>2</sup>) (Table 4). According to the data presented in Table 3, the distribution of the 6 scarabeoid species in the twelve investigated forest nurseries from Covasna County is presented in Figure 2. Comparing the densities of species, the results indicate that the largest densities were registered for *P. (N.) cuprea*: 6.69 larvae / m<sup>2</sup> for Păpăuți, 5.8 larvae / m<sup>2</sup> for Iancău, 4.08 larvae / m<sup>2</sup> for Dârnău; for *A. solstitiale*: 3.4 larvae / m<sup>2</sup> in Turia forest nursery, for *R. aestivus*: 2.83 larvae / m<sup>2</sup> in Ojdula forest nursery and for *M. melolontha*: 2.5 larvae / m<sup>2</sup> in Ozunga-Băi forest nursery.

The authors also analysed the data regarding the density of larvae in different types of forests (deciduous forests, coniferous forests, mixed forests) – table 4. Thus, the largest densities of *M. melolontha*, *A. solstitiale* and *R. aestivus* were registered for mixed forests area; *Anomala* sp., *Phyllopertha horticola* (Linnaeus 1758) and *P. (N.) cuprea* – for coniferous forests area (Fig. 3).

Table 4. Survey of species, number of individuals and density of scarabeoid larvae identified for different types of forest from Covasna County (October 2013).

Species	Deciduous forests			Coniferous forests			Mixed forests			Total		
	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>
<i>M. melolontha</i>	4	14	0.29	28	66	0.42	20	41	0.49	52	121	0.43
<i>A. solstitiale</i>	1	14	0.07	17	66	0.26	17	41	0.41	35	121	0.29
<i>R. aestivus</i>				6	66	0.09	34	41	0.83	40	121	0.33
<i>Anomala</i> sp.				9	66	0.14				9	121	0.07
<i>P. horticola</i>				19	66	0.29	10	41	0.24	29	121	0.24
<i>P. (N.) cuprea</i>				263	66	3.98	49	41	1.20	312	121	2.58
<b>Total</b>	<b>5</b>	<b>14</b>	<b>0.36</b>	<b>342</b>	<b>66</b>	<b>5.18</b>	<b>130</b>	<b>41</b>	<b>3.17</b>	<b>477</b>	<b>121</b>	<b>3.94</b>

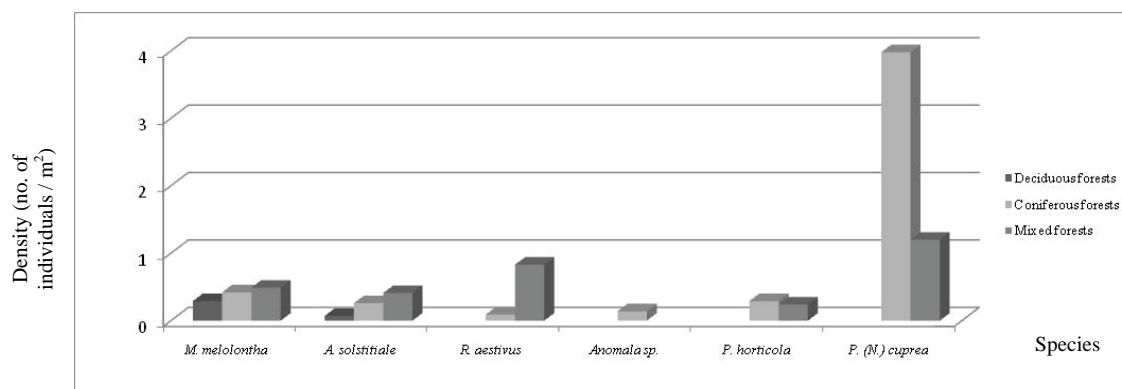


Figure 3. Survey of species, the density of scarabeoid larvae identified for different types of forest from Covasna County (October 2013).

Studying the density of scarabeoid larvae in different types of soil (Table 5), the results indicate that the typical eutricambosol presented the largest number of species (all six), the largest number of individuals (302) and the largest density of larvae (6.43 larvae / m<sup>2</sup>). Also, it can be noticed that typical luvisol registered a large density of *M. melolontha*; typical aliosol – a large density of *A. solstitiale*; typical preluvisol – a large density of *R. aestivus*; typical eutricambosol – large densities of *Anomala* sp. and *P. horticola*; alluvial soil – a large density of *P. (N.) cuprea* (Fig. 4).

