

**MUZEUL  
JUDEȚEAN  
ARGEȘ**

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## BIODIVERSITY CONSERVATION IN BUDA AND RÂIOSU MOUNTAINS, FĂGĂRAŞ MASSIF

DANIELA ILEANA STANCU

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**ABSTRACT.** In the paper we presented plants and community interest habitats from Râiosu and Buda Mountains, Făgărăş Massif. The conservation of species, particularly those in danger of extinction, forms one of the basic elements of biodiversity conservation. Not surprisingly, the largest families contain the largest number of species. The rate of man-made extinction at planetary level is high enough to be called catastrophic. Every year, tens of thousands of species are disappearing from our planet and the intensity of the extinction process is much higher. It is essential to make the complete inventory of the component of the flora of any mountain for conservation and sustainable use. This fact requires an efficient management of the mountains where they vegetate.

**Keywords:** conservation, flora biodiversity, extinction, Râiosu and Buda Mountains.

**REZUMAT. Conservarea biodiversității din munții Râiosu și Buda, Masivul Făgărăș.** În lucrare sunt prezentate speciile de plante și habitatele de interes comunitar din munții Râiosu și Buda, Masivul Făgărăș. Deloc surprinzător, familiile cele mai mari conțin cel mai mare număr de specii de plante. Rata extincției provocate de om la nivel planetar este destul de mare astfel încât să o putem numi catastrofală. În fiecare an sute de mii de specii dispar de pe planetă și intensitatea procesului de extincție este mare. Este esențial să se realizeze inventarul complet al plantelor din fiecare munte pentru conservarea și folosirea lor pe termen lung. Acest fapt necesită un management eficient al munților unde acestea vegetează.

**Cuvinte cheie:** conservare, biodiversitatea florei, extincție, munții Râiosu și Buda.

## INTRODUCTION

Carpathian's flora have been studied by generations of Austrian, Czech, Slovakian, Polish, Hungarian, Romanian, and Ukrainian botanists. These studies are summarized in a number of documents including Checklists and Keys, some of which are complete, and some of which are still in preparation.

It can now be asserted that the native flora of the Carpathians is among the richest on the European continent. Făgărăș massif is individualized in the Carpathian chain as an extended peak, which runs from east to west on a length of about 70 km, developing at a width of about 40 km. Făgărăș Mountains are

individualized by accentuated massiveness, typical alpine relief with peaks reaching the maximum altimetric elevations of Romania's relief: Moldoveanu 2,544 m and Negoiu 2,535 m.

## MATERIALS AND METHODS

The conservation of species, particularly those in danger of extinction, forms one of the basic elements of biodiversity conservation. The lifespan of a species is not unlimited. Over a period of millions of years, species either become extinct in the ever - changing environment or develop into new distinctive forms. It is assumed that in natural conditions at least one species per year becomes extinct for purely natural reasons.

This situation has rapidly changed today, with people altering the biosphere and pushing an uncountable number of species to the verge of extinction. The rate of man-made extinctions is high enough to be called catastrophic. Every year, tens of thousands of species are disappearing from our planet and the intensity of the extinction process is much higher.

## RESULTS AND DISCUSSIONS

Bearing in mind that we have so far described less than 2 million species globally - only a 10% to 15% fraction of total world species diversity - the majority of extinct forms are not known and never will be known to science.

Progress in ecology and related sciences, including conservation biology, has proven that mountain areas are of particular value for human beings. These ecosystems are key sources and reservoirs of freshwater. The specific micro- and meso-climates of mountain areas play an important role in diminishing the global greenhouse effect.

Vast complexes of mountain forests are vital for the timber production industry. Moreover, in the past several decades, mountains have become the main areas for the rapid development of tourism and recreation. First and foremost, however, mountains host a unique variety of species, many of which are rare, vulnerable or threatened. All over the world, mountains are the sites of continental or regional species diversity hot spots.

Făgăraș massive is the one that preserves the largest surface sculptured by glaciers in the Southern Carpathians. The alpine area was periodically located in Pleistocene above the limit of permanent snow and had sufficient rainfall to supply the glaciers. Structurally there are circulairs and glacial valleys. The Nordic slopes with an accentuated gradient have limited the development of the glaciers in length, while the south and the long valleys have allowed the formation of valley glaciers over 7 km in length. Glacier circles differ in appearance and complexity.

The southern slopes offer numerous examples of hanging circuses, the most spectacular being on the western side of the Arpașu Mic - Buda - Râiosu -

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Mușeteica summit, connected with the steep corridor of the Capra Valley, previously occupied by the glacier tongues.

With all the floristic importance of the southern sector of the Făgăraş Mountains revealed by the research conduct by Al. Buia and I. Todor in 1947 the floral investigation of the Râiosu and Buda Mountains was delayed and the phytosociological studies were completely absent.

To a large extent, the geobotanic researches in the limestone sector of the Fagaras massif have encountered both access and cantonment difficulties. These have also been added to the avalanche difficulties that blocked the various ways of access, even during the summer.

The purpose of the researches carried out during the period 1996-2005 in the Râiosu and Buda Mountains, the Fagaras Mountains, was the inventory of the flora in this region, together with the ecological, cariological, cenological characterization and the statistical study of the bioforms and geoelements as well as the identification and characterization of the plant associations.

An attempt was made to present a complete picture of the flora and vegetation of this territory, to provide a comparative basis for future similar research and to broaden the knowledge horizon of the vegetal carpet in our country.

The glacial valleys in the south have a length of 6 to 7 km, a sinuous tract with branches that flow from the tributary valleys. The most extensive are Capra and Buda valleys, formed in glacial valley complexes.

The two investigated mountains are situated at the northern tip of Argeş County and form a part of the southern slope of Făgăraş Massif.

Buda Mountain with 2,431 m altitude separates at the north Buda Lake at 2,055 m altitude. The lake occupies an area of 0.86 ha; it has a triangular shape, the maximum depth being 2.2 m. The Buda Valley, originated in the Buda Heathrow, flows south, digging into the limestone a key called the Gegiu Key with hardly accessible walls. At the foot of the Buda Mountain, the valley of the same name goes through 18 km until it flows into the Vidraru reservoir. Alongside it there are various tributaries including the Râiosu stream.

The other one is Râiosu Mountain, 2,395 m altitude, which is a continuation of Buda Mountain, forming an almost continuing summit, separated by a small saddle, call Drumul lui Vodă (Vodă's Road). This mountain has the shape of a huge pyramid and presents all the characters of a limestone mountain with steep walls and beginning of scree.

Lake Râiosu occupies an area of 0.15 ha and is maintained only during rainy periods. It is situated in the southern part of the massif, in the eastern part of the Arpaşul Mic - Buda - Mușeteica ridge, at 2,180 m altitude, in the glacier circle dominated to the west by Mușeteica Peak and to the east by Râiosu peak.

This is probably the area with the most spectacular scenery in the Făgăraş Mountains. The lake is in an advanced state of clogging due to rock disaggregation processes and its transport to the snow and ice masses. In summer, it is very often covered by frozen snow. Access to this lake is very difficult, with no marked trail. The limestone from the Râiosu and Buda Mountains are home for a series of

calciphile vegetal associations that, despite their location in these mountains, remain representative for the Romanian Carpathians.

The numerous endemites and relicts of these vegetal groups, attest to the great vegetation of this limestone mass, surviving the catatherm extremes of the glaciations due to the thermal characteristics of the limestone substrate. The numerous endemics and relicts in the vegetal groups attest the great vegetation age of this limestone massif. They survived glaciations due to the thermal characteristic of the limestone substratum. In the glacial periods, the heights of the two mountains that exceed 2,300-2,400 m altitude, functioned as a true "nunatak" that was discovered by the glacier and was able to facilitate the preservation of this rich flora in endemics and relicts.

The flora of these two mountains includes a wide variety of phytogeographical elements, caused by the altitude variations between 600 and 2,431 m. On the background of the Eurasian elements (which predominantly prevail in the studied territory), European, Circumboreal, Central European, there are the Carpathian endemites, the Carpatho - Balkanic elements and Alpic - Carpathian, representing 18% of the flora of these mountains.

In the Râiosu and Buda Monuntains there were identified 135 rare, vulnerable or endangered taxa.

There are: 11 Endangered taxa (*Achillea oxyloba* (DC.) SCHULTZ-BIP. ssp. *schurii* (SCHULTZ-BIP.) HEIMERL), *Alopecurus laguriformis* SCHUR, *Armeria maritima* WILLD. ssp. *alpina* (WILLD.) P. SILVA, *Centaurea kotschyana* HEUFF., *Centaurea pinnatifida* SCHUR, *Gentiana lutea* L., *Iris aphylla* L., *Kobresia myosuroides* (WILL.) FIORI, *Leontopodium alpinum* CASS., *Nigritella nigra* (L.) REICHENB.); 1 Critically Endangered taxa (*Salix alpina* SCOP.); 4 Vulnerable or rare Taxa (*Campanula transsilvanica* SCHUR, *Erigeron nanus* SCHUR, *Galium lucidum* ALL., *Rhododendron myrtifolium* SCHOTT & KOTSCY); 6 Vulnerable taxa (*Angelica archangelica* L., *Aquilegia nigricans* BAUMG., *Daphne cneorum* L., *Juniperus sabina* L., *Nigritella rubra* (WETTST.) K. RICHTER, *Oxytropis carpatica* UECHTR.,) and 113 Rare taxa.

There are also 20 restricted range endemic species (*Achillea oxyloba* (DC.) SCHULTZ-BIP. ssp. *schurii* (SCHULTZ-BIP.) HEIMERL), *Aconitum moldavicum* HACQ. ex REICHENB., *Centaurea pinnatifida* SCHUR, *Cerastium transsilvanicum* SCHUR, *Dianthus spiculifolius* SCHUR, *Onobrychis montana* DC. ssp. *transsilvanica* (SIMK.) JAV., *Ranunculus carpaticus* HERB., *Festuca bucegiensis* MARKGRAF-DANNENBERG), 8 Carpathian endemic species (*Campanula carpatica* JACQ., *Dianthus henteri* HEUFF. ex GRISEB. et SCHENK, *Leucanthemum waldsteinii* (SCHULTEZ-BIP.) POUZAR, *Silene nutans* L. ssp. *dubia* (HERB.) ZAPAL., *Veronica baumgartenii* R. & S.) and 7 Carpatho - Balkan endemic species (*Carduus kernerii* SIMONKAI ssp. KERNERI, *Centaurea kotschyana* HEUFF., *Doronicum carpaticum* (GRISEB. & SCHENK) NYM., *Gypsophilla petraea* (BAUMG.) REICHENB., *Sesleria bielzii* SCHUR, *Thlaspi dacicum* HEUFF., *Viola dacica* BORB.).

The following families have the highest percentage in threatened taxa: Asteraceae (15%), Orchidaceae (12%), Caryophyllaceae (12%), Poaceae (10%),

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Ranunculaceae (6%), Brassicaceae (6%), Fabaceae (5%), Primulaceae (5%), Scrophulariaceae (5%), Campanulaceae (5%).

This list of threatened vascular plants in the Râiosu and Buda mountains is the first attempt to assess the conservation status of the flora of this natural geographic unit.

Also, we described 21 community interest natural habitats in the Râiosu and Buda mountains, Făgăraş Massif. 13 of these are habitats with high conservation value as follow: Southern Carpathian dwarf azalea heaths (*Loiseleuria procumbens* (L.) Desv., South-Eastern Carpathian heaths with *Rhododendron myrtifolium* SCHOTT & KOTSCY and *Vaccinium myrtillus* L., South-East Carpathian bushes with pine scrub (*Pinus mugo* Turra) and alpenrose (*Rhododendron myrtifolium* SCHOTT & KOTSCY), *Dryas octopetala* L. dwarf heaths, South Carpathian grasslands with *Sesleria rigida* Heuffelssp. *haynaldiana* (Schur) Beldie and *Carex sempervirens* Vill., South Carpathian grasslands with *Carex sempervirens* Vill. and *Sesleria bielzii* Schur, Springs and streams South-East Carpathian communities with *Doronicum carpaticum* (Griseb. et Schenk) Nyman, *Saxifraga aizoides* L., *Chrysosplenium alpinum* Schur and *Achillea oxyloba* (DC) SCHULTZ-BIP ssp. *schurii* (SCHULTZ-BIP) HEIMERL, South-East Carpathian communities of mobile or semi-fixed siliceous screes with *Oxyria digyna* (L.) Hill, South-East Carpathian communities of semi-fixed siliceous screes with *Saxifraga bryoides* L., *Silene acaulis* (L.) Jacq. and *Veronica baumgartnerii* R. & S., South-East Carpathian communities of mobile or semi-mobile calcareous screes with *Papaver alpinum* L. ssp. *corona sancti-stephani* (Zapal) Borza, *Cersatiumarvense* L. ssp. *lerchenfeldianum* (Scur) Ascherson et Graebner and *Cerastium transsilvanicum* SCHUR.

## CONCLUSIONS

Mountains host a unique variety of species, many of which are rare, vulnerable or threatened. All over the world, mountains are the sites of continental or regional species diversity hot spots.

Râiosu and Buda Mountains from Făgăraş Massif are home to many rare, vulnerable or threatened plants. There can be no doubt that further field investigations on the populations of threatened plants would provide new data on which to base a more specific estimation of the conservation status of threatened plant species. Their eventual extinction in the Făgăraş Massif would be a great loss not only to regional Carpathian flora but also to world flora.

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## **MASTODON TEETH IN CÂMPULUNG MUSCEL MUSEUM COLLECTIONS**

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**ABSTRACT.** Two mastodon cheek teeth are hosted in the collection of Natural History of the Câmpulung Muscel Museum, documenting Pliocene species. The first is originating from Capu Piscului locality and concerns Auvergne mastodon (*Anancus arvernensis*). The fossil probably originates from Upper Pliocene (Dacian) deposits. The second documents the presence of the Borson's mastodont (*Mammuthus borsoni*) and was collected decades ago from Aninoasa locality. According to the geology of the area, the deposits the fossil may originated from are Lower Pliocene (Dacian). Both species are very characteristic for the Pliocene of the Dacian basin. Obviously, since the early Pliocene, large areas of the actual Argeș County were already emerged and fluvio-lacustrine environments allowed the development of these mastodon species. Although these fossils were found decades ago and their stratigraphy is not very detailed, their presence in the exhibition of the Câmpulung Muscel Museum is important for the large public, allowing a better understanding of the Pliocene evolution in this region.

**Keywords:** Dacian basin, Carpathian Foredeep, Pliocene, proboscidea, mastodons, Romania.

**REZUMAT. Dinți de Mastodon din colecțiile Muzeului din Câmpulung Muscel.** Doi molari de mastodont se găsesc în colecția de Istorie Naturală a Muzeului din Câmpulung Muscel, dovedind prezența a două specii pliocene. Prima provine din localitatea Capu Piscului și se referă la *Anancus arvernensis*. Fosila provine probabil din depozitele pliocene superioare (Romanian). Cea de-a doua fosilă dovedește prezența speciei *Mammuthus borsoni* și a fost colectată cu decenii în urmă din localitatea Aninoasa. Pe baza geologiei locale, depozitele de proveniență au putut reveni Pliocenului Inferior (Dacian). Ambele specii sunt foarte caracteristice Pliocenului din Bazinul Dacic. În mod clar, încă din Pliocenul timpuriu, suprafețe vaste ale actualului județ Argeș erau deja uscaturi pe care se găseau instalate paleomedii fluvio-lacustre care au permis existența acestor specii de mastodonți. Deși

aceste fosile au fost găsite cu decenii în urmă, iar stratigrafia lor este mai puțin exactă, prezența lor în expoziția Muzeului din Câmpulung Muscel este importantă pentru marele public, permitând o mai bună înțelegere a evoluției pliocene din regiunea argeșeană.

**Cuvinte cheie:** Bazinul Dacic, Avanfosa Carpatică, Pliocen, proboscidiensi, mastodonți, România.

## INTRODUCTION

Pliocene-Pleistocene Proboscidean fossils are not rare in the Dacian basin. A large number of finds refers to the southern mammoth, *Mammuthus meridionalis* (NESTI, 1825), but the huge majority of finds concerns only isolate cheek teeth. Fragmentary skeletons are by far, rarer (as an exception, a rich sample of bones originates from the locality Leu, in Dolj County; Popescu, 2004, 2008, 2011).

The mastodon remains are common in the Pliocene deposits of the South Carpathians Foredeep. In the first volume of the yearbook of the Geological Institute of Romania, Athanasiu (1908) published an overview on the Pliocene Borson's mastodon *Mammut borsoni* (HAYS, 1834; "Mastodon Borsoni" in Athanasiu) finds from the former Romanian Kingdom, soon followed (Athanasiu, 1909) by a similar approach on the Auvergne mastodon *Anancus arvernensis* (CROIZET & JOBERT, 1828; "Mastodon arvernensis" in Athanasiu). This couple of mastodon species is the most specific for the whole Pliocene of Romania, a rule also for the Pliocene of the whole Balkan region. Among Athanasiu's Pliocene finds, there are some from the sector of the Southern Carpathian Foredeep located in Argeș County.

In the paleontological collection of the Câmpulung Muscel Municipal Museum, Natural Sciences (hereinafter, abbreviated as CMNSC), there are hosted two mastodon cheek teeth, found in the Argeș County in the last century, several decades ago. As we think that each such find could bring a light to a better knowledge of the local geology, here we describe these fossils.

The first tooth is an isolate lower molar of the Auvergne mastodon (*A. arvernensis*), labeled as CMNSC 979. In the museum repertory, there are not too many details about this find. It is simply mentioned that it was found in 1970 in the locality Capu Piscului, situated ca. 12 km SW from Câmpulung Muscel, on Bughea River. On the geological map of the Geological Institute of Romania, scale 1:200,000, folio 34 Pitești (L-35-XXV, Murgeanu et al., 1967), in this area there are exposed both Lower (Dacian) and Upper (Romanian) Pliocene deposits (Fig. 1). It is difficult to know after so many years from which level the tooth originated from, in absence of any additional detail in the museum's documents. The bearing rock for this tooth was a microconglomerate, as the rock matrix still fixed on the tooth documents. If considering the location of Capu Piscului near the Dacian/Romanian boundary and as in Romanian the sand and sandstone increase in prevalence (Mărgărit, 1987), one may think that this fossil could originate from the basal portion of the Upper Pliocene (Romanian) succession.

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The second mastodon tooth refers also to an isolate molar assigned to Borson's mastodon (*M. borsoni*). In the repertory of the museum (CMNSC 119) for this tooth we had on hand some richer data: it originates from Aninoasa locality (Argeș County) and it was found by Mr. Costică Constantinescu, in Valea Romilor. In this case, on the same mentioned geological map (Fig. 1), in the whole area only Lower Pliocene (Dacian) deposits are exposed, with sand, marl, clay, and coal (lignite) seams inter-beddings. The matrix fixed on the tooth concerns microconglomerate and sandstone. Therefore, in this situation it is clear an origin from Lower Pliocene rocks.

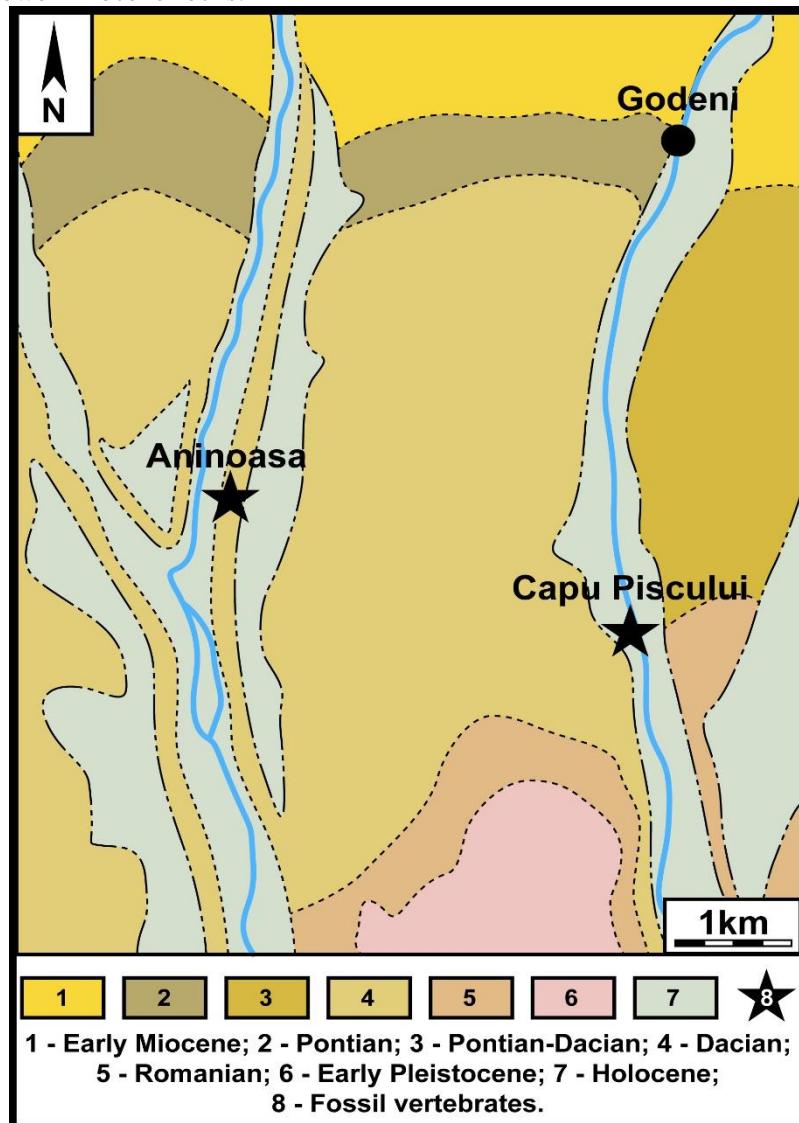


Figure 1 - Location of the mastodon localities on the geological map.

## METHODS

The teeth were not cleaned of their entire rock matrix, as all the details concerning the morphology were clear enough. Photographs of the teeth were captured with a D700 Nikon camera and a 105 mm Sigma lens, using a professional tripod. The measurements are done using professional calipers.

For both mastodons we follow the systematic of Shoshany and Tassy (1997). For *Anancus* we follow the dental terminology of Tobien (1973, 1986), Tassy (1997), Göhlich (1998); for *Mammut* we follow Tobien (1997).

Institutional abbreviations: CMNSC, Câmpulung Muscel Municipal Museum, Natural Sciences; MTC, Tării Crișurilor Museum, Oradea.

## RESULTS

### Systematic paleontology

Order Proboscidea ILLIGER, 1811

Family Gomphotheriidae HAY, 1922

*Anancus* AYMARD, 1855

*Anancus arvernensis* (CROIZET & JOBERT, 1828) (Fig. 2. 1-3)

Locality: Capu Piscului, CMNSC 979.

Geological age: ? Late Pliocene (Romanian).

Measurements (mm). In table 1.

**Description.** An isolated right m<sub>2</sub> documents this species. It originated from an adult specimen, still young. Only the crown is preserved. The roots are broken, result of the strong action of hydrotaphonomy: the water streams carried the tooth probably on a rather long distance before its definitive burial into the sediment. The molar outline in crown view is rectangular elongate, slightly arched outward in the mesial portion, typical for its position in the lower tooth row. It has four transverse lophids. As the cheek tooth has a typical anancoid pattern, with the posttrite cusps advanced forward in relation to the pretrite ones, the transverse lophids are directly influenced by this pattern. This degree of anancoidy is indicating an advanced bunodont mastodon (Tobien, 1973). The attrition acted heavily on all tubercles and erased them nearly to their bases, but the most advanced wear refers to the area of the protoconid and metaconid. According this wearing, obviously the tooth was ejected from the tooth row during the mastodon lifetime. Pressure marks can be noticed both mesial and distal. Cingulums can be observed on the buccal side and only as weak portions on the lingual one.

**Discussion.** This species is largely spread (Athanasius, 1909; Barbu, 1930; Apostol, 1968; Macarovici, 1978; Simionescu, 1990; Feru et al., 1983; Rădulescu et al., 2003; Codrea & Diaconu, 2011) in the Pliocene deposits of the Dacian basin (Andreeescu et al., 2011, 2013). In the Dacian locality Mălușteni (MN 15a, Late Dacian) from southern Moldavia (eastern region of the basin), *A. arvernensis* was recorded together with *M. borsoni* (Rădulescu et al., 2003). On the western side of the basin, the same situation can be noticed in Oltenia, in the Late Pliocene

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(Romanian) localities Covrigi or Groșerea (both, in MN 16a). In Cernătești (MN 16a), both mastodons share the same mammalian assemblage with the oldest European mammoth *Mammuthus rumanus* (ȘTEFĂNESCU, 1924). After the mammalian zone MN 16a, both mastodons went extinct in the Dacian basin, only mammoth being recorded.

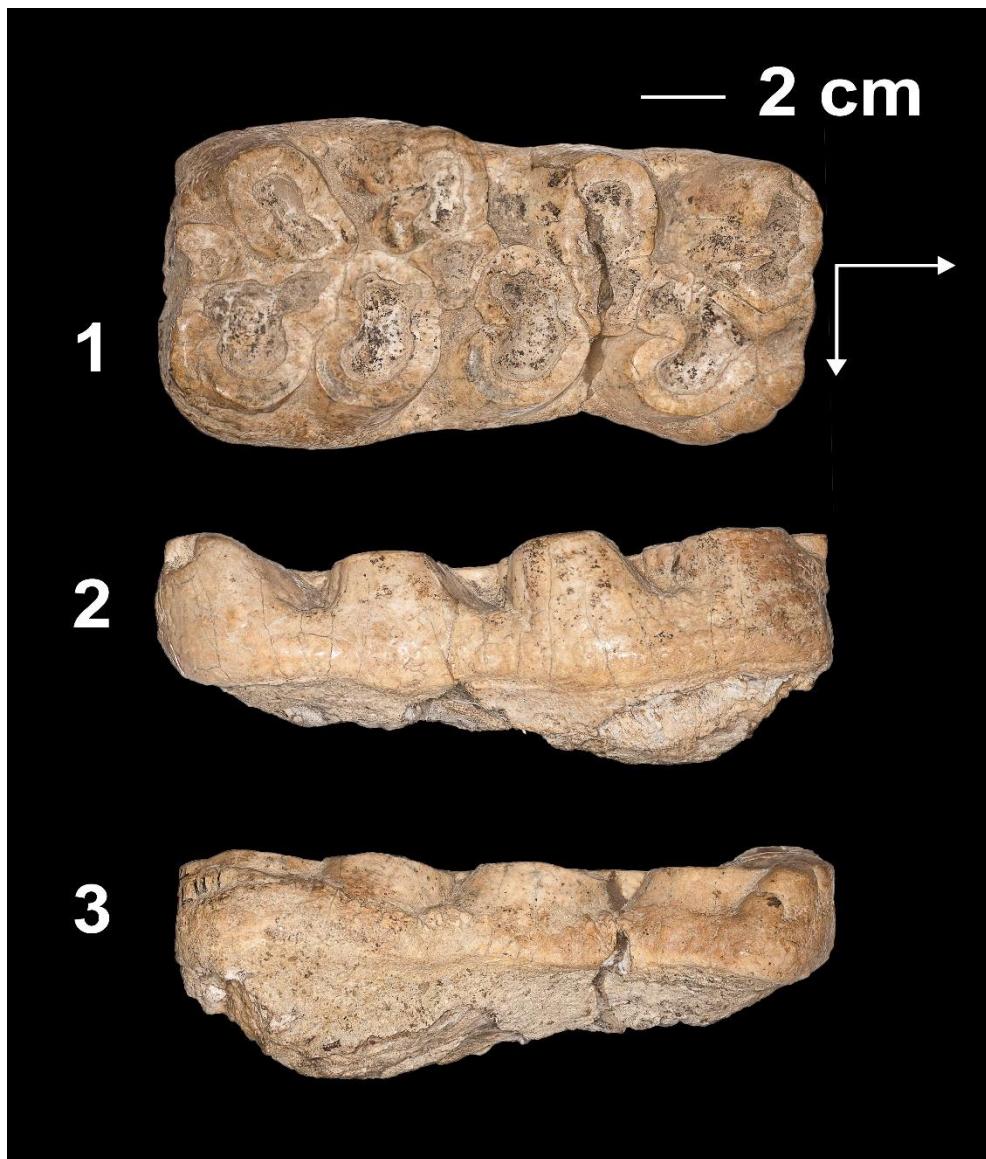


Figure 2 - *Anancus arvernenis*, Romanian, Capu Piscului, Argeș, CMNSC 979, right m2. 1- Crown view; 2 - Lingual view; 3 - Buccal view. Arrows indicate the mesial and buccal sides.

