

THE SAPROXYLIC COLEOPTERA AS INDICATORS OF FORESTS OF EUROPEAN IMPORTANCE FROM CENTRAL MOLDAVIAN PLATEAU

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Abstract. *The present work is dedicated to the research of the complexes of saproxilic coleopterans, their circulation and their role in the identification of the forests of European importance from the territory of the Central Moldavian Plateau. As a result of the investigations made during the years 2002-2007, on the area of the Central Moldavian Plateau, there were identified 34 species of saproxilic coleopterans, including 11 species of saproxilic indicators belonging to 6 families: Carabidae, Rhysodidae, Lucanidae, Scarabaeidae, Cucujidae și Cerambycidae. For the first time, on the bases of saproxilic indicators, there were selected 7 types of forests of an European importance (62,8 ha): the durmast forest with carpinus mixture (6,7 ha), durmast forest with tilia-fraxinus mixture (8,4 ha), fagus forest (6,8 ha), oak forest with durmast mixture (3,2 ha), durmast forest (25,1 ha), carpinus forest with tilia-oak mixture (7,8 ha), oak forest (4,8 ha), and there were elaborated recommendations regarding their protection and conservation on the territory of the Republic of Moldova.*

Key words: *coleopterans, biodiversity, saproxilic species.*

Rezumat. Coleopterele saproxilice indicatori ai pădurilor de importanță europeană din zona podișului Moldovei centrale. *Lucrarea de față prezintă un studiu asupra coleopterelor saproxilice în identificarea pădurilor seculare de importanță europeană din zona Podișului Moldovei Centrale. Investigațiile au cuprins colectarea și analiza complexelor saproxilice, inclusiv a speciilor de coleoptere saproxilice indicatori ai pădurilor de importanță europeană, caracteristice pădurilor seculare cu esențe foioase, de tipul celor central-europene. Drept rezultat, a fost alcătuită lista coleopterelor saproxilice ce conține 34 specii, în care au fost incluse și speciile saproxilice indicatori, identificate în pădurile investigate, care aparțin la 6 familii: Carabidae, Rhysodidae, Lucanidae, Scarabaeidae, Cucujidae și Cerambycidae. Pentru prima dată, în baza speciilor saproxilice indicatori au fost selectate 7 tipuri de pădure de importanță europeană (62,8 ha): pădure de gorun cu amestec de carpen (6,7 ha), pădure de gorun cu amestec de tei-frasin (8,4 ha), pădure de fag (6,8 ha), pădure de stejar pedunculat cu amestec de gorun (3,2 ha), pădure de gorun (25,1 ha), pădure de carpen cu amestec de stejar pedunculat și tei (7,8 ha), pădure de stejar pedunculat (4,8 ha).*

Cuvinte cheie: *coleoptera, biodiversitate, specii saproxilice.*

INTRODUCTION

The Republic of Moldova is a country with the lowest forestation grade from Europe. The forested surfaces from the country constitute only 8-9% of the whole territory, and the most important old forest massives that are 150-200 years old, are situated in the Centre, North and South of the Republic. The forest vegetation is constituted of deciduous forests – the Central European type (oak, durmast, fagus, tilia, ash, carpinus, ulmus, aspen, salix, maple etc.). These old forests are important as inherited resources, as well as examples of self-regulated ecosystems.

During the last 2-3 decades the state of the primeval forests from the Republic of Moldova aggravated. The protection and conservation of the forests, inclusively of those primary primeval, was not taken into consideration, because all the forests from the Republic of Moldova and also from Europe have been and are considered as vegetal associations, and not as integral functional ecosystems. The forests suffer a lot because of the deforestation and continuous pollution. At present, this is something more pronounced in the Republic of Moldova, considering its transition to the market economy. As a result of the human factor and clearance of the primeval forests, the changes happen within the biodiversity as whole, natural habitats of rare species of coleopterans are destroyed; the whole complex of saproxilic coleopterans (indicator coleopteran species – the main initiators in the process of animal and vegetal wastes decomposition) is modified. (BABAN 2004; 2005; NECULISEANU et al., 2003; NECULISEANU & BABAN 2003a, 2003b, 2003c).