Table 5. Survey of species, number of individuals and density of scarabeoid larvae identified for different types of soil from Covasna County (October 2013).

Species	1			2			3			4			5			6			7		
	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>
<i>M. m</i>	7	26	0.27	12	47	0.26	10	15	0.67	4	12	0.34				7	4	1.75	12	12	1
<i>A. s</i>	13	26	0.5	5	47	0.11	17	15	1.13												
<i>R. a</i>	34	26	1.31	6	47	0.13															
<i>A. sp.</i>				9	47	0.19															
<i>P. h</i>				27	47	0.57	2	15	0.13												
<i>P. c</i>				243	47	5.17				49	12	4.08	29	5	5.8						
<b>Total</b>	<b>54</b>	<b>26</b>	<b>2.08</b>	<b>302</b>	<b>47</b>	<b>6.43</b>	<b>19</b>	<b>15</b>	<b>1.93</b>	<b>53</b>	<b>12</b>	<b>4.42</b>	<b>29</b>	<b>5</b>	<b>5.8</b>	<b>7</b>	<b>4</b>	<b>1.75</b>	<b>12</b>	<b>12</b>	<b>1</b>

Legend: 1 = typical preluvisoil; 2 = typical eutricambosol; 3 = typical alsol; 4 = mollic, lithic soil; 5 = alluvial soil; 6 = typical luvisol; 7 = antrisol. *M. m* = *M. melolontha*; *A. s* = *A. solstitiale*; *R. a* = *R. aestivus*; *A. sp.* = *Anomala sp.*; *P. h* = *P. horticola*; *P. c* = *P. (N.) cuprea*.

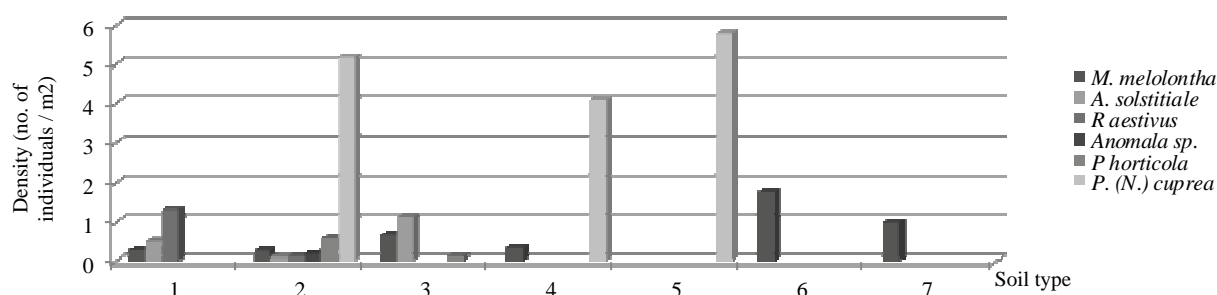


Figure 4. Survey of species, the density of scarabeoid larvae identified for different types of soil from Covasna County (October 2013): 1-7 – according to table 5.

Regarding the types of station (Table 6), it can be noticed that *M. melolontha* presented a high density in hilly regions, beech forests with high and medium productivity; *A. solstitiale*, *R. aestivus* and *P. horticola* were found in hilly regions, with sessile oak and beech forests and also in mountain regions, with mixed forests and medium productivity; *Anomala sp.* was identified in mountain regions, with mixed forests and medium productivity; *P. (N.) cuprea* registered high densities in mountain regions, with mixed forests (medium productivity and semi-swampy) (Fig. 5).

Table 6. Survey of species, number of individuals and density of scarabeoid larvae identified for different types of stations from Covasna County (October 2013).