Table 1 - Comparative measurements (mm) of the mastodon tooth from Capu Piscului and some other comparable finds in Romania.

<i>Anancus arvernensis</i> m2 dext.	Capu Piscului, Argeș	Huta Păgăia, Bihor <sup>1</sup>	Oradea, Dealul Vilior, Bihor <sup>2</sup>	Ceptura, Prahova <sup>3*</sup>	Zăvelcești, Gorj <sup>4</sup>	Hurezani, Gorj <sup>5**</sup>	Tigveni, Argeș <sup>6</sup>	Ghidfalău, Covasna <sup>7</sup>	Brădețu, Gorj <sup>8</sup>	Fântâna Domnească, Mehedinți <sup>9</sup>
Crown length	149	136	140	163	146	141	-	142.5	ca. 140	-
Width of the first transverse ridge	80.7	-		-	-	-	-	81		-
Width of the second transverse ridge	81	77	80	54	70	65	-	-		-
Width of the third transverse ridge	70	-	-	-	-	-	-	-	ca. 73	70.5
Width of the fourth transverse ridge	75	-	-	67	78	70	70	-		70

**Legend:** 1. Jurcsák & Popa, 1977, Pannonian s.l.; 2. Jurcsák, 1973, "Villafranchian"; 3. Athanasiu, 1909, "middle Pliocene", i. e. Dacian, \* - measured at the crown base, the crown was missing; 4. Ibidem, Pliocene, "from levantine beds or from *Vivipara bifarcinata* beds from the upper part of the Dacian"; former Pojaru de Sus locality; 5. Ibidem, "Orezanii de Jos", in fact on the road connecting Vladimir and Hurezani; probably Romanian; 6. Ibidem, devoid of sharp stratigraphy; 7. Radulesco et al., 1965, "Villafranchien"; 8. Feru et al., 1965, on Sănișlava Creek, Motru-Jiu Formation, early Romanian ("under the XIII coal seam"); 9. Codrea & Diaconu, 2011; Romanian.

A similar situation may be noticed in Bârsei basin (southeastern Transylvania), but there is no locality documenting the coexistence of mastodons with the archaic mammoth. It is interesting to note that a damaged tooth was found in the locality Ghidfalău (Covasna County; Radulesco et al., 1965; Macarovici, 1978), but visibly this discovery remained as an isolated one, since no other subsequent reference resumed this find. According these paleontologists, the age of the rocks the tooth originated from is "Villafranchian". In later references (e.g. Rădulescu & Samson, 1985), Ghidfalău became a reference locality (Ghidfalău-1 and Ghidfalău-2) in the Sfântu Gheorghe sub-basin of Bârsei basin, but for Mindel/Elster age. In this context, in order to avoid any confusion, the mastodon find should be regarded just as an isolate record there, from older deposits than the Mindel/Elster glacial.

Apart these regions *A. arvernensis* was noticed in several localities situated westward from the Apuseni Mountains (Jurcsák, 1973; Codrea & Iuga, 2006), but in the majority of situations the finds refer only to isolate teeth and bones. Exceptions concern two fragmentary skeletons found in Oradea (Bihor County;

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Jurcsák, 1973) or Huta (Bihor County; Jurcsák & Popa, 1977), both in a bad state of preservation. However, in both localities m2 are available and allowed direct comparisons with the tooth from Capu Piscului (Tab. 1, Fig. 3). The most valuable find from stratigraphical viewpoint originates from Derşida (Sălaj County, Șimleu sub-basin of the Pannonian basin). The mastodon remains from this locality document an uppermost Late Miocene (Pontian) representative, from the unit MN 13 (Jurcsák, 1973, 1983; Codrea et al., 2002).

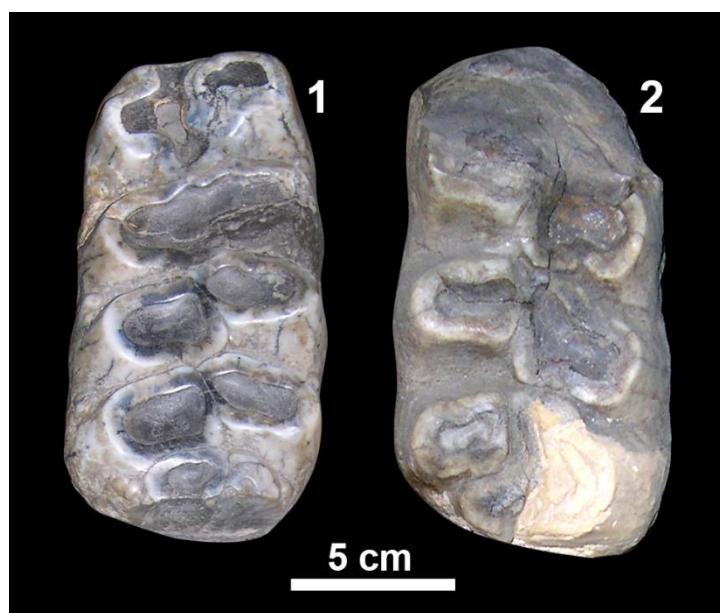


Figure 3 - *Anancus arvernensis*, Pliocene, m2. 1 - Huta Bihor, MTC 8927; 2 - Oradea Bihor, MTC 5290. Crown views.

For instance, in none region of Romania there were not coined evolutionary stages for these both mastodon species, i.e. diagnostic morphologic characters allowing clear assignations to archaic or evolved forms. However, the data available allow some observations concerning the anancoidy of m2 as marker of evolutionary stages of *A. arvernensis* in Romania. In Derşida on Peșterii Creek (Jurcsák, 1973), the m2 is missing in the repertory of discoveries, therefore we cannot make any direct comparison, although a such one would be interesting and useful, as long as it concerns an uppermost Miocene representative. The tooth form Capu Piscului exposes similar degree of anancoidy with the mastodon from Huta, but seems to be more evolved compared with the one from Oradea. This last one is damaged mostly in the mesial portion of the tooth rendering an incomplete anterior transverse ridge, but offers better details on the second and third ridges. The stratigraphy of Huta locality is poor, but Jurcsák & Popa (1977) estimates that the mastodon unearthed there would refers to "an evolved form of *Anancus (Mastodon) arvernensis* (CROIZET & JOBERT, 1828) from a female specimen, with

numerous pathologic deformations” (p. 92), avoiding to specify a clear geological age for the sedimentary deposits where the fossil originated from. In Oradea, the paleontological finds from Dealul Viilor (Tóth, 1895) could be more indicative, as long as Kretzoi (1982) mentioned some fossil vertebrate older finds including: *Hipparium* sp., *Procapreolus* sp., *Procapra* sp., Tragocerinae indet., Muntiacinae indet. Assigned to “Baltávarium, probably bérbaltavárium”, i.e. uppermost Pannonian s.l. or lowermost Pliocene (“lower Levant” “*Unio wetzleri*”; Kretzoi, 1982, p. 387). This fauna resembles closely the one from Derşida, where *Hipparium* is well represented beside *Procapreolus* sp. (Codrea et al., 2002). A level with “*Unio wetzleri*” is also known from this locality (Maxim & Ghiurcă, 1960, 1963, 1964). Therefore, if the sands from Oradea would be rather coeval with the deposits from Derşida (where apart the mastodon, the large sized deinotheriid *Deinotherium proavum* EICHWALD, 1831; Codrea et al., 2016, was discovered too, as argument for an uppermost Miocene age of those rocks), one may consider the specimen as belonging to a basal representative and the difference in anancoidy degree would be logical. In such circumstances, the mastodons from Huta and Capu Piscului could represent more evolved forms compared with the ones from Oradea, the Romanian age for the rocks from Capu Piscului being credible.

Although, we mention that there is no mounted skeleton in Romania of any of these two mentioned mastodon species. The most complete find concerns the so-called “Racoş mastodon”, a nearly complete *A. arvernensis* skeleton from Baraolt sub-basin (Toth et al., 2010; Codrea et al., 2018).

Family Mammutidae HAY, 1922

Genus *Mammut* BLUMENBACH, 1799

*Mammut borsoni* HAYS, 1834 (Fig. 4. 1-3)

Locality: Aninoasa, CMNSC 119.

Geological age: Early Pliocene (Dacian).

Measurements (mm). In table 2.

**Description.** A single isolate right M2 was found in the microconglomerates and sandstone from Aninoasa. This upper cheek tooth shares a lot of common features with the one described by Codrea & Diaconu (2007) from Husnicioara, in the westernmost sector of the Dacian basin. But in Aninoasa, the attrition wearing is by far, much advanced. The preservation is fair, but in the mesial-lingual portion the last inner half ridge, as well as the distal cingulum are damaged, with the enamel broken.

The tooth has three transverse ridges. As the median sulcus is not obstructed by any cusp, it runs on the whole length of the crown, on mesial-distal direction. In this manner, each transverse ridge is divided into a couple of distinct half-ridges. The attrition acted on all the cusps, the more advanced wear being in the first transverse ridge, on protocone and paracone areas, decreasing distally both on the pretrite and posttrite portions. In this manner, several details cannot be observed, as the conelets. On the pretrite part, the attrition wear united the protocone, the antecrescentoid, the postcrescentoid and the conelets. Same stage

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concerns the hypocone and metacone on the second transverse ridge, and is similar on the third ridge too. A strong pressure mark is on the anterior cingulum; on the distal cingulum it is less evident as this part is damaged. Lateral cingulums are present, both buccally and lingually. One can conclude that this tooth was ejected from the buccal cavity of the mastodon during its lifetime, at mature stage.



Figure 4 - *Mammut borsoni*, Dacian, Aninoasa, Argeș, CMNSC 119, right M2. 1 - Crown view; 2 - Buccal view; 3 - Lingual view. Arrows indicate the mesial and buccal sides.

Table 2 - Comparative measurements (mm) of the mastodon tooth from Aninoasa and some other comparable finds in Romania.

<i>Mammut borsoni</i>	Aninoasa, Argeș	Husnicioara, Mehedinți <sup>1</sup>	Budești, Vâlcea <sup>2</sup>	Sălcuța, Dolj <sup>3</sup>
Length	116.5	118.5	114	120
Width 1 <sup>st</sup> transverse ridge	90.2	87	82	-
Width 2 <sup>nd</sup> transverse ridge	91	91	85	90
Width 3 <sup>rd</sup> transverse ridge	87	93	83	-

**Legend:** 1. Codrea & Diaconu, 2007, Dacian; 2. Athanasiu (1908), on Simnicu Creek, in the Upper "Pontian"; 3. Ibidem, in "Levantine beds".

**Discussion.** *Mammut* is a genus occurred since the late Miocene (MN 12), as the discoveries from Northern China document. The basal most representatives of this genus seem to share common features with Choerolophodontidae, having therefore a common ancient ancestor among the basal Elephantida (Wang et al., 2017).

Since the discovery of the mastodon tooth from Husnicioara, very few data can be added in Romania about the Borson's mastodon (Codrea & Diaconu, 2007 and references therein). A tooth was also reported in Hurducești (Mehedinți County) by Codrea & Diaconu (2010), but as it concerns an old find, it brings nearly nothing new about the stratigraphy of the Pliocene in the Dacian basin. The find refers to a tooth reworked into the actual alluvia of the Hușița Valley, a river incising various Pliocene and Pleistocene rocks. In such circumstances, it is hard to coin in our country evolutionary tendencies for this species.

A comparison between sizes, shows that the tooth from Aninoasa share nearly the same ones with the tooth from Husnicioara, probably because of the same geological age of the specimens, both Dacian. The Table 2 illustrates that the metric data for M2 in Romania are still too scarce. However, if the locality Budești is really a Pontian locality (but in our opinion based on the data issued on the geological map 1:200,000, folio 34 Pitești (Murgeanu et al., 1967), this age could be difficult to support in this area) and Sălcuța a Romanian one, one may think about an increasing size trend of this species, from older geological ages to the younger ones, at least for the time span Dacian-Pontian. But, there are extremely few data either about the early representatives of this lineage (see data about *M. praetypicum* (SCHLEZINGER, 1919) from Păgaia in Codrea et al., 2005), or the extinction of this species in Romania, and other details could be added only if late representatives originating from localities well dated from stratigraphical viewpoint will be discovered.

In such circumstances, the stratigraphy of this species in Romania do not break the rule already coined in the whole Central and Eastern Europe regions, this mastodon being a rather common presence in the mammalian communities since the uppermost Miocene, until the early Pleistocene (Göhlich, 1999).

### CONCLUDING REMARKS

The mastodon teeth from Câmpulung Museum collection are, like in numerous other collections in our country just isolate finds, happened decades ago. In such situations it is difficult, even impossible to recover data on the exact stratigraphic level of provenance and implicitly, on taphonomy or sedimentology of the deposits of origin. The rock matrix still adherent to the teeth we described can offer some indications, but not very rich. In these circumstances, the mastodon remains from this collection can just enlarge the list of localities in our country where these species originated from. We want underline the remarkable potential of Argeș County for such discoveries, pointing out that all are important for a better knowledge about the vertebrate paleontology in our country. If such a new find will occurs, it is essential that professional paleontologists know as soon as possible about it and weigh in with their knowledge. Otherwise, as time is running, the scientific value of these finds is lowering and a lot of data are lost.

Last but not least, the value of these specimens for the local museums like the one of Câmpulung remains is important: people interested about Earth evolution can find in such evidence a key for better understanding the Earth history, in this case about the geological time that preceded the Ice Age, as well as for the regional geology.

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## A PLIOCENE MASTODON AT BERBEȘTI (VÂLCEA DISTRICT)

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**ABSTRACT.** The Pliocene coal-bearing deposits from north-western Oltenia are mined since several decades, from the 20<sup>th</sup> century. These works are still continuing, but slower than once. An iconic mining area for such works is Berbești, located in Vâlcea County. The frequent fossils found there concern invertebrates, in dominance molluscs. Vertebrates were never mentioned from this locality. This paper deals with an upper tusk fragment originating from a mastodon found in the clay covering the coal seam V mined in Berbești open pit. These rocks are Parscovanian (= middle Dacian, early Pliocene) in age. Although the fragment available for study is limited to the apical portion of the incisor, one may presume that the tusk was longer when it was found in the rock, the broken part being a fresh one. This fossil record is of special importance because the vertebrate remains of this age are rather rare in Oltenia. The environment where this mastodon lived was fluvial-deltaic.

**Keywords:** mastodon, early Pliocene, Carpathian Foredeep, Oltenia, Romania.

**REZUMAT. Un Mastodon Pliocen la Berbești (județul Vâlcea).** Depozitele purtătoare de cărbuni Pliocene din nord-vestul Olteniei sunt exploataate de câteva decenii, începând din secolul 20. Aceste lucrări continuă și în prezent, însă mult diminuate. O arie minieră emblematică pentru astfel de lucrări este Berbești, localizată în Județul Vâlcea. Fosilele frecvent descoperite acolo se referă la nevertebrate, predominant moluște. Vertebrate nu au fost niciodată semnalate din această localitate. Această lucrare se referă la un fragment de fildeș superior provenind de la un mastodont descoperit în argile care acoperă stratul de cărbune V exploatat în cariera Berbești. Rocile sunt parscoviene (= Dacian mediu, Pliocen Inferior). Deși fragmentul aflat la dispoziție pentru studiu este limitat strict la terminația apicală a incisivului, se poate presupune că fildeșul aflat în strat a fost mai lung, spărtura mesială fiind proaspătă. Această semnalare a fosilei este de importanță deosebită, fiindcă resturile de vertebrate având această vechime sunt mai degrabă rare în Oltenia. Mediul în care acest mastodont a viețuit a fost unul fluvial-deltaic.

**Cuvinte cheie:** mastodont, Pliocen Inferior, Avanfosa Carpatică, Oltenia, România.

## INTRODUCTION

In northern Oltenia (south-western Romania, western sector of the Dacian basin) between Olt and Jiu rivers, Pliocene exposures are largely spread as a belt-like area trended W-E. This area was and still is of economic interest, due to the coal seams interleaved in the Pliocene rocks. In the Pliocene sedimentary succession, both Lower and Upper Pliocene (= Dacian and Romanian) rocks can be observed.

In the basal most Dacian deposits sand is in prevalence, while towards the top of this succession the lithology is more diverse, with sand, silt clay and coal (lignite) seams being inter-bedded (Andreeșcu et al., 1985; Țicleanu & Pătruțoiu, 1987). In late Getian (= early Dacian) the coal occurs only on restricted areas and is devoid of mining interest. The Getian deposits are included in a distinct lithostratigraphic unit named the Berbești Formation (Andreeșcu et al., 1985). Later in the Dacian, the coal seams became thicker (locally reaching nearly to ten meters) and are mined in open pits, the lignite being burn in thermoelectric power plants. The participation of sand decreased, and silt, silt clay and clay prevail. Fossils are represented mainly by molluscs indicative for low brackish waters (Andreeșcu et al., 1985). The middle and late Dacian (= Parscovian and Siensian) deposits are included in the Motru-Jiu Formation.

In the northern Oltenia sector of the Carpathian Foredeep, the Romanian was a time of transition from fluvial to alluvial depositional systems. The lithology of the deposits did not change too much compared to the Dacian ones, but the participation of gravel (more precisely, of coarser gravel), became more and more important to the top of the Pliocene sedimentary succession. Polycyclic sequences of coarse pebble, sands, silts and clay are in dominance. Coal seams still occur in Romanian too. For the northern margin of the Dacian basin, these Romanian deposits are included in the Cândești Formation (Andreeșcu et al., 2011, 2013 and references therein). Apart of various freshwater molluscs, mammal remains, mainly of large herbivores are recorded in several localities (*Ibidem*).

In reference to the coal seams, it is worth to mention that such beds were used on the whole territory of Oltenia as markers used for local or regional correlations. The coal seams were numbered either regionally or just locally (Petrescu et al., 1987). If the regional numbering refers to whole Oltenia region, there are also local numberings, as is the case of Jiu-Olt area (Țicleanu & Pătruțoiu, 1987). In our opinion, the local numbering caused confusion in interpreting of the regional charts and it may be useful strictly for local correlations, as the ones between different neighbouring coal open pits. The magnetostratigraphy is much more accurate than allowed better correlations of the coal seams (Andreeșcu et al., 1986, 1987). In the sector of our interest, the Dacian/Romanian boundary falls between the coal seams XIII and XIV (in the regional numbering of the coal seams; Ion Andreeșcu, written communication).

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Among the open pits mining the coal in northern Oltenia, Berbeşti is an iconic one. This locality is situated along Tărâia left affluent of Olteţ River (Fig. 1).

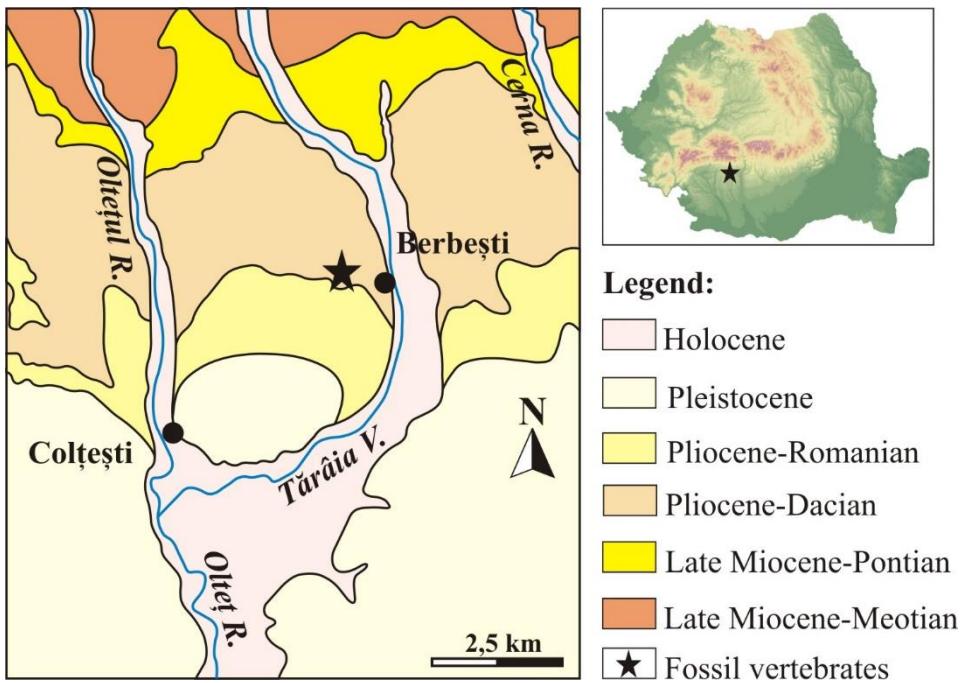


Figure 1 - Location of the locality Berbeşti on the geological map. Legend: Miocene: Po - Pontian; Pliocene: Dc - Dacian, Ro - Romanian; Quaternary: Pl - Pleistocene; Ho - Holocene. Star: vertebrate fossil.

Two open pits are mining the coal in Berbeşti: a first one is located ca. 3 km westward (Berbeşti open pit), and a second eastern one (Panga open pit), at ca. 3 km distance from the locality. In Berbeşti open pit, during the coal mining works over a decade ago, an upper mastodon tusk fragment (I2) has been unearthed in the clay covering the coal seam V (in the regional numbering, II in the local one; Fig. 2). Probably the tusk preserved within the rock was longer, but the careless extraction of the fossil by miners damaged a large part. Therefore, only this fragment is now available for study.

## MATERIAL AND METHODS

The tusk fragment did not need special preparation. Its state of preservation was fair. However, as it was broken into three parts, they were glued with a professional polymer.

The tusk fragment was compared with the ones of the "Stoina mastodon" (Demetrescu & Nicolaescu-Plopşor, 1929) hosted in the Oltenie Museum Natural Sciences Branch in Craiova (inventory number 1466) and with the fossil illustrate

by Athanasiu (1908) from Adjud. For *Mammut borsoni* (HAYS, 1834), comparisons were based on references of the Milia mastodon specimens (Greece; Tsoukala & Mol, 2016).

Photographs were captured with Sony® DSC-RX100M5 with lens ZeissVario-Sonnar T\* 1.8-2.8/8.8-25.7, then processed in Adobe®Photoshop® CS2 Version 9 in order to sharpen some details.

Systematic follows Shoshani & Tassy (1997).

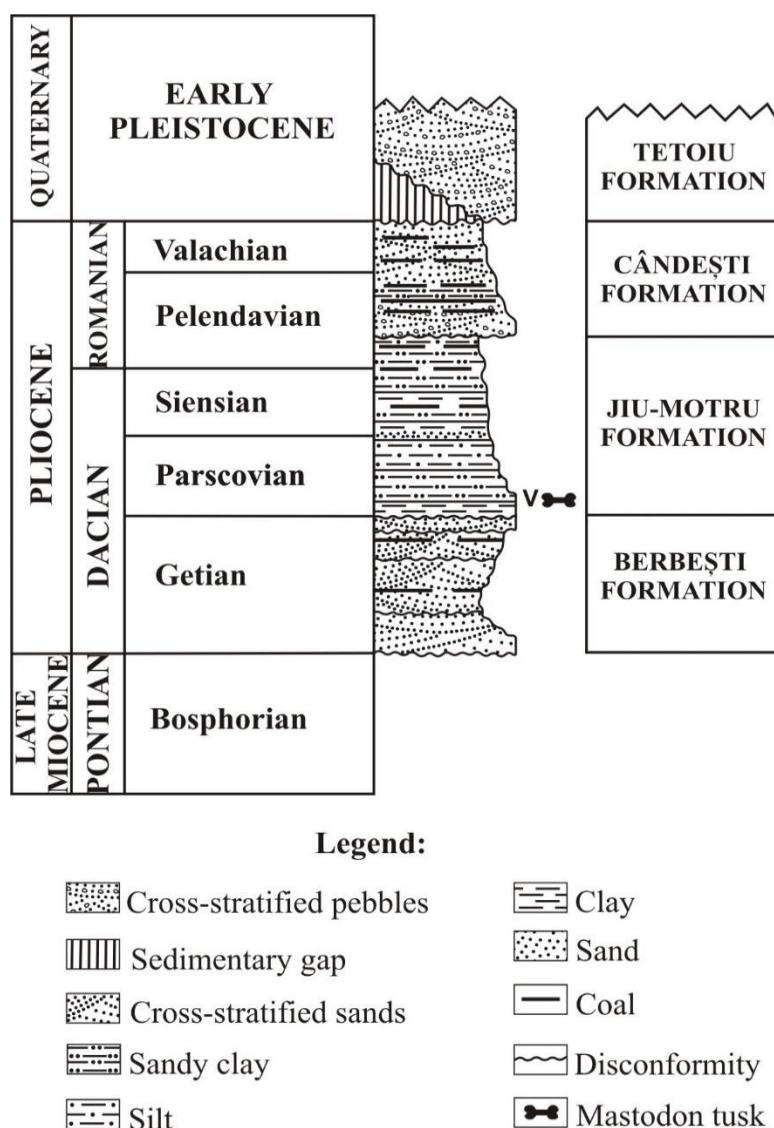


Figure 2 - Pliocene lithostratigraphy between Jiu and Olt rivers. In legend, V indicates the level where the mastodon tusk originated from.

## RESULTS

### Systematic palaeontology

Order Proboscidea ILLIGER, 1811

Suborder Elephantiformes TASSY, 1988

Superfamily Elephantoidea GRAY, 1821 sensu TASSY, 1988

Family Mammutidae HAY, 1922, *Mammut* BLUMENBACH, 1799, probably *M. borsoni* (HAYS, 1834) or,

Plesion *Anancus* AYMARD, 1855, probably *A. arvernensis* (CROIZET & JOBERT), 1828 (Fig. 3).

The single remain documenting the presence of mastodons in the Parscovanian deposits of Berbeşti is an apical fragment of an upper tusk (I2), most likely the right one. The tusk is broken at its tip, as well as in the mesial extremity. The tusk is devoid of any enamel band and the dentine is polished in the tip area. The colour of dentine is greenish-gray. The size of the tusk is pronouncedly increasing from the tip towards the skull: on only 40 cm length, the largest diameter increases from 36 mm at the tip torn zone, to 84 mm in the mesial cross section. The cross sections are different, from oval (Fig. 3, 1 a) to the tip, to a quasi-circular one in the mesial area (Fig. 3, 1 c). In the mesial torn area, the inner dentine has a blackish colour. The Schreger lines angles (Fig. 3, 3) exceed  $90^{\circ}$  near the tusk surface, and decrease towards its longitudinal axis, where the angle is sharp. This tendency is noted also in other proboscideans, as the woolly mammoth (Ábelová, 2008).

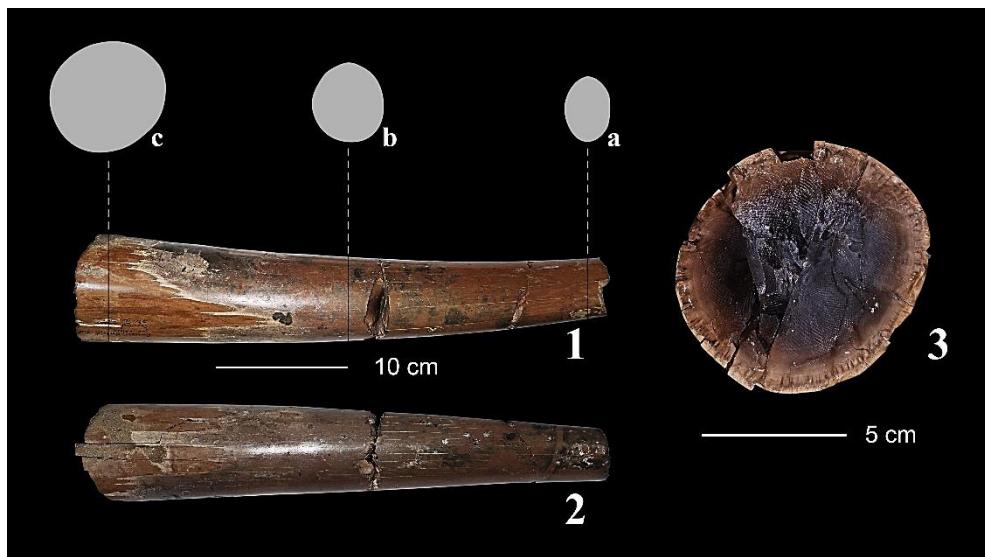


Figure 3 - Mastodon tusk fragment from Berbeşti: 1. Outer view with successive cross sections (marked a, b, c from distal to mesial portions); 2. Ventral view; 3. Mesial cross section with Schreger lines.