For the purpose of protection and conservation of European primeval forests, of saproxilic complexes and of the rare and indicator saproxilic species and of their natural habitats, the Council of Europe has developed a unique methodology of identification, selection and conservation of European primeval forests on the basis of indicator saproxilic species proper for these forests (SPEIGHT, 1989). The purpose of the action was to offer a concrete help to the European Countries in the identification of the forests of European importance from the due territories and another purpose was to contribute at the forces unification for the conservation sake of the coleopterans saproxilic complexes, of the disappearing endangered and rare specie and of the indicator saproxilic species, that continue to be endangered on the European continent.

MATERIALS AND RESEARCHING METHODOLOGY

The analysis of different sectors of the forests of European importanace has been made on the basis of saproxilic indicator species, and the selection of these species has been done according to SPEIGHT'S (1989) methodology, taking into consideration the folowing criteria:

- Species of invertebrates associated with the prevailing primeval tree species from the european forests;
- Species of invertebrates depending on the dead wood of the old trees, as their natural habitat;
- Species of invertebrates having now a very localised spread on the european continent;
- Species of invertebrates having big and medium dimensions;
- Species of invertebrates relatively easy tracked down;
- Species of invertebrates that can be relatively easy determined.

In order to track down the indicator saproxilic species of coleoptera, there were investigated different saproxilic habitats.

I. Dead trees:

1. Vertical stumps:
 - the bark surface;
 - under the bark and in the upper wood layers;
 - burnt trunks.
2. Recently fallen stumps:
 - under the bark and in the upper wood layers;
 - trunks partially sinked in water or very damp trunks.
3. Stumps in an advanced decomposition state.

II. Living trees:

1. Hollow trees:
 - a. Large cavities in the trunks
 - b. Hollows with rotten wood:
 - at the lower part of the trunk;
 - at the upper part of the trunk;
 - very damp (full of water).
2. Damaged, cut trees
3. Tree mushrooms
4. Dead branches
5. Dead roots
6. Remade stumps

RESULTS AND DISSCUSIONS

The planned investigations comprised the research and the analysis of the saproxilic complexes, including the species of saproxilic coleopterans which are indicators of the forests of Europeann importance, characteristic to the primeval forests with deciduous essences, of the central european type. As a result, there was made up a list of saproxilic insects that comprises 34 species, that belong to the Coleoptera order.

In addition, the indicator species of saproxilic coleopterans have been included in the list of saproxilic species.

They belong to 6 families: Carabidae, Rhysodidae, Lucanidae, Scarabaeidae, Cucujidae și Cerambycidae. They have been tracked down on different species of trees, that can be considered as the main natural saproxilic habitats. (tab. 1.)

Table 1. The trophic relation between saproxilic indicator insects and the main species of host trees.
Tabel 1. Relațiile trofice ale insectelor saproxilice indicatori cu principalele specii de arbori gazdă.

Saproxilic Coleopteras	The Genus of the host-trees									
	Ca	Ce	Fa	Fr	Po	Py	Qu	Ro	Sa	Ul
<u>Carabidae</u>										
<i>Carabus intricatus</i> LINNAEUS, 1761							■			
<u>Rhysodidae</u>										
<i>Rhysodes germari</i> GANGLBAUER, 1892							■			
<i>Rhysodes sulcatus</i> (FABRICIUS, 1787)							■			
<u>Lucanidae</u>										
<i>Lucanus cervus</i> LINNAEUS, 1758	■			■			■			
<u>Scarabaeidae</u>										
<i>Cetonischema aeruginosa</i> (DRURY, 1770)			■			■	■	■		
<i>Gnorimus octopunctatus</i> (FABRICIUS, 1775)			■			■	■	■		
<i>Liocola lugubris</i> (HERBST, 1786)						■	■			
<u>Cucujidae</u>										
<i>Cucujus cinnaberinus</i> (SCOPOLI, 1763)		■			■					
<u>Cerambycidae</u>										
<i>Morimus funereus</i> MULSANT, 1863		■	■		■		■			
<i>Rosalia alpina</i> (LINNAEUS, 1758)			■				■			
<i>Saperda punctata</i> (LINNAEUS, 1767)							■			■

* Ca – *Carpinus*, Ce – *Cerasus*, Fa – *Fagus*, Fr – *Fraxinus*, Po – *Populus*, Py – *Pyrus*, Qu – *Quercus*, Ro – *Robinia*, Sa – *Salix*, Ul – *Ulmus*.