Species	5152			3332			3630			5243			5232		
	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>
<i>M. melolontha</i>	14	19	0.74	15	69	0.22	4	17	0.23	17	14	1.21	2	2	1
<i>A. solstitiale</i>	18	19	0.95	17	69	0.25		17			14			2	
<i>R. aestivus</i>	6	19	0.31	34	69	0.49		17			14			2	
<i>Anomala sp.</i>		19		9	69	0.13		17			14			2	
<i>P. horticola</i>	2	19	0.11	27	69	0.39		17			14			2	
<i>P. (N.) cuprea</i>		19		234	69	3.39	78	17	4.59		14			2	
<b>Total</b>	<b>40</b>	<b>19</b>	<b>2.11</b>	<b>336</b>	<b>69</b>	<b>4.87</b>	<b>82</b>	<b>17</b>	<b>4.82</b>	<b>17</b>	<b>14</b>	<b>1.21</b>	<b>2</b>	<b>2</b>	<b>1</b>

Legend: 3332 – mountain, mixed forests, medium productivity, brown medium edaphic, with *Asperula – Dentaria*; 3630 - mountain, mixed forests, semi-swampy; 5152 – hilly, sessile oak and beech forests with inferior (medium) productivity, alluvial, low humiferous, in flood plain; 5232 – hilly, beech forests, medium productivity, podzolic, medium edaphic, with *Festuca*; 5243 - hilly, beech forests, high productivity, brown, large edaphic, with *Asperula – Asarum*.

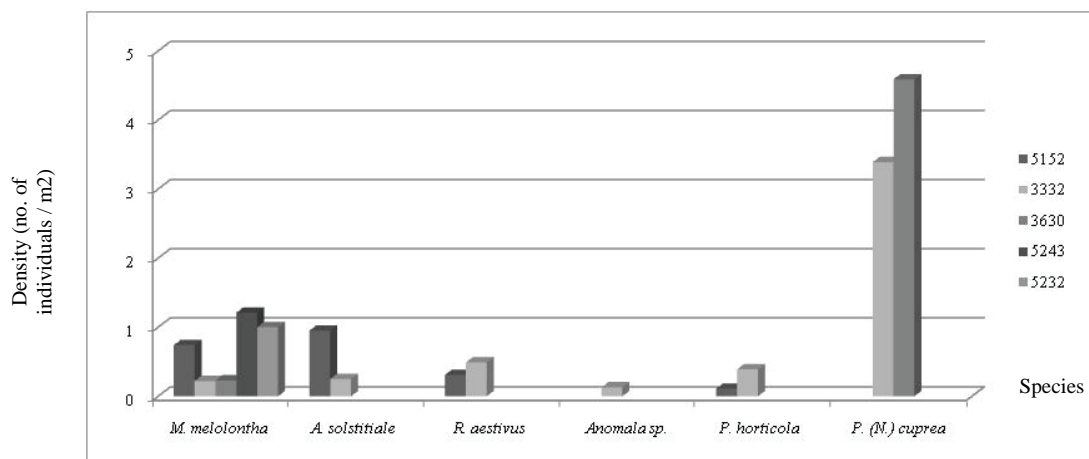


Figure 5. Survey of species, the density of scarabeoid larvae identified for different types of station from Covasna County (October 2013): 3332, 3630, 5152, 5232, 5243 – according to table 6.

The twelve forest nurseries are situated at different altitudes: 400-500 m: Vârghiș (470 m); 500-600 m: Păpăuți (550 m); 600-700 m: Szalkas (620 m), Brețcu (630 m), Ojdula (635 m), Oituz (640 m), Ozunca Băi (650 m), Ghelința (670 m); 700-800 m: Turia (700 m); 800-900 m -; 900-1000 m: Dârnău (948 m), Iancău (973 m); 1000-1100 m: Comandău (1017 m). According to the results, the largest numbers of species were registered for different altitudes: five species for 600-700 m, four species for 700-800 m; three species for 1000-1100 m; and two species for 500-600 and 900-1000 m (Table 7). *M. melolontha* was found in almost all the altitudes: 400-800 m and 1000-1100 m (the largest density was at 700-800 m – 2 larvae / ha); *A. solstitialis* at 600-800 m and 1000-1100 m (the largest density – 3.4 larvae / ha – at 700-800 m); *R. aestivus* at 600-800 m (the largest density – 1.2 larvae / ha – at 700-800 m); *Anomala* sp. only at 600-700 m (0.19 larvae / ha); *P. horticola* at 600-800 m and 1000-1100 m (the largest density – 2 larvae / ha – at 1000-1100 m); *P. (N.) cuprea* at 500-600 m and 900-1000 m (the largest density – 6.69 larvae / ha – at 500-600 m) (Fig. 6).