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## DISCUSSIONS

In Romania, as in many other regions of Europe, in the Pliocene there are only two mastodon species: the gomphotheriid *Anancus arvernensis* (CROIZET & JOBERT, 1828) and the mammutid *Mammut borsoni* (HAYS, 1834).

The fossil record of *Mammut praetypicum* (SCHLEZINGER, 1919), a third species that could be eventually present in Pliocene, is still a subject of debate, as outlined among others by Lungu & Obadă (2001) and Codrea et al. (2005). The finds originating from Păgaia (Bihor County) that yielded fossils for the last mentioned species were not enriched by new ones in the last years; therefore it is hard to resume a new discussion based on richer samples. There are no new geological studies on Păgaia area that could lead to a clearer stratigraphy. Therefore, the possible Pliocene age of this locality should be based on stronger arguments, still missing. Anyhow, *M. praetypicum* was never mentioned in the Dacian basin.

In these circumstances we have to refer only to the couple of mastodon species firstly mentioned above. Both are reported from various early and late Pliocene localities from Oltenia. What is less clear in this region is the stratigraphy of several localities where these fossils originated from. But, it is obviously clear that both mastodon species were at last for a time span in the Pliocene contemporaneous, each one adapted to a specific food.

Without any intention to redact an exhaustive list of localities where these Pliocene mastodons were reported from, we will discuss some of the localities from Oltenia. A first problem to be solved concerning not only the local stratigraphy but the whole Dacian basin is to reassess the regional geological maps, consequence of relocation of the Pliocene/Pleistocene boundary at ca. 2.58 Ma. instead the former limit of ca. 1.8 Ma (e.g. Van Couvering, 2004; <http://www.stratigraphy.org/ICSchart/ChronostratChart2018-08.pdf>). The geological maps on scale 1:200,000 made by the Geological Institute of Romania are rather old, the folios being published in the years '60-'70 of the 20<sup>th</sup> century. In the specific case of the Berbești locality, the Tg. Jiu folio L-34-XXX (Codarcea et al., 1967) issued when the Pliocene/Pleistocene boundary was younger than nowadays. More recent maps on scale 1:50,000 for this area are missing. In such circumstances, the Pliocene/Pleistocene limits on the geological map 1:200,000 should be redrawn. Obviously, a part of the former deposits of the Valachian (= late Romanian) have to be now considered as Pleistocene.

The same concerns several Pliocene vertebrate localities reported from Oltenia by Rădulescu & Samson (2001) and Rădulescu et al. (2003) that should be stratigraphically reassessed: Slatina 2 and Tetoiu-Bugiulești area with the sites Valea Roșcăi, La Pietriș or Valea Greuceanului are considered now Pleistocene and not Upper Pliocene, as once (a chart of reassessed Pliocene and Pleistocene mammalian localities from the Dacian Basin specifying also the paleomagnetically investigated sites in Andreescu et al., 2011, 2013). But all these above mentioned localities are devoid of interest for mastodons, as long as in the mammal unit MN

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17 the only proboscideans ever reported belong to *Mammuthus*, mastodons being already extinct in this region. In the older MN 16a subunit (Romanian, late Pliocene) Cernăteşti is an outstanding locality, where *Anancus arvernensis* and *Mammut borsoni* were coeval with *Mammuthus rumanus* (ȘTEFĂNESCU, 1924), the earliest known European mammoth (Ştefănescu, 1924; Listner & van Essen, 2003; Markov, 2012). In the other localities of the same subunit as Groşerea or Covrigi only mastodons are reported, and in Mătăsari-Brădeţu only *A. arvernensis* is mentioned (possibly due to the scarcity of vertebrate fossils in this locality: apart the mastodon, only the rhinoceros *Stephanorhinus* cf. *etruscus* is present; Rădulescu et al., 2003).

The tentative of comparison of this portion of tusk to the similar ones of *A. arvernensis* from Stoina (Gorj District; Demetrescu & Nicolaescu-Plopșor, 1929) and Adjud (Athanasiu, 1908) or *M. borsoni* from Milia (Greece; Tsoukala & Mol, 2014, 2016) reveals nothing but the impossibility to separate these two species based on this fragment. Neither the internal structure, nor the dimensions and cross-section geometry are not useful for such discrimination. The single reasonable conclusion to be done based on this fossil is that mastodons were present in the Lower Pliocene coal bearing deposits of the South Carpathian Foredeep, in this specific case at Berbeşti. Other finds are supporting the same evidence, as the one from Husnicioara (Mehedinți County) coal open pit, where a left upper second molar of *M. borsoni* was unearthed during the coal mining works from the rocks covering the coal bed IV (Codrea & Diaconu, 2007). It is clear that in the Dacian the mastodon remains are not frequent at all, possibly due to the specific taphonomy in deltaic environments, sometimes with some increased fluvial plain influences, specific since the Berbeşti Formation deposition (between the whole region comprised between Danube and Olt River; Ion Andreeescu, written communication).

As it concerns an old find, there is scarce data about the taphonomy. The fossil was collected by a coal miner that gave it to the geologist. In Berbeşti quarries, as in the majority of coal open pits in Oltenia, only large sized excavators are used for coal extraction (Fig. 4). The underground mining once working (the mines Alunu, Berbeşti and Copăceni) ceased still long time ago and manual extraction in the open pits was never used. In these circumstances, even a whole skeleton of a large herbivore like a mastodon could have gone unnoticed. In the mesial portion, the tusk broken area has a fresh aspect, which let us to presume that at least another of its part was present into the rock. The mastodon upper tusks can be very hardly moved before their definitive burial, as they are nearly always very long (in Milia, the *M. borsoni* tusks exceeds five meters; Tsoukala & Mol, 2014, 2016). In such circumstances, we may think that probably the whole tusk was in the rock bed, and even the mastodon skeleton, complete or fragmentary was nearby.



Figure 4 - Coal mining in Panga open pit with large size excavator.

## CONCLUSIONS

Mastodons were a common presence in the early and late Pliocene, leaving fossil evidence in numerous localities of the Dacian basin. *A. arvernensis* and *M. borsoni* were coeval since the Dacian and continued until the early Romanian (subzone MN16a), when they lived besides the first European mammoth, *M. rumanus*. After that, *M. borsoni* became rarer, while the frequency of *A. arvernensis* increased. The explanation should be found in the changes occurred in the Pliocene environments of the Dacian basin, the deltaic ones being gradually replaced mostly on the western and northern sides by fluvial and alluvial environments (Andreeșcu et al., 2011, 2013). These changes, certainly had influences in the vegetal communities as noticed by Petrescu et al. (1989 a, b) and Codrea et al. (2006). These authors made even a reconstruction of the Pliocene environments (Figs. 5, 6), that Codrea (1997) resumed. The different diets of the two mastodon taxa were probably a strong control factor that could explains the different stratigraphic frequencies above mentioned.

This is the first fossil record of a mastodon in Berbești, a new locality for the Pliocene vertebrates in the Dacian basin. The mastodon tusk was found in the basal portion of the Jiu-Motru Formation, in Dacian deposits.

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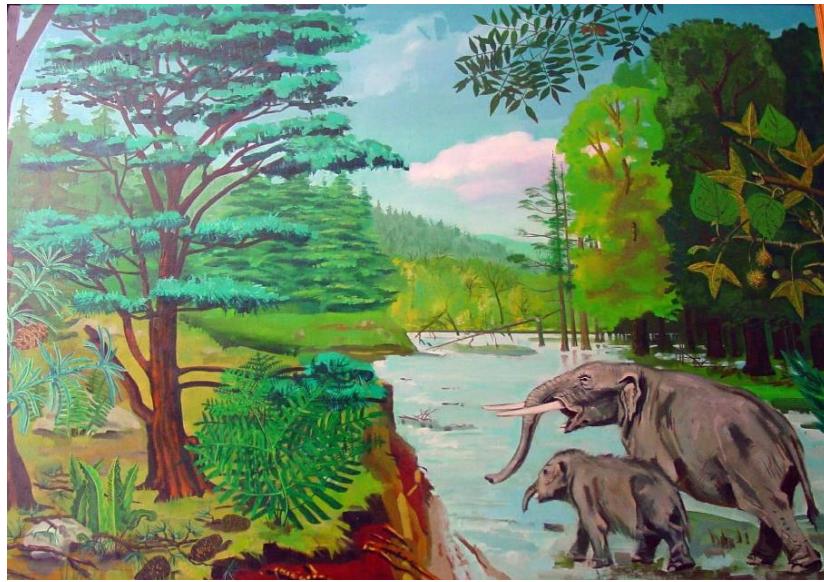


Figure 5 - Reconstruction of the lower Pliocene (Dacian) environment in the Dacian basin; in front, *M. borsoni*. Oil on canvas by painter V. Svințiu, scientific supervision of I. Petrescu (plants) and V. Codrea (mastodon).

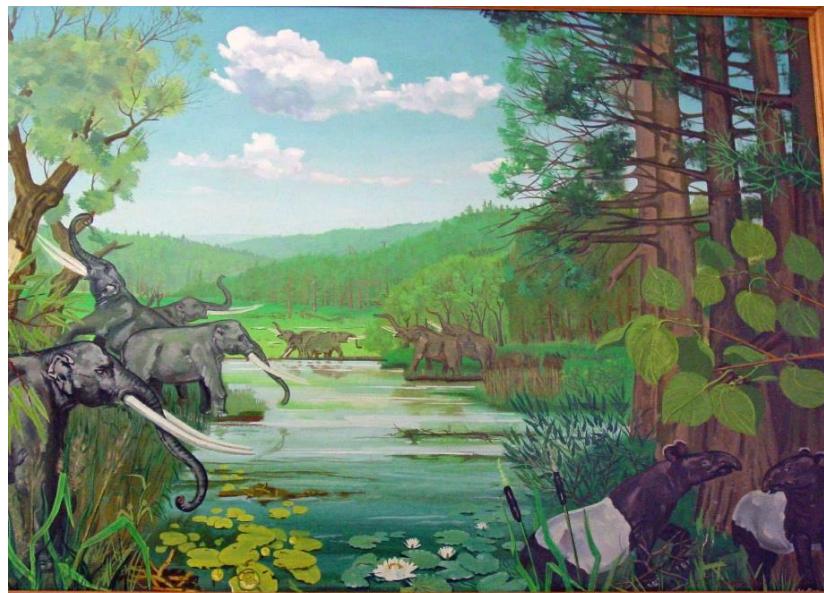


Figure 6 - Reconstruction of the upper Pliocene (Romanian) environment in the Dacian basin; in front, *A. arvernensis* and the tapir *Tapirus arvernensis* CROIZET & JOBERT, 1828. This last one was never found in Oltenia, but it was added based on the discoveries from Baraolt basin and South Moldova (Mălușteni), considered at that time as Romanian ones (now, reassessed as Dacian). Oil on canvas by painter V. Svințiu, scientific supervision of I. Petrescu (plants) and V. Codrea (mastodon).

Probably, the vertebrate fossils unearthed during the coal mining were by far more numerous, but they were lost. The potential of these deposits for vertebrate remains is considerable, and a systematic scientific survey would be desirable.

### ACKNOWLEDGEMENTS

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## NEW OBSERVATIONS ABOUT THE FAUNA OF SOME INSECT'S GROUPS FROM TINCA AREA (BIHOR COUNTY, ROMANIA)

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**ABSTRACT.** This paper presents the observations registered by author in Tinca area, during March 1, 2017 – September 1, 2018. There were recorded 63 species, belonging to four orders. Many species are common, but there were identified some ecological aspects unmentioned in literature.

**Keywords:** insects, Tinca area, ecological aspects.

**REZUMAT.** **Noi observații despre fauna unor grupe de insecte din zona Tinca (județul Bihor, România).** Această lucrare prezintă observațiile înregistrate de autor în zona Tinca, în perioada 1 martie 2017 – 1 septembrie 2018. Au fost consemnate 63 de specii care aparțin la patru ordine. Multe specii sunt comune, dar au fost identificate unele aspecte ecologice nemenționate în literatură.

**Cuvinte cheie:** insecte, zona Tinca, aspecte ecologice.

### INTRODUCTION

Tinca area is situated in the south-western part of Bihor County, belonging to the historical province Crișana, at the Confluence of the Miersig Plain and the Holod Depression. The average altitude is 115 m, the Climate is temperate continental, moderate, having one particular nuance, the Pannonic. From the hydrographical point of view, the analysed territory belongs to the inferior limit of the Crișul Negru River, middle Course. The vegetation of the area belongs to the oak stage, having a predominant Central-European origin. The forests are formed of the species belonging to the genus *Quercus* L. isolated troops of beech tree, false acacia, hornbeam, maple tree, ash tree. In the lawns of Tinca area were identified different leguminous plants, graminaceae, some Compositae, etc.

Tinca village includes: Tinca, Gurbediu, Râpa, Belfir and Girișu Negru villages. Data about the fauna of insects from Tinca area were published by author in a book and some scientific papers (Ilie, 2003, 2006, 2009, 2012, 2013, 2014, 2015, 2016, 2017). The context in which those observations were realized is represented by the general decline of the biodiversity under the influence of

anthropogenic pressure and the climatic changes. Although many species are common, there were recorded a few specimens of these, comparatively to the same period of the last years. Abundant precipitations (approximately in every day), extreme thermic variations and probably chemical substances used in agriculture determined this situation.

## MATERIAL AND METHODS

The observations were performed between March 1, 2017 and September 1, 2018. Many species were collected with entomological net. For the determination of species, different guides were used (Rákosi, 2013; Székely, 2010; Dijkstra, 2006; Panin & Săvulescu, 1961; Warchałowsky, 2003).

## RESULTS AND DISCUSSIONS

In the analysed period were identified the following species:

### Order ODONATA

#### Suborder Zygoptera

##### Familia Platycnemididae:

- *Platycnemis pennipes* (PALLAS, 1771):

- one male specimen, Tinca, June 6, 2018.

##### Family Coenagrionidae:

- *Ischnura pumilio* (CHARPENTIER, 1825):

- two immature female specimens, Tinca, August 8, 2018.

Species mentioned for the first time in area.

#### Suborder Anisoptera

##### Family Aeshnidae:

- *Anax imperator* LEACH, 1815:

- one male specimen, Râpa, May 20, 2018.

##### Family Libellulidae:

- *Libellula depressa* LINNAEUS, 1758:

- one female specimen, Tinca, May 21, 2018;

- one immature male specimen, the edge of Tinca forest, July 26, 2018.

- *Orthetrum brunneum* (FONSCOLOMBE, 1837):

- one male specimen, Gurbediu forest, June 1, 2018.

- *Sympetrum sanguineum* (MÜLLER, 1764):

- one male specimen, Gurbediu forest, June 1, 2018.

### Order MANTODEA

#### Family Mantidae:

- *Mantis religiosa* (LINNAEUS, 1758):

- one female specimen, green coloured, Tinca, August 17, 2018;

- one female specimen, green coloured, Tinca, August 31, 2018.

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Common species.

**Order COLEOPTERA**

**Family Lucanidae:**

- *Lucanus cervus* (LINNAEUS, 1758):
  - one pair, Tinca, April 4, 2018 (first observation of the year in area);
  - one male specimen flying, Gurbediu forest, June 1, 2018;
  - one female specimen, Tinca, July 2, 2018.

Common and protected species (<https://eunis.eea.europa.eu/species/221>).

**Family Scarabaeidae:**

- *Amphimallon solstitialis* (LINNAEUS, 1758):
  - many specimens during May 24 - June 27, 2018, Tinca.

Common species.

- *Melolontha melolontha* (LINNAEUS, 1758):
  - two specimens, Tinca, April 16, 2018, t = 23 °C;
  - two specimens, May 2, 2018, t = 22 °C. There are the single observations for this species this year, during 2013-2016 were observed hundreds of specimens and in 2017 only six specimens.

Relatively common species.

- *Oryctes nasicornis* (LINNAEUS, 1758):
  - one male specimen, Tinca, May 7, 2018 (first observation of the year);
  - one female specimen, Tinca, May 31, 2018;
  - one male specimen, Tinca, June 7, 2018;
  - one male specimen, Tinca, July 15, 2018.

Common species.

**Family Coccinellidae:**

- *Coccinella septempunctata* (LINNAEUS, 1758):
  - many specimens during the analysed period.

Very common species.

**Family Cerambycidae:**

- *Dorcadiion aethiops* (SCOPOLI, 1763):
  - many specimens during April 25 - June 5, 2018. The raised temperatures determined premature appearance of this species, the period of flight is June-July (Panin & Săvulescu, 1961);
    - one pair in copula, Gurbediu forest, June 1, 2018. This species and *Dorcadiion murrayi* KUST. were intense hunted by *Passer montanus* LINNAEUS, 1758 and *Passer domesticus* LINNAEUS, 1758 (Aves Class).

Common species.

- *Dorcadiion murrayi* KUSTER, 1847:
  - many specimens in Tinca village during April-May, 2018.

Common species.

**Family Chrysomelidae:**

- *Altica oleracea* (LINNAEUS, 1758):

- 
- four specimens (two specimens-typical form, two specimens belonging to chromatic variety *lugubris* WEISE), Tinca, April 13, 2018, t = 23 °C.
    - Common species.
    - *Cassida viridis* LINNAEUS, 1758:
  - two specimens, Tinca spa, April 15, 2018.
    - Common species.
    - *Chaetocnema concinna* (MARSHAM, 1802):
  - three specimens, Tinca, May 15, 2018.
    - Common species.
    - *Chrysolina aurichalcea* ssp. *bohemica* (MÜLLER, 1948) - ab. *gibbipennis* FALDERMANN, 1835:
      - one female specimen, feeding the pollen of *Digitaria sanguinalis* (L.) SCOP., at the edge of Tinca forest, July 26, 2018. This subspecies is mentioned for the first time in Romania. It is interesting that although is a mountainous species, this is the second time when this species is recorded at a low altitude, other mention being forest Leamna, Dolj County (80-100 m altitude; Ilie, 1999).
    - Relatively rare species at national level.
    - *Chrysolina fastuosa* SCOPOLI, 1763:
  - two specimens, Tinca, April 14, 2018, t = 23 °C (first observation of the year in area);
  - one pair in copula, Tinca, August 1, 2018.
    - Common species.
    - *Chrysolina limbata* (FABRICIUS, 1775):
  - one female specimen, Tinca, June 8, 2018.
    - Common species.
    - *Chrysolina sturmi* WESTHOFF, 1882:
  - one male specimen, Tinca, June 23, 2018;
  - one pair, Tinca, June 29, 2018;
  - one female specimen feeding the pollen of *Digitaria sanguinalis* (L.) SCOP., at the edge of Tinca forest, July 22, 2018;
  - one pair, Tinca, August 2, 2018.
    - Common species.
    - *Chrysomela vigintipunctata* SCOPOLI, 1763:
  - one specimen, Tinca, April 13, 2018, in my personal court, although in this place there isn't a willow or a poplar tree like food. This phenomenon was observed by author too in the last years, probably this coleopteran feed other plants besides Salicaceae family.
  - Common species.
  - *Clytra laeviuscula* RATZEBURG, 1837:
  - one specimen, Tinca, June 6, 2018;
  - one specimen, Tinca, July 3, 2018.
    - Common species.
    - *Cryptocephalus flavipes* FABRICIUS, 1781:
  - one female specimen, Tinca, June 9, 2018.

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Common species.

- *Cryptocephalus octacosmus* BEDEL, 1891:

- one male specimen, Tinca, June 13, 2018.

Common species.

- *Cryptocephalus sericeus* (LINNAEUS, 1758):

- one female specimen, Tinca, June 11, 2018.

Common species.

- *Galeruca rufa* GERMAR, 1824:

- one male specimen, Tinca, June 20, 2018. This species presents a pronounced thanatosis (feigning death, approximately two minutes!).

Common species.

- *Gonioctena fornicata* (BRÜGGEMANN, 1873):

- one specimen feeding a leaf of genus *Rumex* L. (Polygonaceae family), Tinca, April 25, 2018. This is a new host plant, unmentioned in literature. The host plants of this species belong to Fabaceae family (Warchalowsky, 1994).

Common species.

- *Labidostomis longimana* (LINNAEUS, 1761):

- five specimens, during June 9 - July 4, 2018, Tinca.

Common species.

- *Leptinotarsa decemlineata* SAY, 1824:

- one female specimen belonging to chromatic variety *basijuncta* PIC., 1870, Tinca, August 11, 2018. This variety is mentioned for the first time in Romania;
- one specimen, Tinca, August 31, 2018.

Common species.

- *Luperus xanthopoda* SCHANK, 1781:

- one female specimen feeding a withered ear of *Hordeum murinum* L. (Poaceae family), Tinca, May 20, 2018. It is surprisingly, because his host plants are the elm, Salicaceae family and some Rosaceae (Warchalowsky, 1994).

Common species.

- *Phaedon laevigatus* (DUFTSCHMID, 1825):

- one male specimen, Tinca, March 13, 2018, t = 7 °C.

Common species.

- *Phyllotreta ochripes* (CURTIS, 1837):

- one male specimen belonging to chromatic variety *cruciata* WEISE, Tinca, June 21, 2017.

Species recently mentioned in Tinca area (Ilie, 2017).

- *Podagrion malvae* (ILLIGER, 1807):

- some specimens feeding with the leaves of *Lamium purpureum* L., but the attacks were very feeble and the pants served too like refuge during the winter 2017-2018. This phenomenon was observed too at *Altica oleracea* (LINNAEUS, 1758).

Common species.

**Family Curculionidae:**

- *Coniocleonus nigrosuturatus* (GOEZE, 1777):

- one male specimen, Tinca, April 2, 2018, t = 7 °C;

- one female specimen, Tinca, June 5, 2018;

- one male specimen, Tinca, July 4, 2018.

Common species.

**Order LEPIDOPTERA**

**Family Hesperiidae:**

- *Thymelicus sylvestris* (PODA, 1761):

- two male specimens, Tinca, August 2, 2018.

Relatively common species in area.

**Family Papilionidae:**

- *Iphiclus podalirius* (LINNAEUS, 1758):

- one specimen (Fig. 1), Tinca, April 18, 2018, t = 23 °C;

- six specimens, Tinca, June 10-30, 2018, t = 22-31 °C;

- two specimens, the edge of Tinca forest, July 26, 2018, t = 28 °C;

- two specimens, Tinca, August 1, 2018; after these data, when the precipitations were stopped, many specimens were observed.

Generally, common species, but in this year he was relatively rare during the abundant precipitations (April-July).



Figure 1 - *Iphiclus podalirius* (LINNAEUS, 1758) (foto A. L. Ilie).

- *Papilio machaon* LINNAEUS, 1758:

- one specimen, Tinca, April 22, 2018, t = 24 °C;

- one specimen, Tinca, July 29, 2018;

- one specimen, Tinca, August 21, 2018;

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- one specimen, Tinca, August 30, 2018;
- one specimen, Tinca, August 31, 2018.

There are the single observations of the year, although the period of flight is middle of April-middle of June, July-August. Common species, but very rare in 2018.

**Family Pieridae:**

- *Anthocaris cardamines* (LINNAEUS, 1758):

- one specimen, Tinca, April 14, 2018, t = 23 °C;
- three specimens, Tinca spa, April 15, 2018, t = 29 °C.

Relatively common species.

- *Colias erate* (ESPER, 1805):

- one male specimen, Tinca, August 21, 2018, t = 34 °C;
- one specimen, Tinca, August 29, 2018;
- one specimen, Tinca, August 31, 2018.

Generally, common species but very rare in 2018, because the abundant precipitations (April-July).

- *Gonopteryx rhamni* (LINNAEUS, 1758):

- one specimen, Tinca, March 12, 2018, t = 16 °C;
- one specimen, Tinca, April 8, 2018, t = 24 °C.

Common species.

- *Leptidea sinapis* (LINNAEUS, 1758):

- one female specimen, Tinca, April 21, 2018, t = 24 °C.

Relatively common species.

- *Pieris brassicae* (LINNAEUS, 1758):

- many specimens during the analysed period.

Very common species.

- *Pieris rapae* (LINNAEUS, 1758):

- same situation like precedent species.

Common species.

- *Pontia edusa* FABRICIUS, 1777:

- one female specimen, Tinca, June 6, 2018, t = 26 °C.

Common species.

**Family Riodinidae:**

- *Hamearis lucina* (LINNAEUS, 1758):

- one male specimen, Tinca, May 12, 2018;
- two male specimens, Tinca, June 24, 2018;
- one male specimen, Tinca, August 2, 2018.

Common species.

**Family Lycaenidae:**

- *Satyrium ilicis* ESPER, 1779:

- one female specimen, Tinca, June 16, 2018, t = 26 °C, on cultivated roses. Rákosi (2013) mentioned like preference for nectar some plants: species of genus *Thymus* L. or *Sambucus ebulus* L.

Rare species.

**Family Nymphalidae:**

- *Aglais (Inachis) io* (LINNAEUS, 1758):

- four specimens, Tinca, April 8-14, 2018, t = 23-25 °C;
- three specimens, Tinca spa, April 15, 2018, t = 29 °C;
- one specimen, Tinca, June 5, 2018, t = 21 °C;
- two specimens, Tinca, June 9, 10, 18, 2018, t = 25-26 °C;
- one specimen, Tinca, August 31, 2018, t = 34 °C.

Common species.

- *Apatura iris* (LINNAEUS, 1758):

- one specimen, Tinca, May 26, 2018, t = 24 °C.

Relatively rare species.

- *Argynnis paphia* (LINNAEUS, 1758):

- one male specimen, Tinca, August 4, 2018.

Relatively common species.

- *Brintesia circe* (FABRICIUS, 1775):

- one female specimen, Tinca, June 16, 2018, t = 26 °C;
- two species, Tinca forest, July 26, 2018, t = 28 °C;
- one female specimen, Tinca, August 19, 2018, t = 33 °C.

Relatively rare species.

- *Issoria lathonia* (LINNAEUS, 1758):

- one male specimen, Tinca, April 8, 2018, t = 24 °C;
- two male specimens, Tinca, August 3, 2018.

Common species.

- *Neptis hylas* (LINNAEUS, 1758):

- many specimens, Tinca and Râpa forests, during the analysed period.

Common species.

- *Nymphalis antiopa* (LINNAEUS, 1758):

- one specimen, Tinca spa, April 15, 2018, t = 29 °C. The specimen presented the edge of wings coloured white and not yellow, specific to the specimens who hibernated (Rákosy, 2013).

Relatively common species.

- *Pararge aegeria tircis* (GODART, 1821):

- one specimen, Tinca, April 16, 2018, t = 23 °C;
- many specimens during August 2018.

Common species.

- *Polygonia c-album* (LINNAEUS, 1758):

- one specimen, Tinca, June 7, 2018, t = 27 °C.

Common species.

- *Vanessa atalanta* (LINNAEUS, 1758):

- three specimens, Tinca, April 15 - July 17, 2018, t = 21-30 °C.

Very common species.

- *Vanessa cardui* (LINNAEUS, 1758):

- three specimens, Tinca, April 8, 2018, t = 24 °C;
- one specimen, Tinca, July 6, 2018, t = 22 °C.

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Common species.

**Family Saturniidae:**

- *Saturnia pyri* DENIS & SCHIFFERMULLER, 1775:
- one female specimen, Tinca, May 3, 2018.

Common species in area.

**Family Sphingidae:**

- *Acherontia atropos* (LINNAEUS, 1758):
  - one specimen, Tinca, June 12, 2018.
- Rare species.
- *Agrius convolvuli* (LINNAEUS, 1758):
  - one-two specimens every day, during August 18-31, 2018.

Migratory species.

- *Hyles euphorbiae* (LINNAEUS, 1758):
- one specimen, Tinca, April 9, 2018, t = 25 °C. Although the period of flight for this species is till September, this species was not observed till September 1, 2018.

Common species.

**Family Erebidae:**

- *Amata phegea* (LINNAEUS, 1758):
  - one specimen, Tinca spa, June 11, 2018, t = 26 °C.
- Relatively common species.

