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MARISIA

NATURAL SCIENCES

II

2022

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Front cover: *Narcissus poeticus* L. ssp. *radiiflorus* (Salisb.) Baker (photo and design: Mihaela Sămărghițan)

ISSN 2821-4145; ISSN-L 2821-4145

editura MEGA
Editura Mega | www.edituramega.ro
e-mail: mega@edituramega.ro

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Botany

Assessments of aquatic plants and habitats of the small Glavacioc River in the Romanian Plain

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Abstract: Glavacioc River is a small river that crosses many rural areas on the Romanian Plain. Research developed along Glavacioc River has highlighted the fact that all aquatic plant species and habitats there show a strong impact by human activities. Because the Glavacioc River is a short watercourse with a compact catchment, we have been able to treat this river as a case study (an exemplar or microcosm) on which to base the assessment of aquatic plants and habitats in bigger rivers of the Romanian Plain. The pressures and threats are multiple and very diverse along the Glavacioc River: spatial planning, agricultural practices, forestry, random natural changes, management practices, pollution, etc. Aquatic habitats and plant diversity vary along the river from upstream to downstream, becoming less diverse downstream. Where the river passes near settlements, the pressures from human impact upon aquatic habitats are so high as to cause their disappearance altogether.

Keywords: aquatic plants and habitats, small river, Glavacioc, Romania

Introduction

The rivers of the world provide important economic, ecological, and cultural benefits (ecosystem services) for human beings: drinking water, irrigation, wildlife (fish, plants, etc.) and more (NOAA, 2022). They provide crucial habitat for aquatic flora and fauna (WN8, 2000). In recent years, rivers and wetlands have become increasingly degraded and may even disappear due to the pressures and impacts caused by human activities and climate change (Gaglio et al., 2022).

River habitats are very diverse, having regional characteristics that lead to the creation of distinct habitats. Each type of river and the different zones and reaches of the rivers provide a suitable environment (habitat) for different types of species. Diverse habitats vary from narrow stony streams to large flowing channels for ships and boats, to shallow wetland deltas. A river comprises three distinct habitat zones: water channel (river beds), riparian zones (river banks) and floodplains (low, flat land spreading out from the channels) (Orth, 1996; WN8, 2000; NOOA, 2022).

Because the Glavacioc catchment (watershed in American usage) is quite small compared to many other rivers on the Romanian Plain (MSM, 2022), it has been a practical site previously to perform a range of studies i.e. a) monitoring of the evapotranspiration processes in riparian grasslands (Dunea et al., 2019); b) nitrate pollution of groundwater from built-up areas (Lăcătușu et al., 2019a);

c) influence of domestic activity on the quality of groundwater and surface water in the rural built-up area (Lăcătuşu et al., 2019b); d) effects of riparian vegetation on evapotranspiration processes and water quality (Dunea et al., 2021); and e) the vegetation characteristics (Onete et al., 2022).

The objective of the present study was to assess the aquatic habitats of the Glavacioc, together with some of its tributaries (Milcovăț and Sericu) from near the source working downstream toward its confluence with the Câlnișțea. This assessment would:

– Characterise the vegetation and habitat type.

– Note plant species that were important ecologically or in terms of biodiversity.

– Make an appraisal of the impact of human activity on the river itself.

Material and Methods

The Glavacioc River is a small river (cca 120 km) rising near the settlement of Ștefan cel Mare village, Argeș County (44°31′34″N 25°06′19″E) and with a gently sinuous course, discharging into the River Câlnișțea near Ghimpați (44°09′37″N 25°48′07″E). The total area of its basin is 682 km^2 (Fig. 1) (MSM, 2022).

Crossing a small part of the Romanian Plain, the Glavacioc basin contains settlements and associated industry, agricultural fields, and occasional small blocks of woodland (some of them planted for different purposes). The riparian zone of the Glavacioc and its tributaries are highly affected by human activity, in some areas being replaced by agricultural fields.

During mid-September 2021, we made several visits to the Glavacioc basin, focussing on locations where roads and tracks crossed the river(s) and where a rapid field assessment was practical. At each survey-site, the following were noted for the reach: 1) main habitats represented; 2) any minor habitats of particular interest; 3) dominant and characteristic species; and 4) management and/or disturbance of the river by human beings. Although much of the appraisal was conducted on foot focussing upon the river, we were able to make use of a drone (DJI mini2) at sites where a broader view was desirable.

Although the Glavacioc River and its basin are not designated within the Natura 2000 (N2K) network under either the European Union Birds Directive (Directive 2009/147/EC) or the Habitats Directive (Council Directive 92/43/EEC), we nonetheless used the EUR28 Manual (2013) and Gafta &

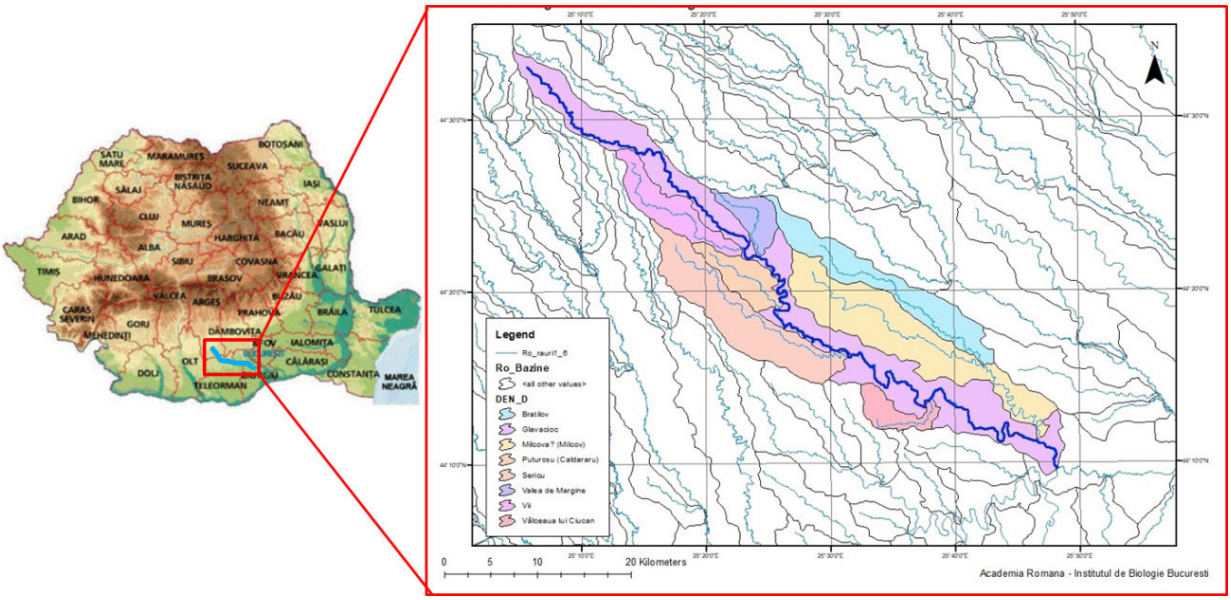

Fig. 1: Location of the Glavacioc River in Romania and its catchment (map EUNIS level 3).

Mountford (2008), together with Doniţă et al. (2005) for the identification and naming of habitats.

Except where a species name is part of the official name for an EU habitat type (EUR28 2013) or in *Habitats from Romania* (Doniţă et al., 2005), the taxonomy of species in this paper follows Sârbu et al. (2013).

Results and discussions

The aquatic vegetation of the Glavacioc River and its tributaries was species-poor and degraded, dominated by communities of eutrophic water with Lemnaceae, *Ceratophyllum* and *Sparganium erectum* prominent. Although some species were present typical of **3260** 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation', the diagnostic Batrachian *Ranunculus* species and *Callitriche* species themselves were absent. Where more diverse aquatic vegetation was present, near the villages of Cătunu and Sericu, the communities were those of still water and were more closely related to Natura 2000 type **3150** 'Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* – type vegetation'. However, with the possible exception of a site at Sericu with *Trapa natans*, no examples were of a high biodiversity standard.

The N2K habitat **6430** 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' is much over-recorded in Europe, especially in lowland and lower hill districts. As is clear from Doniţă et al. (2005), those Romanian habitat types that are part of this Habitats' Directive category are all typical of higher altitudes, indeed the montane zones. The Interpretation Manual (EUR28) and Gafta & Mountford (2008) comment that there are related tall-herb vegetation fringes by many lowland rivers (such as the Glavacioc) but that this is largely composed of nitrophilous communities "comprising only basal, common species" which have no conservation priority. Examination of standard data-forms for SCIs shows that habitat type **6430** has been mistakenly recorded in several lowland areas in Romania, though compilers should not be criticised too much as the official description is somewhat ambiguous.

Using the more detailed and specifically Romanian classification of Doniţă et al. (2005), much of the still-water habitat in the system seems to be closest to type **R2202** (Danubian communities with *Lemna minor, L. trisulca, Spirodela polyrhiza* and *Wolffia arrhiza*) and the presence of *Ceratophyllum demersum,* as well as marginal *Phragmites* and *Sparganium erectum* is consistent with that habitat type. Most of the diagnostic species of type **R2205** (Danubian communities with *Hydrocharis morsus-ranae, Stratiotes aloides* and *Utricularia vulgaris*) and **R2208** (Danubian communities with *Ranunculus aquatilis* and *Hottonia palustris*) were not observed and we may assume that both these habitat types are absent. The most diverse aquatic vegetation seen in the Glavacioc and its tributaries bears a slight resemblance to mixed *Potamogeton* vegetation of type **R2206** (Danubian communities with *Potamogeton perfoliatus, P. gramineus, P. lucens, Elodea canadensis* and *Najas marina*) but the correspondence is insufficient to confirm the presence of this habitat. Though a possible slight saline influence was noted at one site (*Althaea officinalis* and *Trifolium fragiferum*), none of the more characteristic species of brackish water were seen, and we may thus discount the type **R2210** (Danubian communities with *Bolboschoenus maritimus* and *Schoenoplectus tabernaemontani*).

Drawdown vegetation was seen quite frequently along the rivers but only with very small extent and with none of the distinctive assemblage of **R2211** (Danubian communities with *Cyperus fuscus* and *C. flavescens*). However, we may be fairly certain that one drawdown habitat is scattered in the basin i.e. **R5312** (Ponto-Danubian communities with *Bidens tripartita, Echinochloa crus-galli* and *Polygonum hydropiper*) since its dominants and several characteristic species grew together.

The following list (Table 1) is not a full inventory of plant species observed during the field assessment but does indicate the typical phytosociological communities (information derived from Sârbu et al., 2013) and habitats within which they occurred, and the sites where they were noted. The list is compiled in taxonomic order, following Sârbu et al. (2013).

Ceratophyllum demersum (Family Ceratophyllaceae): typical of the *Potamion* and *Potametalia*, and a frequent plant in Romanian habitat **R2206**. In the Glavacioc basin, often dominant in still water, especially in backwaters of the rivers [Sites Gl, Că, Ba, Bl, Câ, Se].

Trapa natans (Family Trapaceae): in still water communities of the *Nymphaeion* and Romanian habitats types **R2202, R2205** and **R2206**. Though widely distributed in still and slow-moving water in the Romanian plain, this is a local and specialised species in Europe, and the Romanian sites are of biodiversity value. Only seen in one place, within a length of the Sericu River near Sericu village, where the road bridge impedes the flow (44°17'04.0"N 25°26'30.9"E) (Fig. 2).

Berula erecta (Family Apiaceae): in swamps and marshes of the *Phragmition, Magnocaricion* and *Glycerio-Sparganion*. In Glavacioc, most common at the upstream end of the river nearing its source, where it formed patches in shallow water at the edge of the flowing river. [Site SM] (Fig. 3)

Table 1. Main dominant aquatic species and others of ecological importance recorded along the river Glavacioc

SPECIES	Ștefan cel Mare	Glavacioc	Cătunu	Butești	Puranii de Sus	Baciu	Blejești	Videle	Crevenicu	Merenii de Sus	Letca Veche	Ghimpați	Câlnișteа	Sericu
Abbreviation	SM	Gl	Că	Bu	P	Ba	Bl	V	Cr	M	LV	Gh	Câ	Se
Alisma plantago-aquatica L.			1											
Berula erecta (Huds.) Coville	3													
Butomus umbellatus L.												+		
Carex riparia Curtis			2				2	1	2		2		1	
Ceratophyllum demersum L.		1	2			4	2	+	1	1			2	4
Echinochloa crus-galli (L.) Beauv.			+							+				
Glyceria maxima (Hartm.) Holmb.							2							
Leersia oryzoides (L.) Sw.			1											
Lemna sp. cf *minor* L.		2	3	1	2	4	2	2	2	5	5	4	5	
Mentha aquatica L.											+			
Phragmites australis (Cav.) Steud.			2			2	2	2	2			3	1	2
Polygonum hydropiper L.											+			
Potamogeton nodosus Poir.			1											
Sagittaria sagittifolia L.										1	1	2		
Schoenoplectus lacustris (L.) Palla			1											
Sparganium erectum L. em. Rchb.	2		2	+		2	2	1	+		2	2		
Spirodela polyrhiza (L.) Schleid.			1											
Trapa natans L.														3
Typha latifolia L.	2		2	1	1		1	1			1	2	1	
Veronica anagallis-aquatica L.	2													

Fig. 2: Distribution of *Trapa natans* on Sericu River (tributary of Glavacioc River).

Fig. 3: Drone image with the distribution of *Berula erecta* (in red frame) toward the source of the Glavacioc river (Ștefan cel Mare).

Alisma plantago-aquatica (Family Alismataceae): found in shallow and still (or slow-moving) water and on the muddy banks of the drawdown zone in vegetation of the *Phragmititi-Magnocaricetea* and *Bidention*. Near the Glavacioc river and its tributaries, it grew in shallows, on gently-sloping wet banks and in seasonally-flooded depressions in riparian scrub or woodland [Site Că].

Sagittaria sagittifolia (Family Alismataceae): morphologically variable and able to grow in flowing or standing water over a range of depths in communities of *Sagittario-Sparganietum, Phragmition, Oenanthion aquaticae* and *Potamion e.g* Romanian habitats **R2202** and **R2205**. Frequent at the edge of rivers in the Glavacioc basin, usually in still water but occasionally as submerged leaves in the flowing portions [Sites M, LV, Gh].

Butomus umbellatus (Family Butomaceae): mainly in still backwaters of rivers and canals (and lakes), but also in slow-moving water of

rivers (*Phragmition* and *Oenanthion aquaticae*). Occasional in rivers of the Glavacioc basin, possibly commoner near the source [Site Gh].

Potamogeton nodosus (Family Potamogetonaceae): in gently flowing water of rivers in vegetation of the *Potametalia* and *Ranunculion fluviatilis*, including N2K habitat **3260** and Romanian habitat **R2206**. Though possibly present downstream, only noted in this survey in the headwaters of the river near Cătunu.

Schoenoplectus lacustris (Family Cyperaceae): morphologically variable and able to grow as an emergent in still or slow-moving water, or submerged in more rapid rivers within communities of the *Phragmition*. Scattered as small patches in the rivers of the Glavacioc basin [Site Că].

Carex acutiformis and *C. riparia* (Family Cyperaceae): these two *Carex* species occur in similar habitats and often grow together in shallow still water at the edge of rivers and pools, or in marshes (sometimes where shaded) – communities of *Magnocaricion elatae, Alnetea glutinosae, Caricenion gracilis* and *Caricenion rostratae*. In the Glavacioc basin, they were most common at the margins of the rivers but also grew in adjacent marshes, especially where these were liable to river-flooding [mainly in Sites Că, Bl, Cr, LV].

Sparganium erectum (Family Sparganiaceae): in fringing communities to water-bodies (*Glycerio-Sparganion*) and in tall swamps (*Phragmition*). In the Glavacioc river system, this plant often defined a shallow-water zone at the edge of the rivers, though it also grew on wet banks [Sites SM, Că, Ba, Bl, LV, Gh].

Typha species (probably mainly *T. latifolia*) (Family Typhaceae): grow in shallow still water, in swamps and also colonise wet mud and sand forming communities of *Phragmiti-Magnocaricetea* and *Phragmition*. In the Glavacioc basin, often forming large patches in backwaters of the rivers [mainly in Sites SM, Că, GH].

Leersia oryzoides (Family Poaceae): patch-forming grass in the transition from shallow edges of rivers or pools (*Glycerio-Sparganion*) to the drawdown zone of wet shores (*Bidentetalia*). Probably frequent on gently sloping river-shores throughout Glavacioc basin but only confirmed at Cătunu.

Phragmites australis (Family Poaceae): the chief dominant grass of many swamps, tall fens and margins of rivers and lakes, including sites that are somewhat saline (communities of *Phragmiti-Magnocaricetea, Phragmition* and *Scorzonero-Juncion gerardii*). Abundant in many parts of the Glavacioc basin, usually in fringing swamps in shallow water but also in still water of backwaters and adjacent pools and marshes [Sites Că, Ba, Bl, V, Cr, Se, dominating in Gh] (Fig. 4).

Spirodela polyrhiza (Family Lemnaceae): common in still water in communities of the *Lemnion minoris* (including Romanian habitat **R2202**). Likely to be frequent with *Lemna minor* in most sites in the rivers, but only certainly seen near Cătunu.

Fig. 4: Drone image with the distribution of *Phragmites australis* and *Lemna minor* in Baciu (left) and Merenii de Sus (right).

Lemna minor (Family Lemnaceae): common in still water vegetation of the *Lemnetalia* (*e.g.* habitat **R2202**). In most lengths of the rivers examined in the Glavacioc basin, *Lemna* dominated most of the width (the flow was seldom sufficient to break up the floating carpets). Although only *Lemna minor* was recorded, the related *L. gibba* is likely to have been present and can be difficult to distinguish in forms without the inflated cells under the frond. [Sites Bu, Ba, Gh, dominating in M, LV, Că] (Fig. 4).

The Glavacioc River is mainly polluted by nitrates from agriculture (excessive fertilisation with mineral nitrogen fertilisers), husbandry (mismanagement of manure) and/or human waste (Lăcătușu et al., 2019a, b). From its source to discharge into the River Câlnișteа, the vegetation becomes increasingly nitrophilous and ruderal (Onete et al., 2022).

Conclusions

All aquatic plant species and habitats are highly affected by human activities. The past or present (pressures) and future or foreseeable (threats) human and/or natural influences can have a cumulative or individual impact upon the long- or medium-term viability of the habitat and/or species. These pressures and threats are multiple and very diverse along the Glavacioc River: spatial planning, agricultural practices, forestry, random natural changes, management practices, pollution, etc. Aquatic habitats and plant diversity vary along the river from upstream to downstream, becoming less diverse downstream. In areas close to settlements, the pressures upon aquatic habitats are high due to human impacts that can lead to the disappearance of the aquatic habitats. Away from settlements, where the river forms shallow or deeper wetlands, the plant species become more diverse. Both by tributaries of the Glavacioc and in more extensive wetland areas, some more demanding species (more sensitive to anthropogenic impacts) species may become dominant (e.g. Sericu).

Acknowledgements. Our special thanks go to George C. Onete who joined us in the field and provided us with drone images. The data were obtained in the framework of Contract 43PCCDI/2018, financed by UEFISCDI in Complex Partnership project PN-III-1.2-PCCDI-2017–0721 (INTER-ASPA). The paper was prepared in the framework of project RO1567-IBB01 of the Institute of Biology Bucharest of the Romanian Academy, financed by Romanian Academy.

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The analysis of the Ranunculaceae collection from The Herbarium of Mureș County Museum, Natural Sciences Department (Romania)

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Abstract: The paper presents a revision and analysis of the Ranunculaceae family species in the Herbarium of Mureș County Museum. A number of 781 herbarium sheets with 931 specimens were taken into consideration. The analysis showed 77 taxa including 65 species, 6 subspecies, and 6 hybrids. The Herbarium of the museum represents an important database for studies because 18 out of 21 genera from the Ranunculaceae family described in our country are stored in the Museum's Herbarium. Most of the Herbarium sheets hold specimens collected from Mureș and Harghita counties. Among the analyzed species some have different threat statuses. The Herbarium of Mureș County Museum plays a pivotal role in preserving and documenting the biodiversity of Romania.

Keywords: Herbarium, botanical collection, Ranunculaceae family

Introduction

Museum and herbarium collections are requisite groundworks for scientific research, providing references for taxonomy, helping in identifying the components of biodiversity, and serving as repositories of material for future study (Figueira & Lages, 2019). The Herbarium of Natural Sciences Department of Mureș County Museum comprises about 20,000 individual samples and provides a basis for exhibitions, teaching, and research. The specimens come from acquisitions, donations, and collections. All these different sources make for a very diverse, geographically broad, herbarium collection with a focus on the Romanian flora. The Museum's Herbarium is managed in two sections: The "higher" (vascular) plants collection and the "lower" plants collection which includes bryophytes (mosses and liverworts), lichens, fungi, and algae. Each section is managed by a curator. The physical material of the botanical collection consists mainly of pressed plants mounted on herbarium sheets and a separate collection of dried fruits and seeds.

The collection covers a broad geographical range with collections from all over the country and some sheets coming from abroad, such as countries like Albania, Austria, Bulgaria, Germany, Ukraine, etc. The botanical collections of the Museum are rich in historical material, with the oldest sheets dating back to 1872, which belong to a collection received from the Băgaciu School (Mureș County). The Herbarium includes specimens collected by personalities of Romanian botany. Because the specimens were collected by a number of outstanding Romanian botanists, this highlights the memorial importance of the collection and preserving the valuable information contained in the specimens.

Specimens have been dried, mounted, and filed according to widely accepted, international standards. The labels record information about where, when, and by whom each specimen was collected and identified with

some labels mentioning notes on the specimen's ecology.

The data of these collections are being continuously entered into the digital database, which is now a tool for herbarium management and research.

Material and methods

The majority of the vascular plants or "higher" plants collection consists of more than 12,000 herbarium sheets, seeds, and fruits of wild and cultivated plants and samples of wood (Sămărghițan, 2019). This study aimed to analyze and revise the Ranunculaceae family in the Herbarium. The study has been based on a review of 781 herbarium sheets counting 931 specimens.

Each label was analyzed, and the nomenclature was updated considering the recent literature (Euro+Med (2006+), Sârbu et al., 2013). For identification and synonymy, the Romanian Flora (Săvulescu, 1953) and Flora Europaea (Tutin et al., 1993) were consulted. The nomenclature is consistent with the international code (McNeill et al., 2012).

In the checklist, the genera and species are listed in alphabetical order. For each species, the status of vulnerability was mentioned. This is consistent with EUNIS classification and the national and international red lists (Dihoru & Dihoru, 1993–1994, Boșcaiu et al., 1994, Olteanu et al., 1994, Oprea, 2005, EC, 2007, Dihoru & Negrean, 2009, Mihăilescu et al., 2015; IUCN, 2022).

The record numbers of the herbarium sheets in Inventory Registries "Higher Plants (I, II, and III)" of the Natural Sciences Department was mentioned in square brackets.

Abbreviations: Counties/Countries: AB-Alba, BH – Bihor, BN – Bistrița Năsăud, BV – Brașov, CJ – Cluj, CS – Caraș Severin, CT – Constanța, CV – Covasna, HD – Hunedoara, HR – Harghita, IF – Ilfov, IS – Iași, MM – Maramureș, MS – Mureș, NT – Neamț, SB – Sibiu, SJ – Sălaj, SV – Suceava, TM – Timiș, VL – Vâlcea, HU – Hungary, MD – Republic of Moldova, UA – Ukraine.

Threat status: R – rare; LC – Least Concern; DD – Data deficient; NT – near threatened

leg. – legit, collected by

det. – determined by

rev. – revised by

IMF – Institute of Medicine and Pharmacy

Results and discussions

The Ranunculaceae family in The Museum's Herbarium includes 18 genera with 77 taxa (65 species, 6 subspecies, and 6 hybrids), representing 86% of the total genera included in the flora of Romania in this family (21 genera according to Sîrbu et al., 2013).

Among the species in the Museum's Herbarium, we note some rare, vulnerable species like *Aconitum napellus*, *Adonis vernalis*, *Aquilegia nigricans* subsp. *nigricans*, *Pulsatilla patens, Pulsatilla pratensis*, *Pulsatilla vulgaris*, *Pulsatilla vulgaris* subsp. *grandis*, *Ranunculus aquatilis*, *Ranunculus carpaticus.* There are also endemic species such as *Aconitum moldavicum*, *Aquilegia transsilvanica*, *Delphinium simonkaianum* var. *psilocarpum*, and *Hepatica transsilvanica*.

The Herbarium consists of a rich database that reflects the biodiversity of a habitat at the time the specimen was collected. With these biodiversity data compiled into a database, scholars and individuals will be able to appreciate the dynamic nature of the species geographical range over time.

The specimens were collected from 20 counties in Romania. Besides these, there are several herbarium sheets with specimens collected from abroad (Hungary, The Republic of Moldova, and Ukraine). The area where the collection took place covers mostly the territory of Mureș (416 records) and Harghita (231 records) counties (Fig. 1).

Concerning the date of collection, the oldest herbarium sheet dates back to 1872. Most of the plants were collected during 1931–1949 (Fig. 2). A large part of the collection comes

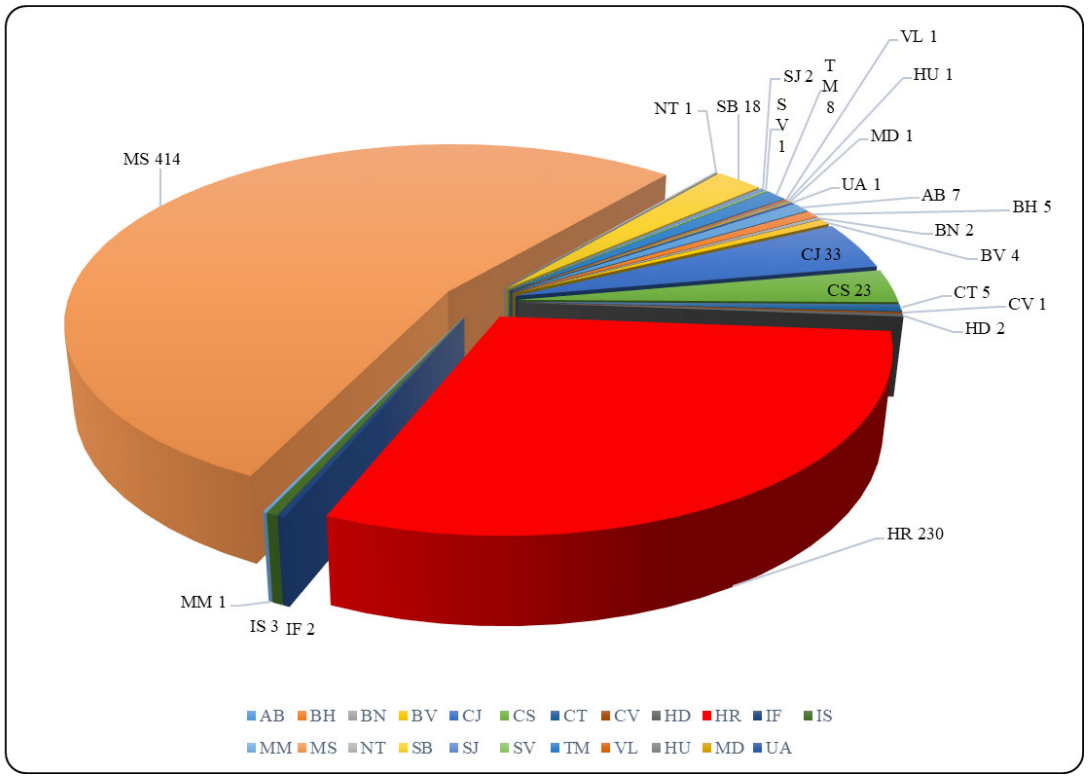

Fig. 1: Proportion of the herbarium collection from differing geographical locations (Romanian counties and abroad).