Table 7. Survey of species, number of individuals and density of scarabeoid larvae identified for different altitudes from Covasna County (October 2013).

Species	Altitude (metres)																				
	400-500			500-600			600-700			700-800			800-900			900-1000			1000-1100		
	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>	No. of individuals	No. of samples	No. of indiv. / m <sup>2</sup>
<i>M.melolontha</i>	12	12	1	10	35	0.29	15	47	0.32	10	5	2	-	-	-	4	17	0.23	1	5	0.2
<i>A. solstitialis</i>	-	12	-	-	35	-	13	47	0.28	17	5	3.4	-	-	-	-	17	-	5	5	1
<i>R. aestivus</i>	-	12	-	-	35	-	34	47	0.72	6	5	1.2	-	-	-	-	17	-	-	5	-
<i>Anomala</i> sp.	-	12	-	-	35	-	9	47	0.19	-	5	-	-	-	-	-	17	-	-	5	-
<i>P. horticola</i>	-	12	-	-	35	-	17	47	0.36	2	5	0.4	-	-	-	-	17	-	10	5	2
<i>P. (N.) cuprea</i>	-	12	-	234	35	6.69	-	47	-	-	5	-	-	-	-	78	17	4.59	-	5	-
<b>Total</b>	<b>12</b>	<b>12</b>	<b>1</b>	<b>244</b>	<b>35</b>	<b>6.98</b>	<b>88</b>	<b>47</b>	<b>1.87</b>	<b>35</b>	<b>5</b>	<b>7</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>82</b>	<b>17</b>	<b>4.82</b>	<b>16</b>	<b>5</b>	<b>3.2</b>

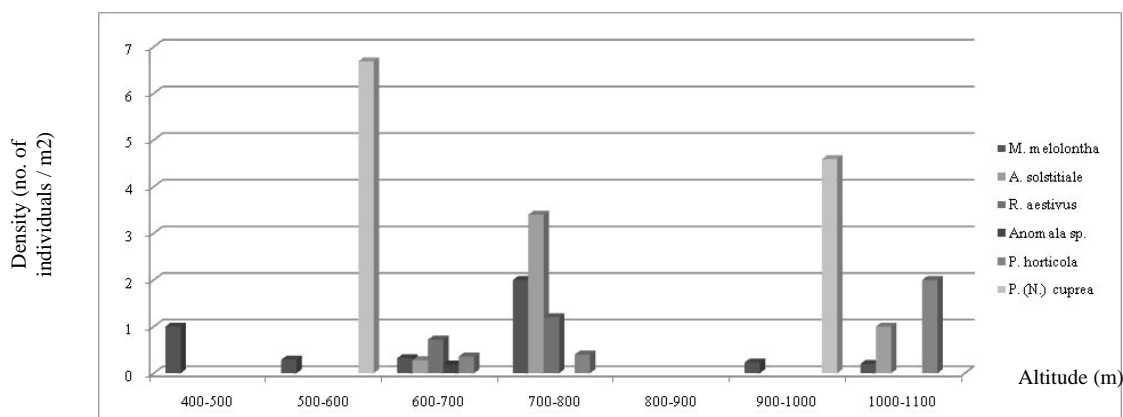


Figure 6. Survey of species, the density of scarabeoid larvae identified for different altitudes Covasna County (October 2013).

In order to establish the level of infestation, for all the species that were identified, it was necessary to calculate the average number of *M. melolontha* transformed in the third larval instar (Table 8).

Table 8. The level of infestation with scarabeoid larvae in the studied forest nurseries from Covasna County (October 2013).