## CONCLUSIONS

In Tinca area, during the analysed period, were recorded 63 species of insects belonging to four orders. Many species are common, but the number of specimens is very little because the anthropogenic pressure and the climatic changes. One subspecies is mentioned for the first time in Romania: *Chrysolina aurichalcea* ssp. *bohemica* (MULLER, 1948) and one species is recently mentioned in area: *Phyllotreta ochripes* (CURTIS, 1837). There were observed some ecological aspects unmentioned in literature.

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## **NEW OBSERVATIONS ABOUT THE INVERTEBRATES AND THE VERTEBRATES FROM DIFFERENT AREAS OF ROMANIA**

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**ABSTRACT.** This paper presents new faunistical data from different parts of Romania during 2018. There were recorded 55 species of invertebrates and 99 species of vertebrates. There were observed some ecological aspects of animals unmentioned in literature.

**Keywords:** vertebrates, invertebrates, faunistical data, Romania.

**REZUMAT. Noi observații despre nevertebratele și vertebratele din diferite zone din România.** Această lucrare prezintă noi date faunistice din diferite părți ale României în anul 2018. Au fost identificate 55 specii de nevertebrate și 99 specii de vertebrate. Au fost observate unele aspecte ecologice ale animalelor, nemenționate în literatură.

**Cuvinte cheie:** vertebrate, nevertebrate, date faunistice, România.

### **INTRODUCTION**

Some ecological aspects of the animals and rare species it could be observed during the travels with the car or train. Similar researches were recorded by Ilie (2011, 2015, 2017). This work carries on the presentation of other faunistical observations in different parts of Romania during 2018.

### **MATERIAL AND METHODS**

The observations were performed with binoculars 8x25 and 20x50, completed with direct observations. For the identification of species, different guides were used (Fuhn, 1969; Mac Donald & Barret, 1995; Rákosy, 1996; Valenciuc, 2002; Székely, 2008, 2010; Dijkstra, 2006; Rákosy, 2013; Swensson 2017).

## RESULTS AND DISCUSSIONS

In the analysed period, there were identified the following species:

### Class GASTROPODA

#### Order STYLOMMAТОPHORA

##### Family Helicidae:

- *Helix pomatia* LINNAEUS, 1758:

- one specimen, Oradea (BH), High School "Lucian Blaga", February 20, t = 7.5 °C;
- one specimen, Tinca (BH), June 4;
- one specimen, Tinca (BH), June 9;
- one specimen, Băile Felix (BH), August 27;
- one specimen, Oradea (BH), September 22.

Common species.

### Class ARACHNIDA

#### Order ACARI

##### Family Eriophyidae:

- *Aceria populi* (NALEPA, 1851):

- galls on the branches of the trees of genus *Populus* L., Tinca (BH), September 8.  
Species mentioned for the first time in Tinca area. Neacșu (2006) mentioned this species only in the southern part of Romania. The identification of these species of galls attests the existence of 95 species of galls in Tinca area (Ilie & Marinescu, 2018).

### Subphylum MYRIAPODA

#### Class DIPLOPODA

#### Order JULIDA

##### Family Julidae:

- *Megaphyllum unilineatum* (KOCH, 1838):

- three pairs in copula, Tinca (BH), October 7, t = 6 °C;
- one pair in copula, Tinca (BH), October 14;
- one pair in copula, Tinca (BH), October 28;
- many specimens in Tinca area during November.

Very common species in Tinca area.

### Class INSECTA

#### Order ODONATA

#### Suborder ZYGOPTERA

##### Family Lestidae:

- *Lestes viridis* (VAN DER LINDEN, 1825):

- many pairs in copula, the edge of Tinca forest (BH), October 6, t = 24 °C.  
Common species.

- *Sympetrum fusca* (VAN DER LINDEN, 1820):

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- one male specimen, Tinca forest (BH), October 6, t = 24 °C.  
Common species.

**Family Coenagrionidae:**

- *Ischnura elegans* (VAN DER LINDEN, 1820):

- one male specimen, Băile Felix (BH), August 27.  
Common species.

**Suborder ANISOPTERA**

**Family Aeshnidae:**

- *Aeshna cyanea* (MULLER, 1764):

- one male specimen, Felix forest (BH), August 27.  
Common species.

**Family Gomphidae:**

- *Gomphus vulgatissimus* (LINNAEUS, 1758):

- one male specimen, Tinca (BH), September 25, t = 25 °C;
- one male specimen, Tinca (BH), October 11, t = 24 °C;
- one female specimen, Tinca (BH), October 12, t = 25 °C;
- one female specimen, Tinca (BH), October 16, t = 23 °C. In this case the flight period was extended with one month, because the raised temperatures.

Common species.

**Family Libellulidae:**

- *Crocothemis erythraea* (BRULLÉ, 1832):

- one male specimen, Băile Felix (BH), August 27.  
Common species.

- *Libellula depressa* (LINNAEUS, 1758):

- one female specimen, Tinca (BH), September 23.  
Common species in wetlands.

- *Orthetrum coerulescens* (FABRICIUS, 1798):

- one male specimen, Băile Felix (BH), August 27.  
Common species.

- *Sympetrum fonscolombii* (SELYS, 1840):

- three female specimens, four male specimens, Tinca spa (BH), September 8.  
Common species.

- *Sympetrum striolatum* (CHARPENTIER, 1840):

- two female specimens, Tinca (BH), October 21, t = 21 °C.  
Common species.

**Order MANTODEA**

**Family Mantidae:**

- *Mantis religiosa* (LINNAEUS, 1758):

- three green female specimens (Fig. 1) and one brown female specimen, Tinca (BH), September 3-29;

- one brown female specimen, Tinca (BH), October 10.  
Common species in Tinca area.



Figure 1 - *Mantis religiosa* (LINNAEUS, 1758) (foto A. L. Ilie).

## Order COLEOPTERA

### Family Scarabaeidae:

- *Cetonia aurata* (LINNAEUS, 1758);  
- one specimen, Tinca forest (BH), October 6, t = 24 °C.  
    Common species in the forests and plains areas.
- *Oryctes nasicornis* (LINNAEUS, 1758);  
- one male specimen, Oradea (BH), June 28;  
- one specimen, Tinca (BH), July 7.  
    Common species in the oak forests.

### Family Buprestidae:

- *Trachys troglodytiformis* OBENBERG, 1918;  
- three specimens, Tinca (BH), November 8, t = 18 °C.  
    According to literature (Panin et al., 2015), the period of activity for the adults is till to September. In this case the period was extended with two months, because the raised temperatures (t = 22-27 °C in October).

### Family Chrysomelidae:

- *Altica oleracea* (LINNAEUS, 1758);  
- two specimens, Tinca spa (BH), September 8;  
- one specimen, Tinca (BH), September 30. It is very surprising the presence only of one specimen in this place and in this period comparatively to the preceding years.  
    Generally, common species.
- *Chrysolina herbacea* (DUFTSCHMID, 1825);  
- one larva of the third age, many adults, Tinca spa (BH), September 8;  
- one female specimens feeding with the leaves of *Cirsium arvense* LINNAEUS, 1758, Schitul Iezer (VL), September 21. The attack was relatively strong, this plant becomes a new host plant for this species, unmentioned in the scientific literature;

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- two female specimens and two larvae of the third age, Schitul Iezer (VL), September 21.

Relatively common species.

- *Chrysolina polita* (LINNAEUS, 1758):

- one male specimen, Schitul Iezer (VL), September 21.

Relatively common species in wetlands.

- *Chrysolina sturmii* (WESTHOFF, 1882):

- one female specimen, Oradea (BH), July 27;

- one female specimen, Tinca (BH), September 28.

Common species.

- *Cryptocephalus sericeus* (LINNAEUS, 1758):

- one specimen feeding with the pollen of *Mentha* sp. LINNAEUS, 1766, Tinca spa (BH), September 8.

Common species in the plain areas.

- *Galeruca tanaceti* (LINNAEUS, 1758):

- one male specimen, Tinca (BH), October 6;

- one male specimen, Tinca (BH), October 30, t = 24 °C.

Common species in the plain areas.

- *Luperus xanthopoda* (SCHRANK, 1781):

- one female specimen, Tinca, August 20.

Common species.

- *Neocrepidodera impressa* (FABRICIUS, 1801) subsp. *obtusangula* (DANIEL, 1904):

- one species, Tinca spa (BH), September 8.

Species mentioned for the first time in Tinca area.

- *Podagrion fuscicornis* (LINNAEUS, 1766):

- one specimen, Tinca spa (BH), September 8.

Relatively rare species in the plain areas.

- *Sphaeroderma rubidum* (GRAELLS, 1858):

- one specimen, Tinca (BH), September 7.

Relatively common species in the plain areas.

**Family Curculionidae:**

- *Coniocleonus nigrosuturalis* (GOEZE, 1777):

- one specimen, Tinca (BH), September 8.

Common species in the plain areas.

**Order LEPIDOPTERA**

**Family Papilionidae:**

- *Papilio machaon* LINNAEUS, 1758:

- one pair, Tinca (BH), September 3;

- two male specimens, Tinca spa (BH), September 8.

Generally common species but being in numerical regress in the last years in Tinca area.

**Family Pieridae:**

- *Pieris brassicae* (LINNAEUS, 1758):
- many specimens, Oradea (BH), August 30;
- three specimens, Schitul Iezer (VL), September 21;
- many specimens in Tinca area till to November 11, t = 18 °C;
- one specimen, Maieru (BN), 476 m altitude, October 27.

Very common species.

- *Pieris rapae* (LINNAEUS, 1758):
- two specimens, Oradea (BH), August 27;
- four specimens, Schitul Iezer (VL), September 21;
- many specimens in Tinca area (BH) till to November 14, t = 15 °C.

Common species.

- *Colias erate* (ESPER, 1805):
- three male specimens, Tinca (BH), September 5;
- many specimens, Tinca spa (BH), till to November 16, t = 7 °C;
- two specimens, Maieru (BN), October 27, 476 m altitude.

Common species.

- *Colias croceus* (FOURCROY, 1785):
- many specimens in Tinca area (BH) till to November 14, t = 15 °C.

Common species.

**Family Lycaenidae:**

- *Lycaena virgaureae* (LINNAEUS, 1758):
- one female specimen, Tinca (BH), October 11, t = 24 °C;
- one male specimen, Tinca (BH), October 20, t = 17 °C. According to literature (Szekely, 2008; Rakosy, 2013), the flight period was extended with two months.

Relatively common species.

- *Phengaris (Maculinea) arion* (LINNAEUS, 1758):
- two male specimens, Tinca (BH), December 10, t = 6 °C.

According to literature (Rákosi, 2013), the flight period is till to June. Maybe is a new generation (the second).

- *Polyommatus (Lysandra) bellargus* (ROTTEMBURG, 1775):
- one female specimen, many male specimens, Tinca spa (BH), September 8.

Common species.

- *Polyommatus icarus* (ROTTEMBURG, 1775):
- many male specimens, three female specimens, Tinca spa (BH), September 8.

Common species.

**Family Nymphalidae:**

- *Aglais (Inachis) io* (LINNAEUS, 1758):
- one specimen, Tinca (BH), September 16;
- one specimen, Tinca (BH), September 28;
- one specimen, Tinca forest (BH), October 5, t = 20 °C;
- one specimen, Tinca (BH), October 30, t = 24 °C;
- one specimen, Tinca (BH), November 4, t = 25 °C;
- three specimens, Râpa (BH), November 14, t = 15 °C.

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Generally, common species, but in numerical regress in Tinca area.

- *Brintesia circe pannonica* FRUHSTORFER, 1911:

- one male specimen, Tinca (BH), September 12, t = 27 °C;
- one male specimen, Tinca (BH), September 28, t = 23 °C. According to literature (Székely, 2008; Rákossy, 2013), this has the flight period till to August 15. Because the raised temperatures, the flight period is extended with one and half month.

Relative common species.

- *Lasiommata megera* (LINNAEUS, 1767):

- one male specimen, Tinca (BH), November 8, t = 18 °C;
- one male specimen, Tinca (BH), November 9, t = 15 °C. According to literature (Rákossy, 2013), the flight period was extended with one month.

Relatively common species.

- *Maniola jurtina* (LINNAEUS, 1758):

- one female specimen, Tinca (BH), November 4, t = 25 °C. According to literature (Rákossy, 2013) the flight period (till to the end of August) was extended with two months.

Relatively common species.

- *Melitaea athalia* (ROTTEMBURG, 1775):

- one female specimen, Tinca (BH), November 4, t = 25 °C. The flight period (till to the beginning of September) was extended with two months because the raised temperatures (Rákossy, 2013).

Relatively common species.

- *Melitaea phoebe* (DENIS & SCIFFERMULER, 1775):

- one male specimen, Tinca (BH), November 7, t = 20 °C. The period of flight is May-the first week of September (Rákossy, 2013), therefore the period of flight was extended with two months.

Common species.

- *Neptis hylas* (LINNAEUS, 1758) syn. *Neptis sappho* (PALLAS, 1771):

- one specimen, the edge of Tinca village (BH), October 6, t = 24 °C, the flight period was extended with one month (Székely, 2008; Rákossy, 2013).

Common species.

- *Pararge aegeria tircis* (GODAT, 1821):

- two specimens, Felix forest (BH), August 27.

Common species.

- *Polygonia c-album* (LINNAEUS, 1758):

- one specimen, Schitul Iezer (VL) September 21;
- eleven specimens, Tinca (BH), during September 15 - October 20;
- one specimen, Tinca (BH), November 4, t = 25 °C.

Common species.

- *Pyronia tithonus* (LINNAEUS, 1767):

- one female specimen, Tinca (BH), November 2, t = 25 °C. The flight period (till to the end of August) was extended with two months (Rákossy, 2013).

Common species.

- *Vanessa atalanta* (LINNAEUS, 1758):

- one specimen, Oradea (BH), July 2;
- two specimens, Schitul Iezer (VL), September 21;
- one specimen flying at  $t = 6.5^{\circ}\text{C}$ , in the morning (8:15 AM), Tinca (BH), October 6;
- many specimens in Tinca area (BH) till to December;
- two specimens, Tinca (BH), December 10.

Very common species.

- *Vanessa cardui* (LINNAEUS, 1758):

- one male specimens, Oradea (BH), June 28;
- one male specimen, Tinca (BH), September 5.

Common species.

#### **Family Geometridae:**

- *Operophtera brumata* (LINNAEUS, 1758):

- one female specimen, Tinca (BH), December 13-15,  $t = 0-3^{\circ}\text{C}$  (day),  $t = -6^{\circ}\text{C}$  (night).

Common species in Tinca area.

#### **Family Sphingidae:**

- *Hyles euphorbiae* (LINNAEUS, 1758):

- one specimen, Tinca (BH), September 8;
- one specimen, Tinca (BH), October 12;
- one specimen, Tinca (BH), November 7,  $t = 20^{\circ}\text{C}$ ;
- one specimen, Tinca (BH), November 13,  $t = 17^{\circ}\text{C}$ . According to literature (Székely, 2010) in this period the species must to be in the stage of pupa, the flight period is August-first week of September (the second generation), therefore the period of flight was extended with two months.

Relative common species in plain areas.

#### **Family Erebidae:**

- *Amata phegea* (LINNAEUS, 1758):

- three specimens, Oradea (BH), July 11.

Relatively common species.

- *Polypogon tentacularia* (LINNAEUS, 1758):

- one male specimen, Tinca (BH), February 15,  $t = 5^{\circ}\text{C}$ ;
- one female specimen, Tinca (BH), November 22,  $t = 5^{\circ}\text{C}$ ;
- three male specimens, Tinca (BH), December 8,  $t = 4^{\circ}\text{C}$ .

According to literature (Rakosy, 1996), the flight period is 15 May - 15 July.

### **Order DIPTERA**

#### **Family Cecidomyiidae:**

- *Contarinia subulifex* KIEFFER, 1897:

- galls on the leaves of *Quercus cerris* L., Tinca forest (BH), October 6.

Species mentioned for the first time in Tinca area.

#### **Family Tipulidae:**

- *Tipula oleracea* LINNAEUS, 1758:

- one pair in copula, Tinca (BH), October 11,  $t = 17^{\circ}\text{C}$  (20:21 PM). The flight period for this species is June-September.

Common species in plain areas.

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**Class AMPHIBIA**

**Order ANURA**

**Family Ranidae:**

- *Rana dalmatina* FITZINGER, 1838:

- many specimens, Tinca spa (BH), September 8.  
Common species in wetlands.

- *Rana ridibunda* (PALLAS, 1771):

- many specimens, Tinca spa (BH), September 8.  
Common species.

**Order URODELA**

**Family Salamandridae:**

- *Triturus vulgaris* (LINNAEUS, 1758):

- one female specimen, Tinca (BH), October 29, t = 17 °C (7:49 AM).  
Common species.

**Class REPTILIA**

**Order SQUAMATA**

**Family Lacertidae:**

- *Lacerta viridis* (LINNAEUS, 1758):

- one female specimen (Fig. 2), Tinca forest (BH), October 6, t = 24 °C.  
Common species in Tinca area.



Figure 2 - *Lacerta viridis* (LAURENTI, 1768) (foto A. L. Ilie).

**Family Colubridae:**

- *Coronella austriaca* (LAURENTI, 1768):

- one female specimen (Fig. 3), Tinca (BH), October 29, t = 27 °C.  
Common species.



Figure 3 - *Coronella austriaca* LAURENTI, 1768 (foto A. L. Ilie).

- *Natrix tessellata* (LAURENTI, 1768):

- one specimen, Tinca spa (BH), near Crișul Negru River, September 8.  
Common species in Tinca area.

#### Class AVES

#### Order PODICIPEDIFORMES

##### Family Podicipedidae:

- *Podiceps auritus* (LINNAEUS, 1758):

- one male specimen, Oradea (BH), Crișul Repede River (BH), December 20.  
Accidental species in Romania, probably mentioned for the first time in Bihor county.
- *Tachybaptus ruficollis* (PALLAS, 1764):  
- one specimen, Ghioroc (TM), September 22.  
Summer visitor, rare winter visitor, in wetlands.

#### Order PELECANIFORMES

##### Family Pelecanidae:

- *Pelecanus onocrotalus* (LINNAEUS, 1758):

- two specimens, Tinca spa (BH), Crișul Negru River, September 5;
- two specimens, Cheșa (BH), October 11;
- two specimens, Tinca spa (BH), Crișul Negru River, November 7.  
Passage species or rare summer visitor in Tinca area.

##### Family Phalacrocoracidae:

- *Phalacrocorax carbo* (LINNAEUS, 1758):

- seven specimens, Craiova (DJ), September 20;
- 13 specimens, Tinca (BH), October 15;

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- 64 specimens, Tinca (BH), October 28;
- seven specimens, Râpa (BH), November 17.  
Summer visitor, rare winter visitor.

**Order CICONIIFORMES**

**Family Ardeidae:**

- *Ardea cinerea* (LINNAEUS, 1758):
  - one specimen, Sântana (lake) (AR), September 19;
  - one specimen, Cheșa (BH), June 8;
  - one specimen, Tinca (BH), December 21.  
Summer or rare winter visitor, common species.
  - *Egretta garzetta* (LINNAEUS, 1766):
    - one specimen, Cefa (BH), September 19.  
Summer visitor.
    - *Egretta alba* (LINNAEUS, 1758):
      - one specimen, Cheșa (BH), July 22;
      - three specimens, Tinca spa, Crișul Negru River, September 5;
      - 20 specimens, Zerind (AR), September 22;
      - one specimen, Râmniciu Vâlcea (VL), Olt river, September 21;
      - one specimen, Salonta (BH), September 19;
      - six specimens, Tămașda lake (BH), September 19;
      - 13 specimens, Tinca (BH), October 6.  
Summer or rare winter visitor, common species.
    - *Ixobrychus minutus* (LINNAEUS, 1766):
      - one specimen, Tinca spa (BH), Crișul Negru River, September 5.  
Summer visitor, breeding species in Tinca area.

**Family Ciconiidae:**

- *Ciconia nigra* (LINNAEUS, 1758):
  - one specimen, Cheșa (BH), August 14.  
Summer visitor in Romania.

**Order ANSERIFORMES**

**Family Anatidae:**

- *Cygnus olor* (LINNAEUS, 1758):
  - three specimens, Cheșa (BH), May 18;
  - two pairs with six nestlings, Drobeta Turnu-Severin (MH), Danube River, September 19;
  - 126 specimens, Tinca (BH), November 3.  
Summer or rare winter visitor.
  - *Cygnus cygnus* (LINNAEUS, 1758):
    - two specimens, Ucuriș (BH), December 22.  
Winter visitor in Romania.
    - *Anser anser* (LINNAEUS, 1758):
      - 57 specimens (in migration), Ciumeghiu (BH), September 22.

Partial migratory species.

- *Anser albifrons* (SCOPOLI, 1769):

- 32 specimens, Tinca (BH), November 2;
- 17 specimens, Tinca (BH), November 11;
- 183 specimens, Râpa (BH), November 12.

Winter visitor in Romania.

- *Anser fabalis* (LATHAM, 1787):

- two specimens, Tinca (BH), November 20.

Winter visitor in Romania.

- *Anas platyrhynchos* (LINNAEUS, 1758):

- five male specimens, Cheșa (BH), March 2;
- four female specimens, Tinca (BH), Crișul Negru River, September 8;
- 23 specimens, Râmniciu Vâlcea (VL), Olt River, September 21;
- 324 specimens, Tinca (BH), November 2.

Sedentary, common species.

- *Aythya fuligula* (LINNAEUS, 1758):

- two male specimens, Cociuba Mare (BH), November 6.

Winter visitor, rarely summer visitor in Romania.

- *Aix galericulata* (LINNAEUS, 1758):

- one male specimen, Cociuba Mare (BH), November 13. Probably, this specimen is escaped from zoo or private bird cage.

Accidental species in Romania.

## Order FALCONIFORMES

### Family Accipitridae:

- *Aegypius monachus* (LINNAEUS, 1766):

- one immature specimen, forest Tinca, October 16;
- one immature specimen (probably the same specimen), Tinca spa, October 20.

Accidental, very rare species in Romania.

- *Aquila chrysaetos* (LINNAEUS, 1758):

- one specimen, Boga (BH), June 16.

Sedentary, relative rare species in Romania.

- *Aquila heliaca* (SAVIGNY, 1809):

- one specimen, Cheșa (BH), July 5.

Sedentary, relative rare species in Romania.

- *Circaetus gallicus* (GMELIN, 1788):

- one specimen, Cheșa (BH), June 4.

Summer visitor or passage species in Romania.

- *Milvus migrans* (BODDAERT, 1783):

- one specimen, Cheșa (BH), October 2.

Passage or sedentary, relative rare species in Romania.

- *Circus cyaneus* (LINNAEUS, 1766):

- one male specimen, Tinca (BH), December 1;
- one female specimen, Tinca (BH), December 3.

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Winter visitor, common species in Romania.

- *Circus macrourus* (GMELIN, 1770):

- one male specimen, Tinca (BH), December 16.

Passage or summer visitor in Romania, relatively rare species.

- *Circus pygargus* (LINNAEUS, 1758):

- one female specimen, Tinca (BH), October 18;
- one female specimen, Tinca (BH), October 28;
- one male specimen, Tinca (BH), November 11. Probably, this is the latest observation of the species in Romania.

Summer visitor, common species.

- *Circus aeruginosus* (LINNAEUS, 1758):

- one juvenile specimen, Oradea (BH), September 19;
- one specimen, Cefa (BH), September 19;
- two specimens, Tămașda lake (BH), September 19.

Summer visitor, rare winter visitor, common species in wetlands.

- *Accipiter nisus* (LINNAEUS, 1758):

- one female specimen hunting a swallow, Tinca (BH), September 7;
- one male specimen, Tinca (BH), December 5;
- one female specimen, Tinca (BH), December 31.

Sedentary, common species.

- *Accipiter gentilis* (LINNAEUS, 1758):

- one female specimen, Zăbrani (AR), September 22;
- one female specimen hunting a swallow Tinca (BH), October 3;
- one female specimen, Tinca (BH), October 8;
- one juvenile specimen, Tinca (BH), October 11;
- one female specimen hunting a ring-dove, Tinca (BH), October 25;
- one female specimen, Tinca (BH), November 12;
- one female specimen, Tinca (BH), November, 14;
- one female specimen, Tinca (BH), December 21.

Sedentary, common species.

- *Buteo buteo* (LINNAEUS, 1758):

- one specimen, Tinca spa (BH), September 8;
- two specimens, Cheșa (BH), September 2;
- three specimens, Tinca (BH), October 23;
- one specimen, Tinca (BH), November 3;
- one specimen, Tinca (BH), November 11;
- one specimen, Leș (BH), one specimen, Husasău de Tinca (BH), two specimens, Miersig (BH), November 23;
- many melanistic, brown-blackish specimens, on Oradea (BH) - Timișoara (TM) route, December 21.

Partial migratory, common species.

**Family Falconidae:**

- *Falco tinnunculus* (LINNAEUS, 1758):

- two juvenile specimens, recent flying, being at 15 cm of their nest, Chișinău (AR), September 19. In this case it comes to a late breeding, registered generally only in mountainous areas, probably is a substitution clutch;
- many specimens in Arad and Timiș countries, September 19-22;
- one male specimen, Tinca (BH), October 23;
- one male specimen, Tinca (BH), November 3;
- one male specimen, Tinca (BH), November 11;
- one specimen, Oradea (BH), November 23.

Partial migratory species, common species.

- *Falco columbarius* (LINNAEUS, 1758):

- one male specimen, Șimandu Nou (AR), December 21;
- one male specimen, Tinca (BH), December 24.

Winter visitor in Romania.

- *Falco peregrinus* (TUNSTALL, 1771):

- one specimen, Tinca (BH), October 15.

Sedentary, rare winter visitor.

## Order GALLIFORMES

### Family Phasianidae:

- *Phasianus colchicus* (LINNAEUS, 1758):

- 21 specimens, in the vicinity of the railway station, near the people, without fear, Salonta (BH), September 19;
- one male albino specimen, Râpa (BH), November 2;
- many specimens in Tinca area (BH), during November-December.

Sedentary, common species.

- *Perdix perdix* (LINNAEUS, 1758):

- one albino specimen, Râpa (BH), October 1;
- one broken egg, on the field, Râpa (BH), October 20.

These observations confirm again the observations of Ilie (2016).

Sedentary, common species.

## Order GRUIFORMES

### Family Rallidae:

- *Rallus aquaticus* (LINNAEUS, 1758):

- one specimen, Miersig (BH), November 23.

Partial migratory species or rare winter visitor in Romania.

- *Fulica atra* (LINNAEUS, 1758):

- two specimens, Sântana lake (AR), September 19.

Partial migratory species, common species in wetlands.

### Family Gruidae:

- *Grus grus* (LINNAEUS, 1758):

- 26 specimens, Râpa (BH), October 23;

- one specimen, Tinca (BH), December 26.

Passage species and winter visitor in Romania.

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**Order CHARADRIIFORMES**

**Family Charadriidae:**

- *Vanellus vanellus* (LINNAEUS, 1758):
  - seven specimens, Tămașda lake (BH), September 19;
  - 32 specimens, Tinca (BH), October 12.
    - Summer visitor in Romania.

**Family Laridae:**

- *Larus michahellis* (NAUMANN, 1840):
  - six specimens, Sântana lake (AR), September 19;
  - five specimens, Cheșa (BH), October 1.
    - Relatively common species in wetlands.

**Order COLUMBIFORMES**

**Family Columbidae:**

- *Streptopelia decaocto* (FRIVALDSZKY, 1838):
  - one juvenile specimen, recent flying, Salonta (BH), September 19 (the fifth or sixth clutch);
  - many specimens in Tinca and Cheșa area (BH) during November-December.
    - Sedentary, very common species.
- *Columba oenas* (LINNAEUS, 1758):
  - one specimen, Cheșa (BH), May 23.
    - Summer visitor, relative rare species in Romania.

**Order STRIGIFORMES**

**Family Strigidae:**

- *Asio otus* (LINNAEUS, 1758):
  - one specimen, Cheșa (BH), October 20;
  - one specimen, Tinca (BH), November 4;
  - one specimen, Cheșa (BH), November 5;
  - one specimen, Gurbediu forest (BH), December 2;
  - 12 specimens, Tinca (BH), central park, December 14.

Because the influence of global warming this species appeared later comparatively with 2017 with one month and half.

Sedentary, common species.

- *Nyctea scandiaca* (LINNAEUS, 1758):
  - one specimen, Cheșa (BH), November 9;
  - one specimen, Cheșa (BH), December 12.
    - Accidental species, very rare in Romania.
- *Strix uralensis* (PALLAS, 1771):
  - one specimen, Cheșa (BH), December 3.