The majority of the saproxylic indicator species belong to the *Cerambycidae* and *Scarabaeidae* families.

In the larval and adult state, these species feed on leaves, sprouts, sets and decomposed or semidecomposed wood fibres.

According to the literature sources, it's known that larvae and adults of the species that belong to *Cerambycidae* family, that have a pretty large habitat, are primary initiators in the processes of decomposition of the wood materials, this way they facilitate the access of other saproxylic organisms to these resources. Our observations permitted us to confirm this known fact.

The representatives of the *Scarabaeidae* (*Cetonischema aeruginosa* DR., *Gnorimus octopunctatus* F.) families can be found in punk and humid wood, but the species from the *Carabidae* (*Carabus intricatus* L.) family – in dry wood material.

Within the investigations carried out in the area of the Central Moldavian Plateau, there have been analyzed 8 sectors of different types of forest. According to the requirements and the methodology worked out by the European Council, on the basis of saproxylic indicators, there were selected 7 types of forests of an European importance (62.8 ha): the durmast forest with *Carpinus* mixture (6.7 ha), durmast forest with *Tilia-Fraxinus* mixture (8.4 ha), *Fagus* forest (6.8 ha), oak forest with durmast mixture (3.2 ha), durmast forest (25.1 ha), *Carpinus* forest with *Tilia*-oak mixture (7.8 ha), and pedunculate oak forest (4.8 ha) (tab. 2.).

Table 2. The forests of European importance from the area of the Central Moldavian Plateau.
Tabel 2. Pădurile de importanță europeană din zona Podișului Moldovei Centrale.