Forest Department	Forest nursery	Species	Density (the average number of individuals / m <sup>2</sup> )	Infestation (the average number of <i>Melolontha melolontha</i> transformed in the third larval instar - L <sub>3</sub> / m <sup>2</sup> )	Level of infestation	
					Per species	Total
Brețcu	Brețcu	<i>M. melolontha</i>	0.29 L <sub>3</sub>	0.32	M	M
		<i>A. solstitiale</i>	0.07 L <sub>3</sub>		L	
	Oituz	<i>M. melolontha</i>	0.14 A	1.87	L	VH
		<i>Anomala</i> sp.	1.29 L <sub>3</sub>		H	
		<i>P. horticola</i>	2.43 L <sub>3</sub>		VH	
	Ojdula	<i>M. melolontha</i>	0.25 L <sub>2</sub>	0.80	L	H
		<i>A. solstitiale</i>	0.5 L <sub>1</sub> + 0.1 L <sub>2</sub> + 0.4 L <sub>3</sub>		M	
		<i>R. aestivus</i>	0.33 L <sub>1</sub> + 2.5 L <sub>2</sub>		H	
	Turia	<i>M. melolontha</i>	0.4 L <sub>2</sub> + 1.4 L <sub>3</sub> + 0.2 A	2,42	VH	VH
		<i>A. solstitiale</i>	0.8 L <sub>1</sub> + 2.6 L <sub>2</sub>		H	
		<i>R. aestivus</i>	0.4 L <sub>1</sub> + 0.8 L <sub>2</sub>		L	
		<i>P. horticola</i>	0.4 L <sub>3</sub>		L	
Comandău	Comandău	<i>M. melolontha</i>	0.2 L <sub>3</sub>	1.63	L	VH
		<i>A. solstitiale</i>	0.2 L <sub>2</sub> + 0.8 L <sub>3</sub>		L	
		<i>P. horticola</i>	2.0 L <sub>3</sub>		H	
	Dârnău	<i>M. melolontha</i>	0.33 L <sub>2</sub>	0.11	L	L
		<i>P. (N.) cuprea</i>	4.08 L <sub>3</sub>		0	
	Iancău	<i>P. (N.) cuprea</i>	5.8 L <sub>3</sub>	0	0	0
	Păpăuți	<i>M. melolontha</i>	0.03 L <sub>1</sub> + 0.03 L <sub>2</sub> + 0.23 L <sub>3</sub>	0.25	L	L
		<i>P. (N.) cuprea</i>	6.69 L <sub>3</sub>		0	
Covasna	Ghelița	-	0	0	0	0
Tălișoara	Ozunca Băi	<i>M. melolontha</i>	1 L <sub>1</sub> + 1.5 L <sub>2</sub>	0.7	H	H
	Szálkás	<i>M. melolontha</i>	1.0 L <sub>2</sub>	0.33	M	M
	Vârghiș	<i>M. melolontha</i>	0.1 L <sub>1</sub> + 0.9 L <sub>2</sub>	0.32	M	M

**Observation:** *Protaetia cuprea* does not attack the roots of the plant (it is not a disturbing biotic agents);

**Legend:** Level of infestation: L – low infestation; M – medium infestation; H – high infestation; VH – very high infestation

Thus, very high infestations were registered for the following species: *P. horticola* – Oituz forest nursery; *M. melolontha* – Turia forest nursery. Data indicate that low infestations were registered for: *A. solstitiale* – Brețcu, Turia and Comandău forest nurseries; *M. melolontha* – Oituz, Ojdula, Comandău, Dârnău and Păpăuți forest nurseries; *R. aestivus* – Turia forest nursery; *P. horticola* – Turia forest nursery.

Regarding the forest nurseries, the results indicate that very high infestations were identified for Oituz, Turia and Comandău. Low infestations were registered for Dârnău and Păpăuți forest nurseries.

## CONCLUSIONS

1. For studying the diversity of scarabeoid larvae in the forest nurseries from Covasna County, 121 soil samples (1 m x 1 m x 0.5 m) from twelve forest nurseries were analysed: Brețcu, Oituz, Ojdula, Turia, Comandău, Dârnău, Iancău, Păpăuți, Ghelița, Ozunca Băi, Szalkas and Vârghiș (Covasna County). The material was collected in October 2013.

2. The biological material (477 larvae) was studied for identifying the species and the larval instar. Systematically, the 477 larvae belonged to three families: Melolonthidae, Rutelidae and Cetoniidae; three subfamilies: Melolonthinae, Rutelinae and Cetoniinae, 6 genera and 6 species.

3. The dominant species was *P. (N.) cuprea* – 312 individuals (in 52 samples) identified for three forest nurseries: Dârnău, Iancău and Păpăuți. It was followed by: *M. melolontha* with 52 individuals collected from 10 forest nurseries (106 samples); *R. aestivus* with 40 individuals (in 2 forest nurseries – 17 samples; *A. solstitiale* – 35 individuals from 3 forest nurseries (22 samples).