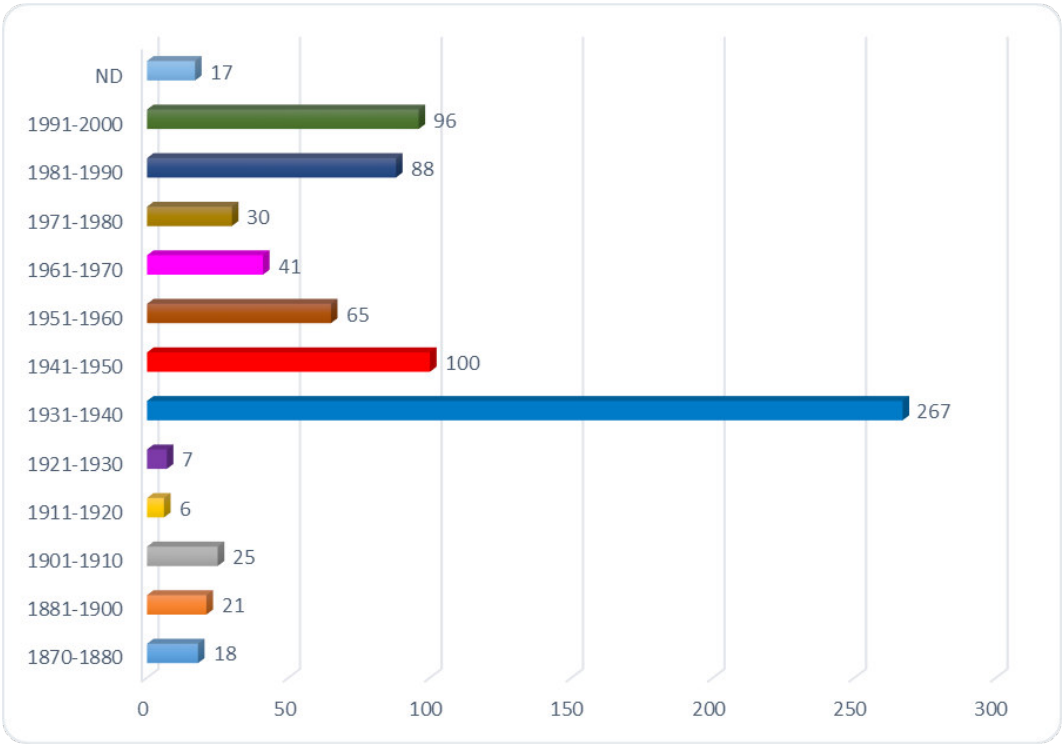

Fig. 2: Variation in collecting intensity over time as measured by the date of herbarium sheets.

from the "Nagy Ödön" collection that was purchased by the museum in 1960 (Oroian, 1995). Some of the sheets from this collection have annotations by professor E.I. Nyárády.

Conclusions

The Ranunculaceae Family in the Herbarium of Mureș County Museum consists of 951 specimens preserved on 781 herbarium sheets. The variety of the collection is pointed out by the 18 genera representing 86% of the total genera in Romania's flora.

The museum's collection of Ranunculaceae has proven to be an important database due to the variety of collecting places, the ages of specimens, and the collectors represented by famous Romanian botanists. The oldest sheets date back to 1872. Besides these, we note the presence of 40 herbarium sheets collected before 1901, highlighting the Herbarium's historical importance. The number of endemics, rare, and threatened species identified in the collection augments the conservation and scientific importance of the Herbarium.

The checklist of Ranunculaceae collection

***Aconitum anthora* L.**
- Lacul Roșu (HR), August 11, 1937, leg. et det. Nagy Ödön [3742]
- Lacul Roșu (HR), August 21, 1937, leg. et det. Nagy Ödön [3743]
- Lacul Roșu (HR), September 28, 1941, leg. et det. Nagy Ödön [3744]
- October 15, 1921, leg. et det. Heinrich Höhr [5121]
- Săbed, natural reserve (MS), September 16, 1989, leg. et det. Silvia Oroian [7295]
- Hăghimașul Mare Mt. (HR), July 28, 1967, leg. et det. Kónya István [7296]
- Hăghimașul Mare Mt. (HR), September 1, 1967, Kónya István [7297]
- Lacul Roșu (HR), September 1, 1966, leg. et det. Kónya István [7298]
- Săbed, Stațiune (MS), September 4, 1960, Ion Patachi [8068]
- Lacul Roșu, Suhardu Mic Mt. (HR), September 1974, leg. et det. I. Gergely [8726]

***Aconitum bucovinense* Zapał.** (as *Aconitum firmum* Rchb. subsp. *bucovinense* (Zap.) A. et G.)
- Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön [3745]
- Cheile Bicazului (HR), August 11, 1941, leg. et det. Nagy Ödön [3746]
- Cheile Bicazului (HR), August 07, 1941, leg. et det. Nagy Ödön [3747]
- Lacul Roșu, Cheile Bicazului (HR), August 17, 1938, leg. et det. Nagy Ödön [3748]
- Cheile Bicazului, (HR), August 22, 1940, leg. et det. Nagy Ödön [3749]
- Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön [3750]
- Cheile Bicazului (HR), August 16, 1940, leg. et det. Nagy Ödön [3751]

***Aconitum degenii* Gáyer** (as *Aconitum paniculatum* Lam.)
- Lacul Roșu, Făgetul Ciucului (HR), August 10, 1937, leg. et det. Nagy Ödön, rev. E.I. Nyárády [3806]
- Lacul Roșu (HR), August 1938, leg. et det. Nagy Ödön [3807]
- Lacul Roșu (HR), August 11, 1938, leg. et det. Nagy Ödön [3808]
- Lacul Roșu (HR), August 17, 1938, leg. et det. Nagy Ödön [3809]
- Lacul Roșu (HR), August 22, 1938, leg. et det. Nagy Ödön [3810]
- Lacul Roșu (HR), 1938, leg. et det. Nagy Ödön [3811]
- Lacul Roșu (HR), August 11, 1938, leg. et det. Nagy Ödön [3812]
- Lacul Roșu (HR), August 1938, leg. et det. Nagy Ödön [3813]
- Lacul Roșu (HR), August 22, 1938, leg. et det. Nagy Ödön [3814]
- Lacul Roșu, Surduc (HR), August 19, 1941, leg. et det. Nagy Ödön [3815]
- Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön [3816]
- Lacul Roșu (HR), August 8, 1938, leg. et det. Nagy Ödön [3817]
- Stâna de Vale (BH), May 4–5, 1963 [9325]

***Aconitum firmum* Rchb.**

– Lacul Roșu, Cheile Bicazului (HR), August 18, 1948, leg. et det. Nagy Ödön [3759]
– Colţii Trascăului near Remetea (AB), July 1952 leg. et det. I. Gergely (as *Aconitum callibotryon* Rchb.) [8731]
– Domogled Mt., Băile Herculane (CS), July 22, 1962, leg. et det. I. Gergely (as *Aconitum callibotryon* Rchb.) [8732]
– Suhardul Mic Peak (HR), August 11, 1941, leg. et det. Nagy Ödön (as *Aconitum firmum* Rchb. f. *callibotryum*), rev. E.I. Nyárády [3758]
– Vlădeasa Mt., Valea Zârnei, in the forest (CJ), July 6, 1968, leg. et det. I. Gergely (as *Aconitum callibotryon* Rchb. subsp. *scărişorensis* (Gay.) G. Grinț.) [8727]

Aconitum lasiocarpum (Rchb.) Gáyer (as *Aconitum toxicum* Rchb. subsp. *lasiocarpum* Gay.)

– Făgăraș Mt., Bâlea Cascadă (BV), August 11, 1956 [9343]

Aconitum lycoctonum L. subsp. ***vulparia*** (Spreng.) Ces.

– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3786]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3787
– Cheile Bicazului (HR), 1940, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3788]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3789]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3790]
– Lacul Roșu, Cheile Bicazului (HR), July 31, 1940, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3791]
– Lacul Roșu, Cheile Bicazului (HR), July 31, 1940, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3792]
– Lacul Roșu, Cheile Bicazului (HR), July 31, 1940, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.) [3793]
– Lacul Roșu, Cheile Bicazului (HR), July 31, 1940, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.) [3794]
– Lacul Roșu (HR), July 24, 1939, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.) [3795]
– Lacul Roșu, Cheile Bicazului (HR), July 24, 1938, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.) [3796]
– Lacul Roșu (HR), July 24, 1939, leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.) [3797]
– Lacul Roșu (HR) leg. et det. Nagy Ödön (as *Aconitum lasianthum* (Rchb.) Simonk.), rev. E.I. Nyárády [3798]
– Lacul Roșu (HR), July 24, 1937, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3818]
– Lacul Roșu (HR), July 24, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3819]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.), rev. E.I. Nyárády [3820]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3821]
– Cheile Bicazului (HR), August 7, 1938, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.), rev. E.I. Nyárády [3822]
– Lacul Roșu (HR), August 17, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.), rev. E.I. Nyárády [3824]
– Cheile Bicazului (HR), July 24, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3825]
– Lacul Roșu (HR), July 24, 1939, leg. et

det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3826]
– Lacul Roșu (HR), July 24, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3827]
– Lacul Roșu, Cheile Bicazului (HR), July 24, 1939, leg. et det. Nagy Ödön (as *Aconitum puberulum* (Ser.) Grinț.) [3828]
– Vlădeasa Mt., Valea Zârnei (CJ), July 6, 1968, leg. et det. I. Gergely (as *Aconitum vulparia* Rchb. F. *richteri* Gáy) [8728]
– Lacul Roșu (HR), July 31, 1940, leg. et det. Nagy Ödön (as *Aconitum vulparia* Rchb.) [8066]
– Lunca Bradului, Valea Ilvei (MS), August 8, 1995, leg. et det. Silvia Oroian (as *Aconitum vulparia* Reichenb.) [8147]

Aconitum moldavicum Hacq. (syn. *A. lycoctonum* L. subsp. *moldavicum* (Hacq.) Jalas) (End. Carp.)
– Târgu Mureș, on the base of Halmok Hill (MS), September 14, 1938, leg. et det. Nagy Ödön [2250]
– Gheorghe Doja (MS), May 17, 1937, leg. Szekely I., det. Nagy Ödön [2251]
– Lacul Roșu (HR), July 9, 1937, leg. et det. Nagy Ödön [3799]
– Leg. et det. Nagy Ödön, rev. E.I. Nyárády, 1936 [3800]
– Lacul Roșu, Cheile Bicazului (HR), July 20, 1937, Nagy Ödön [3801]
– Lacul Roșu (HR), 1936, leg. et det. Nagy Ödön [3802]
– Lacul Roșu, Cheile Bicazului (HR), August 6, 1938, leg. et det. Nagy Ödön [3803]
– Cheile Bicazului (HR), August 2, 1939, leg. et det. Nagy Ödön [3804]
– Lacul Roșu (HR), July 25, 1939, leg. et det. Nagy Ödön [3805]
– Săbed, Lechința forest (MS), July 9, 1980, leg. et det. Silvia Oroian [7300]
– Borsec (HR), August 20, 1959, leg. et det. Ion Patachi [8069]
– Lunca Bradului – Neagra (MS), June 14, 1994, leg. et det. Silvia Oroian [8070]
– Piatra Urdașului Mt., near Colțești (AB), July 8, 1960, leg. et det. I. Gergely [8725]
– Valea Feneșului, forest, Dâmbu (AB), July 3, 1962, leg. et det. I. Hodișan (as *Aconitum moldavicum* Hacq. var. *australe* (Rchb.) Gáy.) [9521]

Aconitum moldavicum Hacq. **subsp**. ***hosteanum*** (Schur) Graebn. & P. Graebn. (as *Aconitum hosteanum* Schur)
– Făgăraș Mt., Lacul Bâlea (SB), September 15, 1980, leg. et det. I. Gergely [8952]

Aconitum napellus L. (LC)
– Târgu Mureș, Botanical Garden of IMF (MS), June 14, 1980, leg. et det. Silvia Oroian [7301]

Aconitum tauricum **Wulfen** (syn. *Aconitum napellus* subsp. *tauricum* (Wulfen) Gáyer)
– Cheile Bicazului (HR), August 7, 1938, leg. et det. Nagy Ödön, rev. E.I. Nyárády, [4448]
– Lacul Roșu, Cheile Bicazului (HR), July 19, 1936, leg. et det. Nagy Ödön [4449]
– Lacul Roșu, Cheile Bicazului (HR), August 31, 1939, leg. Nagy Ödön, det. Mihaela Sămărghițan [4450]
– Lacul Roșu, Cheile Bicazului (HR), August 5, 1937, leg. et det. Nagy Ödön [4451]
– Cheile Bicazului (HR), August 6, 1938, leg. et det. Nagy Ödön, rev. E.I. Nyárády [4452]
– Lacul Roșu (HR), September 1, 1966, leg. et det. Kónya István [7299]
– Vlădeasa Mt. (CJ), October 7, 1969, leg. et det. I. Gergely (as *Aconitum tauricum* Wulf. ssp. *koelleanum* (Rchb.) Gay) [8730]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3761]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3762]
– Cheile Bicazului (HR), August 22, 1940,

leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3763]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3764]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3765]
– Cheile Bicazului (HR), August 15, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3766]
– Cheile Bicazului (HR), August 15, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3767]
– Cheile Bicazului (HR), August 15, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3768]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3769]
– Lacul Roșu (HR), August 16, 1938, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3778]
– Lacul Roșu, Cheile Bicazului (HR), September 2, 1939, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3779]
– Lacul Roșu (HR), August 17, 1938, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3780]
– Lacul Roșu (HR), August 1938, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3781]
– Lacul Roșu (HR), August 6, 1938, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3782]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3783]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum hayekianum* Gay.) [3823]
– Făgăraș Mt., Valea Doamnei (BV), September 3, 1969, leg. et det. I. Gergely (as *Aconitum tauricum* Wulf. subsp. *nanum* (Baumg.) Gáv.) [8733]
– Făgăraș Mt., Lacul Bâlea (SB), September 15, 1980, leg. et det. I. Gergely (as *Aconitum tauricum* Wulf. subsp. *nanum* (Baumg.) Gáv.)) [8953]
– Cheile Bicazului (HR), August 20, 1941, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3752]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3760]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön, rev. E.I. Nyárády (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3770]
– Cheile Bicazului (HR), July 6, 1938, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3771]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3772]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3773]
– Lacul Roșu, Cheile Bicazului (HR), August 19, 1938, leg. et det. Nagy Ödön, rev. E.I. Nyárády (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3774]
– Lacul Roșu, Cheile Bicazului (HR), August 8, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3775]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3776]
– Lacul Roșu (HR), July 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [3777]
– Podul Calului Mt. (HR), September 19, 1942, leg. et det. Nagy Ödön, rev. E. I. Nyárády, (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár. var. *edmundi* Nagy et Nyár.) [4444]
– Lacul Roșu, Cheile Bicazului (HR), August

19, 1938, Nagy Ödön, rev. E. I. Nyárády, July 24, 1939 (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár. Var. *edmundi* Nagy et Nyár.) [4445]
– Lacul Roșu, Cheile Bicazului (HR), August 30, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4439]
– Lacul Roșu, Cheile Bicazului (HR), August 19, 1938, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4440]
– Lacul Roșu, Cheile Bicazului (HR), August 1938, leg. et det. Nagy Ödön, rev. E.I. Nyárády, (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4441]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4442]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4443]
– Lacul Roșu, Cheile Bicazului (HR), September 2, 1930 leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4446]
– Cheile Bicazului (HR), May 26, 1939, leg. Nagy Ödön, det. E.I. Nyárády (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4447]
– Cheile Bicazului (HR), May 26, 1939, leg. Nagy Ödön, det. E.I. Nyárády (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4453]
– Cheile Bicazului (HR), August 11, 1941, leg. et det. Nagy Ödön, rev. E.I. Nyárády (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4454]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4455]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4456]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4457]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4458]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4459]
– Lacul Roșu (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4460]
– Lacul Roșu, Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4461]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4462]
– Lacul Roșu (HR), August 12, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4463]
– Lacul Roșu, Cheile Bicazului (HR), September 28, 1941, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4464]
– Lacul Roșu, Cheile Bicazului (HR), August 20, 1941, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4465]
– Cheile Bicazului (HR), August 11, 1941, leg. et det. Nagy Ödön, rev. E.I. Nyárády (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4466]
– Cheile Bicazului (HR), August 11, 1941, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4467]
– Cheile Bicazului (HR), August 7, 1942,

leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4468]
– Cheile Bicazului (HR), September 17, 1942, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4469]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4470]
– Cheile Bicazului (HR), September 2, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4471]
– Cheile Bicazului (HR), September 2, 1941, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4472]
– Cheile Bicazului (HR), September 2, 1941, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4473]
– Lacul Roșu, Bicaz stream (HR), September 2, 1939, Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4474]
– Lacul Roșu, Cheile Bicazului (HR), September 2, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4475]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4476]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4477]
– Lacul Roșu (HR), September 2, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4478]
– Lacul Roșu, Cheile Bicazului (HR), August, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4479]
– Lacul Roșu, Cheile Bicazului (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4480]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4481]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4482]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4483]
– Lacul Roșu (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4484]
– Lacul Roșu, Cheile Bicazului (HR), August 5, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4485]
– Lacul Roșu (HR), August 6, 1939, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4486]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4487]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4488]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4489]
– Lacul Roșu, Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4490]
– Lacul Roșu, Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4491]

– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4492]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4493]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4494]
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön (as *Aconitum tauricum* Wulf. subsp. *remotisectum* Nagy et Nyár.) [4495]

***Aconitum toxicum* Rchb.**

– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön [4306]
– Lacul Roșu, altit. 950 m, (HR), July 27, 1936, leg. et det. Nagy Ödön [4307]
– Cheile Bicazului, altit. 950 m (HR), August 7, 1942, leg. et det. Nagy Ödön [4308]
– Lacul Roșu, Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön [4312]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön [4313]
– Suhardul Mare Peak (HR), 08 August 1940, leg. et det. Nagy Ödön [4314]
– Lacul Roșu (HR), August 24, 1940, leg. et det. Nagy Ödön [4316]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön [4317]
– Cheile Bicazului (HR), August 24, 1940, leg. et det. Nagy Ödön [4318]
– Lacul Roșu (HR), August 10, 1941, leg. et det. Nagy Ödön [4319]
– Lacul Roșu, altit. 1000 m (HR), August 19, 1938, leg. et det. Nagy Ödön [4320]
– Lacul Roșu, altit. 950 m (HR), August 5, 1936, leg. et det. Nagy Ödön [4324]
– Lacul Roșu (HR), August 1938, leg. et det. Nagy Ödön [4326]
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön [4328]
– Vlădeasa Mt., Valea Zârnei (CJ), July 6, 1968, leg. et det. I. Gergely [8729]
– Lacul Roșu, altit. 900 m (HR), August, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4304]
– Lacul Roșu, Cheile Bicazului (HR), August, 1939, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4305]
– Lacul Roșu, altit. 1000 m, (HR), August 22, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4309]
– Lacul Roșu, altit. 1000 m, (HR), August 22, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4310]
– Lacul Roșu, altit. 850 m, (HR), August 17, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4311]
– Lacul Roșu (HR), August 12, 1940, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4315]
– Lacul Roșu, Cheile Bicazului (HR), 1939, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4321]
– Lacul Roșu, Cheile Bicazului, altit. 880 m, (HR), August 19, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4322]
– Lacul Roșu, altit. 980 m, (HR), August, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4323]
– Lacul Roșu, Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4325]
– Lacul Roșu, altit. 1000 m, (HR), August 13, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4327]
– Lacul Roșu, altit. 950 m, (HR), August, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4329]
– Lacul Roșu, altit. 980 m, (HR), August, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4330]

– Lacul Roșu, altit. 900 m, (HR), August, 1938, leg. et det. Nagy Ödön (as *Aconitum toxicum* Rchb. subsp. *schurii* Beck.) [4331]

***Aconitum variegatum* L.**
– Sânmărtin, "Grădina lui Novak" (HR), July 27, 1940, leg. et det. Nagy Ödön [4332]
– Sânmărtin, "Grădina lui Novak" (HR), July 27, 1940, leg. et det. Nagy Ödön [4333]
– Sânmărtin, "Grădina lui Novak" (HR), July 27, 1940, leg. et det. Nagy Ödön [4334]

***Aconitum* x *cammarum* L.**
– Târgu Mureș (MS), July 10, 1960, leg. Ion Patachi, det. Silvia Oroian (as *Aconitum stoerkianum* Rchb.) [8146]
– September 15, 1910, leg. et det. Heinrich Höhr (as *Aconitum camarum* L.) [5122]

Aconitum remotisectum* x *paniculatum
– Cheile Bicazului (HR), August 11, 1941, leg. et det. Nagy Ödön [3754]

Aconitum firmum* x *remotisectum
– Cheile Bicazului (HR), August 22, 1940, leg. et det. Nagy Ödön [3753]

***Aconitum* x *baumgartenianum* Simonk. (*Aconitum lasianthum-moldavicum*)**
– Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön [3784]
– Lacul Roșu, Cheile Bicazului (HR), August 7, 1939, leg. et det. Nagy Ödön [3785]

***Actaea europaea* (Schipcz.) J. Compton (as *Cimicifuga europaea* Schipcz.)**
– Cheile Bicazului (HR), August 8, 1937, leg. et det. Nagy Ödön [4134]
– Cheile Bicazului (HR), July 15, 1956, leg. et det. Nagy Ödön [4135]

***Actaea spicata* L.**
– Târgu Mureș, Cocoșd Forest (MS), May 9, 1936, leg. et det. Nagy Ödön [2249]
– Băgaciu (neighborhood) (MS), 1872 [5489]
– Răstolița, Podirei (MS), June 15, 1994, leg. et det. Silvia Oroian [8063]
– Răstolița, Podirei (MS), May 18, 1995, leg. et det. Silvia Oroian [8064]
– Răstolița (MS), July 3, 1995, leg. et det. Silvia Oroian [8065]
– Orșova, Cătunul Seci (MS), May, 1979, leg. Sarkany Andrei, det. Silvia Oroian [8067]
– Gutinului Mt. (MM), June 3, 1994, leg. Ana Berbecar, det. Mihaela Sămărghițan [8208]
– Cernăuți, Ukraine, May 23, 1943, leg. et det. E. Țopa [9883]
– June 19, 1915, leg. et det. Heinrich Höhr [5123]

***Adonis aestivalis* L.**
– Târgu Mureș, plowing, (MS), April 30, 1939, leg. et det. Nagy Ödön [2238]
– Târgu Mureș, Cocoșd Forest (MS), May 9, 1936, leg. et det. Nagy Ödön [2239]
– Târgu Mureș, at border with Sântana de Mureș, (MS), May 10, 1939, leg. et det. Nagy Ödön [2240]
– Beșa, Târgu Mureș (MS), June 4, 1944, leg. et det. Nagy Ödön [2241]
– Târgu Mureș, Budiu (MS), May 26, 1936, leg. et det. Nagy Ödön [2242]
– Târgu Mureș, near mink farm Corunca (MS), May 30, 1948, leg. et det. Nagy Ödön [2243]
– Târgu Mureș, crops, (MS), 1947, leg. et det. Nagy Ödön [2244]
– Ocna Sibiului (SB), leg. et det. Hannich H. [4798]
– August 11, 1923, leg. Heinrich Höhr det. Mihaela Sămărghițan [5325]
– Școala Generală Băgaciu (MS) [5533]
– Lacul Fărăgău (MS), June 13, 1976, leg. et det. Kónya István [5855]
– Târgu Mureș, Beșa Forest (MS), May 1, 1953, leg. et det. Kónya István [5927]
– Târgu Mureș, Dealul 1 Mai (MS), May 20, 1940, leg. et det. Babos Bertalan [7302]
– Târgu Mureș, Dealul 1 Mai (MS), May 28, 1940, leg. et det. Babos Bertalan [7303]

– Băla-Lefaia (MS), May 15, 1983, leg. et det. Sarkany Judit [7304]
– Idrifaia (MS), May 28, 1961, leg. et det. Kónya István [7305]
– Valea Izvoarelor (MS), May 15, 1988, leg. et det. Silvia Oroian [7306]
– Sântana de Mureș, Dealul Podirei (MS), June 5, 1990, leg. et det. Silvia Oroian [7307]
– Timișoara, crops (TM), June 1945, leg. et det. Kyri Maria Margareta [7923]
– Târgu Mureș (MS), May 28, 1908, leg. Bitai Arpad, det. Nagy Ödön [8071]
– Târgu Mureș, Beșa Forest (MS), May 24, 1936, leg. et det. Nagy Ödön [8072]
– Săbed, grassland (MS), May 22, 1995, leg. Silvia Oroian, det. Mihaela Sămărghițan [8207]
– Sântana de Mureș (MS), May 14, 1994, leg. Elena Godan, det. Mihaela Sămărghițan [8209]
– Târgu Mureș, field (MS), June 10, 1959, leg. et det. Ion Patachi [8330]
– near Cluj, crops (CJ), May 13, 1947, leg. et det. E. Țopa (as *Adonis aestivalis* L. f. *robusta* Zap.) [9534]
– La Trei Cetăți (CJ), May 13, 1947, leg. et det. E. Țopa [10334]
– between Chitila and Săbăreni (IF), June 20, 1945, leg. et det. S. Forstner [10335]
– Cluj (CJ), May 13, 1947, leg. et det. E. Țopa (as *Adonis aestivalis* L. f. *robusta* Zap.) [10475]