Winter visitor, relative rare species in Romania.

**Family Tytonidae:**

- *Tyto alba* (SCOPOLI, 1739):
  - one specimen, Tinca (BH), November 3;

- one specimen, Cheșa (BH), November 5.  
Sedentary, relatively common species in Tinca area.

## Order APODIFORMES

### Family Apodidae:

- *Apus pallidus* (SHELLEY, 1870):

- three specimens, Cheșa (BH), October 16. Probably, this is the latest observation for Romania.

Accidental species.

## Order CORACIIFORMES

### Family Meropidae:

- *Merops apiaster* (LINNAEUS, 1758):

- seven specimens, Tinca (BH), September 1;
- three specimens, Tinca (BH), September 2;
- twenty specimens, Tinca (BH), September 3;
- 24 specimens, Tinca (BH), September 6;
- twenty specimens, Tinca (BH), September 7;
- three specimens, Tinca (BH), September 8 (the migration).

Summer visitor, common species in wetlands.

## Order PICIFORMES

### Family Picidae:

- *Dendrocopos syriacus* (HEMPRICH ET EHRENBERG, 1833):

- one nest being at 2.17 meters compared to the ground, D = 4.5 cm, depth of nest = 34 cm, inside of depth = 11cm, Tinca forest (BH), October 6.

Sedentary, common species.

- *Dendrocopos minor* (KOCH, 1816):

- one female specimen, Tinca (BH), September 6;
- one specimen, Gurbediu forest (BH), December 3.

Sedentary, common species.

## Order PASSERIFORMES

### Family Hirundinidae:

- *Delichon urbica* (LINNAEUS, 1758):

- one juvenile specimen (Fig. 4) in a nest (the second clutch), Tinca (BH), September 4;
- one specimen, Tinca (BH), September 8 (the migration).

Summer visitor, relatively common species.

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Figure 4 - *Delichon urbica* (LINNAEUS, 1758) (foto A. L. Ilie).

- *Hirundo rustica* (LINNAEUS, 1758):

- three specimens, Tinca spa (BH), September 8;
- four specimens, Tinca (BH), September 13;
- four specimens, Tinca (BH), September 14;
- seven specimens, Tinca (BH), September 15;
- four specimens, Tinca (BH), September 16;
- one specimen, Șimand (AR), September 19;
- 41 specimens, Tămașda (BH), September 19;
- four specimens, Zăbrani (AR), September 22;
- three specimens, Remetea Mică (TM), September 22 (the migration).

Summer visitor, common species.

**Family Motacillidae:**

- *Motacilla cinerea* (TUNSTALL, 1771):

- one specimen, Schitul Iezer (VL), September 21;
- two specimens, Băile Olănești (VL), September 21;
- one specimen, Tinca (BH), October 8 (early presence for a plain area!);
- one specimen, Maieru (BN), 476 m altitude, October 27.

Summer visitor in mountainous areas, rare winter visitor in the plain areas.

- *Motacilla alba* (LINNAEUS, 1758):

- two specimens, Racovița lake (SB), October 27;
- one specimen, Maieru (BN), 476 m altitude, October 27.

Summer visitor, common species.

**Family Laniidae:**

- *Lanius colurio* (LINNAEUS, 1766):

- one male specimen, Salonta (BH), September 19.

Summer visitor, common species.

- *Lanius excubitor* (LINNAEUS, 1758):

- one specimen, Miersig (BH), November 23.

Common species, winter visitor in Romania.

**Family Oriolidae:**

- *Oriolus oriolus* (LINNAEUS, 1758):

- one juvenile specimen, Tinca (BH), September 8;

- one female specimen, Tinca spa (BH), September 8.

Summer or rare winter visitor, common species.

**Family Sturnidae:**

- *Sturnus vulgaris* (LINNAEUS, 1758):

- one male specimen singing, Tinca (BH), September 7;

- three male specimens singing, Tinca (BH), September 12;

- many specimens, Tămașda (BH), September 19;

- many specimens during November in Tinca area;

- two specimens, Tinca (BH), December 7;

- 12 specimens, Tinca (BH), December 26 (generally, rare presence during the winter!).

Partial migratory, common species.

**Family Bombycillidae:**

- *Bombycilla garrulus* (LINNAEUS, 1758):

- two specimens, Cheșa (BH), October 11.

Winter visitor or accidental species.

**Family Corvidae:**

- *Corvus corax* (LINNAEUS, 1758):

- one specimen, Schitul Iezer (VL), September 21;

- one specimen, Tinca (BH), during September 6-9;

- one specimen, Tinca (BH), September 23;

- one pair, Tinca (BH), October 2;

- one specimen, Tinca (BH), October 17;

- one male specimen, Tinca (BH), November 4;

- one pair, Tinca (BH), November 10;

- one specimen, Tinca (BH), November 17;

- one specimen, Tinca (BH), December 1;

- two specimens, Tinca (BH), December 31.

Sedentary, relatively common species in Tinca area.

- *Corvus frugilegus* (LINNAEUS, 1758):

- one specimen on nest and other specimen was near nest and arranging together the twigs of nest, although whole tree was covered with snow. This phenomenon was observed by A. L. Ilie too at Oradea (BH) in February 2017 and Ciocchia (1992) but it is very rarely.

**Family Cinclidae:**

- *Cinclus cinclus* (LINNAEUS, 1758):

- one specimen, Schitul Iezer (VL), September 21.

Sedentary species in mountainous areas or winter visitor.

**Family Troglodytidae:**

- *Troglodytes troglodytes* (LINNAEUS, 1758):

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- one specimen, Tinca (BH), December 2.

Common species, summer visitor or rare winter visitor in Romania.

**Family Sylviidae:**

- *Sylvia curruca* (LINNAEUS, 1758):

- one male specimen, Tinca (BH), September 14.

Summer visitor, common species in Tinca area.

- *Sylvia atricapilla* (LINNAEUS, 1758):

- one female specimen, Cheșa (BH), December 2. This is the latest observation of this species in Romania.

Relatively common species, summer visitor in Romania.

- *Phylloscopus fuscatus* (BLYTH, 1842):

- one specimen, Tinca (BH), October 6.

Accidental species, rare in Romania, mentioned for the first time in Tinca area and in the western part of Romania.

- *Phylloscopus trochiloides* (SUNDEVALL, 1837):

- one specimen, Tinca (BH), September 1.

Accidental species in Romania, mentioned for the first time in Tinca area.

- *Phylloscopus collybita* (VIEILLOT, 1817):

- two specimens with winter plumage, Tinca (BH), September 4;

- one male singing and two female specimens, Tinca spa (BH), September 8;

- one male specimen singing, Tinca forest (BH), October 6.

Summer visitor, relatively common species.

- *Regulus regulus* (LINNAEUS, 1758):

- 13 specimens, Tinca (BH), October 29. The presence of many specimens together at this species is very rare in Romania.

Partial migratory species or winter visitor.

**Family Turdidae:**

- *Erythacus rubecula* (LINNAEUS, 1758):

- one specimen, forest Tinca (BH), October 6.

Summer or rare winter visitor, common species.

- *Phoenicurus ochruros gibraltariensis* (GMELIN, 1789):

- one male juvenile specimen, Pleșoiu (OT), September 21;

- many specimens, Tinca (BH), till to October 24;

- one male juvenile and one adult specimens, Tinca (BH), October 29;

- one male juvenile specimen, Tinca (BH), November 9;

- one male juvenile specimen, Tinca (BH), November 11;

- one male specimen, Tinca (BH), December 17.

Summer visitor, rare winter visitor, common species.

- *Phoenicurus phoenicurus* (LINNAEUS, 1758):

- one male specimen, Tinca (BH), October 20;

- one male specimen, Maieru (BN), October 27.

Summer visitor, common species in the forests.

- *Turdus viscivorus* (LINNAEUS, 1758):

- one specimen, Tinca (BH), October, 31;

- three specimens, Tinca (BH), November 21;
- one specimen, Tinca (BH), November 22;
- one specimen, Tinca (BH), December 4;
- one specimen, Tinca (BH), December 25.

Partial migratory species.

- *Turdus naumanni naumanni* (TEMMINCK, 1820):

- one male specimen, Miersig forest (BH), December 20.

Accidental species in Romania, probably mentioned for the first time in Bihor county.

#### **Family Paridae:**

- *Parus lugubris* (TEMMINCK, 1820):

- one specimen, Tinca (BH), September 4.

Sedentary species, relatively rare but breeding species in Tinca area.

- *Parus major* (LINNAEUS, 1758):

- many specimens during analysed period in Tinca area (BH), Craiova (DJ), Râmnicu Vâlcea (VL), Oradea (BH).

Sedentary, very common species.

- *Parus montanus* (LINNAEUS, 1758):

- one specimen, Schitul Iezer (VL), September 21.

Sedentary species in mountainous areas or winter visitor.

#### **Family Aegithalidae:**

- *Aegithalos caudatus* (LINNAEUS, 1758):

- four specimens, Tinca spa (BH), September 8;

- one juvenile specimen, Zăbrani (AR), September 22 (the second clutch).

Sedentary, relatively common species.

#### **Family Fringillidae:**

- *Coccothraustes coccothraustes* (LINNAEUS, 1758):

- three specimens, Tinca (BH), September 4;

- two specimens, Tinca (BH), September 30;

- one egg (the fourth clutch), Tinca forest (BH), November 2. This clutch, unmentioned in literature, was possible because the raised temperatures registered during the end of October - November 6 (22 - 26 °C).

Sedentary, common species.

- *Carduelis carduelis* (LINNAEUS, 1758):

- one juvenile specimen recent flying, Cheșa (BH), September 30 (the third clutch);

- many specimens in Tinca area during November-December.

Sedentary, very common species.

- *Carduelis chloris* (LINNAEUS, 1758):

- 32 specimens (male and female), Tinca (BH), October 2;

- one male specimen, the edge of Tinca forest (BH), October 6;

- many specimens in Tinca area during November-December.

Sedentary, common species.

- *Carduelis flavirostris* (LINNAEUS, 1758):

- six specimens, Tinca (BH), December 2.

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Accidental species during the winter in Romania, species mentioned for the first time in Tinca area.

- *Fringilla coelebs* (LINNAEUS, 1758):

- two male specimens, Tinca (BH), November 16;
- one male specimen, Tinca (BH), December 16.

Partial migratory, common species.

### **Family Passeridae:**

- *Passer montanus* (LINNAEUS, 1758):

- one pair in copula (!), Tinca (BH), December 28, t = 4 °C;
- many specimens building nests in the garret of A. L. Ilie's house, Tinca (BH), during December!

Very common, sedentary species in Romania.

### **Family Emberizidae:**

- *Plectrophenax nivalis* (LINNAEUS, 1758):

- two male specimens, Râpa (BH), December 8.

Winter visitor in Romania.

- *Emberiza cia* (LINNAEUS, 1766):

- three male specimens, one female specimen, Tinca (BH), December 12.

Sedentary species in Romania in mountainous areas, but winter visitor in Tinca area, mentioned for the first time in Tinca area.

- *Miliaria calandra* (LINNAEUS, 1758):

- 30 specimens, the edge of Oradea city (BH), September 19.

Partial migratory species.

## **Class MAMMALIA**

### **Order LAGOMORPHA**

#### **Family Leporidae:**

- *Lepus europaeus* PALLAS, 1778:

- one specimen, Tinca forest (BH), October 6.  
Common species.

### **Order RODENTIA**

#### **Family Sciuridae:**

- *Sciurus vulgaris* LINNAEUS, 1758:

- two specimens, Băile Olănești (VL), September 21.  
Common species in the forests.

#### **Family Muridae:**

- *Apodemus flavicollis* (MELCHIOR, 1834):

- one dead specimen, but without traces of violence on his body, Tinca forest (BH), October 5.

Common species in the forests, lands.

**Order EULIPOTYPHLA**

**Family Soricidae:**

- *Sorex araneus* LINNAEUS, 1758:
- one specimen, Tinca (BH), October 10.  
Common species.

**Family Erinaceidae:**

- *Erinaceus europaeus* LINNAEUS, 1758:
- one specimen, Leş forest (BH), September 22;
- one specimen Miersig forest (BH), September 19;
- one excrement who contained the seeds of hawthorn, Tinca forest (BH), October 6.  
Common species.

**Family Cervidae:**

- *Capreolus capreolus* (LINNAEUS, 1758):
- 18 specimens during September 19-22 in Ciumeghiu (BH), Salonta (BH), Cefa (BH), Leş (BH), Tămăşda (BH);
- two specimens, Tinca forest (BH), October 6.  
Common species.

**Order CHIROPTERA**

**Family Rhinolophidae:**

- *Rhinolophus ferrumequinum* (SCHREBER, 1774):
- one specimen, Tinca (BH), October 20, t = 20 °C;
- one specimen, Ucuriş (BH), November 3, t = 23 °C.  
Common species in Tinca area.

**Family Vespertilionidae:**

- *Pipistrellus pipistrellus* (SCHREBER, 1774):
- five specimens, Oradea (BH), January 7, t = 13 °C. Premature appearance, because the raised temperatures registered during winter 2017-2018, the bats being in hibernation in winter.  
Common species in Romania.

**Order CARNIVORA**

**Family Canidae:**

- *Vulpes vulpes* (LINNAEUS, 1758):
- one specimen, Pădurea Sarului (OT), September 22;
- one excrement: L = 12 cm, l = 1.9 cm, contained seeds of hawthorn and masticated seeds of maize, Tinca forest (BH), October 6;
- one female specimen, the edge of Tinca village (BH), November 11;
- one specimen, Miersig forest (BH), November 23.  
Common species.

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### CONCLUSIONS

During 2018, there were observed 55 species of invertebrates and 99 species of vertebrates in different parts of Romania. There were obtained new data about the presence of the species at national level, their behaviour and food, phenology and biology. Some species are mentioned for the first time in some areas.

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**DATA ON THE COLEOPTERAN (INSECTA: COLEOPTERA)  
FAUNA FROM THE BOGĂȚII FOREST, BRAȘOV COUNTY,  
ROMANIA**

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**ABSTRACT.** The communication presents the obtained data regarding the coleopteran fauna from the Bogății Forest protected area, Brașov County. In total, 106 species of coleopteran were identified, being grouped in 30 families. From all these, three species: *Lucanus cervus* (LINNAEUS, 1758), *Cucujus cinnaberinus* (SCOPOLI, 1763) and *Rosalia alpina* (LINNAEUS, 1758) are protected by national and European legislation and the species *Carabus intricatus* LINNAEUS, 1761 is included in the category Near Threatened (NT) by the IUCN.

**Keywords:** coleopteran, fauna, Bogății Forest ROSCI0137, Romania.

**REZUMAT. Date asupra faunei de coleoptere (Insecta: Coleoptera) din Pădurea Bogății, județul Brașov, România.** Comunicarea prezintă datele obținute cu privire la fauna de coleoptere din aria protejată Pădurea Bogății, județul Brașov. Au fost identificate 106 specii de coleoptere grupate în 30 de familii. Dintre acestea, 3 specii: *Lucanus cervus* (LINNAEUS, 1758), *Cucujus cinnaberinus* (SCOPOLI, 1763) și *Rosalia alpina* (LINNAEUS, 1758) sunt ocrise de legislația națională și Europeană, iar specia *Carabus intricatus* LINNAEUS, 1761 este inclusă în categoria Near Threatened (NT) de IUCN.

**Cuvinte cheie:** coleoptere, faună, pădurea Bogății ROSCI0137, România.

## INTRODUCTION

Our study had as main objective the identification and mapping of the species *Rhysodes sulcatus* FABRICIUS, 1787, and possibly other species of xylophagous coleopteran of community interest from the Bogății Forest ROSCI0137. As a secondary objective, was to achieve a preliminary inventory of the coleopteran species from this protected area. In this context, were considered the qualitative, faunistic and less the ones quantitative aspects were considered.

The Bogății Forest (Perșani Mountains) was declared a natural reserve in the year 1971 (Șonerie & Ularu, 1972) and reconfirmed as a protected area of national interest corresponding to the category an IV-a of International Union for Conservation of Nature (IUCN), natural reserve by faunal, floristic and geological type, in 2000. In 2008, an area of 6,352 hectares becomes community importance site (SCI), with the name Bogății Forest ROSCI0137 (Natura 2000 Standard Form, Bogății Forest ROSCI ROSCI0137; Formularul Standard Natura 2000, Pădurea Bogății ROSCI ROSCI0137).

From a morphological point of view, the Perșani Mountains can be divided into two groups: eastern and western (Albotă & Fesci, 1980). Eastern Group is characterized by heights of over 1,000 meters (peak Cetății - 1,104 meters, peak Horezu - 1,055 meters, Coasta Țiganului - 1,034 meters) (Albotă & Fesci, 1980). Western group, with heights of less than 1,000 meters (maximum altitude is reached by Măgura Pleașa, 873 meters), is formed from the ridges separated by deep valleys (250-400 meters depth) and narrow depressions. The protected area is located in the central part of the Perșani Mountains (Fig. 1), in the Bogatei Mountains subdivision, bordered to south by the Hamaradia Valley and the Vlădeni depression, and to the north by the Olt defile, from Racoș. The Bogatei Mountains have a length of 26 kilometers and a width of 12 kilometers (Munții Perșani – Wikipedia: [https://ro.wikipedia.org/wiki/Munții\\_Perșani](https://ro.wikipedia.org/wiki/Munții_Perșani)).

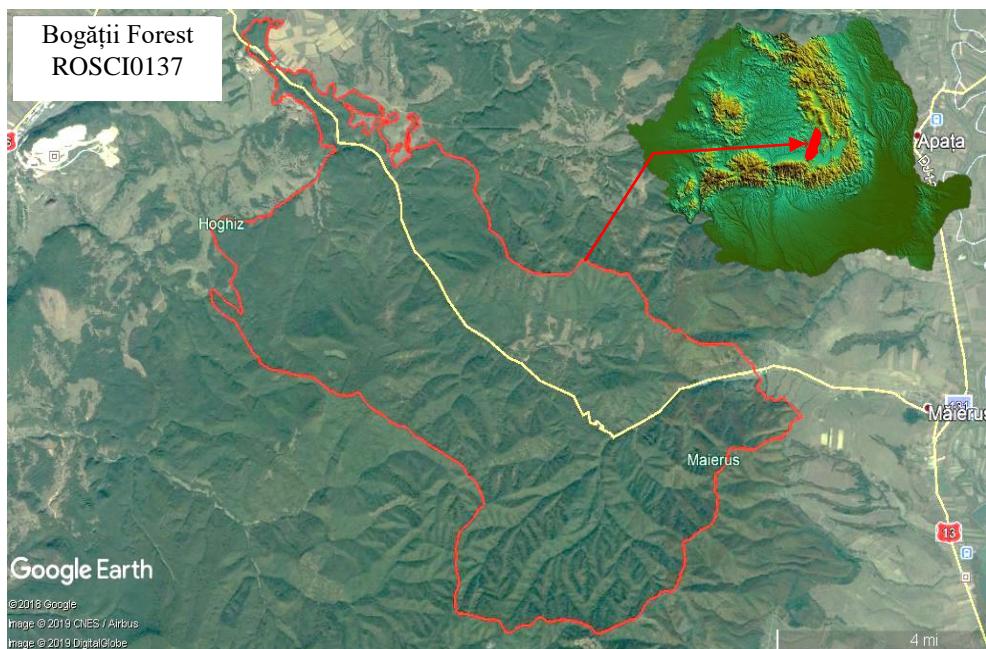


Figure 1 - Location of protected area Bogății Forest (adapted after: Natura 2000 - Standard Data Form and Munții Perșani - Wikipedia).

## DATA ON THE COLEOPTERAN (INSECTA: COLEOPTERA) FAUNA FROM THE BOGĂȚII FOREST, BRAȘOV COUNTY, ROMANIA

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The protected area stretches on one side and the other of the depression corridor of the Bogății Valley. This is crossed by the national road DN 13, the sector Măieruș-Rupea, which connects the Brașov Depression to the Transylvanian Plateau, crossing the Bogății Forest along its entire length. The territory of the protected area is located in the water catchment area of the Bogății creek (the largest area), affluent of the Olt River and in the basin of the Măieruș creek (Şonerieu & Ularu, 1972). The type of soil is brown, podzolic, typical for mountain forest (Şonerieu & Ularu, 1972).

From a climatic point of view, the area is characterized by relatively cold summers (average temperatures in July are between 14-18 °C) and relatively mild winters (the average temperature in January is -4 °C) (Şonerieu & Ularu, 1972). In the Perșani Mountains, the average annual temperature is between 2 and 8 °C. The average annual number of sunny days is between 80 and 100. Average annual rainfall is between 800 and 1000 mm (Albotă & Fesci, 1980).

According to the Natura 2000 Standard Form, the Bogății Forest is one of the most representative deciduous forests in the country, consisting predominantly of beech, hornbeam and sessile oak (Natura 2000 Standard Form. Bogății Forest ROSCI0137). The largest surfaces are occupied by: Luzulo-Fagetum beech forests (code 9110), approximately 45% of the site's surface, Asperulo-Fagetum beech forests (code 9130), approximately 19% of the site's surface, oak-hornbeam forests Galio-Carpinetum (code 9170), approximately 13% of the site's surface and Dacian beech forests Symphyto-Fagion (code 91V0), approximately 10% of the site's surface. The rest of the habitats: Medio-European limestone beech forests of the Cephalanthero-Fagion (code 9150), Dacian oak & hornbeam forests (code 91Y0) and Alluvial forests with *Alnus glutinosa* (L.) GAERTN and *Fraxinus excelsior* L. (Alno-Padion, Alnion incanae, Salicion albae) (code 91E0), occupy, each, approximately 1% of the site area (Natura 2000 Standard Form. Bogății Forest ROSCI0137). In the distribution of the vegetation is observed inversion phenomenon, the sessile oak is frequent at higher altitudes than beech. The sessile oak is frequent at higher altitudes than beech, which usually occupies the base of the versants.

## MATERIALS AND METHODS

During April-August 2014, 98 transects were conducted, these recording altitudes between 513 and 1,091 meters. Six types of habitats have been investigated: **1** - Beech forests, habitats 9110 code (trees of 30 to 100 years) and 91V0 code (trees of 20 to 50 years); 54 transects were made in these habitats. **2** - Beech and hornbeam forests, habitat 9130 code (trees of 30 to 100 years); 7 transects were made in these habitat. **3** - Forests of sessile oak, beech and hornbeam, habitat 9170 code (trees of 50 to 100 years); 24 transects were made in these habitat. **4** - Natural regeneration with beech, hornbeam, spruce, maple, oak, (trees of 10 to 50 years); 7 transects were made in this habitat. **5** - Alluvial forests,

habitat 91E0 code (trees of 10 to 60 years); 4 transects were made in these habitat.

**6 - Meadow**, 2 transects were made in this habitat.

The transects had a length of 1,000 - 2,000 meters, depending on the configuration of the land and a width of 20 meters. Along the transect were identified and researched the characteristic micro habitats characteristics, sheltered by old trees (standing or fallen), with dead wood, trunks, branches with a diameter of more than 40 cm, rotten hubs, with shell, possibly covered with moss. The material was collected with hand, tweezer or the exhauster, directly from the substrate (bosque, stones, bark, fallen trunks, grasses, shrubs, etc.); the entomological net was used to mow the grassy and bushy vegetation.

The coleopterans classification was adopted after Bouchard (2011). The distribution of species was based on their natural spreading only, using the data from Fauna Europaea, Coleoptera Poloniae, the researches made by Gorodkov (1984), Vigna-Taglianti et al. (1992, 1999), Georgiev and Hubenov (2006), Ratti (2007), Horák and Chobot (2009), Akhmetova and Frolov (2014), Qiao Wang (2017).

## RESULTS AND DISCUSSIONS

During the study period, in the perimeter of the protected area, the Bogății Forest ROSCI0137, 106 species of coleopteran were identified, being grouped in 30 families (Tab. 1).

Table 1 - List of the coleopteran species identified in the Bogății Forest with their habitat specification and distribution.

No.	TAXON	1	2	3	4	5	6	Distribution
	Class INSECTA							
	Order COLEOPTERA							
	Suborder ADEPHAGA							
	Family CARABIDAE LATREILLE, 1802							
	Subfamily NEBRIINAE LAPORTE, 1834							
1	<i>Leistus ferrugineus</i> (LINNAEUS, 1758)					+		Eu.-Ca.
2	<i>Nebria brevicollis</i> (FABRICIUS, 1792)					+		Eu.-Ca.
	Subfamily CARABINAE LATREILLE, 1802							
3	<i>Carabus cancellatus</i> ILLIGER, 1798	+	+	+	+			Eu.-Sib.
4	<i>Carabus convexus</i> FABRICIUS, 1775			+				Eu.-Sib.
5	<i>Carabus coriaceus</i> LINNAEUS, 1758	+	+	+	+	+		Eu.
6	<i>Carabus glabratus</i> PAYKULL, 1790	+		+				Eu.-Sib.
7	<i>Carabus intricatus</i> LINNAEUS, 1761	+		+				Eu.

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No.	TAXON	1	2	3	4	5	6	Distribution
8	<i>Carabus linnei</i> PANZER, 1810	+	+					Cent.-East Eu.
9	<i>Cychrus caraboides</i> (LINNAEUS, 1758)	+	+					Eu.
10	<i>Cychrus semigranosus</i> PALLIARDI, 1825	+	+					Southeast Eu.
	Subfamily <b>TRECHINAE</b> BONELLI, 1810							
11	<i>Bembidion quadrimaculatum</i> (LINNAEUS, 1761)					+		Hol.
12	<i>Tachyta nana</i> (GYLLENHAL, 1810)					+		Pal.
13	<i>Trechus quadrifasciatus</i> (SCHRANK, 1781)					+		WPal.
	Subfamily <b>HARPALINAE</b> BONELLI, 1810							
14	<i>Pterostichus melanarius</i> (BONELLI, 1810)					+		Eu.-Sib.*
15	<i>Pterostichus niger</i> (SCHALLER, 1783)	+	+	+	+			Eu.-As.*
16	<i>Abax parallelepipedus</i> (PILLER & MITTERPACHER, 1783)	+	+	+				Eu.
17	<i>Amara ovata</i> (FABRICIUS, 1792)					+		Eu.-Sib.
	Suborder <b>POLYPHAGA</b>							
	Family <b>HISTERIDAE</b> GYLLENHAL, 1808							
	Subfamily <b>HISTERINAE</b> GYLLENHAL, 1808							
18	<i>Platysoma compressum</i> (HERBST, 1783)	+	+	+				Eu.-Sib.
	Family <b>LEIODIDAE</b> FLEMING, 1821							
	Subfamily <b>LEIODINAE</b> FLEMING, 1821							
19	<i>Anisotoma castanea</i> (HERBST, 1792)			+		+		Eu.
	Family <b>SILPHIDAE</b> LATREILLE, 1806							
	Subfamily <b>SILPHINAE</b> LATREILLE, 1806							
20	<i>Phosphuga atrata</i> (LINNAEUS, 1758)	+	+					Eu.-As.
21	<i>Silpha obscura</i> (LINNAEUS, 1758)	+						Pal.
	Subfamily <b>NICROPHORINAE</b> KIRBY, 1837							
22	<i>Nicrophorus vespilloides</i> HERBST, 1783	+		+				Eu.-As.*
	Family <b>STAPHYLINIDAE</b> LATREILLE, 1802							
	Subfamily <b>TACHYPORINAE</b> MACLEAY, 1825							
23	<i>Bolitobius cingulatus</i> MANNERHEIM, 1831	+		+				Eu.-As.*
	Subfamily <b>AEOCHARINAE</b> FLEMING, 1821							
24	<i>Aleochara brevipennis</i> GRAVENHORST, 1806			+		+		Eu.-As.
25	<i>Atheta fungi</i> (GRAVENHORST, 1806)			+				Hol.
	Subfamily <b>SCAPHIDIINAE</b> LATREILLE, 1806							

## NICOLAE LOTREAN, MINODORA MANU

No.	TAXON	1	2	3	4	5	6	Distribution
26	<i>Scaphidium quadrimaculatum</i> OLIVIER, 1790	+						WPal.
	Subfamily PAEDERINAE FLEMING, 1821							
27	<i>Lathrobium elongatum</i> LINNAEUS, 1767	+	+			+		Eu.
	Subfamily STAPHYLININAE LATREILLE, 1802							
28	<i>Philonthus succicola</i> THOMSON, 1860	+	+					Eu.-Sib.
29	<i>Hesperus rufipennis</i> (GRAVENHORST, 1802)					+		Eu.
30	<i>Ocyphus kuntzeni</i> (MÜLLER, 1926)	+						Southeast Eu.
31	<i>Ocyphus ophthalmicus</i> (SCOPOLI, 1763)			+				Pal.
	Family GEOTRUPIDAE LATREILLE, 1802							
	Subfamily GEOTRUPINAE LATREILLE, 1802							
32	<i>Anoplotrupes stercorosus</i> (SCRIBA, 1791)	+	+	+	+	+	+	Eu.-Sib.
33	<i>Trypocopris vernalis</i> (LINNAEUS, 1758)					+		Eu.-Ca.
	Family LUCANIDAE LATREILLE, 1804							
	Subfamily LUCANINAE LATREILLE, 1804							
34	<i>Lucanus cervus</i> (LINNAEUS, 1758)			+				Eu.-Ca.
35	<i>Dorcus parallelipedus</i> (LINNAEUS, 1758)			+				WPal.
	Family SCARABAEIDAE LATREILLE, 1802							
	Subfamily APHODIINAE LEACH, 1815							
36	<i>Aphodius ater</i> (DE GEER, 1774)			+		+		Eu.-As.
37	<i>Aphodius fimetarius</i> (LINNAEUS, 1758)			+		+		Pal.*
38	<i>Aphodius subterraneus</i> (LINNAEUS, 1758)	+	+			+		Pal.*
39	<i>Calamosternus granarius</i> (LINNAEUS, 1767)					+		Pal.****
40	<i>Oxyomus silvestris</i> (SCOPOLI, 1763)	+						Eu.-CAs.
41	<i>Pleurophorus caesus</i> (CREUTZER, 1796)					+		Pal.***
	Subfamily SCARABAEINAE LATREILLE, 1802							
42	<i>Caccobius schreberi</i> LINNAEUS, 1767					+		WPal.
43	<i>Euoniticellus fulvus</i> (GOEZE, 1777)					+		Pal.**
44	<i>Onthophagus fracticornis</i> (PREYSSLER, 1790)					+		WPal.
45	<i>Onthophagus ovatus</i> (LINNAEUS, 1767)					+		Eu.-CAs.
	Subfamily CETONIINAE LEACH, 1815							
46	<i>Cetonia aurata</i> (LINNAEUS, 1758)			+		+		Eu.-As.
47	<i>Protaetia aeruginosa</i> (LINNAEUS 1767)			+				Eu.-CAs.
48	<i>Valgus hemipterus</i> (LINNAEUS, 1758)			+				WPal.