4. The largest densities were registered for *P. (N.) cuprea*: 6.69 larvae / m<sup>2</sup> for Păpăuți, 5.8 larvae / m<sup>2</sup> for Iancău, 4.08 larvae / m<sup>2</sup> for Dârnău; for *A. solstitiale*: 3.4 larvae / m<sup>2</sup> in Turia forest nursery, for *R. aestivus*: 2.83 larvae / m<sup>2</sup> in Ojdula forest nursery and for *M. melolontha*: 2.5 larvae / m<sup>2</sup> in Ozunca-Băi forest nursery.

5. Regarding the density of larvae in different types of forests, the largest densities were registered for *P. (N.) cuprea* in coniferous forests (3.98 larvae / m<sup>2</sup>) and mixed forests (1.20 larvae / m<sup>2</sup>).

6. The typical eutricambosol presented the largest number of species (all six), individuals (302) and the largest density of larvae (6.43 larvae / m<sup>2</sup>).

7. Regarding the types of station, *M. melolontha* presented a high density in hilly regions, beech forests with high and medium productivity; *A. solstitialis*, *R. aestivus* and *P. horticola* were found in hilly regions, with sessile oak and beech forests and also in mountain regions, with mixed forests and medium productivity; *Anomala* sp. was identified in mountain regions, with mixed forests and medium productivity; *P. (N.) cuprea* registered high densities in mountain regions, with mixed forests (medium productivity and semi-swampy).

8. The largest numbers of species were registered for different altitudes: five species for 600-700 m (*M. melolontha*, *A. solstitialis*, *R. aestivus*, *P. horticola* and *Anomala* sp.), four species for 700-800 m (*M. melolontha*, *A. solstitialis*, *R. aestivus* and *P. horticola*); three species for 1000-1100 m (*M. melolontha*, *A. solstitialis* and *P. horticola*); and two species for 500-600 and 900-1000 m (*M. melolontha* and *P. cuprea*).

9. Very high infestations were registered for the following species: *P. horticola* – Oituz forest nursery; *M. melolontha* – Turia forest nursery. Data indicate that low infestations were registered for: *A. solstitialis* – Turia and Comandău forest nurseries; *M. melolontha* – Oituz, Ojdula, Comandău, Dârnău and Păpăuți forest nurseries; *R. aestivus* and *P. horticola* – Turia forest nursery.

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Table 1. The characteristics of the twelve forest nurseries (Romanian National Forest Administration, Covasna Direction), studied in October 2013.

Forest District	Forest nursery	Surface (ha)	No. of samples	Type of culture	Geographical coordinates			type of station	Type of the soil	Exposure	Treatments (nematorin) in the last three years
					Altitude - m -	Latitude N	Longitude E				
Brețcu	Brețcu	1.40	14	De	630	46°02'58"	26°18'57,71"	5152	typical preluvisoil	SE	50 kg / ha (2011, 2012) 30 kg / ha (2013)
	Oituz	0.70	7	Co	640	46°04'29,60"	26°23'37,32"	3332	typical eutricambosol	SE	30 kg / ha (2011, 2012, 2013)
	Ojdula	1.20	12	Co, De	635	45°58'15"	26°16'41,20"	3332	typical preluvisoil	S	50 kg / ha (2011) 30 kg / ha (2012, 2013)
	Turia	0.55	5	Co	700	46°03'59"	25°57'19,39"	5152	typical alisol	NE	50 kg / ha (2011, 2012) 30 kg / ha (2013)
Comandău	Comandău	0.67	5	Co, De	1017	45°45'48,74"	26°16'28,36"	3332	typical eutricambosol	-	30 kg / ha (2012, 2013)
	Dârnău	1.3	12	Co, De	948	45°40'39,80"	26°15'04,69"	3630	mollic, lithic	-	50 kg / ha (2011, 2012, 2013)
	Iancău	0.80	5	Co	973	45°42'14,94"	26°17'0536"	3630	alluvial	-	50 kg / ha (2011, 2012, 2013)
	Păpăuți	3.10	35	Co	550	45°47'41,78"	26°07'30,55"	3332	typical eutricambosol	-	30 kg / ha (2013)
Covasna	Ghelința	1.80	10	Co	670	45°55'17"	26°16'49"	3332	typical alisol	NW	-
Tălișoara	Ozunca Băi	0.20	2	Co	650	46°04'42"	25°46'36"	5243	typical luvisol	N	-
	Szalkas	0.50	2	Co	620	45°56'56"	25°38'46"	5232	typical luvisol	N	-
	Vârghiș	2.0	12	Co, De	470	46°06'03"	25°33'55"	5243	antrisol	S	30 kg / ha (2011, 2013) 50 kg / ha (2012)