***Adonis vernalis* L.** (LC)
– Band, plain (MS), April 14, 1937, leg. et det. Nagy Ödön [2245]
– Porumbeni (MS), April 9, 1947, leg. et det. Nagy Ödön [2246]
– Târgu Mureș, Cocoșd forest clearance (MS), April 20, 1940, leg. et det. Nagy Ödön [2247]
– Târgu Mureș, foot of Halmok Hill (MS), May 10, 1941, leg. Pokory Lenke, det. Nagy Ödön [2248]
– Sibiu, Guștericța (SB), leg. et det. Hannich H. [4797]
– May 1, 1911, leg. et det. Heinrich Höhr [5124]
– Băgaciu (MS) [5532]
– Zau de Câmpie (MS), April 28, 1967, leg. Kónya István, det. Silvia Oroian [5730]
– Târgu Mureș, Botanical Garden of IMF (MS), June 6, 1984, leg. et det. Silvia Oroian [5973]
– Crăiești-Herepea (MS), May 28, 1985, leg. et det. Silvia Oroian [7308]
– Gheja-Luduș (MS), May 3, 1988, leg. et det. Silvia Oroian [7309]
– Băla-Lefaia (MS), May 15, 1983, leg. et det. Silvia Oroian [7310]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian [7311]
– Zau de Câmpie, natural reserve, (MS), April 30, 1991, leg. et det. Silvia Oroian [7340]
– Cluj-Napoca, grasslands (CJ), 1900, leg. et det. Nagy Ödön [7758]
– Târgu Mureș (MS), March 24, 1908, leg. et det. Bitai Arpad [8073]
– Târgu Mureș, Cocoșd Forest (MS), April 25, 1936, leg. et det. Nagy Ödön [8074]
– Zau de Câmpie, natural reserve (MS), April 2, 1994, leg. et det. Mihaela Sămărghițan [8075]
– Hărțău, in the forest (MS), April 12, 1960, leg. et det. Ion Patachi [8076]
– Porumbeni, churchyard (MS), May 7, 1997, leg. Ana Berbecar, det. Mihaela Sămărghițan [8210]
– Cheia (CT), 1995, leg. et det. Marius Făgăraș [8211]
– Pădurea Aroneanu (IS), March 25, 1937 & April 8, 1937, leg. et det. M. Răvăruț et C. Burduja [10119]

***Anemone nemorosa* L.**
– Târgu Mureș, Platoul Cornești (MS), March 30, 1936, leg. et det. Nagy Ödön [2234]
– Târgu Mureș, Căpâlnița (MS), April 27, 1939, leg. et det. Nagy Ödön [2235]
– Lacul Roșu (HR), April 16, 1936, Nagy Ödön [4121]

– Lacul Roșu (HR), May 1, 1948, leg. et det. Nagy Ödön [4122]
– Sibiu, Gușterița (SB), April, 1890, leg. et det. Hannich H. [4801a]
– Pădurea Hoja (CJ), April, 1890, leg. et det. Dr. Odor [4801b]
– April 25, 1916, leg. et det. Heinrich Höhr [5133]
– Băgaciu (neighborhood) (MS), 1872 [5361]
– Băgaciu (neighborhood) (MS), 1872 [5363]
– Băgaciu (neighborhood) (MS), 1872 [5465]
– Săbed, Lechinței Forest (MS), April 23, 1981, leg. Szombath Zoltán, det. Silvia Oroian [5788]
– Târgu Mureș, Dealul 1 Mai (MS), April 20, 1940, leg. et det. Babos Bertalan [7312]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian [7313]
– Crăiești-Herepea (MS), May 28, 1985, leg. et det. Silvia Oroian [7337]
– Răstolița, Listeș (MS), April 12, 1991, leg. et det. Silvia Oroian [7338]
– Gurghiu, grassland (MS), May 4, 1991, leg. et det. Silvia Oroian [7343]
– Gurghiu, Poiana Narciselor (MS), May 4, 1991, leg. et det. Silvia Oroian [7344]
– Răstolița, Podirei, beech forest (MS), April 30, 1995, leg. et det. Silvia Oroian [8077]
– Răstolița, Podirei, beech forest (MS), April 5, 1994, leg. et det. Silvia Oroian [8078]
– Răstolița, Podirei (MS), May 9, 1993, leg. et det. Silvia Oroian [8079]
– Răstolița, Podirei (MS), April 16, 1995, leg. et det. Silvia Oroian [8080]
– Neagra, spruce forest (MS), April 14, 1995, leg. et det. Silvia Oroian [8081]
– Răstolița, Podirei, beech forest (MS), April 8, 1995, leg. et det. Silvia Oroian [8082]
– Răstolița, Podirei, beech forest (MS), May 18, 1995, leg. et det. Silvia Oroian [8083]
– Răstolița, Podirei, beech forest (MS), June 14, 1994, leg. et det. Silvia Oroian [8084]
– Răstolița, Podirei (MS), May 14, 1995, leg. et det. Silvia Oroian [8085]
– Neagra, spruce forest (MS), May 19, 1995, leg. et det. Silvia Oroian [8086]
– Târgu Mureș, Pădurea Rotundă (MS), April 18, 1908, leg. et det. Bitai Arpad [8087]
– Răstolița, Podirei (MS), April 22, 1994, leg. et det. Silvia Oroian [8088]
– Târgu Mureș, Cocoșd Forest (MS), March 14, 1936, leg. et det. Nagy Ödön [8089]
– Gurghiu, grassland (MS), May 4, 1991, leg. et det. Silvia Oroian [8212]
– Gurghiu, Poiana Narciselor (MS), May 16, 1994, leg. et det. Silvia Oroian [8213]
– Porumbeni, churchyard (MS), April 24, 1994, leg. Ana Berbecar, det. Silvia Oroian [8215]
– Târgu Mureș, Dealul 1 Mai (MS), April 20, 1940, Babos Bertalan [8329]
– Repedea, forest (IS), March 28, 1937, leg. et det. M. Răvăruț et C. Burduja [10120]

***Anemone ranunculoides* L.**

– Târgu Mureș, Platoul Cornești (MS), March 8, 1936, leg. Mark Gyozo, det. Nagy Ödön [2230]
– Târgu Mureș, Căpâlnița (MS), March 30, 1937, leg. et det. Nagy Ödön [2231]
– Târgu Mureș, Platoul Cornești (MS), April 16, 1937, leg. et det. Nagy Ödön [2232]
– Târgu Mureș (MS), 1940, leg. et det. Nagy Ödön [2233]
– Băgaciu (neighborhood) (MS), 1872 [5466]
– Săbed, Lechinței Forest (MS), April 23, 1981, leg. Szombath Zoltán, det. Silvia Oroian [5789]
– Târgu Mureș, Platoul Cornești (MS), April 28, 1980, leg. et det. Silvia Oroian [5819]
– Papiu Ilarian, Șandru Forest (MS), May 4, 1988, leg. et det. Silvia Oroian [7314]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian [7315]
– Sântana de Mureș, forest (MS), March 29, 1989, leg. et det. Silvia Oroian [7316]
– Sântana de Mureș, orchard (MS), March 24, 1989, leg. et det. Silvia Oroian [7317]
– Răstolița, Listeș (MS), April 12, 1991, leg. et det. Silvia Oroian [7339]
– Cluj-Napoca, forest (CJ), April 14, 1900, leg. et det. Nagy Ödön [7759]

– Semenic, forest (CS) May 1940, leg. et det. Kyri Maria Margareta [7931]
– Răstolița, Podirei, beech forest (MS), April 22, 1994, leg. et det. Silvia Oroian [8090]
– Răstolița, Podirei, beech forest (MS), April 22, 1994, leg. et det. Silvia Oroian [8091]
– Răstolița, Listeș, beech forest (MS), May 9, 1993, leg. et det. Silvia Oroian [8092]
– Târgu Mureș, Platoul Cornești (MS), May 10, 1959, leg. et det. Ion Patachi [8093]
– Târgu Mureș, Cocoșd Forest (MS), March 14, 1936, leg. et det. Nagy Ödön [8094]
– Porumbeni, churchyard (MS), April 9, 1994, leg. Ana Berbecar, det. Silvia Oroian [8214]
– Cheile Dobrogei (CT), 1995, leg. Dragoș Moise, det. Sălăgeanu Gheorghe [8216]
– Porumbeni, churchyard (MS), April 24, 1994, leg. Ana Berbecar, det. Silvia Oroian [8234]
– Cojușna, Pădurea Strășeni, Rep. Moldova (MD), April 18, 1936, leg. et det. A. Arvat [10121]
– Pădurea Aroneanu (IS), March 25, 1937, leg. et det. C. Burduja et M. Răvăruț [10122]
– Pădurea Săbed (MS), April 14, 2000, leg. et det. Mihaela Sămărghițan [11223]

***Anemone sylvestris* L.**
– Târgu Mureș (MS), May 10, 1937, leg. et det. Nagy Ödön [2236]
– Târgu Mureș, Pădurea Mare (MS), April 26, 1936, leg. et det. Nagy Ödön [2237]
– May 17, 1910, leg. et det. Heinrich Höhr [5134]
– Zau de Câmpie (MS), April 26, 1967, leg. et det. Kónya István [7318]
– Gheja (MS), May 3, 1988, leg. et det. Silvia Oroian [7319]
– Băla (MS), May 18, 1983, leg. Szombath Zoltán, det. Sarkany Andrei [7320]
– Zau de Câmpie, natural reserve (MS), May 28, 1980, leg. et det. Silvia Oroian [7321]
– Valea Izvoarelor, Măgheruș Hill (MS), May 13, 1987, leg. et det. Silvia Oroian [7322]
– Valea Izvoarelor (MS), May 12, 1988, leg. et det. Silvia Oroian [7323]
– Cluj-Napoca, Pădurea Hoia (CJ), April 17, 1900, leg. et det. Nagy Ödön [7762]
– Livezeni (MS), April 25, 1936, [7948]
– Târgu Mureș, Platoul Cornești (MS), May 19, 1959, leg. et det. Ion Patachi [8095]
– Livezeni (MS), April 25, 1936, leg. Nagy Ödön, det. Silvia Oroian [8217]
– Fânețele Clujului, near Cluj-Napoca (CJ), June 6, 1956, leg. et det. I. Hodișan [9448]

Aquilegia nigricans* Baumg. subsp. *nigricans (VU)
– Sasca Montană, "Țiganca" (CS) June, 1900, leg. Dr. Odor (as *Aquilegia* sp.), det. Mihaela Sămărghițan [4900]

***Aquilegia transsilvanica* Schur** (End. Carp., R)
– Făgăraș Mt., Lacul Bâlea (SB), August 10, 1955, leg. et det. Onoriu Rațiu [9244]

***Aquilegia vulgaris* L.**
– Târgu Mureș, cultivated (MS), May 29, 1939, leg. Szabo Arpad, det. Nagy Ödön [2229]
– Lacul Roșu, altit. 1000 m, (HR), July 14, 1938, leg. et det. Nagy Ödön [4128]
– Lacul Roșu, Suhardul Mic, altit. 1000 m (HR), July 14, 1941, leg. et det. Nagy Ödön [4129]
– Suhardul Mic Peak, altit. 1100 m (HR), July 8, 1939, leg. et det. Nagy Ödön [4130]
– Băgaciu (neighborhood) (MS), 1872 [5410]
– Târgu Mureș, museum's yard (MS), May 27, 1985, leg. et det. Silvia Oroian [7324]
– Cluj-Napoca (CJ), May 22, 1900, leg. et det. Nagy Ödön [7757]
– Tulgheș-Pântec (HR), June 10, 1959, leg. et det. Ion Patachi [8096]

***Caltha palustris* L.**
– Târgu Mureș, Căpâlnița (MS), March 30, 1936, leg. et det. Nagy Ödön [2224]

– Târgu Mureș, Kali stream (MS), May 1, 1939, leg. et det. Nagy Ödön [2225]
– Târgu Mureș, Cocoșd forest edge (MS), May 15, 1940, leg. et det. Nagy Ödön [2226]
– Târgu Mureș (MS), July 28, 1940, leg. Farkas Z., det. Nagy Ödön [2227]
– Târgu Mureș (MS), April 15, 1936, leg. et det. Nagy Ödön [2228]
– Lacul Roșu (HR), August 1, 1941, leg. et det. Nagy Ödön [4131]
– Lacul Roșu (HR), July 18, 1941, leg. et det. Nagy Ödön [4132]
– Lacul Roșu (HR), April 10, 1943, leg. et det. Nagy Ödön [4133]
– Sasca Montană, Valea Morii (CS), 1891, leg. et det. Dr. Odor [4782a]
– Căpușul Mic (CJ), 1891, leg. et det. Dr. Odor [4782b]
– Băgaciu (neighborhood) (MS), 1872 (as *Caltha palustris* subsp. *laeta* (Schott & al.) Hegi) [5482]
– Lacul Fărăgău (MS), June 2, 1976, leg. et det. Sarkany Andrei [5854]
– between Răstolița and Bistra Mureșului (MS), May 16, 1988, leg. et det. Silvia Oroian [7325]
– Săbed near natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian [7326]
– Târgu Mureș, on the top of 1 Mai Hill (MS), April 26, 1940, leg. Babos Bertalan, det. Nagy Ödön [7327]
– Gurghiu, Poiana Narciselor (MS), May 4, 1991, leg. et det. Silvia Oroian [7341]
– Gurghiu, pasture (MS), May 4, 1991, leg. et det. Silvia Oroian [7342]
– Semenic, marches (CS), April, 1940, leg. et det. Kyri Maria Margareta [7924]
– Târgu Mureș, near Mureș River (MS), March 21, 1936 [7946]
– Răstolița, Podirei (MS), April 22, 1994, leg. et det. Silvia Oroian [8097]
– Răstolița, Mureș River bank (MS), May 9, 1993, leg. et det. Silvia Oroian [8098]
– Târgu Mureș (MS) April 14, 1960, leg. et det. Ion Patachi [8102]
– Gurghiu, pasture (MS), May 4, 1991, leg. et det. Silvia Oroian [8218]
– Cluj, Făget Forest (CJ), April 30, 1922, leg. et det. Al. Borza (as *Caltha laeta* Schott, Nym., Ky. F. *alpestris* (Schott, Nym., Ky.) Beck) [10008]

***Clematis alpina* (L.) Mill.**
– Cheile Bicăjelului, altit. 800 m (NT), August 27, 1942, leg. et det. Nagy Ödön [4136]
– Valea Iadului, rocky area (BH), June 1947, leg. et det. Kyri Maria Margareta [7938]
– Lunca Bradului, Valea Ilvei (MS), August 8, 1995, leg. et det. Silvia Oroian (as *Atragene alpina* L.) [8099]
– Bistra Mureșului (MS), August 10, 1967, leg. et det. Ion Patachi (as *Atragene alpina* L.) [8100]

***Clematis integrifolia* L.**
– Cluj-Napoca, Fânațele Clujului (CJ), May 20, 1900, leg. et det. Nagy Ödön [7761]
– Cluj-Napoca, Fânațele Clujului (CJ), June 1946, leg. et det. Kyri Maria Margareta [7935]
– Fânețele Clujului, near Cluj-Napoca (CJ), June 1956, leg. et det. Onoriu Rațiu [9282]

***Clematis recta* L.**
– Fazakas hamlet, forest edge (MS), June 20, 1957, leg. et det. Nagy Ödön [2213]
– Târgu Mureș, Reformed Protestant cemetery (MS), June 7, 1953, leg. et det. Nagy Ödön [2214]
– Târgu Mureș, Romano-Catholic cemetery (MS), September 21, 1956, leg. et det. Nagy Ödön [2215]
– Târgu Mureș, Mureș dam (MS), May 20, 1939, leg. et det. Nagy Ödön [2216]
– Târgu Mureș, Platoul Cornești (MS), May 4, 1938, leg. et det. Nagy Ödön [2217]
– Târgu Mureș, the top of 1 Mai Hill (MS), June 18, 1946, leg. et det. Nagy Ödön [2218]
– Târgu Mureș, Reformed Protestant cemetery (MS), June 6, 1952, leg. et det. Nagy Ödön [2219]
– Târgu Mureș, "Dâmbul cu comoară"

(MS), September 27, 1939, leg. et det. Nagy Ödön [2220]
– Târgu Mureș, Reformed Protestant cemetery (MS), June 12, 1952, leg. et det. Nagy Ödön [2221]
– Târgu Mureș, Dealul Mare (MS), June 12, 1935, leg. et det. Nagy Ödön [2222]
– Adămuș, Herepea (MS), 1986, leg. et det. Silvia Oroian [7328]
– Colții Trascăului, shrubs (AB), May 1946, leg. et det. Kyri Maria Margareta [7937]
– Fânețele Clujului, near Cluj-Napoca (CJ), June 1956, leg. et det. Onoriu Rațiu [9281]
– Târgu Mureș, Reformed Protestant cemetery (MS), September 26, 1956, leg. et det. Nagy Ödön, rev. E.I. Nyárády [2223]

***Clematis vitalba* L.**
– Târgu Mureș, Reformed Protestant cemetery (MS), September 9, 1952, leg. et det. Nagy Ödön [2209]
– Târgu Mureș, Papiu Ilarian street (MS), October 17, 1951, leg. et det. Nagy Ödön [2210]
– Târgu Mureș, Mureș River bank (MS), October 17, 1951, leg. et det. Nagy Ödön [2211]
– Târgu Mureș, Reformed Protestant cemetery (MS), 1954, leg. et det. Nagy Ödön [2212]
– Sibiu, Gușterița (SB), leg. et det. Hannich H. [4805]
– Zau de Câmpie, Natural reserve (MS), 1981, leg. Eftenie Ioan, det. Silvia Oroian [5674]
– Săbed, natural reserve (MS), August 12, 1989, leg. et det. Silvia Oroian [7329]
– Sântana de Mureș, orchard (MS), June 5, 1990, leg. et det. Silvia Oroian [7336]
– Timișoara, Pădurea Ghiroculuiui (TM), July 1945, leg. et det. Kyri Maria Margareta [7925]
– Săbed, natural reserve (MS), August 12, 1989, leg. et det. Silvia Oroian [7940]
– Răstolița, Mureș River bank (MS), June 20, 1993, leg. et det. Silvia Oroian (as *Clematis vitalba* L. f. *integrata* (D.C.)) [8101]
– Cheud (SJ), July 16, 1970, leg. et det. I. Gergely, V. Fati [10422]

Clematis x florida
– Timișoara, cultivated (TM), July 1945, leg. et det. Kyri Maria Margareta [7936]

Clematis 'Jackmanii' (as x *Clematis jackmannii*)
– Târgu Mureș, cultivated (MS), June 1948, leg. et det. Nagy Ödön [2206]
– Târgu Mureș, the road to Sângeorgiu de Mureș (MS), August 11, 1950, leg. et det. Nagy Ödön [2207]
– Târgu Mureș, garden (MS), August 11, 1950, leg. et det. Nagy Ödön [2208]

***Consolida ajacis* (L.) Schur**
– Târgu Mureș, garden (MS), August 8, 1959, leg. et det. Nagy Ödön (as *Delphinium ajacis* L.) [3854]

***Consolida orientalis* (J. Gay) Schrödinger**
– Foeni (TM), May 21, 1943, leg. et det. Al. Borza et I. Todor [9984]
– Timișoara (TM), June 3, 1943, leg. et det. Al. Borza et P. Pteancu [9985]

***Consolida regalis* Gray**
– Târgu Mureș (MS), August 11, 1947, leg. et det. Nagy Ödön [2201]
– Târgu Mureș, "Dâmbul cu Comoară" (MS), September 5, 1946, leg. et det. Nagy Ödön [2202]
– Târgu Mureș, field (MS), June 1, 1938, leg. et det. Nagy Ödön [2203]
– Târgu Mureș, "Dâmbul cu comoară" (MS), September 22, 1938, leg. et det. Nagy Ödön [2204]
– Târgu Mureș, Stejăriș (MS), September 15, 1935, leg. et det. Nagy Ödön [2205]
– Petrilova, Cracu (CS), June 11, 1902, leg. et det. Dr. Odor [4793]
– Băgaciu (neighborhood) (MS), 1872 [5428]
– Morești (MS), June 24, 1953, leg. et det. Kónya István [5917]

– Crăiești-Herepea (MS), August 6, 1985, leg. et det. Silvia Oroian [7330]
– Sântana de Mureș (MS), June 23, 1989, leg. et det. Silvia Oroian [7331]
– Sântana de Mureș (MS), June 8, 1989, leg. et det. Silvia Oroian [7332]
– Săbed, natural reserve (MS), June 20, 1989, leg. et det. Silvia Oroian [7333]
– Cerghid (MS), June 19, 1974, leg. et det. Kónya István [7334]
– Târgu Mureș, 1 Mai Hill (MS), May 15, 1940, leg. Babos Bertalan, det. Nagy Ödön [7335]
– Hajdúnánás, Hungary (HU), July 5, 1900, leg. et det. Nagy Ödön [7756]
– Timișoara (TM), wheat crops, June 1945, leg. et det. Kyri Maria Margareta [7930]
– Vidrasău, crops (MS), July 11, 1991, leg. et det. Silvia Oroian [7942]
– Târgu Mureș (MS), June 10, 1959, leg. et det. Ion Patachi [8103]
– Constanța, on seafront (CT), 1995 leg. et det. Marius Făgăraș [8219]
– Jabenița, salty soils (MS), 1994, leg. et det. Silvia Oroian [8220]
– Târgu Mureș, 1 Mai Hill (MS), May 15, 1940, leg. et det. Babos Bertalan [8331]
– Târgu Mureș (MS), April 17, 1935, leg. et det. Nagy Ödön [8332]
– Târgu Mureș (MS), June 2, 1908, leg. et det. Bitai Arpad [8333]
– Borzești (CJ), August 16, 1964, leg. et det. Chiș Viorica (as *Delphinium consolida* L.) [9080]
– Târnava Mică, near Blaj (AB), July 15, 1943, leg. et det. I. Pop Câmpeanu [9882]

***Delphinium simonkaianum* Pawl.** (End.)
– Piatra Urdaşului Mt. near Colţeşti (AB), July 8, 1960, leg. et det. I. Gergely (as *Delphinium simonkaianum* Pawl. var. *psilocarpum* (Simk.) Pawl.) [8681]

***Ficaria verna* Huds.**
– Luduș (MS), April 12, 1939, leg. et det. Nagy Ödön (as *Ranunculus ficaria* L.) [2162]
– Târgu Mureș, Platoul Cornești, 480 m altit. (MS), April 16, 1937, leg. et det. Nagy Ödön (as *Ranunculus ficaria* L.) [2163]
– Timișoara (TM), Scudier Park, leg. et det. Dr. Odor [4795]
– Zau de Câmpie (MS), July 4, 1981, leg. Eftenie Ioan, det. Silvia Oroian [5671]
– Săbed, Pădurea Lechinței (MS), April 23, 1981, leg. Szombath Zoltán, det. Silvia Oroian (as *Ranunculus ficaria* L.) [5807]
– Săbed (MS), May 8, 1980, leg. Szombath Zoltán, det. Silvia Oroian (as *Ranunculus ficaria* L.) [5808]
– Sântana de Mureș, in forest (MS), April 6, 1989, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7361]
– Gheja-Luduș (MS), April 29, 1988, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7362]
– Papiu Ilarian, Șandru Forest (MS), May 4, 1988, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7363]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7364]
– Mureșeni, Mureș River bank (MS), April 3, 1968, leg. et det. Szombath Zoltán (as *Ranunculus ficaria* L.) [7365]
– Zau de Câmpie (MS), April 30, 1991, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7392]
– Cluj-Napoca, Făget (CJ), April 17, 1900, leg. et det. Nagy Ödön (as *Ranunculus ficaria* L.) [7753]
– Mureșeni, Mureș River bank (MS), April 3, 1968, leg. Szombath Zoltán, det. Silvia Oroian (as *Ranunculus ficaria* L.) [7785]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7786]
– Papiu Ilarian, Șandru Forest (MS), May 4, 1988, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7787]
– Luduș, Gheja (MS), April 29, 1988, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7788]
– Sântana de Mureș, in the forest (MS),

April 6, 1989, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7789]
– Zau de Câmpie, natural reserve (MS), April 30, 1991, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [7795]
– Cluj-Napoca, Făget (CJ), April 1946, leg. et det. Kyri Maria Margareta (as *Ranunculus ficaria* L.) [7932]
– Târgu Mureș, Pădurea Rotundă (MS), March 18, 1908, leg. Bitai Arpad, det. Nagy Ödön (as *Ranunculus ficaria* L.) [8128]
– Târgu Mureș, Mureș River bank (MS), April 20, 1936, leg. et det. Nagy Ödön (as *Ranunculus ficaria* L.) [8129]
– Deda (MS), April 16, 1995, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [8130]
– Fântânița Murfatlar, natural reserve (CT), April 25, 1992, leg. et det. Mihaela Sămărghițan (as *Ranunculus ficaria* L.) [8143]
– Gurghiu (MS), May 5, 1992, leg. et det. Silvia Oroian (as *Ranunculus ficaria* L.) [8224]
– Constanța (CT), April 15, 1995, leg. et det. Marius Făgăraș (as *Ranunculus ficaria* L.) [8225]

***Helleborus odorus* Willd.**
– Sasca Montană (CS), April 18, 1902, leg. et det. Dr. Odor (as *Helleborus odorus* W.K.) [4780]
– Beiul Sec (CS), June 29, 1943, leg. et det. Al. Borza cum filio et Al. Buia (as *Helleborus odorus* Kit.) [10009]

***Helleborus purpurascens* Waldst. & Kit.**
– Târgu Mureș, Platoul Cornești, altit. 450 m (MS), April 5, 1939, leg. et det. Nagy Ödön [2197]
– Târgu Mureș, Pădurea Mare (MS), 1911, leg. et det. Nagy Ödön [2198]
– Târgu Mureș, at the base of Halmok Hill (MS), April 29, 1939, leg. et det. Nagy Ödön [2199]
– Târgu Mureș, near Uriaș Hill (MS), April 9, 1937, leg. et det. Nagy Ödön [2200]
– Sasca Montană (CS), February 1900, leg. et det. Dr. Odor [4899]
– Băgaciu (neighborhood) (MS), 1872 [5463]
– Târgu Mureș, Botanical Garden of IMF (MS), 1984, leg. et det. Silvia Oroian [7345]
– Crăiești-Herepea (MS), August 6, 1985, leg. et det. Silvia Oroian [7346]
– Săbed, natural reserve (MS), March 23, 1989, leg. et det. Silvia Oroian [7347]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian [7348]
– Hetiur-Sighișoara (MS), May 29, 1985, leg. et det. Silvia Oroian [7349]
– Zau de Câmpie (MS), July 6, 1981, leg. et det. Eftenie Ioan [7350]
– Gurghiu, Poiana Narciselor (MS), May 4, 1991, leg. et det. Silvia Oroian [7393]
– Cluj-Napoca (CJ), April 14, 1900, leg. et det. Nagy Ödön [7755]
– Zau de Câmpie (MS), July 6, 1981, leg. et det. Eftenie Ioan [7802]
– Hetiur, Sighișoara (MS), May 29, 1984, leg. et det. Silvia Oroian [7803]
– Săbed, natural reserve (MS), April 6, 1989, leg. et det. Silvia Oroian [7804]
– Săbed, natural reserve (MS), March 23, 1989, leg. et det. Silvia Oroian [7805]
– Crăiești-Herepea (MS), August 6, 1985, leg. et det. Silvia Oroian [7806]
– Târgu Mureș, Botanical Garden of IMF (MS), 1984, leg. et det. Silvia Oroian [7807]
– Gurghiu, Poiana Narciselor (MS), May 4, 1991, leg. et det. Silvia Oroian [7808]
– Cluj-Napoca, Făget (CJ), May 1946, leg. et det. Kyri Maria Margareta [7928]
– Târgu Mureș, Cocoșd Forest (MS), March 14, 1936 [7947]
– Deda (MS), April 16, 1995, leg. et det. Silvia Oroian [8104]
– Sîngeorgiu de Mureș (MS), May 10, 1959, leg. et det. Ion Patachi [8105]
– Gurghiu, the hill near Poiana Narciselor