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No.	TAXON	1	2	3	4	5	6	Distribution
	Family <b>BUPRESTIDAE</b> LEACH, 1815							
	Subfamily <b>CHRYSOCHROINAE</b> LAPORTE, 1835							
49	<i>Dicerca berolinensis</i> (HERBST, 1779)	+						Eu.-Sib.
	Subfamily <b>AGRILINAE</b> LAPORTE, 1835							
50	<i>Agrilus viridis</i> (LINNAEUS, 1758)					+		Pal.
	Family <b>EUCNEMIDAE</b> ESCHSCHOLTZ, 1829							
	Subfamily <b>MELASINAE</b> FLEMING, 1821							
51	<i>Melasis buprestoides</i> (LINNAEUS, 1761)	+	+					Eu.-Sib.
	Family <b>ELATERIDAE</b> LEACH, 1815							
	Subfamily <b>AGRYPNINAE</b> CANDÈZE, 1857							
52	<i>Lacon punctatus</i> (HERBST, 1779)				+			Eu.-Ca.
	Subfamily <b>DENDROMETRINAE</b> GISTEL, 1848							
53	<i>Ctenicera pectinicornis</i> (LINNAEUS, 1758)	+	+					Eu.-Sib.
	Subfamily <b>ELATERINAE</b> LEACH, 1815							
54	<i>Ampedus cinnabarinus</i> (ESCHSCHOLTZ, 1829)	+		+				Pal.
55	<i>Calambus bipustulatus</i> (LINNAEUS, 1767)			+				Eu-CAs.
56	<i>Stenagostus rhombeus</i> (OLIVIER, 1790)	+	+					Eu.-Ca.
57	<i>Melanotus erythropus</i> (GMELIN, 1790)	+						WPal.
	Family <b>CANTHARIDAE</b> IMHOFF, 1856 (1815)							
	Subfamily <b>CANTHARINAE</b> IMHOFF, 1856 (1815)							
58	<i>Cantharis nigricans</i> (MÜLLER, 1776)					+		Eu.-As.*
59	<i>Rhagonycha fulva</i> (SCOPOLI, 1763)			+		+		Pal.*
	Family <b>DERMESTIDAE</b> LATREILLE, 1804							
	Subfamily <b>DERMESTINAE</b> LATREILLE, 1804							
60	<i>Dermestes laniarius</i> ILLIGER, 1801					+		Pal.
	Family <b>PTINIDAE</b> LATREILLE, 1802							
	Subfamily <b>PTILININAE</b> SHUCKARD, 1839							
61	<i>Ptilinus pectinicornis</i> (LINNAEUS, 1758)	+	+					Eu.-Sib.
	Family <b>TROGOSSITIDAE</b> LATREILLE, 1802							
	Subfamily <b>PELTINAE</b> LATREILLE, 1806							
62	<i>Ostoma ferruginea</i> (LINNAEUS, 1758)			+		+		Eu.-Sib.*
	Family <b>CLERIDAE</b> LATREILLE, 1802							
	Subfamily <b>CLERINAE</b> LATREILLE, 1802							

No.	TAXON	1	2	3	4	5	6	Distribution
63	<i>Opilo mollis</i> (LINNAEUS, 1758)			+				Cos.
	Family <b>EROTYLIDAE</b> LATREILLE, 1802							
	Subfamily <b>EROTYLINAE</b> LATREILLE, 1802							
64	<i>Tritoma bipustulata</i> FABRICIUS, 1775				+	+		Eu.-Sib.
65	<i>Triplax aenea</i> (SCHALLER, 1783)	+				+		Eu.-Ca.
	Family <b>CRYPTOPHAGIDAE</b> KIRBY, 1826							
	Subfamily <b>CRYPTOPHAGINAE</b> KIRBY, 1826							
66	<i>Cryptophagus scanicus</i> (LINNAEUS, 1758)					+		Hol.
	Family <b>SILVANIDAE</b> KIRBY, 1826							
	Subfamily <b>BRONTINAE</b> BLANCHARD, 1845							
67	<i>Uleiota planata</i> (LINNAEUS, 1761)	+	+	+				Eu.-Ca.
	Subfamily <b>SILVANINAE</b> KIRBY, 1837							
68	<i>Silvanus unidentatus</i> (OLIVIER, 1790)				+			Pal.*
	Family <b>CUCUJIDAE</b> LATREILLE, 1802							
69	<i>Cucujus cinnaberinus</i> (SCOPOLI, 1763)	+	+	+				Cent. East-Eu.
	Family <b>ENDOMYCHIDAE</b> LEACH, 1815							
	Subfamily <b>ENDOMYCHINAE</b> LEACH, 1815							
70	<i>Endomychus coccineus</i> (LINNAEUS, 1758)	+	+	+				Eu.
	Family <b>COCCINELLIDAE</b> LATREILLE, 1807							
	Subfamily <b>COCCINELLINAE</b> LATREILLE, 1807							
71	<i>Anatis ocellata</i> (LINNAEUS, 1758)					+		Pal.*
	Family <b>MYCETOPHAGIDAE</b> LEACH, 1815							
	Subfamily <b>MYCETOPHAGINAE</b> LEACH, 1815							
72	<i>Mycetophagus quadripustulatus</i> (LINNAEUS, 1751)	+	+					Pal.
	Family <b>ZOPHERIDAE</b> SOLIER, 1834							
	Subfamily <b>COLYDIINAE</b> BILLBERG, 1820							
73	<i>Colydium elongatum</i> (FABRICIUS, 1787)	+	+					WPal.
74	<i>Bitoma crenata</i> (FABRICIUS, 1775)	+						Pal.*
	Family <b>TENEBRIONIDAE</b> LATREILLE, 1802							
	Subfamily <b>TENEBRIONINAE</b> LATREILLE, 1802							
75	<i>Bolitophagus reticulatus</i> (LINNAEUS, 1767)	+	+					Eu.-Sib.
	Subfamily <b>DIAPERINAE</b> LATREILLE, 1802							
76	<i>Diaperis boleti</i> (LINNAEUS, 1758)	+	+					WPal.

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No.	TAXON	1	2	3	4	5	6	Distribution
77	<i>Corticeus unicolor</i> PILLER & MITTERPACHER, 1783			+			+	Eu.-Ca.
	Family PYROCHROIDAE LATREILLE, 1806							
	Subfamily PYROCHROIINAE LATREILLE, 1806							
78	<i>Pyrochroa coccinea</i> (LINNAEUS, 1761)		+					Eu.
	Family CERAMBYCIDAE LATREILLE, 1802							
	Subfamily PRIONINAE LATREILLE, 1802							
79	<i>Prionus coriarius</i> (LINNAEUS, 1758)	+						WPal.
	Subfamily LEPTURINAE LATREILLE, 1802							
80	<i>Leptura aurulenta</i> FABRICIUS, 1792			+				WPal.
81	<i>Stenurella melanura</i> (LINNAEUS, 1758)	+						Eu.-Sib.
82	<i>Stictoleptura rubra</i> (LINNAEUS, 1758)						+	WPal.
83	<i>Stictoleptura scutellata</i> (FABRICIUS, 1781)	+						WPal.
84	<i>Rhagium mordax</i> (DE GEER, 1775)	+	+					Eu.-Sib.
85	<i>Xylosteus spinolae</i> FRIVALDSZKY, 1838	+						Cent. Southeast Eu.
86	<i>Pachytodes cerambyciformis</i> (SCHRANK, 1781)	+						Eu.-Ca.
	Subfamily SPONDYLIDINAE AUDINET-SERVILLE, 1832							
87	<i>Saphanus piceus</i> (LAICHARTING, 1784)		+					Eu.-Ca.
88	<i>Tetropium castaneum</i> (LINNAEUS, 1758)				+			Eu.-Sib.
	Subfamily CERAMBYCINAE LATREILLE, 1802							
89	<i>Phymatodes testaceus</i> (LINNAEUS, 1758)			+				Pal.*
90	<i>Ropalopus clavipes</i> (FABRICIUS, 1775)						+	Eu.-Ca.
91	<i>Rosalia alpina</i> (LINNAEUS, 1758)	+		+				Eu.-Ca.
92	<i>Purpuricenus kaehleri</i> (LINNAEUS, 1758)			+				Eu.-Ca.
	Family CHRYSOMELIDAE LATREILLE, 1802							
	Subfamily CHRYSOMELINAE LATREILLE, 1802							
93	<i>Chrysolina haemoptera</i> (LINNAEUS, 1758)					+		Eu.-Ca.
94	<i>Chrysolina polita</i> (LINNAEUS, 1758)						+	Eu.-As.
95	<i>Chrysomela populi</i> (LINNAEUS, 1758)						+	Pal.
96	<i>Oreina intricata</i> GERMAR, 1824						+	Cent. Eu.
97	<i>Oreina plagiata</i> SUFFRIAN, 1861						+	Cent. Eu.
	Subfamily GALERUCINAE LATREILLE, 1802							

No.	TAXON	1	2	3	4	5	6	Distribution
98	<i>Agelastica alni</i> (LINNAEUS, 1758)					+		Eu.-CAs.*
99	<i>Galerucella lineola</i> (FABRICIUS, 1781)					+		Pal.
100	<i>Luperus flavipes</i> (LINNAEUS, 1767)					+		Eu.-CAs.
	Subfamily CRYPTOCEPHALINAE GYLLENHAL, 1813							
101	<i>Clytra laeviuscula</i> (RATZEBURG, 1837)			+				Pal.
	Family ATTELABIDAE BILLBERG, 1820							
	Subfamily ATTELABINAE BILLBERG, 1820							
102	<i>Attelabus nitens</i> (SCOPOLI, 1763)			+				WPal.
	Family CURCULIONIDAE LATREILLE, 1802							
	Subfamily MOLYTINAE SCHÖNHERR, 1823							
103	<i>Lepyrus capucinus</i> (SCHALLER, 1783)					+		Eu.-Sib.*
104	<i>Liparus glabrirostris</i> KUSTER, 1849					+		Eu.
	Subfamily SCOLYTINAE LATREILLE, 1804							
105	<i>Taphrorychus bicolor</i> (HERBST, 1793)	+						Eu.-Ca.
106	<i>Xyleborus monographus</i> (FABRICIUS, 1792)			+				WPal.

**Legend:** **1** - beech forests, 9110/91V0; **2** - beech and hornbeam forests, 9130; **3** - forests of sessile oak, beech and hornbeam, 9170; **4** - natural regeneration: beech, hornbeam, spruce, maple, sessile oak; **5** - meadow; **6** - riparian, alluvial forests, 91E0; Cos. – Cosmopolitan, Hol. – Holarctic, Pal – Palearctic, Eu.-As. – European-Asian (Palearctic zone), WPal. – West Palearctic, Eu.-Sib. – European-Siberian, Eu.-CAs. – European-Central Asian, Eu.-Ca. – European-Caucasian, Eu. – European, Cent.-East Eu. – Central-East European, Cent. Eu. – Central European, Cent. Southeast Eu. – Central Southeast European, Southeast Eu. – Southeast European; \* - introduced species in Nearctic Region, \*\* - introduced species in Nearctic and Neotropical Regions, \*\*\* - introduced species in Nearctic, Neotropical and Afrotropical Regions, \*\*\*\* - introduced species in Nearctic, Neotropical, Afrotropical and Oriental Regions.

Most species identified belong to the Carabidae family, 17 species (16.0%), followed by families: Cerambycidae, 14 species (13.2%), Scarabaeidae, 13 species (12.2%), Chrysomelidae, 9 species (8.5%), Staphylinidae, 9 species (8.5%) and Elateridae, 6 species (5.6%). The rest of the coleopteran families recorded less than 5 species.

Most species were identified in the beech forest, 45 species (42.4%) and in the mixed forest: beech, sessile oak and hornbeam, 40 species (37.7%); the opposite pole was represented by the natural regeneration area where the forest was cut off and then started the regeneration process. Here, six species (5.66%) were identified. Lower values, compared to the beech forest, were obtained for riparian area, alluvial forests, 30 species (28.3%) and beech and hornbeam forests, 27

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species (25.4%). It should be noted that these values reflect the sampling effort that has been correlated with the area of the respective habitats from the site level. Most transects were made in the habitats where the beech is the dominant species, which at the level of the protected area occupy the largest surface.

From the distribution point of view, the most identified species have Palearctic (17.9%) and European-Siberian (17.9%) spread, followed by the species with European-Caucasian (15.0%), West Palearctic (14.1%), European (9.4%), European-Asian (8.4%) and European-Central Asian (5.6%) distribution. The rest of the zoogeographical elements had a share of less than 5% (Fig. 2). From all 106 identified species of coleopterans, 16 species (15.2%) have expanded their areal, being introduced by humans. These are usually involuntarily recorded into one or more biogeographical regions.

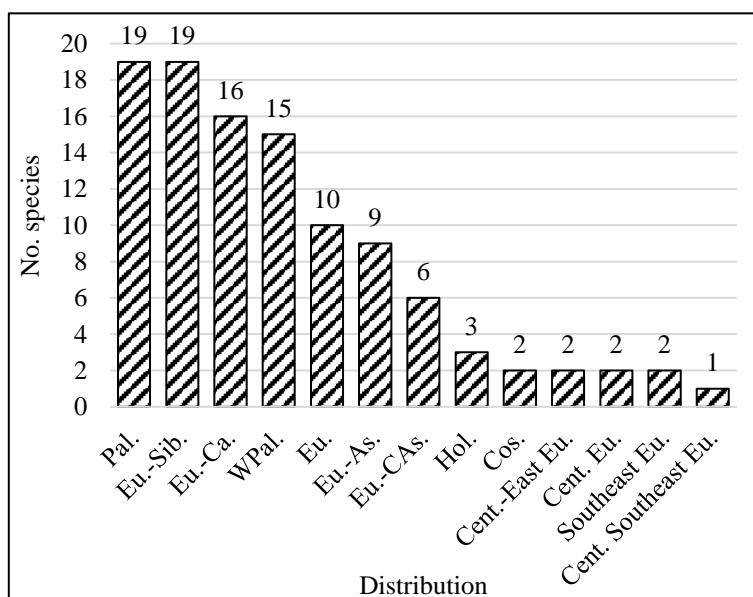


Figure 2 - Distribution of the identified species on zoogeographical groups: Pal – Palearctic, Eu.-Sib. – European-Siberian, Eu.-Ca. – European-Caucasian, WPal. – West Palearctic, Eu. – European, Eu.-As. – European-Asian (Palearctic zone), Eu.-CAs. – European-Central Asian, Hol. – Holarctic, Cos. – Cosmopolitan, Cent.-East Eu. – Central-East European, Cent. Eu. – Central European, Southeast Eu. – Southeast European, Cent. Southeast Eu. – Central Southeast European.

From the conservative point of view, most of the identified species are common. Were identified only three species of coleopterans protected by national and European legislation: *Lucanus cervus* (LINNAEUS, 1758), *Cucujus cinnaberinus* (SCOPOLI, 1763) and *Rosalia alpina* (LINNAEUS, 1758). To these, we can add the species *Carabus intricatus* LINNAEUS, 1761, species included in the

category Near Threatened (NT) by the International Union for Conservation of Nature (IUCN).

There were identified 26 male individuals of the species *Lucanus cervus* (LINNAEUS, 1758), in four locations in the protected area (Fig. 3). *Quercus* L. species dominates the habitats in which the species was identified; trees aged 20 to 100 years.

The species is mentioned in: OUG 57/2007 completed and modified by the Law 49/2011, Annex 3, Habitats Directive - Council Directive 92/43/EEC, Annex 2 and European Convention for the Conservation of the Wild Fauna and Natural Habitats of Bern, Annex 3. It is classed as a European Protected Species (Harvey, 2011). IUCN includes this species in the category of Near Threatened (NT). At European level, there is currently, a declining trend of species populations, especially in northern Europe (IUCN Red List).

The species *Cucujus cinnaberinus* (SCOPOLI, 1763) has been identified in five locations (Fig. 3). Only larvae were found, in forest habitats with dead wood, with beech trees (dominant species), hornbeam, oak and poplar, aged between 30 and 100 years. *Cucujus cinnaberinus* (SCOPOLI, 1763) is one of the rarest coleopterans in Europe and its populations are thought to be declining in several European countries (Mazzei et al., 2010; Horák & Chobot, 2011). It is a predatory species, adults and larvae feed on insects living under the bark of dead trees (Horák et al., 2011). The IUCN includes it in the Near Threatened (NT) category. Population trend of this species increasing (IUCN Red List).

*Rosalia alpina* (LINNAEUS, 1758) is generally associated with beech forests with the presence of mature, dead (or moribund) and sun-exposed trees occurring in open sites. It is saproxylic, xylophagous, xerothermophilic species (Campanaro, 2017). The species was identified in five locations from the ROSCI0137 Bogății Forest site (Fig. 3). There were five specimens recorded, three males and two females. The IUCN includes it in the Vulnerable (VU) category (IUCN Red List).

*Cucujus cinnaberinus* (SCOPOLI, 1763) and *Rosalia alpina* (LINNAEUS, 1758) are mentioned in: OUG 57/2007 completed and modified by the Law 49/2011, Annexes 3 and 4A, Habitats Directive - Council Directive 92/43/EEC, Annexes 2 and 4 and European Convention for the Conservation of the Wild Fauna and Natural Habitats of Bern, Annex 2.

The *Carabus intricatus* LINNAEUS, 1761 species can also be added to the aforementioned species. In the protected area, Bogății Forest, it was identified only one exemplary (Fig. 3). The species was found in the beech and conifer forests, along the valleys, from the low mountain and hill areas. More rarely was observed in the plain area (Panin, 1955). The species is included by IUCN in the Near Threatened (NT) category. In Romania, this species is not included in a certain the protected category, but its status may change in the future, in a negative way, due to the disappearance of the natural habitats, where it lives (Lotrean & Manu, 2017).

All of the species mentioned above are species dependent by the mature/old forests with large amounts of dead wood. Forest disappearance and

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poor forest management, in particular the removal of dead wood from this type of ecosystems, threaten the survival of these coleopteran species. In recent years, many species of coleopteran have become more and more rare, and their populations are isolated due to the loss of habitats, which increases the risk of their disappearance (Hanski & Gaggiotti, 2004; Lachat et al. 2013).

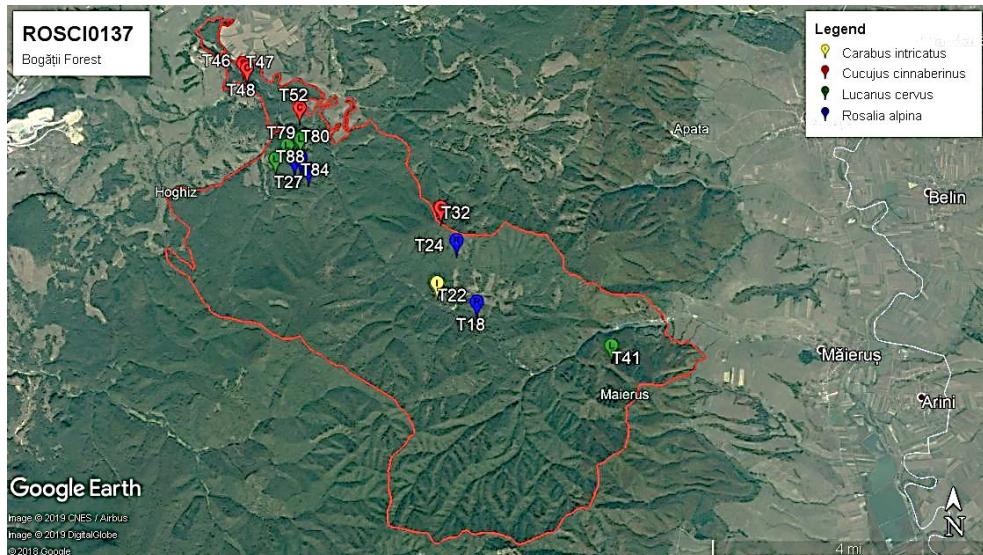


Figure 3 - The location of the transects (T) where protected species have been identified in the Bogății Forest (adapted after: Natura 2000 - Standard Data Form and Munții Perșani - Wikipedia)

In the case of the protected area Bogății Forest, the loss of habitats determined by the exploitation of wood and the construction of forest roads, are the main pressures and threats to address the protected species identified here.

The preservation of forest habitats and their proper management are essential conditions for the maintenance or even numerical growth of the populations of these species, in the perimeter of the protected area Bogății Forest.

The species *Rhysodes sulcatus* (FABRICIUS, 1787), referred to in the Natura 2000 Standard Form, has not been identified within the protected area. The species, considered an indicator of old, natural, primary forests, may be still present in the reserve, but confirmation of its presence is required.

## CONCLUSIONS

They was identified 106 species of coleopteran grouped into 30 families. From these, three species: *Lucanus cervus* (LINNAEUS, 1758), *Cucujus cinnaberinus* (SCOPOLI, 1763) and *Rosalia alpina* (LINNAEUS, 1758) are protected by national and European legislation.

The species, *Carabus intricatus* LINNAEUS, 1761, is part of the Near Threatened (NT) species category, in concordance with according to the International Union for Conservation of Nature (IUCN).

The species *Rhysodes sulcatus* (FABRICIUS, 1787), previously mentioned in the Natura 2000 Standard Form, has not been found in the protected area perimeter.

We note that the present study has a preliminary character and is necessary to continue the research in the Bogății forest in order to complete the list of species. It is possible to identify other species of conservative interest.

From the conservative point of view, we consider that without adequate management measures, in the next 15-20 years, the forest habitats that formed the scientific base of the declaration of the protected area could disappear and implicitly the majority of forest coleopteran species identified.

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**THE COENOTIC AFFINITY OF THE WATER BIRDS SPECIES  
FROM SOME DAM BASINS OF THE ARGEŞ RIVER IN THE  
PREVERNAL SEASON**

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**ABSTRACT.** The main goal of this paper was to present the coenotic affinities established in the prevernal season between the birds' species of the dam basins between Vâlcele and Golești, from ROSPA0062 Lacurile de Acumulare de pe Argeș. The 29 considered water species numbered 4,171 individuals. Among them, *Aythya fuligula*, *Aythya ferina* and *Fulica atra* - the eudominant species, totalised 2,771 individuals (66.43% of all individuals). It was stated that *Vanellus vanellus* and *Ardea purpurea*, respectively *Sterna hirundo* and *Tringa ochropus* were the characteristic species at the level of whole area. Depending on the dam basins, the characteristic species were: *Chlidonias hybridus* and *Larus ridibundus*, on Vâlcele, *Larus argentatus* and *Fulica atra*, on Budeasa, *Larus argentatus* and *Tachybaptus ruficollis*, on Bascov, *Actitis hypoleucus*, *Gallinula chloropus*, *Anas clypeata* and *Pahalacrocorax carbo*, on Pitești, and *Recurvirostra avosetta* and *Ardea cinerea*, on a side, and *Sterna hirundo*, *Tringa ochropus*, *Charadrius dubius* and *Podiceps nigricollis*, on the other side, on Golești.

**Keywords:** birds, ROSPA0062, Argeș River, coenotic affinity.

**REZUMAT.** Afinitatea cenotica a speciilor de păsări dependente de apă de pe unele lacuri de acumulare de pe râul Argeș în sezonul prevernal. Principalul obiectiv al acestei lucrări a fost de a prezenta afinitățile cenotice stabilite în sezonul prevernal între speciile de păsări de pe lacurile de acumulare dintre Vâlcele și Golești, din ROSPA0062 Lacurile de Acumulare de pe Argeș. Cele 29 specii de apă considerate au numărat 4171 exemplare. Dintre acestea, *Aythya fuligula*, *Aythya ferina* și *Fulica atra* - speciile eudominante, au însumat 2771 exemplare (66,43% din total). S-a constatat că *Vanellus vanellus* și *Ardea purpurea*, respectiv *Sterna hirundo* și *Tringa ochropus* au fost speciile caracteristice la nivelul întregii arii. În funcție de lacurile de acumulare, speciile caracteristice au fost: *Chlidonias hybridus* și *Larus ridibundus*, pe Vâlcele, *Larus argentatus* și *Fulica atra*, pe Budeasa, *Larus argentatus* și *Tachybaptus ruficollis*, pe Bascov, *Actitis hypoleucus*, *Gallinula chloropus*, *Anas clypeata* și *Pahalacrocorax carbo*, pe Pitești, și *Recurvirostra avosetta* și *Ardea cinerea*, pe de o parte, și *Sterna hirundo*, *Tringa ochropus*, *Charadrius dubius* și *Podiceps nigricollis*, pe de altă parte, pe Golești.

**Cuvinte cheie:** păsări, ROSPA0062, râul Argeș, afinitate cenotica.

## INTRODUCTION

The avifauna of the dam basins from the Argeș River was relatively well studied until now. The first paper on the subject appeared at the end of '60 (Mătieș, 1969) but many observations from the subsequent years have not seen the light of the print, because of the tragically death of the Mircea Mătieș in 1982. At the transition between the millenniums, the research work was resumed and as a result a series of papers issued (Gava, 1997; Mestecăneanu et al., 2003; Gava et al., 2004; Conete et al., 2006; Mestecăneanu et al., 2010; Conete, 2011; Conete et al., 2012; Mestecăneanu & Gava, 2016, etc.). The avifauna from the prevernal aspect, the spring season of migration for the most of the species, was the centre of the attention in some of these papers (Mestecăneanu et al., 2004, 2006; Conete et al., 2008, 2009a, b, 2010; Mestecăneanu & Gava, 2013). In this item, our main purpose was to show the affinities established between the water species from these ecosystems.

## MATERIAL AND METHODS

The dam basins where the research-studies on the birds were performed are, from upstream to downstream (Fig. 1): Vâlcele (407 ha), Budeasa (389 ha), Bascov (114 ha), Pitești (104 ha), and Golești (610 ha), where the surfaces were measured in Google Earth program. They belong to ROSPA0062 - Lacurile de acumulare de pe Argeș (The Dam Basins from the Argeș River) and are situated on the Argeș River, as suggests the name of the protected site. The river flows between the Cotmeana Platform, in the West, and the Cândești Platform, in the East, and the Argeș Platform and the Pitești High Plain flank the area to the North, respectively to the South.