**Legend type of culture:** Co – coniferous; De - deciduous

**Legend type of station:-** 3332 – mountain, mixed forests, medium productivity, brown medium edaphic, with *Asperula – Dentaria*;

- 3630 -- mountain, mixed forests, semi-swampy;

- 5152 – hilly, sessile oak and beech forests with inferior (medium) productivity, alluvial, low humiferous, in flood plain;

- 5232 – hilly, beech forests, medium productivity, podzolic, medium edaphic, with *Festuca*;

- 5243 – illy, beech forests, high productivity, brown, large edaphic, with *Asperula – Asarum*..



Table 3. Survey of species, number of individuals in samples and density of scarabeoid larvae identified for the forest nurseries from Covasna County (October 2013).

Species	Brețcu			Brețcu		Turia	Comandău			Covasna			Tâlișoara			Total
	Brețcu	Oituz	Ojdula	Oituz	Ojdula		Comandău	Dărmău	Iancău	Păpăuți	Ghelința	Ozunca Băi	Szalkas	Vărghiș		
<b>Melolonthidae / Melolonthinae</b>																
<i>M. melolontha</i>	4 L <sub>3</sub>	1A	3 L <sub>3</sub>	2 L <sub>2</sub> + 7 L <sub>3</sub> + 1 A	1 L <sub>3</sub>	4 L <sub>2</sub>	1 L <sub>1</sub> + 3 L <sub>2</sub>	1 L <sub>1</sub> + 1 L <sub>2</sub> + 8 L <sub>3</sub>			2 L <sub>1</sub> + 3 L <sub>2</sub>	2 L <sub>2</sub>	1 L <sub>1</sub> + 11 L <sub>2</sub>		4 L <sub>1</sub> + 23 L <sub>2</sub> + 23 L <sub>3</sub> 2 A	
Total individuals	4	1	3	10	1	4	10	10			5	2	12		52	
Density (no. larvae / m <sup>2</sup> )	0.29	0.14	0.25	2	0.2	0.33	0.29	0.29			2.5	1	1			
<i>A. solstitiale</i>	1 L <sub>3</sub>		5 L <sub>1</sub> + 1 L <sub>2</sub> + 6 L <sub>3</sub>	4 L <sub>1</sub> + 13 L <sub>2</sub>	1 L <sub>2</sub> + 4 L <sub>3</sub>										9 L <sub>1</sub> + 15 L <sub>2</sub> + 11 L <sub>3</sub>	
Total individuals	1		12	17	5										35	
Density (no. larvae / m <sup>2</sup> )	0.07		1	3.4	1											
<i>R. aestivus</i>			4 L <sub>1</sub> + 30 L <sub>2</sub>	2 L <sub>1</sub> + 4 L <sub>2</sub>											6 L <sub>1</sub> + 34 L <sub>2</sub>	
Total individuals			34	6											40	
Density (no. larvae / m <sup>2</sup> )			2.83	1.2												
<b>Rutelidae / Rutelinae</b>																
<i>Anomala</i> sp.															9 L <sub>3</sub>	
Total individuals															9	
Density (no. larvae / m <sup>2</sup> )																
<i>P. horticola</i>															29 L <sub>3</sub>	
Total individuals															29	
Density (no. larvae / m <sup>2</sup> )																
<b>Cetoniidae / Cetoniinae</b>																
<i>P. (N.) cuprea</i>															312 L <sub>3</sub>	
Total individuals								234 L <sub>3</sub>							312	
Density (no. larvae / m <sup>2</sup> )								234								
No. samples	14	7	12	5	5	5	5	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	
No. species	2	3	3	4	3	3	3	3	3	3	3	3	3	3	3	
No. individuals	5	27	49	35	16	53	29	244	29	244	29	244	29	244	477	
Density / m <sup>2</sup>	0.36	3.86	4.08	7	3.2	4.41	5.8	6.98	5.8	6.98	5.8	6.98	5.8	6.98	3.94	