(MS), June 6, 1991, leg. et det. Silvia Oroian [8221]

***Hepatica nobilis* Schreb.**

– Băgaciu (neighborhood) (MS), 1872 (as *Hepatica nobilis* Mill.) [5360]
– Băgaciu (neighborhood) (MS), 1872 (as *Hepatica nobilis* Mill.) [5452]
– Chimitelnic, Pădurea Șandru (MS), May 14, 1987, leg. et det. Silvia Oroian (as *Hepatica nobilis* Mill.) [7351]
– Cluj-Napoca, Baciului forest (CJ), April 14, 1900, leg. et det. Nagy Ödön (as *Hepatica nobilis* Mill.) [7760]
– Sânger, Chimitelnic village (Cipăieni nowadays), Mășcașăl Hill, Șandru forest (MS), May 14, 1987, leg. et det. Silvia Oroian (as *Hepatica nobilis* Mill.) [7801]
– Semenic, Făget (CS), May 1940, leg. et det. Kyri Maria Margareta (as *Hepatica nobilis* Mill.) [7929]
– Târgu Mureș, Platoul Cornești (MS), April 12, 1970, leg. Kónya István, det. Silvia Oroian (as *Hepatica nobilis* Mill.) [8106]
– Târgu Mureș, in the forest (MS), April 20, 1908, leg. Bitai Arpad, det. Nagy Ödön (as *Hepatica nobilis* Mill.) [8107]
– Săcădat (MS), April 14, 1936, leg. et det. Nagy Ödön (as *Hepatica nobilis* Mill.) [8108]
– Stânceni, Muntele Leu (MS), May 18, 1994, leg. et det. Silvia Oroian (as *Hepatica nobilis* Mill.) [8109]
– Răstolița, Listeș, up to hunting observer (MS), April 12, 1991, leg. et det. Silvia Oroian (as *Hepatica nobilis* Mill.) [8110]
– Răstolița, Gurghiului Mt. (MS), April 16, 1995, leg. et det. Silvia Oroian (as *Hepatica nobilis* Mill.) [8111]
– Sovata, resort (MS), May 5, 1960, leg. et det. Ion Patachi (as *Hepatica nobilis* Mill.) [8112]
– Gurghiu, in the forest (MS), May 23, 1995, leg. et det. Silvia Oroian (as *Hepatica nobilis* Mill.) [8232]
– "Peana" Peak, near Cluj Napoca (CJ), March 25, 1936, leg. et det. G. Bujoreanu (as *Anemone hepatica* L.) [10123]
– "Dealul Tăului", near Rodna Veche (BN), April 18, 1936, leg. et det. G. Bujoreanu (as *Anemone hepatica* L.) [10124]

***Hepatica transsilvanica* Fuss** (End. Glacial Relict)

– Lacul Roșu, altit. 800 m (HR), April 17, 1936, leg. et det. Nagy Ödön (as *Anemone transsilvanica* Heuff.) [4123]
– Lacul Roșu, altit. 900 m (HR), April 16, 1936, leg. et det. Nagy Ödön (as *Anemone transsilvanica* Heuff.) [4124]
– Cupaș, Cheile Bicazului (HR), September 23, 1942, leg. et det. Nagy Ödön (as *Anemone transsilvanica* Heuff.) [4125]
– Lacul Roșu (HR), May 1, 1948, leg. et det. Nagy Ödön (as *Anemone transsilvanica* Heuff.) [4126]
– Lacul Roșu, Casa Albă, altit. 960 m (HR), June 18, 1938, leg. et det. Nagy Ödön (as *Anemone transsilvanica* Heuff.) [4127]
– June 4, 1911, leg. et det. Heinrich Höhr [5332]
– Turia, Târgu Secuiesc (CV), May 10, 1960, leg. et det. Ion Patachi [8113]
– Târgu Mureș, "la vie" (MS), April 18, 1908, leg. Bitai Arpad, det. Nagy Ödön [8114]

***Isopyrum thalictroides* L.**

– Târgu Mureș, Platoul Cornești, altit. 480 m (MS), October 28, 1938, leg. et det. Nagy Ödön [2194]
– Târgu Mureș, Căpîlnița, 350 m altit. (MS), May 2, 1940, leg. et det. Nagy Ödön [2195]
– Târgu Mureș, Căpîlnița (MS), March 30, 1936, leg. et det. Nagy Ödön [2196]
– Lacul Roșu, Cheile Bicazului, altit. 900 m (HR), April 16, 1936, leg. et det. Nagy Ödön [4155]
– Crăiești-Herepea (MS), May 28, 1985, leg. et det. Silvia Oroian [7352]
– Crăiești-Herepea (MS), May 28, 1985, leg. et det. Silvia Oroian [7800]

– Semenic, forest (CS), April 1940, leg. et det. Kyri Maria Margareta [7926]
– Răstolița, Podirei, beech forest (MS), April 8, 1995, leg. et det. Silvia Oroian [8115]
– Târgu Mureș, Cocoșd Forest (MS), March 14, 1936, leg. et det. Nagy Ödön [8144]
– Zau de Câmpie (MS), May 12, 1994, leg. et det. Mihaela Sămărghițan [8145]
– Pădurea Băneasa, near București (IF), April 18, 1965, leg. et det. S. Forstner [9149]

***Nigella arvensis* L.**
– Târgu Mureș, Kali stream bank (MS), June 18, 1947, leg. et det. Nagy Ödön [2190]
– Porumbeni (MS), July 26, 1948, leg. et det. Nagy Ödön [2191]
– Târgu Mureș, Kali stream bank (MS), June 18, 1947, leg. et det. Nagy Ödön [2192]
– Sântana de Mureș (MS), September 21, 1937, leg. et det. Nagy Ödön [2193]
– Sibiu, Gușterița (SB), leg. et det. Hannich H. [4794]
– Băgaciu (neighborhood) (MS), 1872 [5450]
– Morești-Ungheni (MS), April 24, 1953, leg. et det. Kónya István [5918]
– Zau de Câmpie, on the hill near natural reserve (MS), July 12, 1991, leg. et det. Silvia Oroian [7944]

***Nigella damascena* L.**
– Sibiu, Gușterița (SB), leg. et det. Hannich H. [4779]

***Pulsatilla alpina* (L.) Delarbre**
– leg. et det. Heinrich Höhr (as *Anemone alpina* L.) [5309]
– Făgăraș Mt., Suru Peak (SB), August 7, 1956 (as *Pulsatilla alba* Rchb. ssp. *alpicola* (Rouy & Foucaud) Neum.) [9313]

***Pulsatilla montana* (Hoppe) Rchb.**
– July 1924, Heinrich Höhr (as *Anemone montana* Hoppe) [5314]
– Băgaciu (neighborhood) (MS), 1872 [5459]
– Blaj (AB), 1925–1926 [5541]
– Săbed, Corhan Hill (MS), May 3, 1988, leg. Szombath Zoltán, det. Silvia Oroian [7356]
– Săbed, Corhan Hill (MS), May 8, 1980, leg. Szombath Zoltán, det. Silvia Oroian [7794]
– Păltiniș (SB), July 1992, leg. Dragoș Moise, det. Sălăgeanu Gheorghe [8222]

***Pulsatilla patens* (L.) Mill.** (DD)
– Cluj-Napoca, Baciu Forest (CJ), April 14, 1900, leg. et det. Nagy Ödön [7751]

***Pulsatilla pratensis* (L.) Mill.** (DD)
– Sibiu, Gușterița (SB), April 1888, leg. et det. Hannich H. [4799]
– June 9, 1911, leg. et det. Heinrich Höhr (as *Pulsatilla nigricans* Störck) [5240]
– Semenic, glade (CS), May 1940, leg. et det. Kyri Maria Margareta (as *Pulsatilla nigricans* Störck) [7927]

***Pulsatilla vulgaris* Mill.** (NT)
– Gheja-Luduș (MS), May 3, 1988, leg. et det. Silvia Oroian [7355]
– Târgu Mureș, Botanical Garden of IMF (MS), 1984, leg. et det. Silvia Oroian [5972]
– Târgu Mureș (MS), March 9, 1908, leg. Bitai Arpad, det. Nagy Ödön [8117]

***Pulsatilla vulgaris* Mill. subsp. *grandis* (Wender.) Zāmelis)** (R, LC)
– Baciu (CJ), 1890, leg. et det. Dr. Odor (as *Pulsatilla grandis* Wender) [4800]
– Târgu Mureș, "Dealul cu Comoară", altit. 330 m (MS), March 30, 1939, leg. et det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2181]
– Târgu Mureș, at the base of Halmok Hill, altit. 330 m (MS), April 30, 1940, leg. Balint Arpad, det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2182]
– Târgu Mureș, at the base of Halmok Hill, altit. 330 m (MS), April 19, 1939, leg. et det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2183]

– Târgu Mureș, "Dâmbul cu Comoară" (at the base of Halmok Hill) (MS), April 16, 1940, leg. et det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2184]
– Târgu Mureș, at the base of Halmok Hill, altit. 330 m (MS), April 27, 1940, leg. et det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2185]
– Târgu Mureș, Cocoșd Forest (MS), April 2, 1940, leg. et det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2186]
– Târgu Mureș, Platoul Cornești (MS), April 9, 1939, leg. et det. Nagy Ödön (as *Pulsatilla grandis* Wender) [2187]
– Săbed (MS), September 8, 1960, leg. et det. Ion Patachi (as *Pulsatilla grandis* Wender.) [8116]

***Ranunculus acris* L.**

– Târgu Mureș, Cocoșd (MS), May 15, 1940, leg. et det. Nagy Ödön (as *Ranunculus stevenii* Andrz.) [2140]
– Târgu Mureș, plowing (MS), 1941, leg. et det. Nagy Ödön (as *Ranunculus stevenii* Andrz.) rev. S. Jávorka [2141]
– Târgu Mureș (MS), May 29, 1941, leg. et det. Nagy Ödön (as *Ranunculus stevenii* Andrz.) rev. S. Jávorka [2142]
– Târgu Mureș, island, on the "Rîtul cu scoici" (MS), May 25, 1948, leg. et det. Nagy Ödön [2176]
– Târgu Mureș, island, on the "Rîtul cu scoici" (MS), May 25, 1948, leg. et det. Nagy Ödön [2177]
– Târgu Mureș, "Cartierul Funcționarilor" (MS), May 23, 1941, leg. et det. Nagy Ödön (as *Ranunculus acris* L. f. *napellifolius* Crantz) DC.) [2178]
– Târgu Mureș, near brick factory (MS), May 21, 1946, leg. et det. Nagy Ödön [2179]
– Târgu Mureș, plowing (MS), May 8, 1936, leg. et det. Nagy Ödön [2180]
– Lacul Roșu, altit. ±1000 m (HR), July 10, 1936, leg. et det. Nagy Ödön, rev. E.I. Nyárády [4138]
– Cupașului Rocks (HR), September 23, 1942, leg. et det. Nagy Ödön, rev. E.I. Nyárády [4139]
– Lacul Roșu, altit. 1380 m (HR), August 20, 1940, leg. et det. Nagy Ödön (as *Ranunculus stevenii* Andrz.) [4151]
– Suhardul Mic Peak, altit. 1100 m (HR), July 10, 1939, leg. et det. Nagy Ödön (as *R. stevenii* Andrz.) [4152]
– Suhardul Mic Peak (HR), July 7, 1941, leg. et det. Nagy Ödön (as *Ranunculus stevenii* Andrz.), rev. E.I. Nyárády [4153]
– Lacul Roșu (HR), August 22, 1941, leg. et det. Nagy Ödön (as *Ranunculus stevenii* Andrz.) [4154]
– Sasca Montană, Tilva Samueli (CS), May 8, 1901, leg. et det. Dr. Odor [4786]
– Fărăgău, the big lake (MS), May 20, 1976, leg. et det. Kónya István [5853]
– Târgu Mureș, Beșa forest (MS), May 1, 1953, leg. et det. Kónya István [5912]
– Deda-Bistra Mureșului (MS), June 15, 1960, leg. et det. Kónya István [5913]
– Târgu Mureș, hippodrome (MS), July 8, 1960, leg. et det. Kónya István [5914]
– Târgu Mureș, Stejeriș forest (MS), June 1, 1953, leg. et det. Kónya István [5915]
– Târgu Mureș, Platoul Cornești (MS), June 1, 1953, leg. et det. Kónya István [5916]
– Târgu Mureș, Platoul Cornești (MS), April 12, 1970, leg. et det. Kónya István [7357]
– Orșova Pădure (MS), May 26, 1981, leg. et det. Szombath Zoltán [7358]
– Senetea (HR), June 10, 1982, leg. et det. Kónya István [7359]
– Târgu Mureș, Platoul Cornești (MS), April 12, 1970, leg. et det. Kónya István [7395]
– Gurghiu, Poiana Narciselor (MS), June 2, 1992, leg. et det. Silvia Oroian [7625]
– Orăștie (HD), May 17, 1903, leg. et det. Nagy Ödön [7752]
– Senetea, Suseni commune (HR), June 10, 1982, leg. Kónya István, det. Silvia Oroian [7792]
– Târgu Mureș, Platoul Cornești (MS), April 12, 1970, leg. Kónya István, det. Silvia Oroian [7793]

– Vidrasău, Mureș River bank (MS), June 19, 1991, leg. et det. Silvia Oroian [7941]
– Bistra Mureșului, Mureș River bank (MS), May 30, 1993, leg. et det. Silvia Oroian [8118]
– Răstolița, Mureș River bank (MS), September 26, 1993, leg. et det. Silvia Oroian [8119]
– Meștera, glade (MS), June 4, 1995, leg. Florentina Togănel, det. Silvia Oroian [8120]
– Toplița-Ciobotani, swamp (MS), May 18, 1994, leg. et det. Silvia Oroian [8121]
– Răstolița, Mureș River bank (MS), September 26, 1993, leg. et det. Silvia Oroian [8122]
– Toplița, at the exit of the city, marshy place (HR), May 18, 1994, leg. et det. Silvia Oroian [8122]
– Vidrasău, along the Mureș riverside (MS), June 19, 1991, leg. et det. Silvia Oroian [8223]

***Ranunculus aquatilis* L.** (LC)
– Reghin-Iernuțeni (MS), May 17, 1960, leg. et det. Ion Patachi [8148]

***Ranunculus arvensis* L.**
– Târgu Mureș, Budiu (MS), May 22, 1946, leg. et det. Nagy Ödön [2174]
– Târgu Mureș, Beșa (MS), May 30, 1944, leg. et det. Nagy Ödön [2175]
– Târgu Mureș, Beșa forest (MS), May 16, 1936, leg. et det. Nagy Ödön [4140]
– Târgu Mureș, Beșa forest (MS), May 1, 1953, leg. et det. Kónya István [5921]
– Beșa (MS), May 16, 1936, leg. et det. Nagy Ödön [8124]
– Giarmata-Vii (TM), May 29, 1941, leg. et det. I. Todor [9996]
– Petrilova, Cracu Mic (CS), May 1936, leg. et det. Dr. Odor (as *Ranunculus arvensis* L. var. *tuberculatus* Kit.) [4796]
– Târgu Mureș, garden (MS), June 12, 1959, leg. Nagy Ödön det. Mihaela Sămărghițan [8137]

***Ranunculus auricomus* L.**
– Târgu Mureș, Platoul Cornești, 480 m altit. (MS), May 16, 1937, leg. et det. Nagy Ödön [2166]
– Târgu Mureș, Platoul Cornești, 480 m altit. (MS), May 2, 1938, leg. et det. Nagy Ödön [2167]
– Târgu Mureș, Romano-Catholic cemetery (MS), April 21, 1943, leg. et det. Nagy Ödön [2168]
– Târgu Mureș, to Cocoșd Forest, southern part (MS), May 28, 1942, leg. et det. Nagy Ödön [2169]
– Târgu Mureș, Platoul Cornești, 450 m altit. (MS), April 18, 1951, leg. et det. Nagy Ödön [2172]
– Târgu Mureș, Dealul Mare (MS), April 29, 1956, leg. et det. Nagy Ödön [2173]
– Sibiu, Gușterița (SB), leg. et det. Hannich H. [4783]
– Târgu Mureș, Platoul Cornești (MS), May 1, 1953, leg. et det. Kónya István [5922]
– Papiu Ilarian, Șandru Forest (MS), May 4, 1988, leg. et det. Silvia Oroian [7360]
– Gurghiu, pasture (MS), May 4, 1991, leg. et det. Silvia Oroian [7396]
– Papiu Ilarian, Șandru Forest (MS), May 4, 1988, leg. et det. Silvia Oroian [7790]
– Gurghiu, pasture (MS), May 4, 1991, leg. et det. Silvia Oroian [7791]
– Târgu Mureș, at vineyard (MS), April 26, 1908, leg. Bitai Arpad, det. Mihaela Sămărghițan [8125]
– Târgu Mureș, "Subpădure" (MS), June 14, 1960, leg. et det. Ion Patachi [8139]
– Răstolița, Podirei (MS), May 9, 1993, leg. et det. Silvia Oroian (as *Ranunculus auricomus* L. subsp. *binatus* Kit.) [8126]
– Târgu Mureș, Reformed Protestant cemetery (MS), May 1, 1943, leg. et det. Nagy Ödön (as *Ranunculus auricomus* L. subsp. *binatus* Kit.) [2170]
– Târgu Mureș, plowing, 300 m altit. (MS), April 24, 1936, leg. et det. Nagy Ödön (as *Ranunculus auricomus-binatus*) [2171]
– Sibiu, Gușterița (SB), April 1901, leg. et

det. Hannich H. (as *Ranunculus auricomus* L. var. *cassubicus* L.) [4788a]
– Sasca Montană (CS), April 1901, leg. et det. Hannich H. (as *Ranunculus auricomus* L. var. *cassubicus* L.) [4788b]

***Ranunculus breyninus* Crantz**
– Semenic, hayfield (CS), June 1940, leg. et det. Kyri Maria Margareta (as *Ranunculus oreophilus* M.B.) [7933]

***Ranunculus bulbosus* L.**
– Sasca Montană, Tilva Samueli (CS), May 8, 1901, leg. et det. Dr. Odor [4785]
– Băgaciu (neighborhood) (MS), 1886 [5494]

***Ranunculus carpaticus* Herbich** I
– Lacul Roșu, altit. 1000 m (HR), May 31, 1935, leg. et det. Nagy Ödön [4141]

***Ranunculus cassubicus* L.**
– Târgu Mureș, Stejeriș Forest (MS), May 1, 1939, leg. et det. Nagy Ödön [2164]
– Târgu Mureș, Reformed Protestant cemetery (MS), May 1, 1943, leg. et det. Nagy Ödön [2165]
– Răstolița, Mureș River bank (MS), May 9, 1993, leg. et det. Silvia Oroian [8127]

***Ranunculus flabellifolius* Heuff. Et Rchb.**
– Sasca Montană, Tilva Samueli (CS), 1901, leg. et det. Dr. Odor [4791]

***Ranunculus flammula* L.**
– Sibiu, Lazaret (SB), leg. et det. Hannich H. [4790]
– Gurghiu, Poiana Narciselor (MS), July 2, 1992, leg. et det. Silvia Oroian [7623]
– Stânceni-Ciobotani, marshy place (MS), June 14, 1994, leg. et det. Silvia Oroian [8131]
– Stațiunea climaterică Leșu (BH), June 27, 1978, leg. et det. I. Gergely [9572]

***Ranunculus illyricus* L.**
– Orăștie (HD), May 21, 1904, leg. et det. Nagy Ödön [7754]
– Târgu Mureș, at the vineyard (MS), May 2, 1908, leg. Bitai Arpad, det. Nagy Ödön [8132]

***Ranunculus lingua* L.** (LC)
– Inău and Aluniș (SJ), July 16, 1970, leg. et det. I. Gergely, V. Fati [10451]

***Ranunculus montanus* Willd.**
– Lacul Roșu, Cheile Bicazului (HR), May 30, 1935, leg. et det. Nagy Ödön [4142]

***Ranunculus platanifolius* L.**
– Lacul Roșu (HR), July 14, 1939, leg. et det. Nagy Ödön [4145]
– Lacul Roșu, altit. 1200 m (HR), July 14, 1939, leg. et det. Nagy Ödön [4146]
– Lacul Roșu, altit. 1200 m (HR), July 14, 1939, leg. et det. Nagy Ödön [4147]

***Ranunculus polyanthemos* L.**
– Târgu Mureș, Platoul Cornești, 480 m altit. (MS), May 10, 1939, leg. et det. Nagy Ödön [2159]
– Târgu Mureș, "Cartierul Funcționarilor" (MS), April 28, 1936, leg. et det. Nagy Ödön [2160]
– Târgu Mureș, Mureș River dam (MS), May 17, 1946, leg. et det. Nagy Ödön [2161]
– Lacul Roșu, Cheile Bicăjel, Surduc (HR), August 16, 1941, leg. et det. Nagy Ödön [4148]
– Lacul Roșu (HR), July 1941, leg. et det. Nagy Ödön [4149]
– Lacul Roșu, Suhardul Mic Peak (HR), July 14, 1941, leg. et det. Nagy Ödön [4150]
– Sibiu, Pădurea Sibiului (SB), leg. et det. Hannich H. [4789]
– Târgu Mureș, hippodrome (MS), July 1, 1959, leg. et det. Kónya István [5923]
– Răstolița, Podirei (MS), June 20, 1993, leg. et det. Silvia Oroian [8133]
– Glodeni (MS), May 10, 1959, leg. et det. Ion Patachi [8134]
– Gurghiu, near Poiana Narciselor (MS), June 6, 1991, leg. Silvia Oroian, det. Mihaela Sămărghițan [8226]

***Ranunculus polyanthemos* L. subsp. *nemorosus* (DC.) Schübl. & G. Martens**

– Lacul Roșu (HR), July 27, 1941, leg. et det. Nagy Ödön (as *Ranunculus nemorosus* DC) [4143]
– Lacul Roșu, Suhardul Mic (HR), July 14, 1941, leg. et det. Nagy Ödön (as *Ranunculus nemorosus* DC.) [4144]
– Hăghimașul Mare Mt. (HR), July 12, 1968, leg. et det. Kónya István (as *Ranunculus nemorosus* DC.) [7366]
– Hăghimașul Mare Mt. (HR), July 10, 1968, leg. et det. Kónya István (as *Ranunculus nemorosus* DC.) [7367]
– Hășmașul Mare Mt. (HR), July 10, 1968, leg. Kónya István, det. Silvia Oroian (as *Ranunculus nemorosus* DC.) [7783]
– Hășmașul Mare Mt. (HR), July 12, 1968, leg. Kónya István, det. Silvia Oroian (as *Ranunculus nemorosus* DC.) [7784]
– Sântana de Mureș (MS), June 3, 1990, leg. et det. Silvia Oroian (as *Ranunculus nemorosus* DC.) [8138]

***Ranunculus repens* L.**

– Târgu Mureș (MS), June 7, 1941, leg. et det. Nagy Ödön (as *Ranunculus sardous* x *repens*) rev. Jávorka S. [2152]
– Târgu Mureș, the shore of the pond near brick factory (MS), May 11, 1937, leg. et det. Nagy Ödön [2155]
– Târgu Mureș, near Stejeriș forest, 380 m altit. (MS), May 19, 1941, leg. et det. Nagy Ödön [2156]
– Târgu Mureș, Romano-Catholic cemetery (MS), May 20, 1941, leg. et det. Nagy Ödön [2157]
– Târgu Mureș, brick factory (MS), May 11, 1937, leg. et det. Nagy Ödön [2158]
– Sibiu (SB), leg. et det. Hannich H. [4784]
– Băgaciu (neighborhood) (MS), 1872 [5389]
– Sângeorgiu de Mureș (MS), June 1, 1953, leg. et det. Kónya István [5924]
– Târgu Mureș (MS), May 8, 1966, leg. et det. Kónya István [7368]
– Gurghiu, Poiana Narciselor (MS), June 2, 1992, leg. et det. Silvia Oroian [7624]
– Târgu Mureș (MS), May 8, 1966, leg. Kónya István, det. Silvia Oroian [7782]
– Răstolița (MS), July 10, 1995, leg. Silvia Oroian, det. Mihaela Sămărghițan [8135]
– Sasca Montană (CS), 1900, leg. et det. Dr. Odor [8136]
– Porumbeni, churchyard (MS), May 15, 1994, leg. Ana Berbecar, det. Silvia Oroian [8233]
– Borzești (CJ), August 16, 1964, leg. et det. Chiș Viorica [9051]
– Stâna de Vale (BH), June 10, 1964 [9333]
– Fânețele Clujului, near Cluj-Napoca (CJ), June 1956 [9334]

***Ranunculus sardous* Crantz**

– Târgu Mureș, plowing (MS), May 19, 1941, leg. et det. Nagy Ödön [2143]
– Târgu Mureș, Trebely (MS), May 17, 1938, leg. et det. Nagy Ödön [2144]
– Târgu Mureș, Jewish cemetery (MS), June 6, 1943, leg. et det. Nagy Ödön [2145]
– Târgu Mureș, Căpâlnița, altit. 340 m (MS), June 19, 1948, leg. et det. Nagy Ödön [2146]
– Târgu Mureș, Uriaș Hill, altit. 370 m (MS), May 14, 1939, leg. et det. Nagy Ödön [2147]
– Târgu Mureș, airport (MS), August 28, 1941, leg. et det. Nagy Ödön [2148]
– Târgu Mureș, top of Budiu Hill, altit. 380 m, (MS), 1937, leg. et det. Nagy Ödön [2149]
– Târgu Mureș, Papiu Ilarian street (MS), June 12, 1944, leg. et det. Nagy Ödön [2150]
– Târgu Mureș, Reformed Protestant cemetery, altit. 350 m (MS), May 21, 1936, leg. et det. Nagy Ödön [2151]
– Sângeorgiu de Mureș (MS), June 26, 1950, leg. et det. Nagy Ödön [2153]
– Sângeorgiu de Mureș, salty baths (MS), July 1, 1955, leg. et det. Nagy Ödön [2154]
– Sângeorgiu de Mureș (MS), July 1, 1959, leg. et det. Nagy Ödön [3834]
– Sângeorgiu de Mureș (MS), June 23, 1959, leg. et det. Nagy Ödön [3843]