Generally, the basins vegetation occupies the surfaces from their end, but also other parts according to different level of silting. It is typical of wetlands, with species of reed (*Phragmites* ADANS.), bulrush (*Typha* L.), alder (*Alnus* MILL.), willow (*Salix* L.) etc. Regarding the fauna, it is diverse, with various species of vertebrates and invertebrates.

A net of roads links the settlements from nearby.

The climate is temperate with hilly influence and plain features, in the South. The annual average water temperature is 7-8 °C (Barco & Nedelcu, 1974).

As methods of field work, the itinerary method was used in combination to one of the fixed point of observations. All basins were visited in the same day in the middle of March and April, 2013. The observations were performed from the same tracks on the banks of the basins. Binoculars (10x50), a spotting scope (14-45x50) and a photo device (42x optical zoom) were used.

To identify the species characteristic to the ecosystems and to compare the similarities between the avicoenosis of the dam basins, we use the Bray-Curtis

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Index. This is based both on the presence/absence of the species in the sample and on the strengths of the species (Gomoiu & Skolka, 2001).

The scientific nom of the birds is compatible with the Hamlin Guide (Bruun at al., 1999).

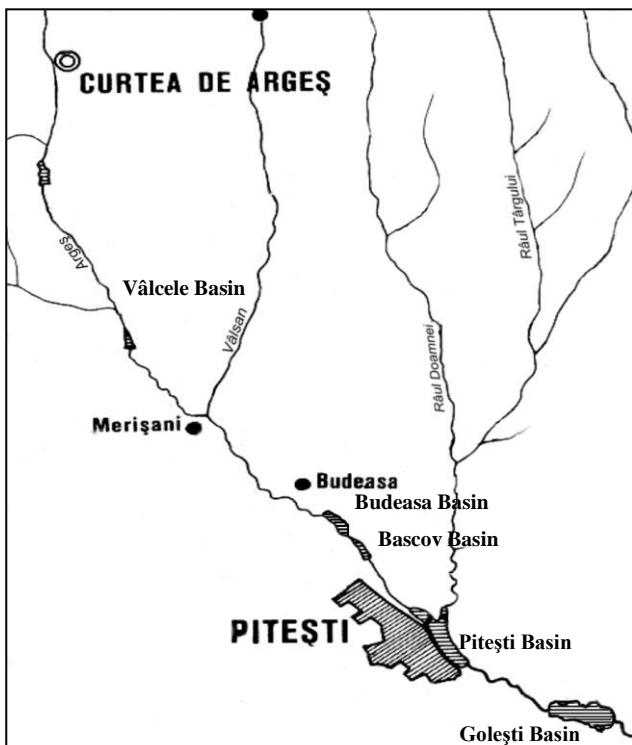


Figure 1 - The map of the Argeș River between Curtea de Argeș and Pitești.

## RESULTS AND DISCUSSIONS

The avifauna of the Vâlcele, Budeasa, Bascov, Pitești and Golești dam basins from the prevernal season, 2013, was formed by 71 species of birds, represented by 4,713 individuals (Mestecăneanu & Gava, 2013). Because not all species are typical to the wetlands, for the coenotic affinity analyse we considered only the species that depend on the water and that feed exclusively or largely from or on it. Also, others species characteristic to wetlands, observed in the area, like *Locustella luscinoides* (SAVI, 1824), *Acrocephalus palustris* (BECHSTEIN, 1798), *Acrocephalus scirpaceus* (HERMANN, 1804), that live in the reed bed or in the willow and alder habitats, were excluded from the calculation, because only a fraction of their strengths was counted. Therefore, the 29 remained species (40.84% of all) numbered 4,171 individuals (88.49% of all), (Tab. 1). 15 species (51.72% of all) - *Podiceps cristatus*, *Phalacrocorax carbo*,

*Egretta alba*, *Ardea cinerea*, *Cygnus olor*, *Anas platyrhynchos*, *Anas penelope*, *Anas querquedula*, *Anas crecca*, *Aythya fuligula*, *Aythya ferina*, *Fulica atra*, *Charadrius dubius*, *Larus argentatus* (sspp. *cachinnans* and *michahellis*), *Larus ridibundus* - were observed in both field trips and 14 species (48.27% of all) - *Podiceps nigricollis*, *Tachybaptus ruficollis*, *Phalacrocorax pygmeus*, *Egretta garzetta*, *Ardea purpurea*, *Anas clypeata*, *Bucephala clangula*, *Gallinula chloropus*, *Vanellus vanellus*, *Actitis hypoleucus*, *Tringa ochropus*, *Recurvirostra avosetta*, *Chlidonias hybridus*, *Sterna hirundo* - were observed only once. 19 species among them (65.51% - *Podiceps cristatus*, *Podiceps nigricollis*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Egretta garzetta*, *Ardea cinerea*, *Cygnus olor*, *Anas platyrhynchos*, *Anas crecca*, *Anas clypeata*, *Aythya fuligula*, *Aythya ferina*, *Gallinula chloropus*, *Fulica atra*, *Vanellus vanellus*, *Charadrius dubius*, *Larus ridibundus*, *Chlidonias hybridus*, *Sterna hirundo*) bred in the area in 2013 and *Larus argentatus michahellis* bred in the nearby city of Pitești. The rest of 9 species (31.03% of all: *Phalacrocorax pygmeus*, *Egretta alba*, *Ardea purpurea*, *Anas penelope*, *Anas querquedula*, *Bucephala clangula*, *Actitis hypoleucus*, *Tringa ochropus*, *Recurvirostra avosetta*) were non breeding species (Mestecăneanu & Gava, 2013).

As phenology in our country, *Podiceps cristatus*, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Phalacrocorax pygmeus*, *Egretta garzetta*, *Egretta alba*, *Ardea cinerea*, *Ardea purpurea*, *Anas querquedula*, *Gallinula chloropus*, *Vanellus vanellus*, *Charadrius dubius*, *Actitis hypoleucus*, *Recurvirostra avosetta*, *Chlidonias hybridus*, *Sterna hirundo* are summer visitors, *Podiceps nigricollis*, *Cygnus olor*, *Anas platyrhynchos*, *Aythya ferina*, *Fulica atra*, *Larus ridibundus* are partial migrant species, *Anas penelope*, *Anas crecca*, *Anas clypeata*, *Tringa ochropus* are passage species, *Aythya fuligula*, *Bucephala clangula* are winter visitors and *Larus argentatus* is resident species (Bruun et al., 1999). At the local level, it is difficult to clearly differentiate the appurtenance of all species to these categories and this will be discussed in a future paper.

By dominance, 3 species (10.34%, *Aythya fuligula*, *Aythya ferina* and *Fulica atra*) were eudominant, 1 species (3.44%, *Anas platyrhynchos*) was dominant, 4 species (13.79%, *Podiceps cristatus*, *Anas crecca*, *Larus argentatus*, *Larus ridibundus*) were subdominant, 2 species (6.89%, *Phalacrocorax carbo*, *Cygnus olor*) were recedent and 19 species (66.51%) were subrecedent (Tab. 1).

From the analyse of the coenotic affinity dendrogram (Fig. 2), we see that there are two pairs of species (*Vanellus vanellus* - *Ardea purpurea* and *Sterna hirundo* - *Tringa ochropus*) that can be considered characteristic species (with 100% similarity), though they were observed only once and in very low number. *Anas crecca* and *Larus argentatus* (sspp. *cachinnans* and *michahellis*) realised also a big coenotic affinity (95.60%) as well as *Egretta garzetta* and *Podiceps nigricollis* (95.23%). This is possible because, the season is characterised through a

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big mobility of the species, both as occurrence and as strengths (20 species, with 3,190 individuals, in March, and 24 species, with 981 individuals, in April).

Table 1 - The species of birds directly dependent on water observed in the prevernal season.

No.	Species	March	April	Individuals	Dominancy
1	<i>Podiceps cristatus</i> (LINNAEUS, 1758)	+	+	109	D3
2	<i>Podiceps nigricollis</i> BREHM C.L., 1831		+	10	D1
3	<i>Tachybaptus ruficollis</i> (PALLAS, 1764)	+		6	D1
4	<i>Phalacrocorax carbo</i> (LINNAEUS, 1758)	+	+	64	D2
5	<i>Phalacrocorax pygmeus</i> (PALLAS, 1773)	+		35	D1
6	<i>Egretta garzetta</i> (LINNAEUS, 1766)		+	11	D1
7	<i>Egretta alba</i> (LINNAEUS, 1758)	+	+	22	D1
8	<i>Ardea cinerea</i> LINNAEUS, 1758	+	+	18	D1
9	<i>Ardea purpurea</i> LINNAEUS, 1766	+		1	D1
10	<i>Cygnus olor</i> (GMELLIN, 1789)	+	+	59	D2
11	<i>Anas platyrhynchos</i> LINNAEUS, 1758	+	+	381	D4
12	<i>Anas penelope</i> LINNAEUS, 1758	+	+	44	D1
13	<i>Anas querquedula</i> LINNAEUS, 1758	+	+	41	D1
14	<i>Anas crecca</i> LINNAEUS, 1758	+	+	207	D3
15	<i>Anas clypeata</i> LINNAEUS, 1758		+	13	D1
16	<i>Aythya fuligula</i> (LINNAEUS, 1758)	+	+	1,420	D5
17	<i>Aythya ferina</i> (LINNAEUS, 1758)	+	+	743	D5
18	<i>Bucephala clangula</i> (LINNAEUS, 1758)	+		21	D1
19	<i>Gallinula chloropus</i> (LINNAEUS, 1758)		+	1	D1
20	<i>Fulica atra</i> LINNAEUS, 1758	+	+	608	D5
21	<i>Vanellus vanellus</i> LINNAEUS, 1758	+		1	D1
22	<i>Charadrius dubius</i> SCOPOLI, 1786	+	+	5	D1
23	<i>Actitis hypoleucos</i> LINNAEUS, 1758		+	3	D1
24	<i>Tringa ochropus</i> LINNAEUS, 1758		+	2	D1
25	<i>Recurvirostra avosetta</i> LINNAEUS, 1758		+	7	D1
26	<i>Larus argentatus</i> PONTOPPIDAN, 1763 ( <i>L. a. cachinnans</i> (PALLAS, 1811) and <i>L. a. michahellis</i> (NAUMANN, 1840))	+	+	203	D3
27	<i>Larus ridibundus</i> LINNAEUS, 1766	+	+	130	D3
28	<i>Chlidonias hybridus</i> (PALLAS, 1811)		+	4	D1
29	<i>Sterna hirundo</i> LINNAEUS, 1758		+	2	D1

**Legend:**

+ - presence; D1 - subprecedent species, D2 - recedent species, D3 - subdominant species, D4 - dominant species, D5 - eudominant species.

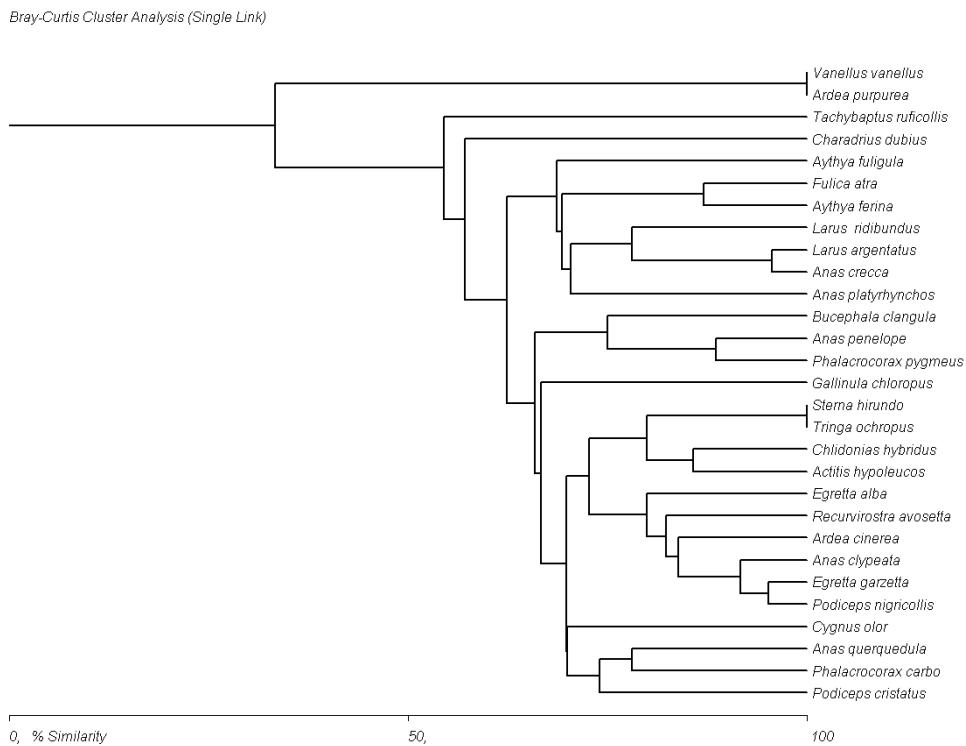


Figure 2 - The dendrogram of the coenotic affinity between the species dependent on water from the area.

The eudominant and dominant species established medium or relatively good similarities among them - between 42.31% for the pair *Aythya fuligula* - *Anas platyrhynchos* and 87.05% for the pair *Fulica atra* - *Aythya ferina*, but there are also good coenotic affinities between *Anas platyrhynchos* and *Anas crecca* - 70.41% and between *Anas platyrhynchos* and *Larus argentatus* - 69.52 (Tab. 2). Other significant similarities are between: *Podiceps cristatus* - *Phalacrocorax carbo* (73.98%), *Ardea cinerea* - *Egretta garzetta* (75.86%), *Anas penelope* - *Phalacrocorax pygmeus* (88.60%), *Anas querquedula* - *Phalacrocorax carbo* (78.09%), *Anas clypeata* - *Egretta garzetta* (91.66%), *Recurvirostra avosetta* - *Podiceps nigricollis* (82.35%), *Recurvirostra avosetta* - *Egretta garzetta* (77.77%), *Larus ridibundus* - *Anas crecca* (77.15%), *Larus ridibundus* - *Larus argentatus* (78.07%), *Chlidonias hybridus* - *Actitis hypoleucus* (85.71%) and *Chlidonias hybridus* - *Recurvirostra avosetta* (72.72%).

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Table 2 - The matrix of similarity by Bray-Curtis index of the eudominant and dominant species.

Species	<i>Anas platyrhynchos</i>	<i>Aythya fuligula</i>	<i>Aythya ferina</i>	<i>Fulica atra</i>
<i>Podiceps cristatus</i>	44.49	14.26	21.83	30.40
<i>Podiceps nigricollis</i>	5.12	1.40	2.66	3.24
<i>Tachybaptus ruficollis</i>	3.10	0.84	1.60	1.95
<i>Phalacrocorax carbo</i>	28.76	8.63	15.86	19.05
<i>Phalacrocorax pygmeus</i>	16.83	4.81	9.00	10.89
<i>Egretta garzetta</i>	5.61	1.54	2.92	3.55
<i>Egretta alba</i>	10.92	3.05	5.75	6.98
<i>Ardea cinerea</i>	9.02	2.50	4.73	5.75
<i>Ardea purpurea</i>	0.52	0.14	0.27	0.33
<i>Cygnus olor</i>	26.82	7.98	14.71	17.69
<i>Anas platyrhynchos</i>	*	42.31	57.47	69.36
<i>Anas penelope</i>	20.71	6.01	11.18	13.50
<i>Anas querquedula</i>	19.43	5.61	10.46	12.63
<i>Anas crecca</i>	70.41	25.45	43.58	50.80
<i>Anas clypeata</i>	6.60	1.81	3.44	4.19
<i>Aythya fuligula</i>	42.31	*	68.70	59.96
<i>Aythya ferina</i>	57.47	68.70	*	87.05
<i>Bucephala clangula</i>	10.45	2.91	5.50	6.68
<i>Gallinula chloropus</i>	0.52	0.14	0.27	0.33
<i>Fulica atra</i>	69.36	59.96	87.05	*
<i>Vanellus vanellus</i>	0.52	0.14	0.27	0.33
<i>Charadrius dubius</i>	2.59	0.70	1.34	1.63
<i>Actitis hypoleucos</i>	1.56	0.42	0.80	0.98
<i>Tringa ochropus</i>	1.04	0.28	0.54	0.66
<i>Recurvirostra avosetta</i>	3.61	0.98	1.87	2.28
<i>Larus argentatus</i>	69.52	25.02	42.92	50.06
<i>Larus ridibundus</i>	50.88	16.77	29.78	35.23
<i>Chlidonias hybridus</i>	2.08	0.56	1.07	1.31
<i>Sterna hirundo</i>	1.04	0.28	0.54	0.66

By dam basins, the characteristic species on Vâlcele were *Chlidonias hybridus* and *Larus ridibundus* (with 85.71% similarity, Fig. 3). They were observed in April and have had 4, respectively 3 individuals. Other pairs with high similarities were: *Aythya fuligula* - *Anas platyrhynchos* (83.09%), *Bucephala clangula* - *Anas crecca* (82.35%), *Phalacrocorax carbo* - *Podiceps cristatus* (80.70%), *Anas clypeata* - *Podiceps nigricollis* (80.00%) and *Charadrius dubius* - *Tachybaptus ruficollis* (80.00%). It is interesting that *Fulica atra*, the species with

the largest strength (134 individuals), realised the biggest coenotic affinity, of only 33.17%, with *Aythya fuligula*.

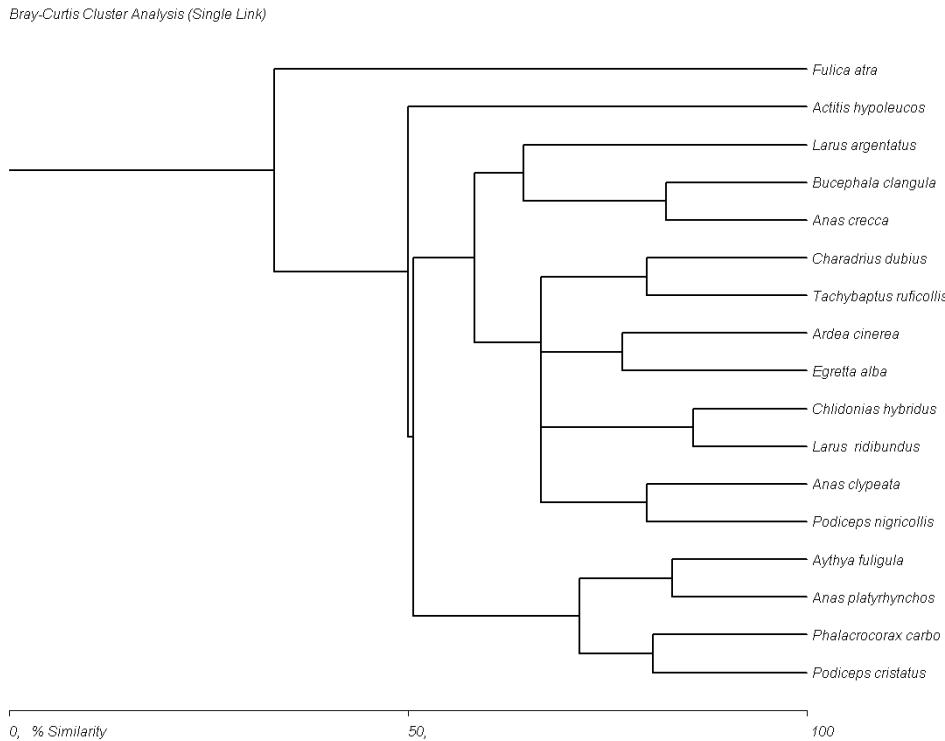


Figure 3 - The dendrogram of the coenotic affinity between the species dependent on water from the Vâlcele Dam Basin.

On Budeasa, the characteristic species were *Larus argentatus* and *Fulica atra* (100.00% - similarity, Fig. 4). Their strengths were relatively low (12 individuals) and decreased from March to April. *Aythya ferina* had high similarity (96.00%) with *Fulica atra*, respectively *Larus argentatus*, because the same reason, and the pair *Ardea cinerea* - *Phalacrocorax carbo* also remarked through a similarity of 88.88%.

On Bascov Dam Basin, the characteristic species were *Larus argentatus* and *Tachybaptus ruficollis* (with 100.00% similarity, Fig. 5). They were seen only in March and have had 4 individuals. The coenotic affinities between the other species were much lower (max. 66.66%, between *Tachybaptus ruficollis* and *Larus ridibundus*, respectively *Larus argentatus* and *Larus ridibundus*). Again, *Fulica atra* - the species with the highest strength (173 individuals), realised the biggest coenotic affinity, of only 63.24%, this time with *Aythya ferina*.

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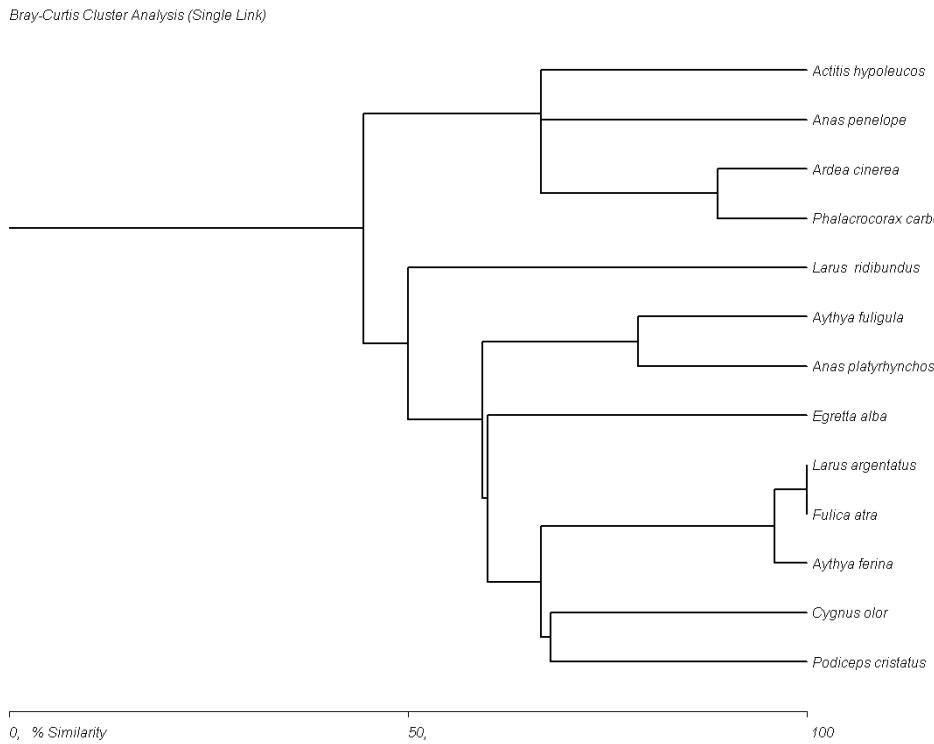


Figure 4 - The dendrogram of the coenotic affinity between the species dependent on water from the Budeasa Dam Basin.

On Pitești, there was a group of four characteristic species - *Actitis hypoleucus*, *Gallinula chloropus*, *Anas clypeata* and *Phalacrocorax carbo* (100.00% similarity, Fig. 6). They were observed only once, in April, and with 1 individual. Also, high coenotic affinities realised: *Anas crecca* - *Larus argentatus* (87.09%), *Aythya fuligula* - *Anas platyrhynchos* (86.36%), *Larus argentatus* - *Aythya fuligula* (86.27%), *Larus ridibundus* - *Aythya fuligula* (82.92%), *Aythya fuligula* - *Anas crecca* (81.35%), *Larus ridibundus* - *Anas platyrhynchos* (81.08%). The strengths of these species in the prevernal season ranged between 17 individuals (for *Larus ridibundus*) and 35 individuals (for *Anas crecca*). The eudominant species (*Aythya ferina*, 190 individuals) realised the largest coenotic affinity (34.68%) with *Fulica atra*, the following species as number of individuals (81).

On Golești Dam Basin, *Recurvirostra avosetta* and *Ardea cinerea* - species observed in April, with 7 individuals, on a side, and *Sterna hirundo*, *Tringa ochropus*, *Charadrius dubius* and *Podiceps nigricollis* - species also observed in April, but with 2 individuals, on the other side, can be considered the characteristic

species (Fig. 7). High similarities were recorded also between: *Larus argentatus* and *Anas crecca* (96.27%), *Phalacrocorax pygmeus* and *Anas penelope* (92.30%), *Cygnus olor* and *Anas querquedula* (88.52%), *Anas platyrhynchos* and *Anas crecca* (86.60%), *Larus ridibundus* and *Larus argentatus* (84.21%), *Anas platyrhynchos* and *Larus argentatus* (83.62%), *Larus ridibundus* and *Anas crecca* (81.25%). *Cygnus olor*, *Anas platyrhynchos*, *Anas crecca*, *Larus argentatus* and *Larus ridibundus* were the species observed in both months, while the others were observed only once. The species with the largest strengths (*Aythya fuligula* - 1,259 individuals and *Aythya ferina* - 460 individuals), present on the area in both months, realised a similarity of only 53.51%.

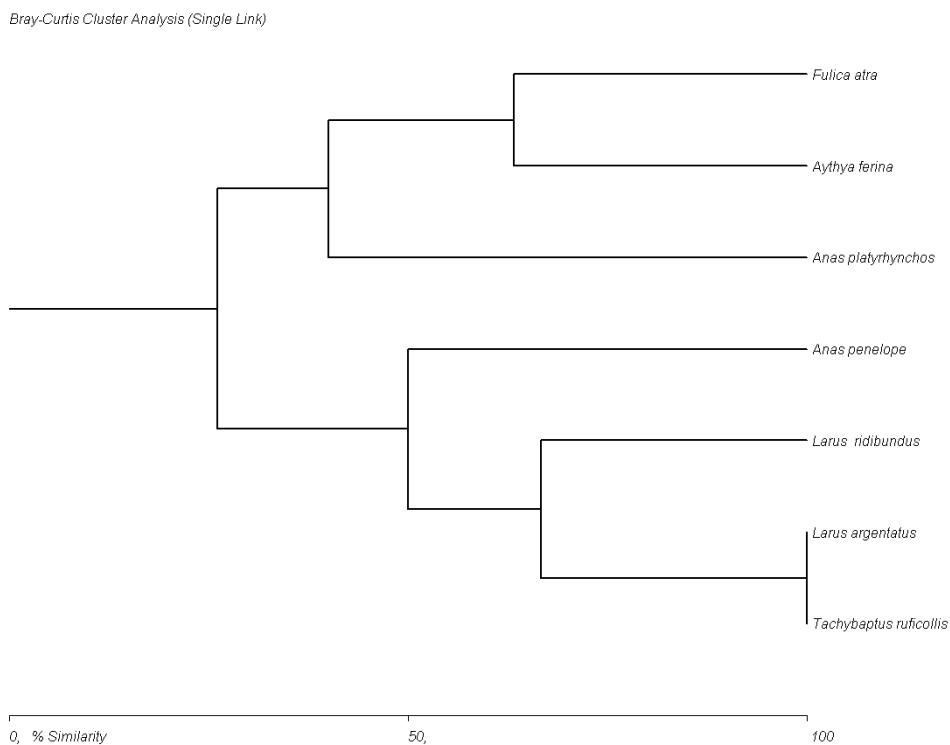


Figure 5 - The dendrogram of the coenotic affinity between the species dependent on water from the Bascov Dam Basin.

Regarding the avicoenoses of the dam basins, the highest similarities by Bray-Curtis (Fig. 8) was stated between Pitești and Bascov (52.52%) and between Budeasa and Vâlcele (51.06%), while the lowest similarity was between Golești and Budeasa. It is interesting that, in April, one of the biggest anthropogenic pressure, the sportive activities on the water, manifested both Bascov and Pitești, while, in March, it was absent. The two adjacent basins have similar areas. On the

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other side, Vâlcele and Budeasa are the lakes from the upstream and, again, they have almost the same area.