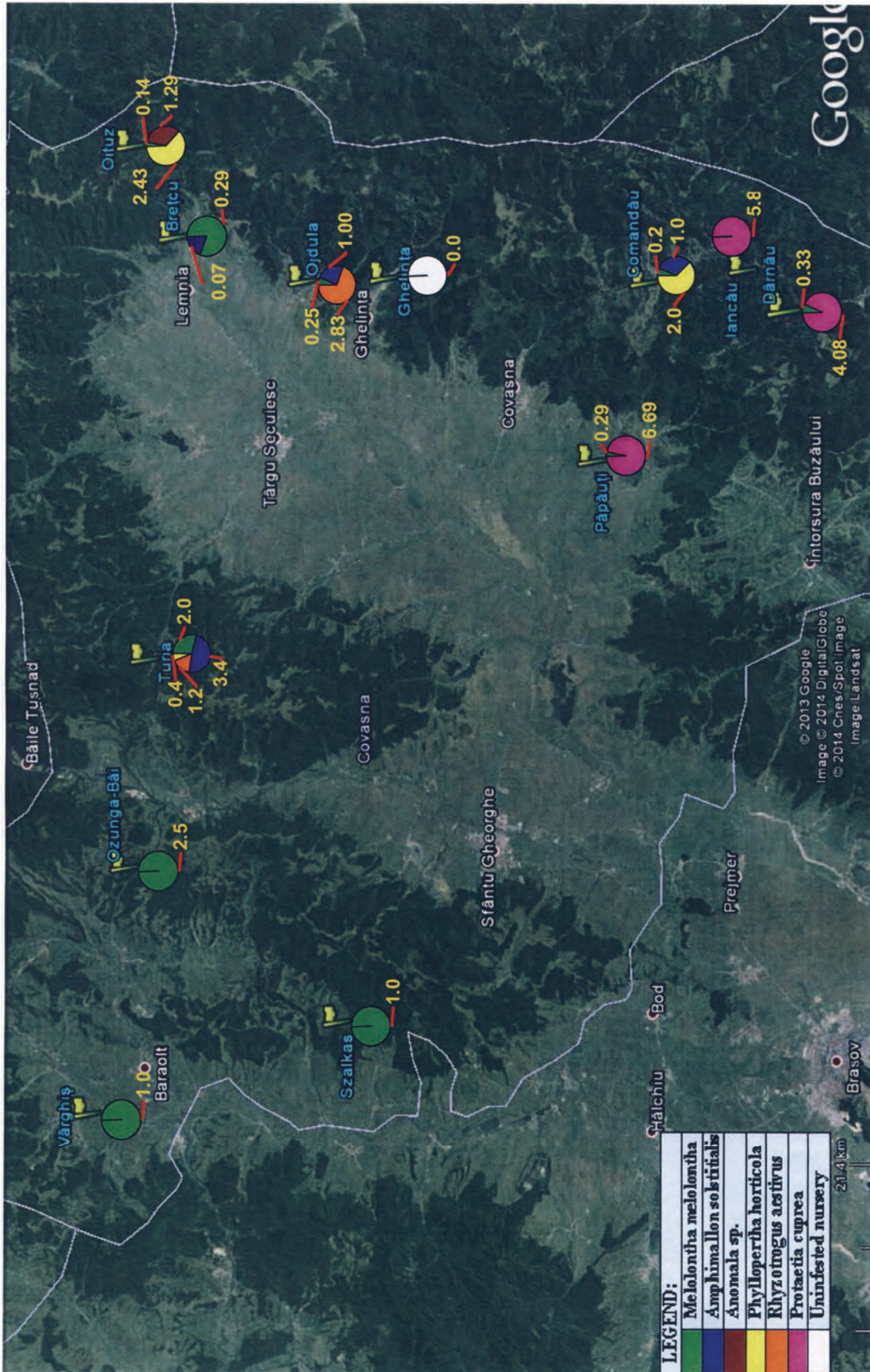


Figure 2. The distribution of scarabeoid species in the twelve forest nurseries from Covasna County.