– Sasca Montană (CS), September 10, 1901, leg. et det. Dr. Odor (as *Ranunculus philonotis* Ehrh.) [4792]
– Băgaciu (neighborhood) (MS), 1872 [5396]
– Târgu Mureș, museum's yard (MS), July 2, 1960, leg. et det. Kónya István [5925]
– Târgu Mureș, museum's yard (MS), July 2, 1960, leg. et det. Kónya István [5926]
– Crăiești-Herepea (MS), May 28, 1985, leg. et det. Silvia Oroian [7369]
– Sântana de Mureș (MS), June 3, 1990, leg. et det. Silvia Oroian [7370]
– Săbed, Lechința Forest (MS), June 9, 1980, leg. et det. Silvia Oroian [7371]
– Sântana de Mureș, Bocșa Hill (MS), June 3, 1990, leg. et det. Silvia Oroian [7372]
– Crăiești-Herepea (MS), August 6, 1985, leg. et det. Silvia Oroian [7373]
– Orșova, Cătunul Seci (MS), May 1979, leg. et det. Sarkany Andrei [7374]
– Sângeorgiu de Mureș (MS), July 21, 1980, leg. et det. Silvia Oroian [7376]
– Zau de Câmpie, the Valea Botei Mari hills (MS), May 28, 1980, leg. Kónya István, det. Silvia Oroian [7777]
– Herepea, Adămuș commune (MS), August 6, 1985, leg. et det. Silvia Oroian [7778]
– Sântana de Mureș (MS), June 3, 1980, leg. et det. Silvia Oroian [7779]
– Săbed, Lechința forest (MS), June 9, 1980, leg. et det. Silvia Oroian [7780]
– Crăiești-Herepea (MS), May 28, 1985, leg. Silvia Oroian, Kónya István junior, det. Silvia Oroian [7781]

***Ranunculus sceleratus* L.**
– Târgu Mureș, "Râtul cu Scoici", altit. 314 m" (MS), June 23, 1947, leg. et det. Nagy Ödön [2137]
– Târgu Mureș, "Râtul cu Scoici", altit. 314 m, June 23, 1947, leg. et det. Nagy Ödön (seeds) (MS) [2139]
– Târgu Mureș, near Căpâlnița (MS), May 30, 1944, leg. et det. Nagy Ödön [2138]
– Sibiu, "Kupferhammer" (SB), leg. et det. Hannich H. [4787]
– Băgaciu (neighborhood) (MS), 1872 [5493]
– Reghin (MS), May 2, 2000, leg. et det. Mihaela Sămărghițan [11222 B]

***Thalictrum aquilegiifolium* L.**
– Băgaciu (neighborhood) (MS), 1872 [5467]
– Târgu Mureș, Budiu (MS), June 3, 1946, leg. et det. Nagy Ödön [2135]
– Târgu Mureș, on the edge of Ștejeriș forest (MS), June 3, 1942, leg. Adorjani K., det. Nagy Ödön [2136]
– Lacul Roșu, Cheile Bicazului, altit. 950 m (HR), July 9, 1937, leg. et det. Nagy Ödön [4157]
– Lacul Roșu (HR), July 4, 1936, leg. et det. Nagy Ödön [4158]
– Sasca Montană, Valea Morii (CS), May 11, 1902, leg. et det. Dr. Odor [4804]
– Băgaciu (neighborhood) (MS), 1872 [5490]
– Fărăgău, the knoll between Lacul Mare and Lacul Dracului (MS), June 3, 1967, leg. et det. Sarkany Andrei [5838]
– Zau de Câmpie, Valea Botei Mari (MS), May 28, 1980, leg. et det. Silvia Oroian [7379]
– Gurghiu (MS), May 8, 1967, leg. et det. Kónya István [7380]
– Orșova, Cătunul Seci (MS), May 1979, leg. et det. Sarkany Andrei [7381]
– Orșova, Cătunul Seci (MS), May 1979, leg. Sarkany Andrei, det. Silvia Oroian [7773]
– Gurghiu (MS), May 8, 1967, leg. Kónya István, det. Silvia Oroian [7774]
– Zau de Câmpie, hillocks of Valea Botei Mari (MS), May 28, 1980, leg. et det. Silvia Oroian [7775]
– Zau de Câmpie, hillocks of Valea Botei Mari (MS), May 28, 1980, leg. et det. Silvia Oroian [7776]
– Lunca Bradului (MS), July 19, 1959, leg. et det. Ion Patachi [8140]
– Orșova Pădure (MS), June 3, 1994, leg. Silvia Oroian, det. Mihaela Sămărghițan [8227]
– Gurghiu, the hill near Poiana Narciselor (MS), June 6, 1991, leg. et det. Silvia Oroian [8228]

– Semenic Mt., under Cozna and Siminic Peaks (CS), June 20–21, 1942, leg. et det. Al. Borza and I. Todor
– Fânețele Clujului, near Cluj-Napoca (CJ), May 1958, leg. et det. Onoriu Rațiu [9304]
– Vlădeasa Mt., Valea Zârnei (CJ), July 6, 1970, leg. et det. I. Gergely (as *Thalictrum aquilegiifolium* L. f. *niveum* (Baumg.) A. Nyar.) [10466]

***Thalictrum foetidum* L.**
– Lacul Roșu (HR), July 15, 1938, leg. et det. Nagy Ödön [4156]

***Thalictrum lucidum* L.**
– Târgu Mureș, "Râtul cu Scoici", altit. 309 m (MS), July 21, 1940, leg. et det. Nagy Ödön [2133]
– Târgu Mureș, Kali stream bank (MS), June 18, 1947, leg. et det. Nagy Ödön [2134]
– Târgu Mureș (MS), July 26, 1958, leg. et det. Nagy Ödön (as *Thalictrum aquilegiifolium* L.), rev. Mihaela Sămărghițan [4576]
– Sibiu, Lazaret (SB), leg. et det. Hannich H. (as *Thalictrum peucedanifolium* Griseb. & Schenk) [4803]
– near Sântimbru, meadow (HR), July 6, 1982, leg. et det. I. Gergely [9374]

***Thalictrum minus* L.**
– Târgu Mureș, Reformed Protestant Cemetery (MS), July 13, 1953, leg. et det. Nagy Ödön [2132]
– July 12, 1936, leg. et det. Heinrich Höhr (as *Thalictrum minus* L. var. *medium* Jacq.) [5261]
– Orșova, Cătunul Seci (MS), May 1979, leg. et det. Sarkany Andrei [7382]
– Săbed, Corhan Hill (MS), July 1, 1981, leg. et det. Silvia Oroian [7383]
– Săbed, natural reserve (MS), August 12, 1989, leg. et det. Silvia Oroian [7384]
– Valea Izvoarelor, Măgheruș Hill (MS), May 13, 1987, leg. et det. Silvia Oroian [7385]
– Saschiz, Cloașterf (MS), June 12, 1984, leg. et det. Silvia Oroian [7386]
– Herepea (MS), 1986, leg. et det. Silvia Oroian [7387]
– Herepea, Adămuș commune (MS), 1986, leg. et det. Silvia Oroian [7767]
– Cloașterf, Saschiz (MS), June 12, 1984, leg. et det. Silvia Oroian [7768]
– Sânpaul, Valea Izvoarelor, Măgheruș Hill, southern slope (MS), May 13, 1987, leg. et det. Silvia Oroian [7769]
– Săbed, natural reserve (MS), August 12, 1989, leg. et det. Silvia Oroian [7770]
– Săbed, Corhan Hill (MS), July 1, 1981, leg. et det. Silvia Oroian [7771]
– Orșova, Cătunul Seci (MS), May 1979, leg. Sarkany Andrei, det. Silvia Oroian [7772]
– Zau de Câmpie, natural reserve (MS), July 12, 1991, leg. et det. Silvia Oroian [7943]
– Andreneasa, Răstolița commune (MS), May 18, 1994, leg. et det. Silvia Oroian [8141]
– Jabenița, salty soil (MS), July 12, 1994, leg. Silvia Oroian, det. Mihaela Sămărghițan [8229]

***Thalictrum minus* L. ssp. *majus* (Crantz) Rouy et Foucad**
– Sasca Montană, Râtul Mare, "Țiganca" (CS), May 25, 1901, leg. et det. Dr. Odor (as *Thalictrum elatum* Jacq.) [4802]

***Trollius europaeus* L.**
– Tulgheș, Păltiniș Peak (HR), July 11, 1941, leg. Márk Gyözö, det. Nagy Ödön [4159]
– Lacul Roșu, altit. 1380 m (HR), July 21, 1937, leg. et det. Nagy Ödön [4160]
– Făgetul Ciucului, altit. 1000 m (HR), August 20, 1942, leg. et det. Nagy Ödön [4161]
– Sibiu, Guștericța (SB), leg. et det. Hannich H. [4781]
– June 1910, leg. et det. Heinrich Höhr [5333]
– Cluj-Napoca, Fânaţele Clujului (CJ), May 21, 1900, leg. et det. Nagy Ödön [5355]
– Hăghimașul Mare Mt. (HR), July 12, 1968, leg. et det. Kónya István [7388]

– Orșova, Cătunul Seci (MS), May 1979, leg. et det. Sarkany Andrei [7389]
– Senetea (HR), June 10, 1982, leg. et det. Kónya István [7390]
– Gurghiu, Poiana Narciselor (MS), May 4, 1991, leg. et det. Silvia Oroian [7394]
– Gurghiu, Poiana Narciselor (MS), May 4, 1991, leg. et det. Silvia Oroian [7763]
– Senetea (HR), June 10, 1982, leg. Kónya István, det. Silvia Oroian [7764]
– Orșova, Cătunul Seci (MS), May 1, 1979, leg. Sarkany Andrei, det. Silvia Oroian [7765]
– Hășmașul Mare Mt. (HR), July 12, 1968, leg. Kónya István, det. Silvia Oroian [7766]
– Valea Latoriței, Piatra Tîrnovului (VL), June 15, 1991, leg. et det. Silvia Oroian [7939]
– Tulgheș-Pântec (HR), June 16, 1959, leg. et det. Ion Patachi [8142]
– Gurghiu, Poiana Narciselor (MS), May 16, 1994, leg. Silvia Oroian, det. Mihaela Sămărghițan [8230]
– Orșova Pădure (MS), June 3, 1994, leg. Silvia Oroian, det. Mihaela Sămărghițan [8231]
– Stâna de Vale (BH), June 10, 1964, leg. et det. Onoriu Rațiu [9309]
– Rarău Mt. (SV), June 30, 1958, leg. et det. I. Hodișan [9491]
– Corongișul Mic Peak, Rodnei Mt. (BN), July 01–07, 1937, leg. et det. C. Gürtler [10118]
– May 19, 1926, leg. et det. Heinrich Höhr [5268]
– leg. et det. Heinrich Höhr [5298]

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Zoology

Ornithological observations in the winter 2021–2022 in ROSPA0062 Lacurile de acumulare de pe Argeş (Romania)

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Abstract. An image of the avifauna, mostly dependent on the wetlands, present on some dam basins from the upper and middle course of the Argeş River (Romania), included in ROSPA0062 Lacurile de acumulare de pe Argeş, during the winter 2021–2022, was captured in this paper. Discussions about the local conditions that influenced its presence were made and it was stated that the size of the aquatic area is not enough to determine the number of species and the amount of individuals on every component dam basin and other ingredients, such as the silting, the type of habitats and the human pressure, are very important in this respect. Also, external or general factors were considered, among which the global warming. Each species has its ecological preferences and, as a result, some of them are more abundant that others, the case of *Anas platyrhynchos*, *Aythya ferina*, *Larus ridibundus*, eudominant species, or *Anas crecca*, *Fulica atra*, *Larus argentatus* and *L. canus*, dominant species. They establish the importance of the Anseriformes, Charadriiformes and Gruiformes orders in the ecosystem.

Keywords: dam basins, birds, winter, protection.

Introduction

Starting with 1990, the reservoirs from the Argeş River between Vâlcele and Goleşti were yearly monitored by the local ornithologists, with the Argeş (now, Piteşti) Subsidiary of the Romanian Ornithological Society establishment in Piteşti. Observations in the area were performed previously, too, but only a part of them were published (Munteanu & Mătieş, 1983; Munteanu et al., 1989). Winter observations were mostly performed to check the dynamics of the avifauna and, as a result, own to the high number of specimens and of the occurrence of the protected species, the area was proposed for conservation, it becoming ROSPA0062 Lacurile de acumulare de pe Argeş (The Dam Basins from the Argeş River). Also, a series of papers about its avifauna (Gava, 1997; Gava et al., 2004a, b, 2007; Conete et al., 2008; Conete, 2011; Mestecăneanu & Gava, 2016a, 2018, 2019, 2021 etc.) issued in this period, which we expect will serve as the milestone for the ongoing researches in the area. Also, we hope that they will help to improve the status of the birds that live here and of the protected zone itself. The present paper keeps the same aims.

Material and methods

The dam basins whose ornithofauna was the object of our research-study are: Vâlcele (640 ha), Budeasa (643 ha), Bascov (140 ha), Piteşti (150 ha) and Goleşti (680 ha). Mostly, they were built after 1970, chiefly to produce electrical energy and also to supply with water the local consumers, to irrigate the crops from the vicinity, and to stop the floods. They are located in the upper and middle hydrographical basin of the Argeş River, an important tributary of the Danube from Romania, with

the springs in the Făgăraş and Iezer-Păpuşa Mountains from the Southern Carpathians (Barco & Nedelcu, 1974) (Fig. 1). The Argeş Platform flanks them to the North, the Cotmeana Platform, to the West, the Cândeşti Platform, to the East, and the Piteşti High Plain, to the South.

A rich wetland vegetation, composed especially by reed bed (*Phargmites* sp.), bulrush (*Typha* sp.), alder (*Alnus* sp.), and willow (*Salix* sp.), occupies the silted portions mainly from the end of the basins and along their banks unfitted by bevels. Also, it is present on the appeared islands on Bascov and Piteşti, resulted from the same process of clogging. The meadows from the environs are cultivated mainly with cereals, while the versants of the hills are the domain of the orchards and of the broadleaf forests, where the beech (*Fagus sylvatica*) and the sessile oak (*Quercus petraea*) predominate. Planted coniferous and grasslands are sporadically met here. The reservoirs are limited on long sectors by belt ways or even by intensely circulated roads that connect the settlements from the nearby. Also, a highway is in construction at the current date, which extends the existent one, so that all the dam basins taken into consideration will be soon more or less adjacent to it.

The specific continental climate of the area, with hilly features in the North and plain characteristics, in the South, determines ca. 9 °C at Piteşti, the average annual temperature of the water, which is covered with a bridge of ice, principally, in January and February (Barco & Nedelcu, 1974).

The field methodology combined the itinerary method and the method of the fixed points of observations, so the whole aquatic area was surveyed. However, some small portions remained uncovered because of the vegetation and of the hard access, but we consider that they did not significantly change the results. The birds dependent of water were counted, using the estimation method in the case of the ones with large strengths, and, complementary, the other birds present in the area. The activity took place on January 17,

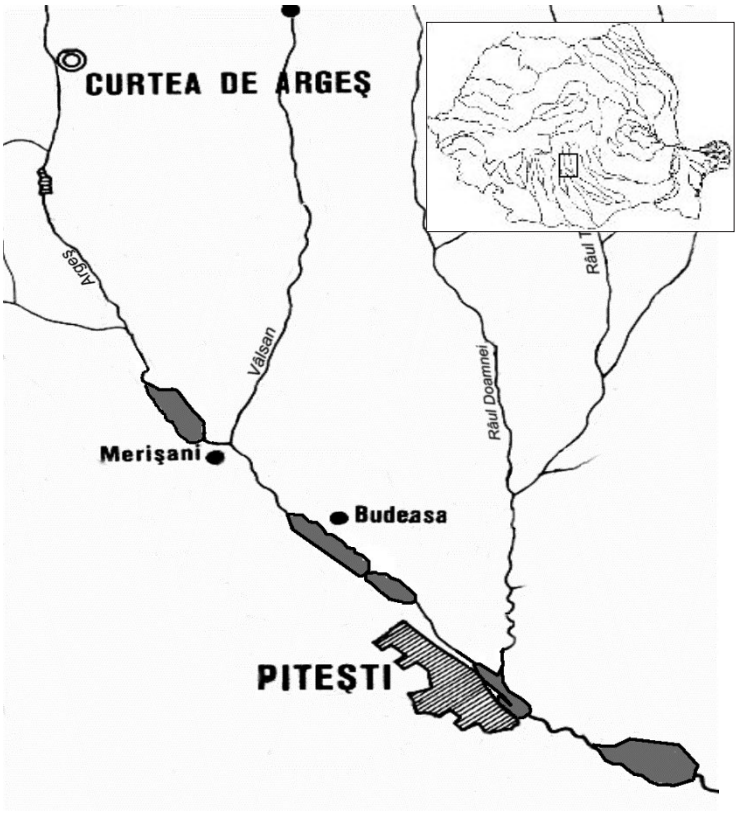

Fig. 1: The map of the area.

2022, between 8:30 and 15:30, when the weather was characterised by: -4–7 °C – the temperature of the air, 0–60% – the sky nebulosity, and 0–2 – the wind intensity on the Beaufort scale. The ice shell over water was not formed. As tools, binoculars (10 × 50) and a spotting scope (60x) were used.

The scientific nomenclature and classification are compatible with the Hamlin Guide (Bruun et al., 1999). It was adopted mainly for statistical calculation reasons, because of the difficulty of identification in particular conditions of the familiar gulls in the area during winter, *Larus michahellis* and *L. cachinnans*, and of the rarer *L. argentatus*, today distinct species (Swensson et al., 2017), not long ago all considered subspecies of *L. argentatus*.

The data were calculated using the standard indicators (Gomoiu & Skolka, 2001) and methods (Gache, 2002), while the similarities between the avicoenoses of the dam basins were obtained using BioDiversity Pro, version 2.

Results and discussions

The avifauna observed on the five considered dam basins consisted of 45 species and 14,784 individuals, which means more that the average number of species/year (39.39) for 1999–2021 period and more that the average number of individuals/year (12,622) for the same interval of time (Table 1). There is obvious the tendency of increase of both indicators achieved on long term and that can be in relation with the global warming, on the one hand (Mestecăneanu & Gava, 2022), but also with other elements, like the silting process that comes with the increase of the habitat diversity, on the other hand. The eutrophication was reminded sometimes, too (Munteanu & Mătieş, 1983; Mestecăneanu & Gava, 2014a, 2022), although it is not happening as the same extent as on the natural lakes. Other external or general influences, like the breeding success, the predation, the diseases, the degree of protection, the changes of the migratory or wintering habits etc., can be brought up in the discussion, too. The silting is continuous and started immediately after the reservoirs construction, it being already significant on Bascov and Piteşti since 1990s (Gava, 1997), ca. 20–25 years after their commissioning. The third stage of avifauna evolution of the dam basins, that of stabilisation, formerly mentioned by some authors (Munteanu & Mătieş, 1983), probably was reached at least on some of the reservoirs, although we think that Bascov is not far from the beginning of the fourth stage, that of avifauna decline, when, in the absence of ample unclogging actions, the biodiversity of the wetland avifauna will decrease, because the lake will practically turn into a simple course of river (Mestecăneanu & Gava, 2014a).

The average number of species/dam basin was 22.8, while the average number of individuals/dam basin was 3,113. Regarding the species dependent on wetlands, their total number was 30 (17.2 species/dam basins), while their total strength got 14,477 individuals (2,895.4 individuals/dam basins), which shows the importance of the artificial water accumulation for the species normally met on lakes and rivers. They had a significant weight from all registered avifauna, but primarily this derived from the method of census focused on the species typical of wetland, when the terrestrial species were only partially evaluated. But, at the same time, some individuals of the species that live hidden among reed and bulrush certainly were overlooked. As usually, Bascov, with its arrangement for the nautical competitions, was the poorest regarding the number of species and individuals, while Piteşti, with an area relatively equal with Bascov, was the richest in number of species and Goleşti, the largest dam basin among all, was the richest in number of individuals (Table 2).

The local conditions of every dam basin reflected in the similarities between the avicoenoses. By Jaccard Index (Fig. 2), that counts only the presence/absence of the species in the samples, the highest similarity (56.66%) was

between Budeasa and Goleşti, while the lowest (27.77%) was between Piteşti and Goleşti. Instead, by Bray-Curtis Index (Fig. 3), that takes into account the presence/absence of the species in the samples and their strengths, the highest similarity (41.22%) was between Piteşti and Goleşti, while the lowest (13.24%) was between Bascov and Goleşti. The area, the position on the river course and the type of habitats influenced the occurrence of the species on the dam basins, but also the anthropogenic impact played a high role, as we have seen with other occasions, too (Mestecăneanu & Gava, 2014a, b, 2016a, b, 2018 etc.). Concerning the species dependent on wetlands, the highest similarity by the Jaccard Index was between Goleşti and Budeasa (56.66%), while the lowest was between Piteşti and Vâlcele (27.77%). This time, Bascov showed moderate similarity with the other dam basins, inclusively by comparison with Piteşti (Table 3). About the Bray-Curtis Index, it is noticeable that the highest similarity was between Piteşti and Goleşti (41.22%), while the lowest was between Bascov and Goleşti (13.24%), with the mention that Bascov showed in this case an intermediate similarity with Piteşti (31.67%) (Table 4).

Table 1: The occurrence of the species on the dam basins, their strengths and classification by the categories of constancy and dominance.

No.	Species	Dam Basin					Strength	Category of constancy	Category of dominance
		Vâlcele	Budeasa	Bascov	Piteşti	Goleşti			
1	*Podiceps cristatus**	+	+			+	297	C3	D3
2	*Podiceps grisegena**					+	2	C1	D1
3	*Podiceps nigricollis**	+					2	C1	D1
4	*Tachybaptus ruficollis**	+	+	+	+		26	C4	D1
5	*Phalacrocorax carbo**	+	+	+	+	+	186	C4	D2
6	*Phalacrocorax pygmeus**	+	+	+	+	+	48	C4	D1
7	*Egretta alba**	+	+	+		+	11	C4	D1
8	*Ardea cinerea**				+	+	7	C2	D1
9	*Cygnus olor**		+		+	+	171	C3	D2
10	*Cygnus cygnus**		+			+	107	C2	D1
11	*Anser albifrons**		+			+	68	C2	D1
12	*Anas platyrhynchos**	+	+	+	+	+	2,607	C4	D5
13	*Anas strepera**				+		2	C1	D1
14	*Anas acuta**				+		1	C1	D1
15	*Anas penelope**	+	+	+	+	+	109	C4	D1
16	*Anas crecca**	+	+	+	+	+	864	C4	D4
17	*Anas clypeata**				+		3	C1	D1
18	*Tadorna tadorna**		+		+	+	42	C3	D1
19	*Aythya fuligula**	+			+	+	736	C3	D3
20	*Aythya ferina**	+	+		+	+	1,980	C4	D5
21	*Bucephala clangula**	+	+			+	50	C3	D1
22	*Mergus albellus**	+				+	8	C2	D1
23	*Haliaeetus albicilla**					+	1	C1	D1
24	*Buteo buteo*					+	1	C1	D1
25	*Phasianus colchicus*		+				1	C1	D1

No.	Species	Dam Basin					Strength	Category of constancy	Category of dominance
		Vâlcele	Budeasa	Bascov	Piteşti	Goleşti			
26	*Gallinula chloropus**				+		1	C1	D1
27	*Fulica atra**		+	+	+	+	1,341	C4	D4
28	*Larus argentatus**	+	+	+	+	+	781	C4	D4
29	*Larus canus**			+	+	+	822	C3	D4
30	*Larus ridibundus**	+	+	+	+	+	4,202	C4	D5
31	*Anthus spinoletta*		+				2	C1	D1
32	*Motacilla cinerea**				+		1	C1	D1
33	*Pica pica*		+		+	+	14	C3	D1
34	*Corvus monedula*				+		2	C1	D1
35	*Corvus frugilegus*				+	+	202	C2	D2
36	*Corvus cornix*				+		6	C1	D1
37	*Corvus corax*	+					1	C1	D1
38	*Turdus viscivorus*					+	30	C1	D1
39	*Parus caeruleus*				+		3	C1	D1
40	*Parus major*				+		9	C1	D1
41	*Passer domesticus*				+		6	C1	D1
42	*Fringilla coelebs*				+		3	C1	D1
43	*Carduelis carduelis*	+					7	C1	D1
44	*Carduelis cannabina*					+	20	C1	D1
45	*Emberiza schoeniclus**	+					1	C1	D1

Legend: * – species dependent on wetlands; + – presence; C1 – occasional species, C2 –accessory species, C3 – constant species, C4 – euconstant species; D1 – subrecedent species, D2 – recedent species, D3 – subdominant species, D4 – dominant species, D5 – eudominant species.

Table 2: The distribution of species and individuals on every dam basin and per total.

Dam Basin	Vâlcele	Budeasa	Bascov	Piteşti	Goleşti	Whole area
No. species	20	23	13	30	28	45
No. individuals	880	1,451	709	2,921	9,604	14,784
No. species*	16	17	11	20	22	30
No. individuals*	856	1,328	646	2,813	8,834	14,477

Legend: * – species dependent on wetlands.

Table 3: The similarity matrix by Jaccard Index between the avicoenoses of the dam basins.