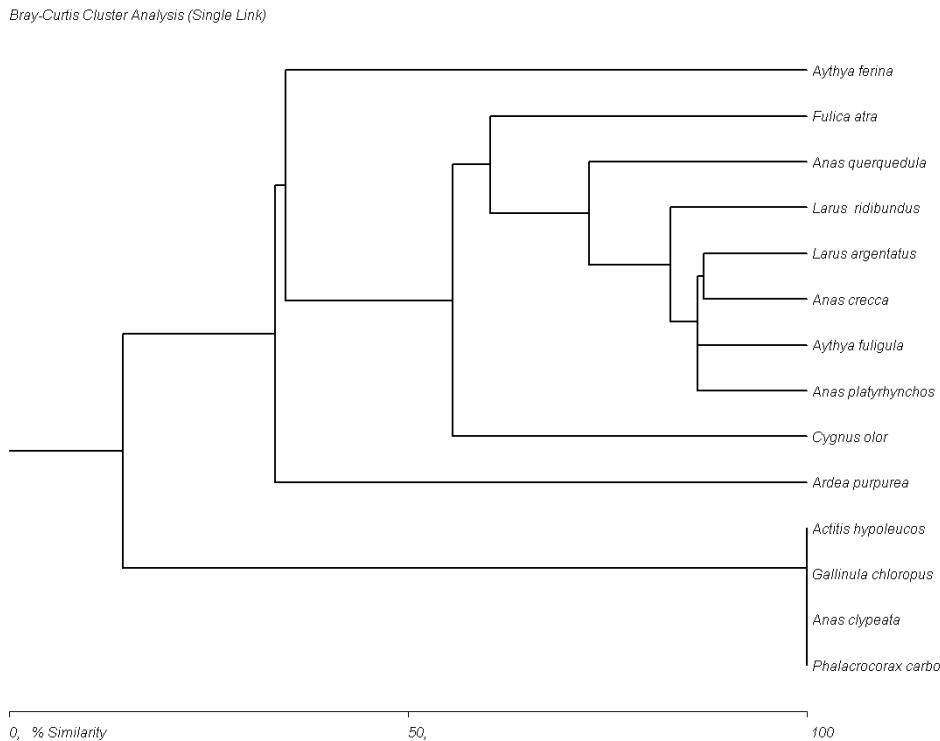


Figure 6 - The dendrogram of the coenotic affinity between the species dependent on water from the Pitești Dam Basin.

## CONCLUSIONS

The exclusively or largely dependent on water avifauna of the prevernal season from the Vâlcele, Budeasa, Bascov, Pitești and Golești Dam Basins from ROSPA0062 - Lacurile de acumulare de pe Argeș recorded 29 species that numbered 4,171 individuals.

15 species (51.72% of all) - *Podiceps cristatus*, *Phalacrocorax carbo*, *Egretta alba*, *Ardea cinerea*, *Cygnus olor*, *Anas platyrhynchos*, *Anas penelope*, *Anas querquedula*, *Anas crecca*, *Aythya fuligula*, *Aythya ferina*, *Fulica atra*, *Charadrius dubius*, *Larus argentatus* (sspp. *cachinnans* and *michahellis*), *Larus ridibundus* - were observed both March and April and 3 species (10.34%, *Aythya fuligula*, *Aythya ferina* and *Fulica atra*) were eudominant.

Bray-Curtis Cluster Analysis (Single Link)

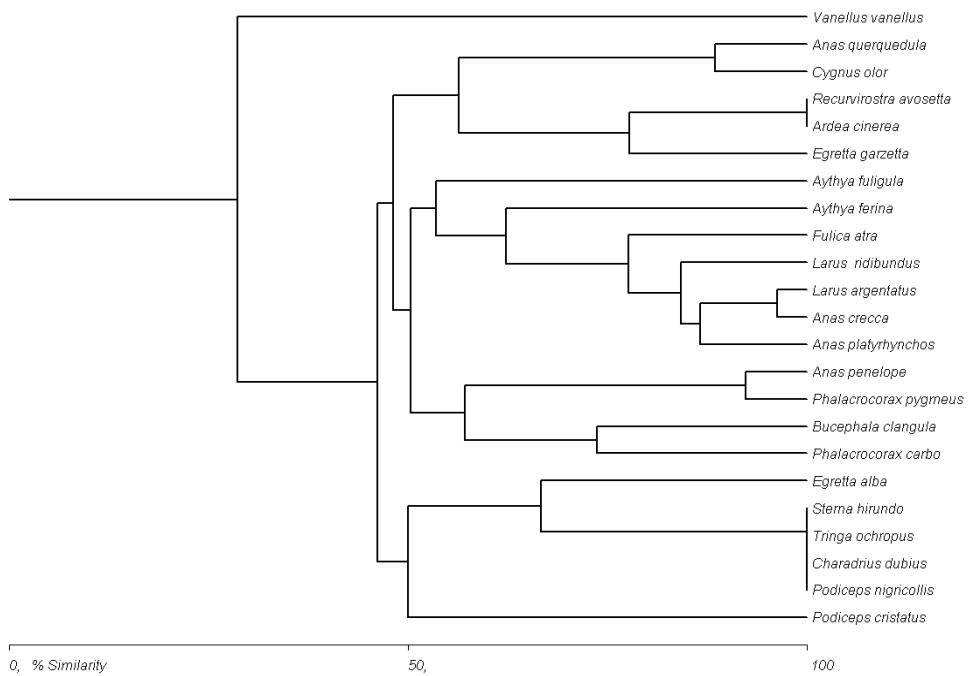


Figure 7 - The dendrogram of the coenotic affinity between the species dependent on water from the Golești Dam Basin.

For the whole area, *Vanellus vanellus*, *Ardea purpurea*, *Sterna hirundo* and *Tringa ochropus* can be considered the characteristic species. Depending on the component dam basins, the characteristic species were: *Chlidonias hybridus* and *Larus ridibundus*, on Vâlcele, *Larus argentatus* and *Fulica atra*, on Budeasa, *Larus argentatus* and *Tachybaptus ruficollis*, on Bascov, *Actitis hypoleucus*, *Gallinula chloropus*, *Anas clypeata* and *Phalacrocorax carbo*, on Pitești and *Recurvirostra avosetta*, *Ardea cinerea*, *Sterna hirundo*, *Tringa ochropus*, *Charadrius dubius* and *Podiceps nigricollis*, on Golești. Generally, these species were observed in low number and at a field trip, fact that can be related to the large mobility of the species from the prevernal season, manifested both as constancy and dominancy. Also, an important role can play the anthropogenic pressure, which was inconstant as force in time and space. Because of the large discrepancies between the strengths, the dominant and eudominant species at general or local level registered usually moderate or low coenotic affinities with the other species.

To increase the accuracy of the results, more field trips in the prevernal season should be performed.

## THE COENOTIC AFFINITY OF THE WATER BIRDS SPECIES FROM SOME DAM BASINS OF THE ARGEŞ RIVER IN THE PREVERNAL SEASON

Bray-Curtis Cluster Analysis (Single Link)

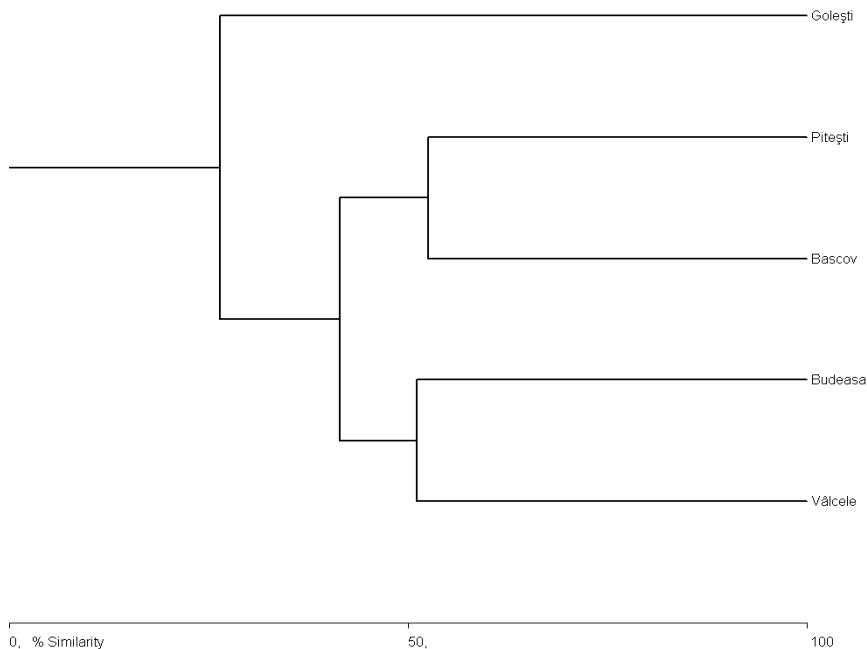


Figure 8 - The dendrogram of similarity between the dam basins avicoenoses by Bray-Curtis Index.

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## **CONSIDÉRATIONS CONCERNANT L'ÉVALUATION DU BOIS HISTORIQUE PAR MÉTHODES NON DESTRUCTIVES**

**LUMINIȚA ENESCU**

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**RESUME:** La possibilité d'évaluer l'état des objets de patrimoine ou des monuments en utilisant des moyens techniques non destructives présente un intérêt majeur. Les premières méthodes d'essais non destructifs ont été conçues pour des matériaux présentant une structure homogène et isotrope. Les résultats obtenus ont permis d'étendre certains procédés au bois en général et au bois historique en particulier. La littérature spécialisée de ces dernières années indique que ces méthodes sont validées par l'expérience et qu'elles peuvent donc être des instruments utiles en termes de l'appréciation de l'état de conservation des objets, mais surtout des structures en bois en œuvre. Le présent document propose d'examiner brièvement quelques méthodes d'évaluation non destructive du bois historique, en mentionnant des situations concrètes dans lesquelles ces méthodes ont été appliquées avec des résultats satisfaisants.

**Mots clé:** bois, évaluation non destructive (NDE), méthodes et moyens techniques.

**REZUMAT.** Considerații privind evaluarea lemnului istoric prin metode nedistructive. Posibilitatea de a evalua starea obiectelor de patrimoniu sau a monumentelor folosind mijloace tehnice nedistructive prezintă un interes major. Primele metode de testare nedistructivă au fost concepute pentru materiale cu o structură omogenă și izotropă. Rezultatele obținute au făcut posibilă extinderea anumitor procedee la lemn în general și la lemnul istoric în particular. Literatura de specialitate din ultimii ani indică faptul că aceste metode sunt validate de experiență și că ele pot să fie instrumente utile pentru aprecierea stării de conservare a obiectelor, dar mai ales a structurilor din lemn aflate în operă. Lucrarea își propune să prezinte pe scurt câteva metode de evaluare nedistructivă a lemnului istoric, cu referire la situații concrete în care aceste metode au fost aplicate cu rezultate satisfăcătoare.

**Cuvinte cheie:** lemn, evaluare nedistructivă (NDE), metode și mijloace tehnice.

## 1. GÉNÉRALITÉS. LES PRINCIPALES MÉTHODES D'ÉVALUATION NON DESTRUCTIVE

Bien que la plupart de la recherche sur les essais d'évaluation non destructive a été concentrée sur des matériaux manufacturés tels que les métaux, les polymères, la céramique et le béton, on a trouvé des possibilités d'utiliser des techniques d'essais non destructives aussi pour inspecter et évaluer les produits et les structures en matériaux naturels comme par exemple le bois (RH Falk, et al., 1990). Les principales méthodes de contrôle non destructif des matériaux sont résumées dans le tableau ci-dessous (Tab. 1).

Tableau 1 - Les principales méthodes de contrôle non destructif des matériaux.

LE PRINCIPE DE LA MÉTHODE	METHODE D'EVALUATION	APPLICATIONS
Optique	Examen visuel	Examen des zones visibles
	Thermographie infrarouge	Determination des caractéristiques thermo-physiques à la surface du matériel
En utilisant des fluides	A l'aide des fluides pénétrantes	Contrôle de l'étanchéité; contrôle des défauts traversant le matériau
Electromagnétique	Des courants électriques tourbillonnaires	Détection des défauts qui traversent le matériau
	Magnétoscopie	Détection des défauts de surface
En utilisant des rayonnements ionisants	Irradiation avec des rayonnements X ou gamma	Détection des défauts dans la masse du matériel
En utilisant des ondes mécaniques	Acoustiques; avec des ultrasons	L'évaluation des propriétés mécaniques Détection des défauts internes ou de surface

L'évaluation non destructive (NDE) du bois a été effectuée depuis des générations. L'inspection visuelle visant à déterminer les caractéristiques qui influencent la résistance aux sollicitations a été utilisée traditionnellement pour classer le bois en catégories d'utilisation finale. Cette évaluation de la qualité du bois est basée seulement sur la taille et la répartition des anomalies du bois qu'on peut observer à la surface du matériau. En utilisant cette technique, les anomalies induisant la réduction de la résistance et les caractéristiques des espèces sont associées empiriquement au comportement du matériau soumis aux sollicitations de traction, de flexion ou de compression.

Dans les dernières années, pour évaluer les propriétés du bois sans le détruire, on a créé des méthodes et on a développé des techniques et des équipements de contrôle non destructif (NDT / NDE) beaucoup plus précises. Tout cela vise l'étude et la détection des changements critiques des paramètres

## **CONSIDÉRATIONS CONCERNANT L'ÉVALUATION DU BOIS HISTORIQUE PAR MÉTHODES NON DESTRUCTIVES**

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structurels, pour faciliter le calcul de la résistance structurelle afin de prévenir les éventuels dommages sérieux lors de l'exploitation (Sohi et al., 2011).

### **2. LE BOIS HISTORIQUE. LA DÉGRADATION DU BOIS À L'AIR LIBRE**

Le bois longtemps exposé aux sollicitations mécaniques, aux rayonnements solaires et aux intempéries est soumis à une série de processus de dégradation complexes. Parmi ceux-ci, les plus courants sont les dégradations de nature:

- a) photochimique, causée par les rayonnements ultraviolets;
- b) thermique, déterminée par la chaleur;
- c) physico-chimique, favorisée par l'hydroscopicité et l'hygroscopicité du bois;
- d) biochimique et biologique, sous l'action des agents biologiques: bactéries; champignons; insectes.

### **3. METHODES D'EVALUATION NON DESTRUCTIVE DU BOIS HISTORIQUE**

La restauration d'un bien culturel connaît un certain déroulement de phases:

- la phase d'étude d'objet;
- la phase d'élaboration de la documentation de restauration;
- la phase de préparation et de mise en place des conditions nécessaires à l'intervention proprement dite;
- la phase d'intervention proprement dite.

Tout d'abord, l'objet est examiné et étudié avec soin, pour déterminer son état et ses problèmes; la procédure est essentielle et assez difficile à réaliser. L'analyse implique la recherche au-delà de l'aspect de la surface, l'évaluation du degré de fragilité de l'objet, la détermination du degré d'affectation des propriétés physico-mécaniques. En règle générale, les spécialistes de laboratoire d'investigations prélèvent des échantillons pour l'analyse de la structure et de la composition, pour déterminer la nature des produits d'alteration et l'état réel de l'objet.

Afin de préserver l'intégrité de l'objet ou de la structure analysée, il est indiqué d'effectuer ces analyses sans prélever des échantillons (analyses non destructives). Dans le cas du bois, l'évaluation non destructive se déroule généralement en deux étapes:

1. l'examen visuel;
2. l'inspection en utilisant des outils / équipements.

Parmi les méthodes d'évaluation non destructive du bois, les plus couramment utilisées sont: la méthode d'impact dynamique, la méthode résistographique, les méthodes basées sur des mesurages acoustiques.

### 3.1. La méthode des mesurages locales de la dureté (la méthode d'impact dynamique)

La méthode d'impact dynamique consiste dans l'introduction d'un poinçon métallique dans la pièce de bois avec une certaine énergie (Fig. 1), la profondeur de pénétration étant inversement proportionnelle à la dureté du bois dans la section transversale. La profondeur de pénétration peut être utilisée comme mesure de la densité du bois, ainsi que de l'intensité et de la profondeur de la dégradation fongique (Cruz et al., 1999 ; Teles et Valle, 2001). La méthode est appliquée plus fréquemment pour l'évaluation des structures en bois telles que les pylônes de réseau, les installations portuaires, etc. et moins fréquemment pour les constructions.

Les résultats de l'évaluation dépendent: du lieu de test dans l'élément; de l'anisotropie et de la densité du bois; du pourcentage de bois tardif; de défauts ou dégradation du matériau; de l'expérience des opérateurs (Bonamini, 1995).

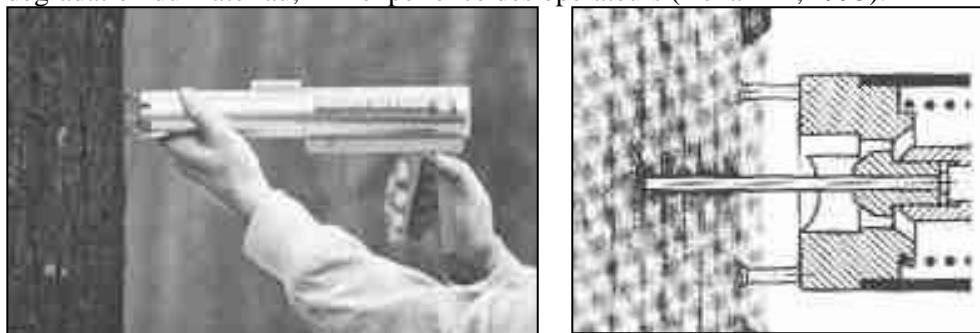


Figure 1 - La méthode d'impact dynamique - équipement et principe ([https://inspectapedia.com/structure/Pilodyn\\_Wood\\_Test.php](https://inspectapedia.com/structure/Pilodyn_Wood_Test.php); 29 sept. 2018).

### 3.2. La méthode résistographique

La méthode résistographique consiste dans la détermination de la résistance du matériau à l'avancement d'une petite perceuse dont le diamètre varie entre 1,5 mm et 3 mm (Fig. 2a). Le principe de ce processus est la corrélation d'entre la résistance du matériau testé à l'avancement de la perceuse et la densité du matériau. Le résultat de l'essai est le profil de la densité de l'échantillon (Fig. 2b), qui peut être utilisé pour évaluer la présence ou l'absence de zones de dégradation.

### 3.3. Méthodes basées sur des mesurages acoustiques

Ces méthodes sont utilisées pour étudier les propriétés élastiques des pièces en bois massif, mais également pour inspecter qualitativement le contreplaqué et d'autres matériaux composites à base de bois. Les propriétés élastiques des matériaux solides sont d'une importance considérable tant dans le domaine de la science que de la technologie. Pour le bois, leur mesurage fournit des informations essentielles pour une meilleure compréhension des caractéristiques structurelles du matériau, qui détermine ses propriétés physico-mécaniques et, implicitement, son comportement en service.

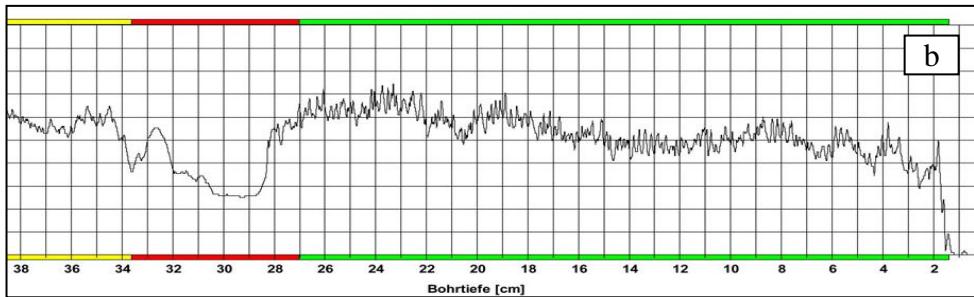
## CONSIDÉRATIONS CONCERNANT L'ÉVALUATION DU BOIS HISTORIQUE PAR MÉTHODES NON DESTRUCTIVES



a

Figure 2 - Essais du bois par la méthode résistographique:

a. l'équipement; b. le profil résulté après le test.  
([http://www.imlusa.com/html/drilling\\_resistance\\_measurement.html](http://www.imlusa.com/html/drilling_resistance_measurement.html)/ 29 sept. 2008).



b

**3.3.1.** La technique basée sur le principe de détermination de la fréquence de résonance utilise une onde acoustique pour évaluer la qualité du matériau. L'onde incidente est générée par un coup de marteau, dont le poids doit être d'environ 1% du poids de l'élément testé, appliqué à une extrémité ; un microphone sensible enregistre l'onde à l'autre extrémité.

**3.3.2.** La technique à base d'ultrasons est, apparemment, la méthode acoustique la plus utilisée dans la pratique. Le procédé implique l'utilisation d'une paire de transducteurs piézoélectriques, d'un générateur de signal pour produire le signal d'impulsion ultrasonique et d'un dispositif pour mesurer le temps de transmission de l'impulsion ultrasonique par l'échantillon (temps de vol). À partir des résultats des mesurages, le module d'élasticité dynamique peut être calculé, c'est-à-dire sa valeur en direction longitudinale. C'est la propriété mécanique la plus importante, définissant la qualité du matériau.

#### **4. OBSERVATIONS ET CONCLUSIONS FORMULEES PAR DES PRATICIENS**

##### **4.1. Conclusions fondées sur l'évaluation non destructive des plaques de contreplaqué par ultrasons (Iancu, 2002):**

- entre la résistance au cisaillement et le temps de vol des ultrasons, une très forte corrélation est constatée pour tous les types de stratifications;
- la corrélation entre la résistance à la flexion statique ( $\sigma_i$ ) et le temps de vol des ultrasons est très élevée pour les structures 3, 5, 7 et élevée pour la structure à 9 couches; ceci est justifié par le fait qu'au phénomène de flexion participe principalement les couches de feuilles de placage qui composent le panneau, puis la résistance de l'adhésif. Par conséquent, plus le nombre de couches est élevé, plus la résistance à la flexion diminue légèrement;
- on a constaté une très forte corrélation entre le module d'élasticité longitudinal (EII) et le temps de vol des ultrasons (tUS) par la plaque pour le contreplaqué à 3 et 5 couches, et une forte corrélation pour le contreplaqué à 7 couches; pareil qu'à la résistance à la flexion, avec le nombre croissant de couches, la corrélation commence à diminuer;
- le film phénolique forme des pellicules homogènes presque parfaits - car il est appliqué sous forme de feuille -, suivi de l'adhésif urée-formaldéhydique et celui-ci suivi de l'adhésif polyuréthanique qui forme de films beaucoup plus spongieux que l'adhésif urée-formaldéhydique. La porosité de l'adhésif après la polymérisation entre les couches contribue à la déviation de l'impulsion ultrasonique transmise;
- il n'y avait pas une corrélation très rigoureuse entre le module transversale d'élasticité (GT) et la masse volumétrique des échantillons étudiés, à cause de certaines inhomogénéités présentes dans le matériau, qui dévient le trajet des ultrasons;
- en cas d'adhésion insuffisante (couche pauvre d'adhésif entre les feuilles de placage), les temps de vol obtenus ont des valeurs beaucoup plus élevées, en raison de la déviation du trajet des ultrasons due à la présence de l'air (Fig. 3);
- les déterminations expérimentales indiquent que la vitesse des ultrasons augmente avec l'épaisseur de la plaque; la couche adhésive joue un rôle très important dans la méthode d'évaluation par ultrasons;
- pour les défauts naturels de type noeud, du fait que le bois dans ces zones est plus dense que dans la zone voisine, les temps de vol ont des valeurs inférieures aux temps normaux pour cette épaisseur (une différence d'environ 1,1 à 1,7  $\mu\text{s}$ );
- pour le défaut de type manque de matière dans les couches centrales, les temps de vol ont des valeurs plus basses que dans la région voisine.

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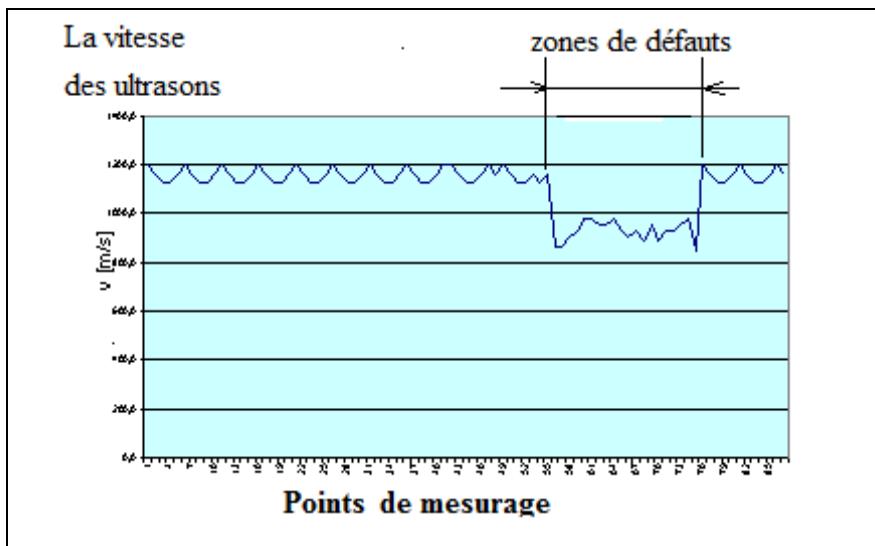


Figure 3 - Représentation de la vitesse des ultrasons sur l'épaisseur d'un plaque de contreplaqué de 3,72 mm, constitué de 3 couches de placage, en cas de défaut (absence de film adhésif).

### 4.2. Conclusions de l'analyse comparative de l'évaluation non destructive des éléments en bois de la structure du toit du vestibule de la Gare Masaryk de Prague (Hasnicova et Kuklik, 2014):

Equipement utilisé: Sylvatest, Dynamic, Pilodyn (Fig. 4a). Les tests effectués ont abouti aux principales conclusions suivantes:

- les méthodes d'essais non destructifs sont très utiles pour les investigations préliminaires. À partir des déterminations, les paramètres mécaniques de la pièce peuvent être approximés avec une précision suffisante, mais une évaluation correcte de ceux-ci nécessite une grande expérience;
- une surveillance à long terme, en utilisant le même équipement, par une équipe expérimentée, est recommandée et les résultats des déterminations sont fiables;
- les recherches ont mis en évidence un aspect particulier qui a été présenté en détail: une fissure superficielle influe considérablement sur les tests ultrasoniques lorsqu'elle est placée sur la même surface sur laquelle les capteurs sont appliqués, mais elle n'est pas détectable à la surface opposée de la poutre (Fig. 4b).

Les mesurages in situ ont montré que certains éléments en bois de la structure de la Gare Masaryk de Prague n'étaient plus conformes aux normes contemporaines. Ces éléments ne pouvaient pas être retenus dans la structure de la gare, malgré le désir des experts impliqués dans les travaux de conservation. Par conséquent, on a sélectionné seulement les pièces de la plus haute qualité, qui ont été réutilisées, le reste étant remplacé par des composants en bois lamellé collé.

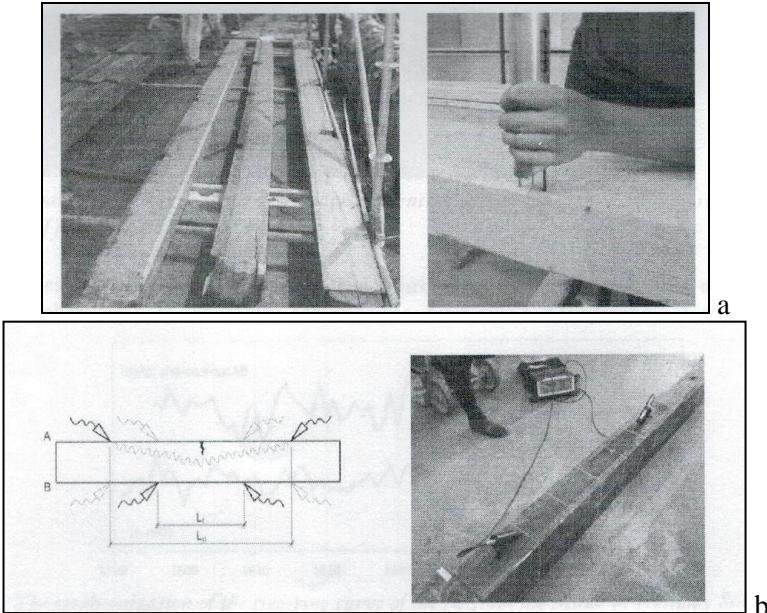


Figure 4 - L'évaluation non destructive des éléments de structure de la toiture de la Gare Masaryk de Prague: la méthode de détermination de la dureté locale (a); la méthode aux ultrasons (b).

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