The description of the forest	S (ha)	Indicator saproxylic coleopteran species	Saproxylic coleopterans complexes
Type of forest: Beech forest (The Plaiul Fagului Nature Reserve) Parcel 26 Composition: 80% <i>Fagus</i> (100, 160 years) 20% <i>Carpinus</i> (60 years)	6,8	<i>Cetonischema aeruginosa</i> (DRURY) <i>Lucanus cervus</i> LINNAEUS <i>Morimus funereus</i> MULSANT	<i>Dorcus parallelipedus</i> LINNAEUS <i>Prionus coriarius</i> (LINNAEUS) <i>Uleiota planatus</i> LINNAEUS <i>Pterostichus melanarius</i> (ILLIGER) <i>Carabus coriaceus</i> LINNAEUS
Type of forest: Pedunculate Oak forest with durmast mixture (The „Plaiul Fagului” Nature Reserve) Parcel 29 Composition: 30 % oak (160 years) 20% <i>Fagus</i> (160 years) 50% <i>Carpinus</i> (120)	3,2	<i>Carabus intricatus</i> LINNAEUS <i>Lucanus cervus</i> LINNAEUS <i>Morimus funereus</i> MULSANT <i>Cetonischema aeruginosa</i> DR.	<i>Dorcus parallelipedus</i> L. <i>Carabus coriaceus</i> L. <i>Prionus coriarius</i> (L.) <i>Platynus assimile</i> (PAYK.) <i>Pterostichus oblongopunctatus</i> (FABRICIUS) <i>Perostichus niger niger</i> (SCHALL.)
Type of forest: Durmast forest (The „Plaiul Fagului” Nature Reserve) Parcel 17 Composition: 40% <i>Carpinus</i> (110 years) 30% beech (150 years) 20% ash (110 years) 10% durmast (130 years)	25,1	<i>Carabus intricatus</i> LINNAEUS <i>Lucanus cervus</i> LINNAEUS <i>Morimus funereus</i> MULSANT <i>Rhysodes germari</i> GANG. <i>Rhysodes sulcatus</i> (FABRICIUS)	<i>Carabus coriaceus</i> LINNAEUS <i>Platynus assimile</i> (PAYKUL) <i>Prionus coriarius</i> (LINNAEUS) <i>Pterostichus melanarius</i> (ILLIGER) <i>Pterostichus niger</i> (SCHALLER) <i>Pterostichus oblongopunctatus</i> (FABRICIUS) <i>Uroma culinaria</i> LINNAEUS
Type of forest: Durmast forest with <i>Carpinus</i> mixture The „Codri” Nature Reserve) Composition: Durmast – 60% <i>Carpinus</i> – 30% Ash – 10%	6,7	<i>Carabus intricatus</i> LINNAEUS <i>Rhysodes sulcatus</i> (FABRICIUS) <i>Lucanus cervus</i> LINNAEUS <i>Morimus funereus</i> MULSANT <i>Cetonischema aeruginosa</i> DR. <i>Cucujus cinnaberinus</i> (SCOPOLI)	<i>Carabus coriaceus</i> L. <i>Prionus coriarius</i> (L.) <i>Platynus assimile</i> (PAYK.) <i>Pterostichus oblongopunctatus</i> (FABRICIUS) <i>Perostichus niger niger</i> (SCHALL.)
Type of forest: Durmast forest with <i>Tilia</i> -ash mixture (The „Codri” Nature Reserve) Composition: Durmast (80-110 years) <i>Tilia</i> (50-70 years) Ash (120 years)	8,4	<i>Lucanus cervus</i> LINNAEUS <i>Cetonischema aeruginosa</i> (DRURY) <i>Morimus funereus</i> MULSANT	<i>Agonum assimile</i> (PAYKUL) <i>Ampedus balteatus</i> (LINNAEUS) <i>Prionus coriarius</i> (LINNAEUS) <i>Pterostichus melanarius</i> (ILLIGER) <i>Pterostichus oblongopunctatus</i> (FABRICIUS)
Type of forest: <i>Carpinus</i> Forest with oak- <i>Tilia</i> mixture (Durlești) Composition: Durmast (80-110 years) <i>Tilia</i> (50-70 years) Ash (120 years)	7,8	<i>Lucanus cervus</i> LINNAEUS <i>Cetonischema aeruginosa</i> (DRURY) <i>Morimus funereus</i> MULSANT <i>Carabus intricatus</i> LINNAEUS	<i>Platynus assimile</i> (PAYKUL) <i>Prionus coriarius</i> (LINNAEUS) <i>Pterostichus melas</i> (CREUTZER) <i>Pterostichus melanarius</i> (ILLIGER) <i>Pterostichus oblongopunctatus</i> (FABRICIUS)

The description of the forest	S (ha)	Indicator saproxilic coleopteran species	Saproxilic coleopterans complexes
<p>Type of forest: Pedunculate Oak forest (The „Telița” Nature Reserve)</p> <p>Parcel 7</p> <p>Composition: Rufous Oak (80-110 years) Durmast (50-70 years) Elm, Carpinus, maple</p>	4,8	<p><i>Lucanus cervus</i> LINNAEUS <i>Cetonischema aeruginosa</i> (DRURY) <i>Rhysodes germari</i> GANGL.</p>	<p><i>Carabus coriaceus</i> LINNAEUS <i>Platynus assimile</i> (PAYKUL) <i>Prionus coriarius</i> (LINNAEUS) <i>Pterostichus melanarius</i> (ILLIGER) <i>Pterostichus oblongopunctatus</i> (FABRICIUS)</p>

Taking into consideration the european level of the issue of primeval forests, it is absolutely necessary for the Republic of Moldavia to intensify its observation measures for this type of forests, and to undertake urgent measures for stopping the deforestation in the areas where this type of forests are still left. We consider that this issue could be solved only through strong cooperation between the decision-making factorss, scientists and the entire society.

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