Values	Vâlcele	Budeasa	Bascov	Piteşti	Goleşti
Vâlcele	*	46.15	45.00	27.77	40.62
Budeasa	*	*	47.61	37.14	56.66
Bascov	*	*	*	34.48	35.71
Piteşti	*	*	*	*	41.02
Goleşti	*	*	*	*	*

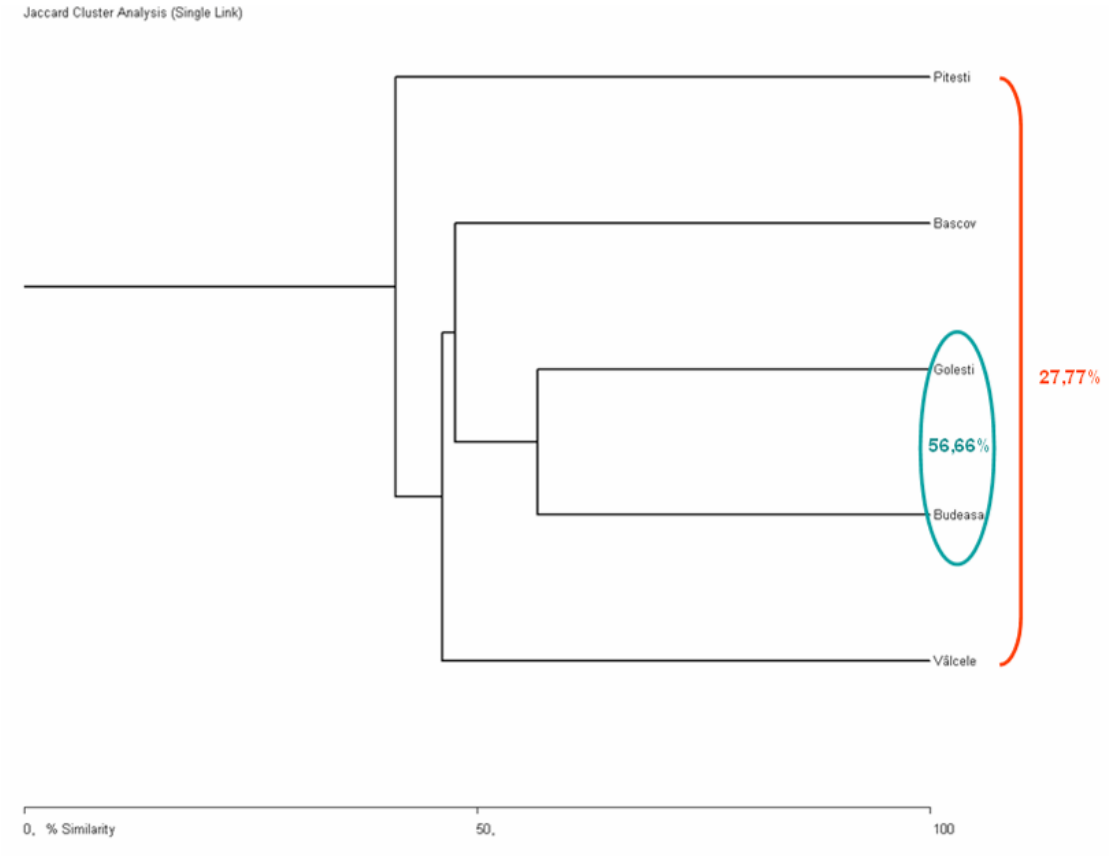

Fig. 2: The dendrogram of the avicoenoses similarity by the Jaccard Index.

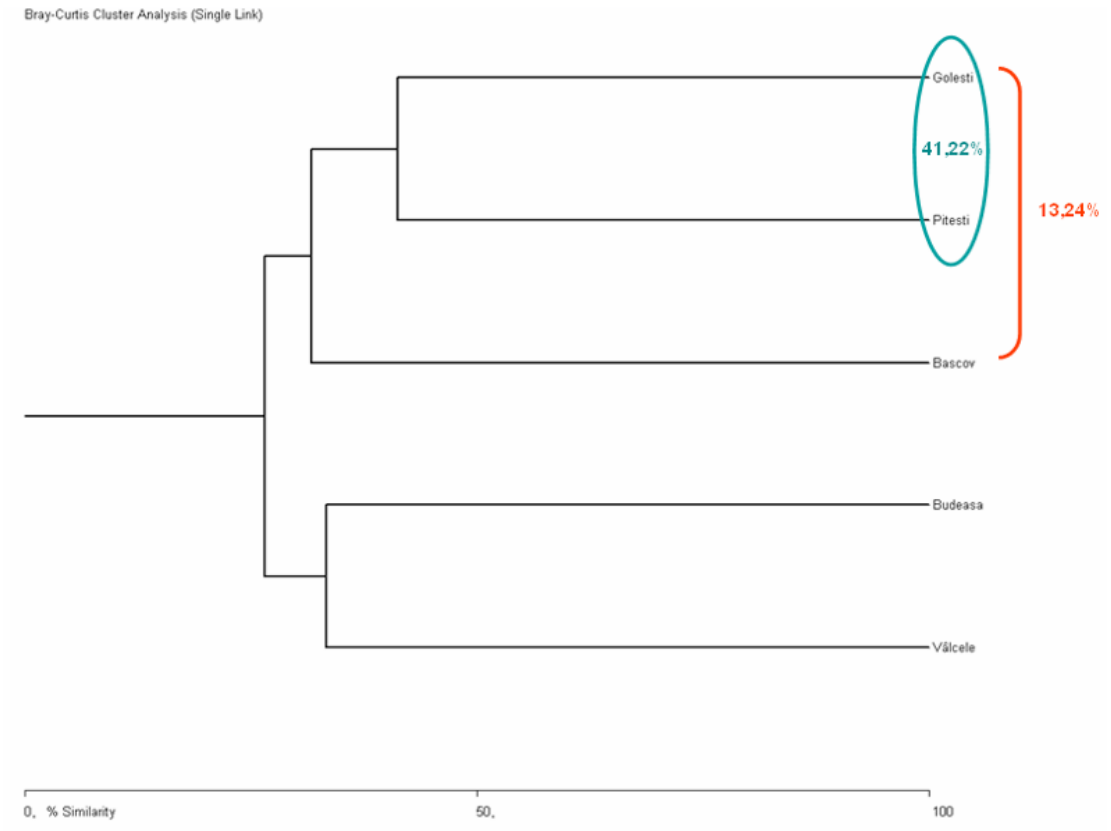

Fig. 3: The dendrogram of the avicoenoses similarity by the Bray-Curtis Index.

Table 4: The similarity matrix by Bray-Curtis Index between the avicoenoses of the dam basins.

Values	Vâlcele	Budeasa	Bascov	Piteşti	Goleşti
Vâlcele	*	33.30	26.49	17.30	16.44
Budeasa	*	*	23.93	24.88	24.58
Bascov	*	*	*	31.67	13.24
Piteşti	*	*	*	*	41.22
Goleşti	*	*	*	*	*

The importance in the ecosystem was not the same for every species. By constancy (Fig. 4), the majority of the species were occasional (C1), while the fewest were accessory (C4). The occasional species appeared only on a dam basin, generally with one or two individuals, except *Carduelis carduelis* – 7 individuals registered on Vâlcele Dam Basin, *Anas clypeata* – 3 individuals, *Corvus corone cornix* – 6 individuals, *Parus caeruleus* – 3 individuals, *Parus major* – 9 individuals, *Passer domesticus* – 6 individuals, *Fringilla coelebs* – 6 individuals, all observed on the Piteşti Dam Basin, and *Turdus viscivorus* – 30 individuals and *Carduelis cannabina* – 20 individuals, all registered on the Goleşti Dam Basin. However, because of the method of census, in fact, the species of Passeriformes were more frequent than it resulted. Some euconstant species (*Tachybaptus ruficollis*, *Egretta alba*, *Aythya ferina*, *Fulica atra*) were observed on four dam basins, while the other euconstant ones (*Phalacrocorax carbo*, *Phalacrocorax pygmeus*, *Anas platyrhynchos*, *Anas penelope*, *Anas crecca*, *Larus argentatus*, *Larus ridibundus*) on five. Among them, *Tachybaptus ruficollis*, *Phalacrocorax pygmeus*, *Egretta alba*, *Anas penelope* are subrecedent, *Phalacrocorax carbo* is recedent, *Anas crecca*, *Fulica atra*, *Larus argentatus* are dominant and *Anas platyrhynchos*, *Aythya ferina*, *Larus ridibundus* are eudominant. On the other hand, the two subdominant species, which represent the poorest category by dominance (Fig. 5), were constant (*Podiceps cristatus* was recorded on Vâlcele, Budeasa and Goleşti and *Aythya fuligula* on Vâlcele, Piteşti and Goleşti), while, generally, the subrecedent species, the richest group from the dominance point of view, were occasional and met only a dam basin. Regarding the strengths of the eudominant species, these varied much from a reservoir to another. Notable is that Goleşti was preferred by all of them, Budeasa lodged a relatively high number of individuals of *Anas platyrhynchos* (480) and Bascov was completely avoided by *Aythya ferina*. Instead, *Larus ridibundus* had increasing numbers from upstream to downstream, from 1 or 2 individuals, on Vâlcele and Budeasa, to 2,500 individuals, on Goleşti (Fig. 6).

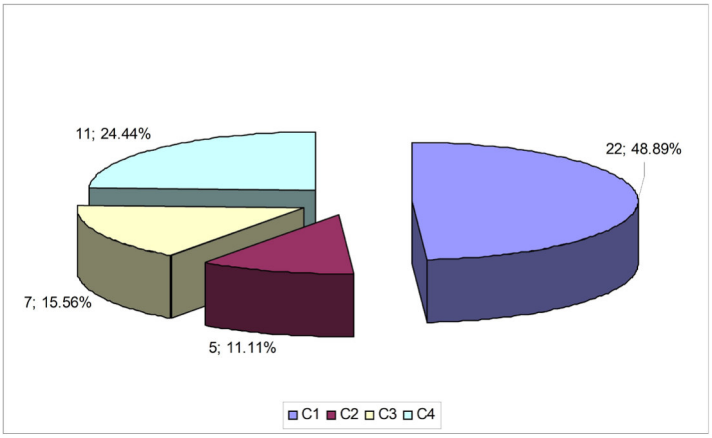

Fig. 4: The distribution of the species by the categories of constancy (C1 – occasional species, C2 – accessory species, C3 – constant species, C4 – euconstant species).

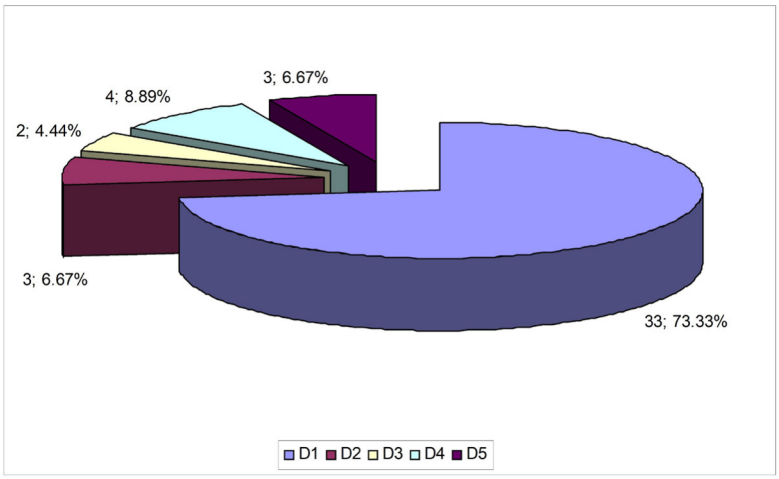

Fig. 5: The distribution of the species by the categories of dominance (D1 – subrecedent species, D2 – recedent species, D3 – subdominant species, D4 – dominant species, D5 – eudominant species).

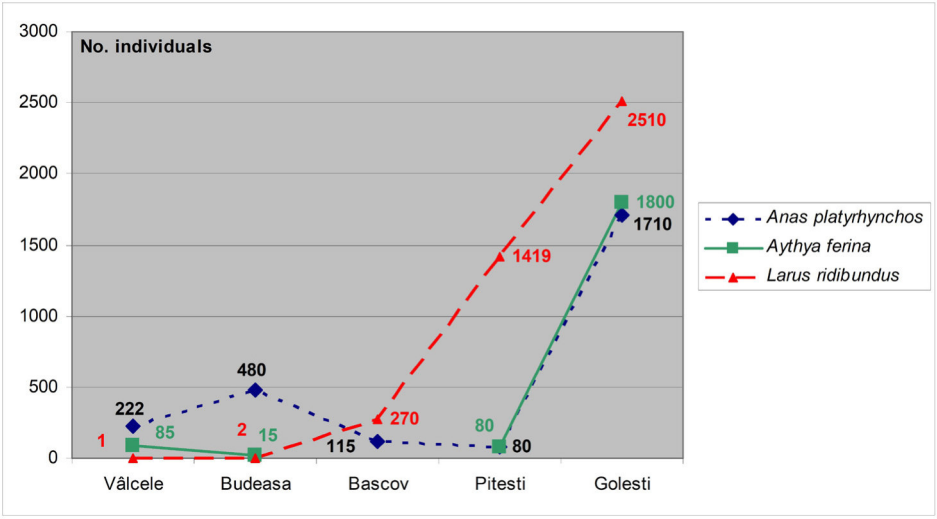

Fig. 6: The sharing on the dam basins of the eudominant species strengths.

Given that the Index of Relation of the orders is based on the Index of Dominance at the level of species, Anseriformes and Charadriiformes were the most representative orders (Fig. 7). They were overdominant, summing together almost 73% of the total strengths of the species, while no dominant orders registered. Within Anseriformes, out of *Anas platyrhynchos* and *Aythya ferina*, only *Anas crecca* and *Aythya fuligula* remarked as numbers and, within Charadriiformes, *L. argentatus* (with the subspecies *L. a. michahellis* and *L. a. cachinnans*) and *L. canus*, the other two component species beside *Larus ridibundus*, had important strengths, too. The other orders were complementary, separately token. Gruiformes was the best represented among them (9.08% of all) and, here, out of *Fulica atra*, dominant species, the second one, *Gallinula chloropus*, brought a low contribution, being subrecedent.

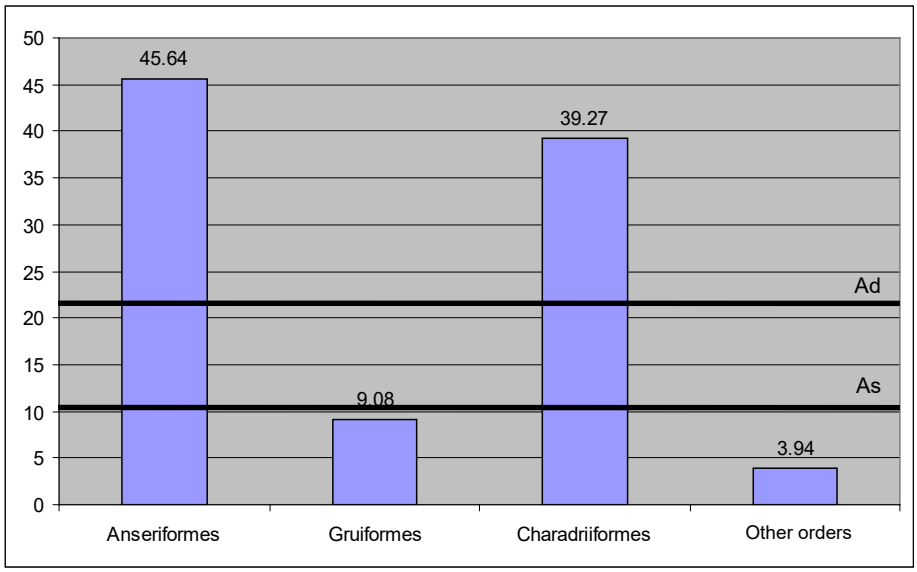

Fig. 7: The participation of the orders to the avicoenose formation.

Depending on the status of protection, five species (*Phalacrocorax pygmeus*, *Egretta alba*, *Cygnus cygnus*, *Mergus albellus*, and *Haliaeetus albicilla,* 11.11% of all) belong to the Annex 1 of the Directive 2009/147/CE, also known as the Birds Directive (https://ec.europa.eu). They are viewed as particularly threatened and special protective measures must be envisaged to their survival. *Phalacrocorax pygmeus* was an euconstant species, present on all dam basins, with numbers that fluctuated between 2 and 26 individuals, and, also, *Egretta alba*, which had lower strengths (maximum 7 individuals, on Goleşti, and no individuals, on Piteşti). *Cygnus cygnus* and *Mergus albellus* were accessory species, the first being found on Budeasa (8 individuals) and Goleşti (with an impressive number of 99 individuals) and the two on Vâlcele and Goleşti. Finally, *Haliaeetus albicilla*, occasional species, was seen in flight only over the Goleşti Dam Basin (Fig. 8).

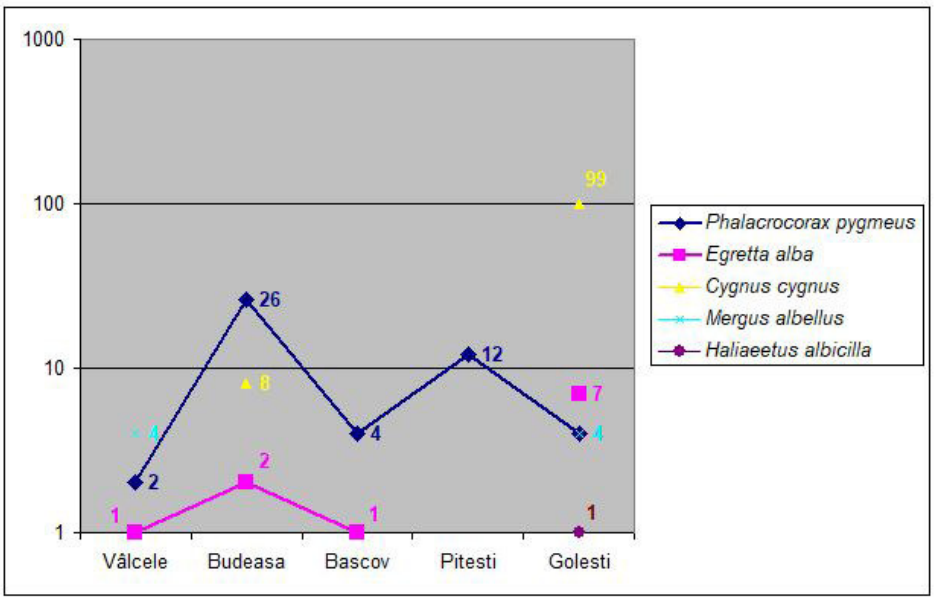

Fig. 8: The sharing on the dam basins of the species from the Annex 1 of the Birds Directive.

Conclusions

The 45 species, represented by 14,784 individuals, observed on the dam basins between Vâlcele and Goleşti from ROSPA0062 Lacurile de acumulare de pe Argeş in the winter 2021–2022, denote an increasing of biodiversity by comparison with the average for 1999–2021 and that can be attributed to a mix of local (the conditions from the area, which include the food supply, the habitat diversity, the human pressure, etc.), external (the fledgling rate and the mortality rate from the breeding and the passage grounds, the adjusts of the migration routes, etc.) and general factors (the climatic changes, the evolution of the infectious diseases, the application of the international legislation of protection of the birds and their habitats, etc.).

Depending on the local conditions, essentially the food availability and the human intrusion, the birds differently used the dam basins. Bascov was the less attractive for them, principally because of its nautical arrangements, and that matters mainly in the case of the species dependent on wetlands. An obvious difference between it and Piteşti, the next reservoir on the river course, with a comparable area, as number of species and individuals was registered.

As usually, *Tachybaptus ruficollis*, *Phalacrocorax carbo*, *Phalacrocorax pygmeus*, *Anas platyrhynchos*, *Anas crecca*, *Aythya ferina*, *Fulica atra, Larus argentatus* were among the most frequent species on the dam basins, while *Anas platyrhynchos*, *Aythya ferina* and *Larus ridibundus* were among the most abundant species, the majority of their strengths being hosted by the Goleşti Dam Basin. They contributed to the positioning of Anseriformes and Charadriiformes as overdominant orders among all orders of the avifauna.

Phalacrocorax pygmeus, *Egretta alba*, *Cygnus cygnus*, *Mergus albellus*, and *Haliaeetus albicilla* were the species with the highest level of protection, according to the Annex 1 of the Birds Directive.

While the stage of stabilisation of the dam basins winter avifauna probably was reached on some reservoirs, although the number of species still can increase with rare taxa at the national level, we think that the dam basins can become more propitious for the birds through adequate measures of conservation, which implies, above all, except for maintenance actions, a lower human derange. The Bray-Curtis similarities between the avicoenoses highlight the potential of development especially of the Bascov and Vâlcele biodiversity.

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Butterflies of the Nymphalidae Family (Lepidoptera: Papilionoidea) from the "R. Stepanov" Entomological Collection housed at National Museum of Ethnography and Natural History of The Republic of Moldova

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Abstract. The paper presents the analysis of diurnal butterflies from Nymphalidae family preserved in the entomological collection "R. Stepanov" which is curated at the National Museum of Ethnography and Natural History of the Republic of Moldova. This collection has an indisputable historical and scientific value, being one of the first of its kind in the Republic of Moldova, the specimens stored in it were collected during the years 1907–1978. The 114 butterflies specimens belong to a total of 36 species included in 22 genera and 4 subfamilies: Heliconiinae (5 species), Nymphalinae (8 species), Apaturiinae (10 species), and Satyrinae (1 species).

Keywords: Nymphalidae, museum, Stepanov, Entomological Collection, species.

Introduction

The National Museum of Ethnography and Natural History, located in Chișinău, Republic of Moldova stores the oldest entomological collections from the country. Of these, the Entomological Collection "N. Zubowsky" is the oldest in the Republic of Moldova, elaborated during 1900–1940 in Bessarabia and has a considerable scientific interest. The "N. Zubowsky" collection includes 10752 specimens of insects (Derjanschi et al., 2016). Besides this entomological collection in the museum is stored another ancient valuable collection of R. Stepanov who was a famous naturalist too. The Entomological Collection "R. Stepanov" consists of more than 20000 insects from Orthoptera, Lepidoptera and Coleoptera orders, which will be published in the future. The specimens were collected during 1900–1980 from various ecosystems, both anthropogenic and natural from Bessarabia, which represents the current territory of the Republic of Moldova and a few localities that now belong to Ukraine. The Entomological Collection "R. Stepanov" is divided into two parts, one curated by the Museum of Ethnography and Natural History and the second part belongs to the Museum of Entomology of the Institute of Zoology from Chișinău, Republic of Moldova. The study of the Entomological Collection "R. Stepanov" began recently with a publication that presents the moths from that collection (Țugulea et al., 2020; Țugulea, 2021).

The purpose of this paper is to continue the publication of species preserved in the "R. Stepanov" Entomological Collection for a better understanding of the diversity and the habitat of the insects from the Republic of Moldova. The paper presents the catalogue of Nymphalidae collection of the R. Stepanov collected in 1910–1939 during Stepanov's research into the insect's fauna in the Bessarabia

(in our days Republic of Moldova and some towns from Ukraine).

Material and methods

The analysed material is represented by the species of the Nymphalidae family preserved in the "R. Stepanov" Entomological Collection of the National Museum of Ethnography and Natural History, collected during 1910–1939.

The nomenclature and taxonomy of the species used in this work are consistent with the taxonomic system of Rakosy (2003) and de Jong et al. (2014).

For each species, there were recorded: the number of specimens, the sites, the collection dates, and the protection statute. Collection sites are listed in alphabetical order, and the collection dates, are in chronological order of the years and months of collection.

Results and discussions

After analyzing the 114 specimens, 36 species included in 22 genera and 4 subfamilies: Heliconiinae (5 species), Nymphalinae (8 species), Apaturiinae (10 species), and Satyrinae (1 species) were identified. The distribution of specimens, species, and genera in the subfamilies is uneven (Table 1).

Of 114 specimens stored in the "R. Stepanov" Entomological Collection, three are from Romania and Ukraine, and 93 are from 19 collecting sites from the Republic of Moldova (Table 2). About those 18 remained specimens nothing is known because the labels with the collection date and place are missing.

In what follows, we present list of identified species in accordance with the taxonomic systems utilized by Rakosy (2003) and Fauna Europaea.

Table 1: The numerical spectrum of the analysed Nymphalidae family from "R. Stepanov" Entomological Collection.

No.	Subfamily	No. of genera	No. of species	No. of specimens		
				Republic of Moldova	Other countries	No data
1.	Heliconiinae	3	5	14	1	2
2.	Nymphalinae	5	8	27	2	8
3.	Apaturiinae	5	10	23	-	1
4.	Satyrinae	9	13	29	-	7
Total		**22**	**36**	**93**	**3**	**18**

Table 2: Collection sites list of Nymphalidae specimens from the "R. Stepanov" Entomological Collection.

I. Republic of Moldova	
1. Baurci-Moldoveni (Cahul district)	13. Micăuți (Strășeni district)
2. Bender	14. Pârlița (Ungheni district)
3. Bularda (Călărași district)	15. Scoreni (Strășeni district)
4. Călărași	16. Strășeni
5. Căpriana (Strășeni district)	17. Talmaza (Ștefan-Vodă district)
6. Cărpineni (Hîncești district)	18. Tuzara (Călărași district)
7. Chișinău	19. Văsileni (Rîșcani district)
8. Cornești (Ungheni district)	
9. Cricova (Chișinău)	**II. Romania**
10. Dănceni (Ialoveni district)	20. Piatra Neamț
11. Gîsca (Căușeni district)	**III. Ukraine**
12. Leuntea (Căușeni district)	21. Izmail

Order Lepidoptera
Superfamily Papilionoidea
Family Nymphalidae

Subfamily Heliconiinae

1. ***Argynnis aglaja*** (Linnaeus, 1758)
Examined material – 2 specs.: Baurci-Moldoveni, 24.06.1911, 2 specs.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

2. ***Argynnis niobe*** (Linnaeus, 1758)
Examined material – 4 specs.: Baurci-Moldoveni, 02.07.1911, 2 specs.; 30.06.1911, 2 specs.
Protection statute: As the species' populations have declined considerably in recent years, it needs to be monitored and establish the species' conservation status.

3. ***Argynnis paphia*** (Linnaeus, 1758)
Examined material – 5 specs.: Căpriana, 29.07.1911, 1 spec.; Cornești, 13.06.1937, 1 spec.; Călărași, 20.07.1923, 1 spec.; Piatra Neamț (Romania), 25.07.1924, 1 spec.; no data, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

4. ***Issoria lathonia*** (Linnaeus, 1758)
In collection: *Argynis lathonia*
Examined material – 5 specs.: Micăuți, 18.07.1910, 1 spec.; Durlești, 05.08.1922, 1 spec., Baurci-Moldoveni, 01.06.1911, 1 spec.; 24.06.1911, 1 spec.; no data, 22.04.1911, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

5. ***Boloria dia*** (Linnaeus, 1767)
In collection: *Argynis dia*
Examined material – 1 spec.: Durlești, 22.05.1932, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

Subfamily Nymphalinae

6. ***Vanessa atalanta*** (Linnaeus, 1758)
In collection: *Pyrameis cardui*
Examined material – 2 specs.: Pîrlița, 11.08.1911, 1 spec.; Izmail (Ukraine), 18.06.1911, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

7. ***Vanessa cardui*** (Linnaeus, 1758)
In collection: *Pyrameis cardui*
Examined material – 5 specs.: Chișinău, 07.08.1932, 1 spec.; 22.07.1924, 1 spec.; 07.08.1932, 1 spec.; Talmaza, 11.07.1932, 1 spec.; Izmail (Ukraine), 05.06.1911, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

8. ***Aglais io*** (Linnaeus, 1758)
In collection: *Vanessa io*
Examined material – 16 specs.: Durlești, 21.06.1934, 1 spec.; Chișinău, 29.08.1912, 1 spec., 05.09.1912, 12 specs.; no data, 3 specs.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

9. ***Aglais urticae*** (Linnaeus, 1758)
In collection: *Vanessa urticae*
Examined material – 1 spec.: Scoreni, 22.07.1917, 1 spec.
Protection statute: As the species' populations have declined considerably in recent years, it needs to be monitored to accurately establish the species' conservation status.

10. ***Polygonia c-album*** (Linnaeus, 1758)
Examined material – 5 specs.: Pîrlița, 12.08.1911, 1 spec.; Talmaza, 03.08.1932, 1 spec., 11.07.1932, 1 spec.; Cărpineni [Toporscaia], 26.07.1911, 1 spec.; no data, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

11. ***Araschnia levana*** (Linnaeus, 1758)
In collection: *Araschnia levana f. prorsa*
Examined material – 3 specs.: Pîrlița, 12.08.1911, 1 spec.; Cornești [Pereval], 26.06.1938, 1 spec.; no data, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

12. ***Nymphalis polychloros*** (Linnaeus, 1758)
In collection: *Vanessa polychloros*
Examined material – 4 specs.: Chișinău, 05.06.1914, 2 spec.; no data, 2 specs.
Protection statute: Rare species in the fauna of the Republic of Moldova that requires protection and conservation.

13. ***Nymphalis vaualbum*** (Denis & Schiffermüller, 1775)
In collection: *Vanessa l-album*
Examined material – 1 spec.: no data, 1 spec.
Protection statute: Rare species in the fauna of the Republic of Moldova that requires protection and conservation. The species is included in the Red List of Butterflies in Europe (Van Swaay et al., 2010).

Subfamily Apaturiinae

14. ***Apatura ilia*** (Denis & Schiffermüller, 1775)
Examined material – 5 specs.: Talmaza, 11.07.1932, 3 spec.; Leuntea, 01.08.1932, 1 spec., no data, 1 spec.
Protection statute: Rare species in the fauna of the Republic of Moldova. In recent years, an increase in the species' populations has been observed.

15. ***Limenitis populi*** (Linnaeus, 1758)
Examined material – 1 spec.: no data, 1 spec.
Protection statute: endangered species (EN), included in the Red Book of the Republic of Moldova, 2015.

16. ***Neptis sappho*** (Pallas, 1771)
In collection: *Neptis aceris*
Examined material – 3 specs.: Micăuți, 18.07.1910, 1 spec.; Căpriana, 10.05.1914, 1 spec.; Durlești, 06.05.1910, 1 spec.
Protection statute: vulnerable species (VU), included in the Red Book of the Republic of Moldova, 2015 (Țugulea et al., 2021). The species is included in Red List of Butterflies in Europe (European Red List of Butterflies, 2010). In recent years, an increase in the species' populations has been observed on the territory of the Republic of Moldova.

17. ***Euphydryas maturna*** (Linnaeus, 1758)
In collection: *Melitaea maturna*
Examined material – 1 spec.: Tuzara, 06.06.1935, 1 spec.
Protection statute: endangered species (EN), included in the Red Book of the Republic of Moldova, 2015. The species is included in Annex II of the Bern Convention (1979) and in the Red List of Butterflies in Europe (European Red List of Butterflies, 2010). In recent years, an increase in the species' populations has been observed on the territory of the Republic of Moldova.

18. ***Melitaea athalia*** (Rottemburg, 1775)
Examined material – 3 specs.: Chișinău, 01.06.1924, 1 spec.; Talmaza, 17.07.1932, 1 spec.; Bender, 07.08.1935, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

19. ***Melitaea diamina*** (Lang, 1789)
In collection: *Melithea dictynna*
Examined material – 1 spec.: Baurci-Moldoveni, 01.07.1911, 1 spec.
Protection statute: The conservation status of the species on the territory of the Republic of Moldova is unknown. In the last decades, there are no reports of the species on the territory of the Republic of Moldova.

20. ***Melitaea didyma*** (Esper, 1778)
Examined material – 2 specs.: Bularda, 22.07.1939, 1 spec.; Cornești [Pereval], 27.07.1935, 1 spec.
Protection statute: the species is not

endangered in the fauna of the Republic of Moldova.

21. ***Melitaea phoebe*** (Denis & Schiffermüller, 1775)
In collection: *Athalia phoebe*
Examined material – 3 specs.: Bularda, 22.07.1939, 1 spec.; Bender, 07.06.1926, 1 spec.; Gîsca, 06.08.1932, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

22. ***Melitaea trivia*** (Denis & Schiffermüller, 1775)
Examined material – 4 specs.: Cornești [Pereval], 19.07.1938, 2 spec., 27.07.1935, 1 spec.; Bender, 16.07.1936, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

23. ***Melithea cinxia*** (Linnaeus, 1758)
Examined material – 2 specs.: Micăuți, 04.05.1910, 1 spec.; Dănceni, 16.05.1937, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

Subfamily Satyrinae

24. ***Pararge aegeria*** (Linnaeus, 1758)
In collection: *Pararge aegeria* f. *egerides*
Examined material – 1 spec.: Chişinău, 16.07.1922, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

25. ***Coenonympha arcania*** (Linnaeus, 1761)
Examined material – 2 specs.: Chişinău [Durleşti], 16.06.1924, 2 specs.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

26. ***Coenonympha glycerion*** (Borkhausen, 1788)
In collection: *Coenonympha iphis*
Examined material – 3 specs.: Corneşti [Pereval], 14.09.1935, 1 spec.; Cricova, 28.08.1935, 1 spec.; Micăuți, 08.07.1910, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

27. ***Coenonympha pamphilus*** (Linnaeus, 1758)
Examined material – 2 specs.: Văsieni (Ialoveni), 21.06.1910, 2 specs.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

28. ***Maniola jurtina*** (Linnaeus, 1758)
In collection: *Epinephele jurtina*
Examined material – 4 specs.: Chişinău [Petricani], 29.06.1939, 1 spec.; Străşeni, 03.07.1927, 1 spec.; no data, 2 specs.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

29. ***Hyponephele lycaon*** (Rottemburg, 1775)
In collection: *Epinephele lycaon*
Examined material – 1 spec.: no data, 1 spec.
Protection statute: There is only one report of the species on the territory of the Republic of Moldova. The presence of the species in the country's fauna needs to be confirmed.

30. ***Erebia medusa*** (Denis & Schiffermüller, 1775)
Examined material – 2 specs.: Chişinău, 23.07.1922, 1 spec.; Chişinău [Durleşti], 23.07.1922, 1 spec.
Protection statute: The conservation status of a species in the Republic of Moldova is unknown.

31. ***Melanargia galathea*** (Linnaeus, 1758)
In collection: *Melanargia iapygia*
Examined material – 10 specs.: Chişinău, 07.08.1922, 1 spec.; Călărași, 09.08.1911, 1 spec.; Baurci-Moldoveni, 24–28.06.1911, 8 specs.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

32. ***Minois dryas*** (Scopoli, 1763)
In collection: *Satyrus dryas*
Examined material – 3 specs.: Chişinău [Durleşti], 05.08.1922, 1 spec.; Micăuți, 18.07.1910, 1 spec.; Căpriana, 01.08.1911, 1 spec.
Protection statute: the species is not endangered in the fauna of the Republic of Moldova.

33. ***Hipparchia alcyone*** (Linnaeus, 1764)
In collection: *Satyrus hermione*
Examined material – 1 spec.: Căpriana, 09.08.1911, 1 spec.
Protection statute: The conservation status of the species on the territory of the Republic of Moldova is unknown. In the last decades, there are no reports of the species on the territory of the Republic of Moldova.

34. ***Hipparchia semele*** (Linnaeus, 1758)
In collection: *Satyrus semele*
Examined material – 1 spec.: no data, 1 spec.
Protection statute: The conservation status of the species on the territory of the Republic of Moldova is unknown. In the last decades, there are no reports of the species on the territory of the Republic of Moldova.

35. ***Hipparchia statilinus*** (Hufnagel, 1766)
In collection: *Satyrus statilinus*
Examined material – 2 specs.: Căpriana, 05.08.1911, 1 spec.; no data, 1 spec.
Protection statute: The conservation status of the species on the territory of the Republic of Moldova is unknown. In the last decades, there are no reports of the species on the territory of the Republic of Moldova.

36. ***Arethusana arethusa*** (Denis & Schiffermüller, 1775)
In collection: *Satyrus arethusa*
Examined material – 4 specs.: Chişinău, 08.08.1937, 2 spec.; no data, 2 specs.
Protection statute: The conservation status of the species on the territory of the Republic of Moldova is unknown. In the last decades, there are no reports of the species on the territory of the Republic of Moldova.

The best represented subfamily in terms of the number of specimens is the Nymphalinae and Satyrinae subfamilies, which sums up to 37 and 36 specimens of the 114, representing 32% each (Fig. 1). It is followed by the Apaturiinae subfamily with 24 specimens (21%) and Heliconiinae with 17 specimens (15%).

Regarding the distribution of species in the subfamilies, the Satyrinae, Apaturiinae and Nymphalidae subfamilies still own most species – 13, 10 and 8, respectively. Heliconiinae subfamily includes only 5 species (Fig. 2).

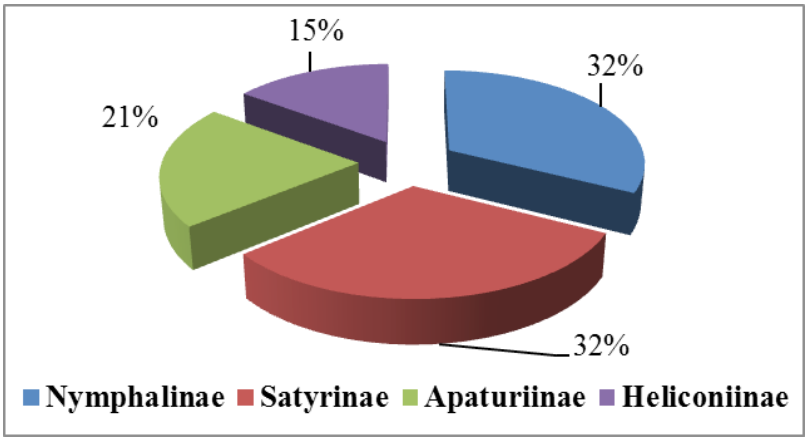

Fig. 1: The numerical spectrum of the analysed specimens of Nymphalidae butterflies from "R. Stepanov" Entomological Collection.

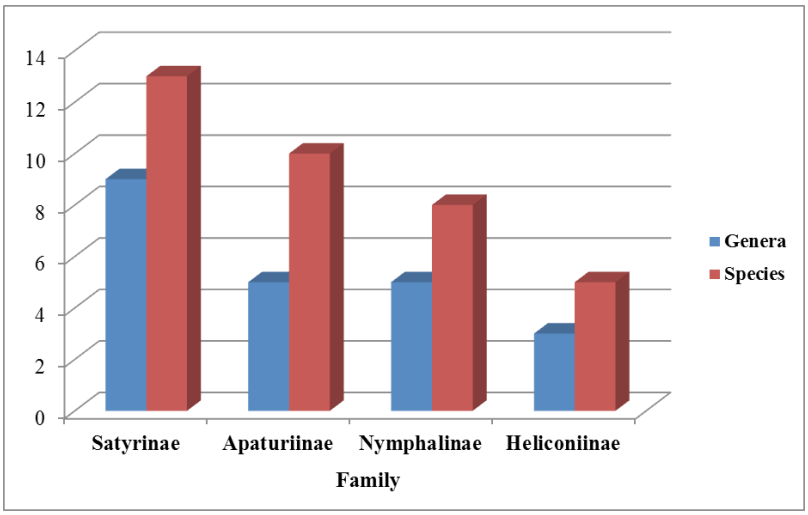

Fig. 2: The numerical spectrum of genera and species of Nymphalidae butterflies from "R. Stepanov" Entomological Collection.

For the species *Arethusana arethusa, Erebia medusa, Hipparchia hermione, Hipparchia statilinus* it is the second citation in the fauna of the Republic of Moldova. For the following species in the country's fauna: *Nymphalis vaualbum, Hipparchia semele* and *Hyponephele lycaon* the collection site of the specimens is not indicated by R. Stepanov.

Nymphalis vaualbum, *N. polychloros*, *Limenitis populi*, *Neptis sappho,* and *Euphydryas maturna* represent rare species for the fauna of the Republic of Moldova and need protection and conservation. The last three species are included in the Red Book of the Republic of Moldova, 2015. As a result of research in recent years, a significant increase in the populations of *Neptis sappho* and *Euphydryas maturna* has been observed.

Conclusions

The catalogue of butterflies from Nymphalidae family (Lepidoptera, Papilionoidea) from the "R. Stepanov" Entomological Collection housed at the Museum of Ethnography and Natural History of the Republic of Moldova includes 114 specimens belonging to a total of 36 species included in 22 genera and 4 subfamilies: Heliconiinae (5 species), Nymphalinae (8 species), Apaturiinae (10 species), and Satyrinae (1 species).

The best represented subfamilies in terms of number of specimens are the Nymphalinae and Satyrinae subfamilies. Regarding the distribution of species in subfamilies, the Satyrinae, Apaturiinae, and Nymphalidae subfamilies still own most species.

The results of this research contribute to a better understanding of the Nymphalidae butterflies diversity and of their habitat in the Republic of Moldova's fauna.

Acknowledgments. The research was carried in the project 20.80009.7007.02. from the State program of the Institute of Zoology and 20.80009.0807.24 from the State program of the National Museum of Ethnography and Natural History, Republic of Moldova.

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First record of the *Trypetimorpha occidentalis* (Huang & Bourgoin, 1993) (Hemiptera: Tropiduchidae) in the Republic of Moldova

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Abstract: The species *Trypetimorpha occidentalis* (Huang & Bourgoin, 1993) is reported as a new species to the fauna of the Republic of Moldova. This planthopper was described by Huang & Bourgoin in 1993. Earlier, there was mentioned another species of this genus for the fauna of the Republic of Moldova – *Trypetimorpha fenestrata* (Costa, 1862), which was probably wrong, because at the very beginning the type species was described on the basis of females only, an aspect that created a lot of subsequent misunderstanding.

Keywords: *Trypetimorpha fenestrata*, type species, description, biology.

Introduction

The genus *Trypetimorpha* was originally described by A. Costa in 1862 from Italy, and included two new species: *T. fenestrata* (type species) and *T. psyllipennis*. The status of the genus has been changed several times during its history, and its present status – i.e. member of the family Tropiduchidae – was given by Melichar (1914) (Orosz, 2012). As a medium size family within the Fulgoromorpha, Tropiduchidae Stal, 1866 currently comprises 652 described species included in 183 genera. Its global latitudinal profile is distributed between the north temperate and the south subtropical bioclimatic zones, but mainly in the warmer regions. Most species feed on shrubs and trees, and some are crop pests, their association with host plants is quite diverse concerning 21 plant orders, including some monocots (Gnezdilov et al., 2016). Although *Trypetimorpha* itself has no species of proven economic importance, this study of its systematics and phylogeny is intended as a contribution to the understanding of the group as a whole.

The present paper contains information about the systematic positions, distribution, short description, and biology of the species *Trypetimorpha occidentalis*, which was found on the territory of the Republic of Moldova.

Materials and methods

The insects were collected in 2021 on the territory of the Republic of Moldova by the method of mowing with the entomological net. There were explored the biotopes as below: tree and shrub vegetation (Hîrbovăț), mesophilic meadows, mesophilic grassland under the forest cover (Vila Nisporeni), cereal weeds with viper's bugloss (*Echium vulgare* L.) and yarrow (*Achillea millefolium* L.), annual fleabane (*Erigeron annuus* L.) – Ialoveni, feather-grass-fescue steppes (*Festuca* sp., *Stipa* sp.) (Bugeac) (Fig. 1).

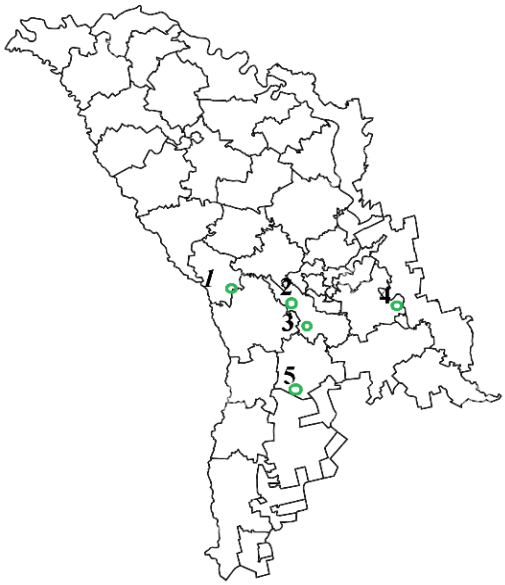

Fig. 1: Map of the Republic of Moldova with the explored biotopes:
1 – Vila Nisporeni; 2 – Costești; 3 – Hansca; 4 – Hîrbovăț; 5 – Topala (steppe Bugeac).

The collected material was laid on cotton pads for further determination in laboratory conditions. The male aedeagus was removed to accurately determine the species. The genital segments of examined specimens were macerated in 10% KOH and were studied on a microscope MBS-10. The pictures were taken of the general appearance of adults as well as the genital apparatus of males.

Genital preparations are stored in microvioles (length 16.00 mm, diameter 5.20 mm), which were pinned on an entomological pin with the corresponding species. The collected material is stored in the Museum of Entomology of the Institute of Zoology, Republic of Moldova. The material determination was made using keys for Europe (Emeljanov, 1964), Far East (Anufriev & Emeljanov, 1988) and the articles with species description or genus revisions (Huang & Bourgoin, 1993).

Results and discussions

Trypetimorpha occidentalis Huang & Bourgoin, 1993

Trypetimorpha fenestrata auct.

Systematic position. The species *Trypetimorpha occidentalis* belongs to subphylum Hexapoda, class Insecta, order Hemiptera, infraorder Fulgoromorpha, family Tropiduchidae, genus *Trypetimorpha*.

Material examined: Vila Nisporeni (23.08.2021 – 1 ♂, 7 ♀), Hîrbovăț (25.08.2021 – 1 ♂), Topala (27.09.2021 – 1 ♂), Costești (19.10.2021 – 32 ♂, 22 ♀), Hansca (19.10.2021 – 1 ♂).

Description. The representatives of genus *Trypetimorpha* Costa, 1862 have shortened body, their elytra are compacted, cellular, diverging along the seam and do not fit tightly to the body and stick out behind the abdomen even in short-winged specimens. Their head has sharp carinae, vertex is pentagonal, frons has protruding longitudinal carinae in middle, clypeus is convex, without carinae. Pronotum and mesonotum have longitudinal carinae. The posterior margin of the pronotum is slightly obtuse-angled. The shield has three keels. The legs are strong, rather short (Anufriev & Emeljanov, 1988).

Male: Dimensions of the body of the macropterous forms 3.6–4 mm, and of the brachypterous forms 2.1–2.9 mm (Huang & Bourgoin, 1993).

Gonostyli triangular, short, apically

a. b.

Fig. 2: Female of species *T. occidentalis*: a-macropterous, b-brachypterous.

rounded. Aedeagus strongly curved in a right angle. Lateral process of the periandrium unibranched surpassing the middle length of the aedeagus, regularly narrowed and apically acute. Laterally, uritee dorsal margin as long as ventral one.

Female: Like male, it is yellowish with intense spots that create a dark brown pattern. Dimensions of the body of the macropterous forms 3.7–4.2 mm, and of the brachypterous forms 2.6–2.9 mm (Fig. 2a, b). Thick basal part of the copulatory duct is shorter than wide, then thin and sinuous (Huang & Bourgoin, 1993).

Host plant: Unknown.

Distribution: Western Europe from CIS to Italy, south of France and Spain, Austria, Canary Is., Cyprus, former Yugoslavia, Kazakhstan (Huang & Bourgoin, 1993; Orosz, 2012).

Biology: The species is rare and prefers warmth. A few specimens of *T. occidentalis* were found in central and southern parts of the Republic of Moldova among forbs and grasses.

The species most likely has one generation per year. Adult cicadas presumably appear in the second half of summer, in August and September. The largest number of specimens of cicada was found in October.

Historical account. The species *T. fenestrata* was indicated for the first time for the fauna of the Republic of Moldova in the work of Talitsky et al. (1966). The specimens of cicada were found in localities Hîncești and Ciumai in August 1963 (Talickij & Logvinenko, 1966). Unfortunately, the specimens of cicadas are not preserved in the cicada collection of Institute of Genetics, Physiology and Plant Protection, the Laboratory of Entomology and Biocenology, Republic of Moldova.

In the key "Insects of the European part of the USSR" (1964), A. Emeljanov gives the description of only one species: *T. fenestrata* Costa, 1862.

V. Logvinenko (1975) gives the detailed description of the species *T. fenestrata* Costa, 1862 in the work named "Fauna of the Ukraine", also giving the pictures. She mentions that on the territory of the Ukraine few specimens of cicada were found in the sandy steppe and steppe areas among forbs and cereal vegetation in the extreme south of the steppe zone – in the lower reaches of the Dnieper, on the territory of the Black Sea Reserve (Logvinenko, 1975).

The information about frequency of occurrence of the species *T. fenestrata* in Europe was given in the work "The Auchenorrhyncha (Homoptera) of Europe" with additional

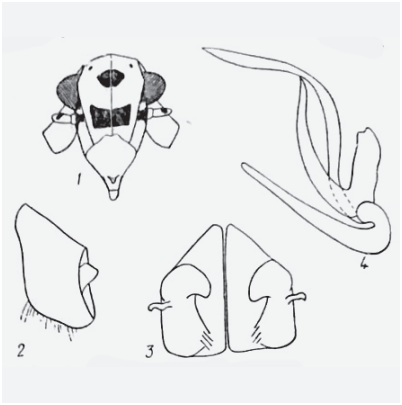

Fig. 3: Male genitalia of *Trypetimorpha fenestrata* (from Logvinenko, 1975).

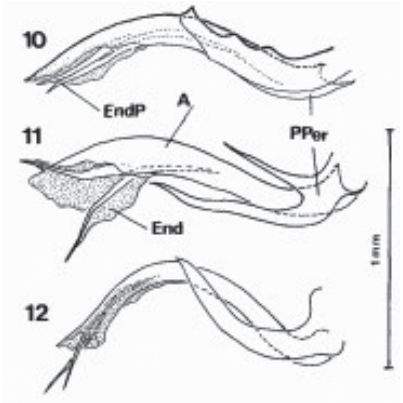

Fig. 4: Apical parts of male genitalia (10 – *T. fenestrata*, 12 – *T. occidentalis*) (from Huang & Bourgoin, 1993).

Fig. 5: Apical parts of male genitalia of species *T. occidentalis*. (Photo: Grozdeva S.)

data from the southern parts of the USSR (Nast, 1987).

Taxonomic position of the species *T. fenestrata* has not been changed until the 1990s.

After a detailed study of male and female genitalia and with the addition of other morphological characters, Huang & Bourgoin presented in 1993 a systematic revision of the genus *Trypetimorpha*, synonymizing five of the previously described species and describing four others. Despite the fact that the species *T. fenestrata* is a spread species, its newly collected specimens have differences from the type species, so they were assigned to a new species *T. occidentalis* (Huang & Bourgoin, 1993).

According to the pictures that were made by different authors, the species that is meant is *Trypetimorpha occidentalis* (Figs. 3–5).

The review of the scientific literature on the study of genus *Trypetimorpha* allowed us to trace the history of the appearance and distribution of species *T. occidentalis* on the territory of Europe.

Conclusions

Despite great interest to study of phylogenetic relationships within planthoppers the taxonomy of genera *Trypetimorpha,* as well as the whole infraorder Fulgoromorpha is still not stable. To date, based on the results of our research, there was found and identified only one species of the genus on the territory of the Republic of Moldova – *Trpetimorpha occidentalis* (Huang & Bourgoin, 1993). The features of the behavior of this species in the conditions of this territory will be studied.

Acknowledgments. I'd like to thank the Head of the laboratory of Entomology, Institute of Zoology, Republic of Moldova Dr. habilitatus Galina Bușmachiu for assistance in the field studies.

The study was performed in the framework of the project 20.80009.7007.02 – "Evolutionary changes of economically important terrestrial fauna, of rare and protected species in the conditions of anthropogenic and climatic changes".

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The composition of necrophagous beetles on a goat carrion in the forest ecosystem from "Codri" scientific reserve (Republic of Moldova)

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Abstract: This work presents data on the fauna and dynamics of coprophagous and necrophagous coleopterans, which participated in a carrion's decomposition process. The research was carried out between 04.06–24.07.2004 on a goat carcass found in the sessile oak forest with a mixture of hornbeam in the "Codri" scientific reserve (Republic of Moldova). As a result of the research, it was established that in the process of decomposing the carrion, a total of 26 species of coleopterans belonging to 6 families were identified: Carabidae (3 species with 4 specimens), Geotrupidae (1 species with 3 specimens), Scarabaeidae (12 species with 5751 specimens), Silphidae (6 species with 65 specimens.), Staphylinidae (3 species with 3 specimens.) and Histeridae (1 species with 14 specimens). On the first day of decomposition, specimens of random species were identified (10 specimens belonging to 5 species), while the largest number of species and specimens were identified one week after the beginning of the decomposition process (22 species with 5825 specimens). Three weeks later, when the carrion was completely decomposed, only 5 species were observed with 18 specimens.

Keywords: Coleoptera, goat carrion, coprophagous beetles, necrophagous beetles, trophic spectrum.

Introduction

Insects are the most important components of the terrestrial fauna associated with carrion because they recycle organic matter back into the ecosystem. (Anton et al., 2011; Zanetti et al., 2014).

In terrestrial ecosystems, vertebrate carrion and feces form unevenly distributed, ephemeral resource islands that are enriched with nitrogen, phosphorus, sulfur, and other vital elements, in contrast to the relatively nutrient-poor surroundings consisting of plant biomass. These properties of carrion, therefore, make them high-quality resources and hotspots of biological and chemical activity that microbes, insects, and other scavengers can utilize as their diet and for reproduction. (Sowig & Wassmer, 1994; Weithmann et al., 2020).

There is little information in the Republic of Moldova about coprophagous and necrophagous coleopterans species in natural ecosystems, that participate in the animal feces and carrions decomposition process and also about fragmentation.

Thus, some data on the identified coleopteran were recorded by Miller & Zubovwski (1917), Medvedev & Sapiro (1957), Cilipic (1998), Bacal & Munteanu (2012), Baban, (2012), Baban & Tălămbuță (2016).

The aim of this study is to provide some data on the fauna and temporal succession of the coleopterans that participate in the vertebrate animals' carrions decomposition process.

Material and methods

The research was carried out between 04.06–24.07.2004 on a goat carrion identified in the sessile oak forest mixed with hornbeam in the "Codri" scientific reserve (47° 04' N, 28° 30' E), which was located in the shade, directly on ground. Samples were taken every two weeks, for 30 days, until the carcass was completely decomposed.

Three coleopterans were collected every 7 days. Three stages of decomposition were investigated, in which 5846 adult specimens of coleopterans from the families Carabidae, Geotrupidae, Scarabaeidae, Silphidea, Staphilynidae and Histeridae were collected.

The identification of collected species was done based on the works: Krijanovschij (1965), Kabacov (2006); Gîdei & Popescu (2009), Chimișliu (2014).

Results and discussions

As a result of the research, it was established that during the period of carrion's decomposition, a total of 26 species of coleopteran belonging to 6 families were identified: Carabidae (3 species with 4 specimens), Geotrupidae (1 species with 3 specimens), Scarabaeidae (12 species with 5751 specimens), Silphidae (6 species with 65 specimens), Staphylinidae (3 species with 3 specimens) and Histeridae (1 species with 14 specimens). (Table 1).

Table 1: Coleopteran species identified in the goat carrion's decomposition process

Nr.	Taxon name	Decomposition period		
		04–06.06 no. of specimens	06–11.06 no. of specimens	24.07 no. of specimens
	Carabidae family			
1.	*Nebria transsylvanica* (Germ., 1824)	1	-	-
2.	*Carabus excellens* Kr., 1887	2	-	-
3.	*Platynus assimile* (Payk., 1790)	1	-	-
	Geotrupidae family			
4.	*Anoplotrupes stercorosus* Scriba, 1791	3	-	-
	Scarabaeidae family			
5.	*Onthophagus coenobita* (Herbst, 1783)	3	886	-
6.	*Onthophagus verticicornis* Leich., 1781	-	130	-
7.	*Onthophagus illyricus* Scop., 1763	-	16	-
8.	*Onthophagus ruficapillus* Brulle, 1832	-	3	-
9.	*Onthophagus fracticornis* Preyss., 1790	-	2393	-
10.	*Onthophagus vacca* (L., 1767)	-	11	-
11.	*Onthophagus ovatus* (L., 1758)	-	53	-
12.	*Onthophagus taurus* Schrb., 1759	-	316	-
13.	*Aphodius luridus* F., 1775	-	5	-
14.	*Aphodius rufipes* (L., 1758)	-	1348	-
15.	*Aphodius fimetarius* (L., 1758)	-	564	-
16.	*Caccobius schreberi* (L., 1761)	-	26	-
	Silphidae family			
17.	*Oiceoptoma thoracicum* (L., 1758)	-	40	4
18.	*Necrodes littoralis* (L., 1758)	-	6	3

Nr.	Taxon name	Decomposition period		
		04–06.06 no. of specimens	06–11.06 no. of specimens	24.07 no. of specimens
19.	*Tanatophilus rugosus* (L., 1758)	-	1	-
20.	*Nicrophorus investigator* (Zett., 1824)	-	1	-
21.	*Nicrophorus vespilloides* Hbst., 1784	-	9	3
22.	*Silpha carinata* (L., 1758)	-	-	1
	Staphylinidae family			
23.	*Abaemus chloropterus* (Pz., 1796)	-	-	1
24.	*Ontholestes tessellatus* (Geoff., 1785)	-	-	1
25.	*Ontholestes murinus* (L., 1758)	-	-	1
	Histeridae family			
26.	*Margarinotus neglectus* (Germ., 1813)	-	10	4
	Total	**10**	**5821**	**15**

Thus, on the second day of decomposition, 10 random specimens appeared around the carrion (Fig. 1): representatives of the *Nebria transsylvanica* species (1 specimen); *Carabus excellens* (2 specimens), *Platinus assimile* (1 specimen), *Onthophagus coenobita* (3 specimens) and *Anoplotrupes stercorosus* (3 specimens), which were moving around.

But as the carrion's decomposition intensifies, their number increases. At the end of the first week (11.06.2004) representatives of the Sacarabaeidae family were observed in enormous numbers: genera *Aphodius* (*A. luridis* [5 specimens], *A. rufipes* [1348 specimens], *A. fimetarius* [564 specimens]), *Onthophagus* (*O. taurus* [316 specimens], *O. verticicornis* [130 specimens], *O. illyricus* [16 specimens], *O. ruficaphyllus* [3 specimens], *O. coenobita* [886 specimens], *O. fracticornis* [2393 specimens], *O. vacca* [11 specimens], *O. ovata* [53 specimens], *Caccobius* (*C. schreberi* [26 specimens]), followed by the Geotrupidae family: the genus *Anoplotrupes* (*A. stercorosus* [28 specimens]), the Silphidae family (with 4 species and 46 specimens) and the Histeridae family with the species *Margarinotus neglectus* (10 specimens). In total, 5825 specimens from 22 species were collected (Fig. 2).

Fig. 1: The carrion at the beginning of the decomposition process.

Fig. 2: The carrion in the process of decomposition (at one week).

Fig. 3: Decomposed carrion (at 3 weeks).

After 3 weeks (Fig. 3), when the corpse was completely decomposed, only a few species were observed with a population of 18 specimens, representatives of the Silphidae family (*Necrodes littoralis*, *Nicrophorus vespilloides*, *Silpha carinata*, *Oiceoptoma thoracica*), the Staphylinidae family (with 3 species and 3 specimens) and the Histeridae family with 1 species and 10 specimens, and the species *Margarinotus neglectus* (family Histeridae).

During the carrion's decomposition process, it was observed that the fairly common *Nicrophorus* species were in very small numbers.

Conclusions

It was established that in the carrion's decomposition process, a total of 26 species of coleopterans belonging to 6 families were identified: Carabidae (3 species with 4 specimens), Geotrupidae (1 species with 3 specimens), Scarabaeidae (12 species with 5751 specimens), Silphidae (6 species with 65 specimens), Staphylinidae (3 species with 3 specimens) and Histeridae (one species with 14 specimens). On the first day of decomposition, random species specimens were identified (10 specimens from 5 species), while the largest number of species and specimens were identified one week after the beginning of the decomposition process (22 species with 5825 specimens). After 3 weeks, when the carrion was completely decomposed, only 5 species with a population of 18 specimens were observed. As a result of the study, it was determined that each stage of carrion's decomposition is characterized by the presence of certain species of coprophagous and necrophagous coleopteran.

Acknowledgments. The study was performed in the framework of the project 20.80009.7007.02 – "Evolutionary changes of economically important terrestrial fauna, of rare and protected species in the conditions of anthropogenic and climatic changes".

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Geology

MARISIA, Natural Sciences 2022, II: p. 81–95

Some new data on the Eocene sirenians from Cluj-Napoca Someș-Dig (Transylvanian Basin, Romania)

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Abstract: The sedimentary rocks of the Transylvanian Basin, the largest molassic basin in Romania, range in age from the latest Cretaceous to the late Miocene. While younger ages are prevalent in the basin's central area, only a few areas on the basin's periphery expose older ages. The Paleogene Gilău sedimentary area is among the latter ones. On the surface of this area, both in the municipality of Cluj-Napoca and in the close vicinity, are Paleogene rocks of marine and terrestrial origin that include fossils from several types of vertebrates. The fossil locality from Someș-Dig, where the Priabonian Cluj Limestone Formation is exposed, is a key location for sirenian fossils. Recent excavations at this location revealed postcranial sirenian fossils. In this study, an anatomically attached radius and ulna, and a fragmentary pelvis are firstly described in Romania, alongside four rib fragments. Due to the absence of a conclusive classification at the species or even genus level, the recovered fossils were only assigned to the Dugongidae family. Even though they were discovered in the same location on a restricted area, the fossilized bones exhibit distinct ontogenetic characteristics, indicating that they belonged to different individuals.

Keywords: Dugongidae, Sirenia, Priabonian, Cluj Limestone Formation, Cluj-Napoca, Romania

Introduction

Sirenians, also known as "sea-cows", represent a mammalian order wholly suited to an aquatic lifestyle. The sirenians are the only marine mammals that are exclusively herbivorous (Domning, 2001; Domning et al., 2010). They have streamlined bodies, lack hind limbs, and every bone in their skeleton indicates pachyosteosclerosis, a condition in which bones become denser and devoid of internal marrow (Domning & de Buffrénil, 1991; Romero, 2009 and related references), an adaptation for feeding into immersion. These mammals are members of the clade Tethytheria, named after the ancient Tethys Sea (e.g., McKenna, 1975; Gingerich et al., 1994; Domning, 2001; Uhen, 2007; Voss et al., 2016; Berta, 2020). In a way similar to that of cetaceans, sirenians developed from land-dwelling ancestors, the earliest of which was the prorastomid *Prorastomus sirenoides*, the remains of which have been traced back to Early and Middle Eocene rocks in Jamaica (Domning, 2000; Berta, 2020). During this time span, primordial sirenians possessed completely developed fore- and hindlimbs, allowing them to live an amphibious lifestyle, like current hippopotamuses. This was followed by a rising and dipping of taxonomic variations in the Oligocene – Miocene timespan (Domning et al., 2010), during which the sirenians became increasingly adapted to a completely

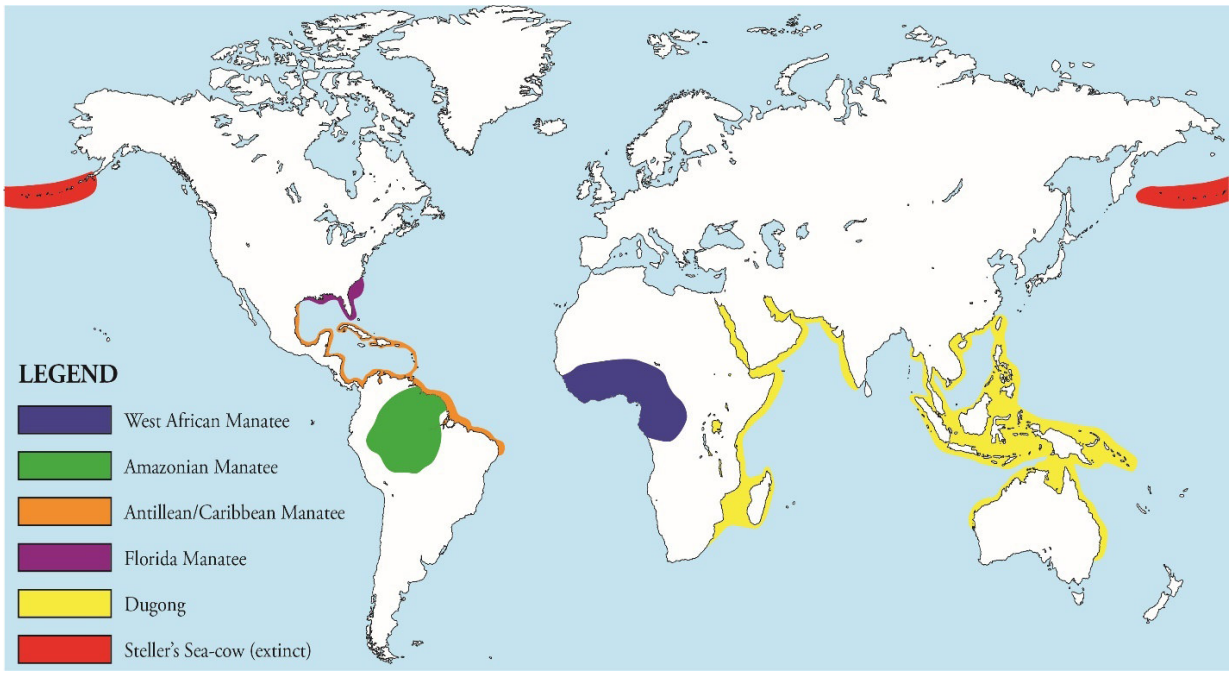

Fig. 1: Distribution of extant sirenians (following the distribution data from Romero, 2009).

aquatic lifestyle, resulting in the following morphological changes: the forelimbs turned into flippers while the hindlimbs shrunk until they vanished, their tails developed paddle and fluke forms to facilitate better underwater locomotion (Domning, 2001; Uhen, 2007; Berta, 2020). These evolutionary changes eventually lead to the relatives that are living today. There are two families of extant sirenians: the Dugongidae (dugongs) and the Trichechidae (the manatees). These two families have just five species (Fig. 1), one dugong and four manatees, with a sixth species, i.e., Steller's sea-cow, now extinct due to human overhunting (Domning, 1978; Mattioli & Domning, 2006; Romero, 2009).

The fossil record of sirenians demonstrates a global distribution on all continents excluding Antarctica. Modern species have a rather restricted global distribution, primarily inhabiting the following regions: West Indies, Amazon Basin, Western and Eastern Africa, Madagascar, Western India, Indonesia, and Northern Australia (Domning et al., 2010).

The stratigraphic range of sirenian fossils in Romania is extensive, particularly in the region of Transylvania (Fuchs, 1971). The earliest known sirenian remains from this region were discovered in Middle Eocene strata, followed by remnants collected in younger Oligocene levels, a number of which were identified in Cluj County (Fuchs, 1971).

Michael Ackner discovered the first sirenian fossils in the Eocene limestones at Turnu Roșu (=Porcești), and Hermann von Meyer identified them (*fide* Koch, 1894, in Șuraru & Codrea, 1988). Then followed a number of fossils mentioned in various papers, beginning with Koch (1894), who mentioned such occurrences beginning with the Upper Lutetian layers from Iara and from Valea Chioarului, the Priabonian limestones from Leghia and Cluj-Napoca (Mănăștur, Hoia Hill, Cheile Baciului), as well as the surrounding areas (Mera, Jebuc, Baba, Stana) (Șuraru & Codrea, 1988). Outside of Transylvania, Grigorescu (1967, 2017) described a single isolated sirenian fossil rib fragment from the Albești Limestone (see also Veress & Codrea, 2020). Even if some of the fossils were incorrectly referred to the genus *Halitherium*, which is now known to have existed during the Lower Oligocene – Lower Miocene timespan (Șuraru & Codrea, 1988), these descriptions are

significant in terms of the occurrences of sirenians in Romania and European territories. The following are examples of such works: Tulogdy (1944), Fuchs (1959, 1971, 1973), Nicorici & Popovici (1981), and Șuraru & Codrea (1988). In addition, Florei (1961) noted to have discovered a potential sirenian rib fragment from the Miocene deposits of Zorlențu Mare (Banat region), but unfortunately this fossil is now lost.

Herein are described several recently discovered sirenian fossils from the Cluj Limestone in the Someșul Mic riverbed at Cluj-Napoca. This fossil site is known as Someș-Dig (translated in English as Someș-Dam in Codrea et al., 1997). The fossil remains include rib fragments and, most importantly, an anatomically connected ulna and radius, as well as an incomplete/damaged pelvic bone.

Geological setting

The Transylvanian Depression is an intramountain basin filled by latest Mesozoic and Cenozoic sediments. Dumitrescu (1968) stated that this basin contains sediments from the lowermost Paleogene to the Late Miocene. However, it is now known that sedimentation began earlier, in the uppermost Cretaceous (i.e., Codrea & Godefroit, 2008; Codrea & Venczel, 2020 and references therein), since the discrepancies between the different interpretations of the various deposits of the geological ages have been clarified (Codrea & Dica, 2005). The Transylvanian Basin is the largest molasse sedimentary basin in Romania (Săndulescu, 1984; Săndulescu & Dimitrescu, 2004). Numerous sedimentary basins occurred after the collision between the African promontory and Europe led to the uplift of the Carpathian Mountains (Krézsek & Bally, 2006).

The collisions associated with Alpine orogenesis were so intense that the cratons of the pre-Apulian and Getic microplates were deformed, crushed and sheared, with advanced subduction-type contacts between them. Several transform fault lines, which crossed and split the old cratons and gave rise to blocks with their own types of movement, developed (Balintoni, 1997). It was a time of severe tectonic activity during which the Carpathian region was reshaped (Codrea & Venczel, 2020). In the Late Cretaceous, following the 'Laramide' tectonic pulse, a sequence of faults developed. As evidenced by the occurrence of dykes that puncture through the sedimentary strata, intense magmatic activity began during the Late Cretaceous, folding the sedimentary formations.

In the area of interest for this study, the immediate result of the 'Laramide' pulse was the rise of the Gilău Mountains from the Tethys Ocean, which led to an increased erosion and sediment deposition (Mészáros & Clichici, 1976). These mountains are part of the northern Apuseni Mountains. Their basal most rocks belong to the Bihor Unit, which consists of mid-metamorphic schists (Dumitrescu, 1968; Săndulescu, 1984) of the Precambrian Someș Lithogroup, but also of retro-metamorphic schists that were originally called the 'Arada Series' (Balintoni, 1997, 2005, and references therein).

Sedimentation around the Gilău Mountains and towards the Transylvanian Basin occurred in three megacycles: (1) latest Cretaceous – Early Miocene, (2) Early Miocene – Middle Miocene, and (3) Middle – Upper Miocene (Codrea & Dica, 2005; Codrea & Venczel, 2020), with marine and continental interbeddings (Mészáros & Moisescu, 1991; Mészáros, 2000; Codrea & Hosu, 2001; Filipescu, 2011; Sabău et al., 2021).

The municipality of Cluj-Napoca is located inside the Paleogene Gilău sedimentary area (Rusu, 1995 and references therein). From a morphological aspect, the region is characterized by a hilly relief that gradually decreases in height toward the eastern half of the city and is fragmented by a dense hydrographic system that drains into the Someșul Mic River (Mészáros & Clichici, 1976). This river crosses the city from west to east for ca. 16 kilometers.

The city is situated near the contact between the Apuseni Mountains and the Transylvanian Plateau, at the confluence of the Someșul Mic and the Nadăș rivers (Dumitrescu, 1968).

Occurring in the Gilău Mountains and extending towards Cluj-Napoca, a monocline of younger, predominantly uniform strata extends over the metamorphic basement (Fig. 2). The exposed Paleogene sedimentary rocks stretch to what is known as Cetățuia Hill in the city center. From there, sedimentary strata get progressively younger, including Oligocene and Miocene (Mészáros & Clichici, 1976).

Hoffman (1879) was the first to coin the Cluj Limestone, naming it "the Cluj Layers". Later, Koch (1894) renamed it the "Upper Coarse Limestone Horizon", mentioning some distinct lithologic levels (see details in Venczel & Codrea, 2022); this limestone is a porous skeletal wackestone (at the base) to packstone (at the top) with varied terrigenous grains (Chira & Igrițan, 2004). It consists of five biohorizons: *Crassostrea transilvanica* (regional marker), *Vulsella*, *Campanile*, *Echinolampas*, and *Nummulites fabianii*, the last two being observable in both the Cluj Limestone and the overlapping Brebi Marls Formation (Popescu, 1984; Rusu, 1995). All five of these biohorizons indicate the development of a shallow marine deposit (Chira & Igrițan, 2004).

The Someș-Dig outcrop was initially described by Pávay (1871), who emphasized the site's paleontological significance. When the dam was erected in 1866, several rocks were removed by explosives. Consequently, many fossils, including vertebrates (fish, turtles, crocodiles), were discovered. Pávay initially identified certain fossils as belonging to the crocodilian '*Crocodylus toliapicus* OWEN, 1849' (Pávay, 1871). Later, Koch reassessed them as mammalian fossils belonging to the sea-cows (i.e., the *Halitherium* genus), identifying similarities with the fossils from Porcești (Koch, 1894; Tulogdy, 1944). Since then and up to the present day, numerous sirenian remains have been recovered in the region, consisting primarily of isolate rib and vertebrae and few teeth. The Someș area

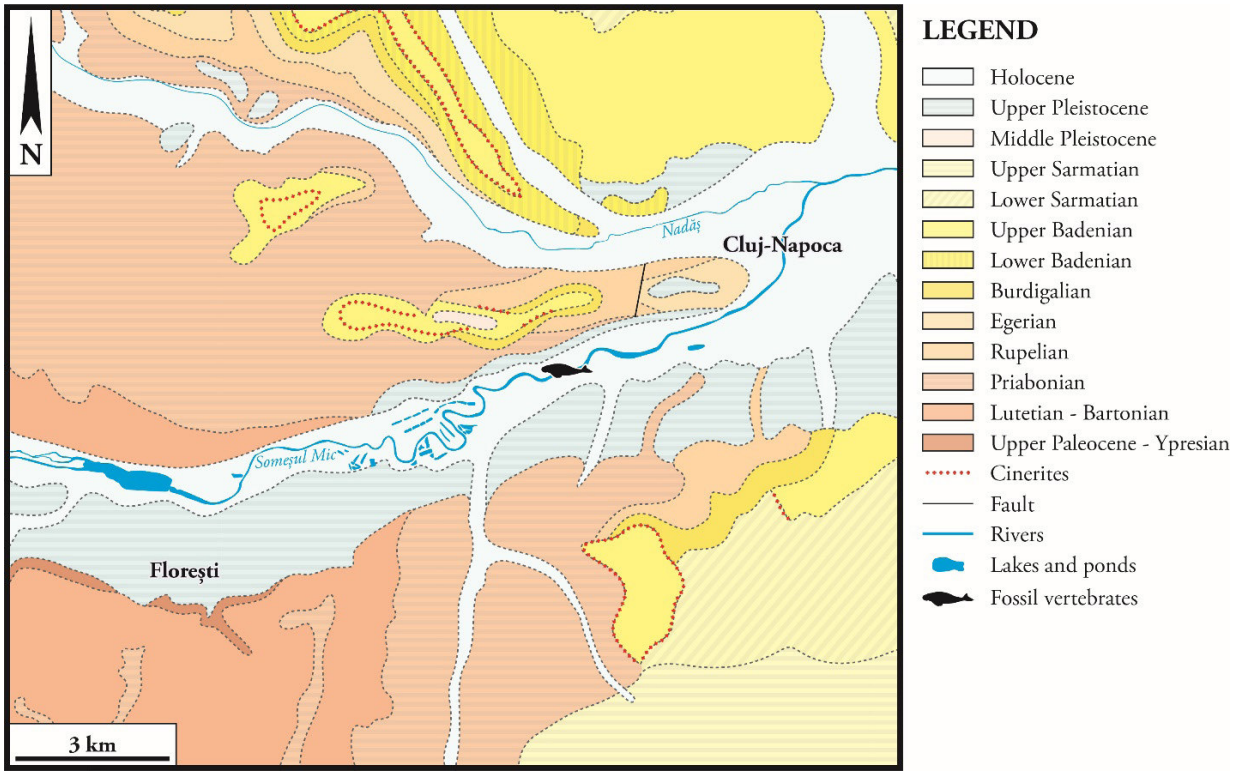

Fig. 2: Geological map of municipality of Cluj-Napoca and surrounding regions (modified after Răileanu & Saulea, 1967; hydrography after maps.google.com).

was widened in 1962, further up the Garibaldi bridge, in order to prepare it for recreative navigation. The Eocene layers of the Cluj Limestone surfaced yet again following more controlled explosions deployed for excavations in the area. In 1988, when the Grigorescu microhydropower plant was completed, a geographically straight shore was exposed, but it was afterwards covered. Recently, the outcrop on the left bank of the river covered around half a hectare (Codrea et al., 1997). In the riverbed, upstream and downstream from the outcrop, the deposit has a 5° monoclinic structure and covers the terrestrial red beds of the Valea Nadășului Formation and the gypsums of the Jebucu Formation, and is overlain by the deeper marine Brebi Marls Formation to the east (which includes the Eocene – Oligocene boundary) (Codrea et al., 1997). Unfortunately, as a result of recent renovations to the riverbanks, the outcrop may only be explored during the dry season, when the river's water level is enough low. Presently, the exposed portion of the outcrop is just 0.05 hectares in size, while the rest was covered with mud, gravel, and construction debris.

Material and methods

The collecting of fossils at the Someș-Dig fossil site involved multiple field campaigns. The fossils were discovered on the riverbed eroded surface of the Cluj Limestone at the site. We utilized a GBH 18V-26 F Bosch percussion-hammer and a hammer and chisel for fine extractions to remove the fossils. It was necessary to carefully remove the fossilized bones in large blocks of rock so that they could be as complete as possible. After extraction, they were moved to Babeş-Bolyai University's Paleotheriology and Quaternary Geology Laboratory for further preparation. After removing excess matrix, the appropriate pieces were attached with care using professional adhesives. The fossils were subsequently measured with a 150 mm digital caliper and a 250 mm basic caliper. Strings were utilized to determine circumferences. All of the materials have collection numbers that begin with SD (Someș-Dig). The following fossils were measured and described: radius and ulna, pelvis, and four rib pieces. The measurement techniques follow Zalmout & Gingerich (2012). The descriptions and morphologic nomenclature follow the work of Sagne (2001a).

Collection abbreviations

BBU-PC: Paleontological Collection of the Babeş-Bolyai University, Cluj-Napoca, Romania; CGM: Cairo Geological Museum (Egyptian Geological Museum), Cairo, Egypt; RGHP: Geological Reserve of Haute-Provence, Digne, France.

Systematic paleontology

The Eocene sirenians are poorly known worldwide. Domning (1994) emphasized at the end of the twentieth century the necessity for a substantial revision that would drastically alter the evolutionary tree. Sagne (2001b) initiated change by introducing *Halitherium taulannense* as a new species. Voss (2014) subsequently proposes the invalidity of *Halitherium schinzii* KAUP, 1838, which would result in the rejection of the Halitherinae subfamily. Due to the fact that only postcranial bones were utilized in this research, the systematic assignment is only definite at the Family level. The systematic analysis was done in accordance with the work of Voss et al. (2016).

Class Mammalia LINNEAUS, 1758
Mirorder Tethytheria McKENNA, 1975
Order Sirenia ILLIGER, 1811
Family Dugongidae GRAY, 1821
Dugongidae indet.

Material: fragmentary radius and ulna in anatomical connection (BBU-PC SDRU1, Plate 1, Tables 1, 2), fragmentary pelvis (BBU-PC SDP1, Plate 2, Table 3) and four rib fragments (BBU-PC SDR1–4, Plate 3).

Descriptions:

1. Radius and Ulna (BBU-PC SDRU1)

Measurements: see Table 1, 2.

• *Lateral outer view*. The transverse widths of the radius and ulna are unequal to one another, the radius being wider. Under the proximal and distal epiphysis, the radial neck can be clearly observed. At the distal end of the radius there are two crests: the first one is anteriorly trended, prominent at the distal neck of the epiphysis, although it becomes smooth and flat along the diaphysis; the second crest is noted to be located anterolaterally, oriented roughly the same as the previous one. Between these two crests is a shallow groove. Due to the slight twisting of the radius, the radial diaphysis exposes at the distal portion a curvature that is slightly convex anterolaterally and slightly concave anteromedially. The proximal half of the diaphysis is difficult to discern, due to the lack of a few anteromedial pieces. The surface of the entire diaphysis is smooth, the exception being the proximal epiphysis, since its texture exposes rugosity. The ulna cannot be discerned due to the limestone matrix on the distal portion and to a piece missing in the proximal part. The coronoid process marks the separation of two laterally articulated surfaces for the humerus, which are asymmetrical. A concave groove is visible at the proximal end of the ulna, separating the lateral and medial edges. Due to the limestone matrix that covers the distal end of the ulna, it is rather difficult to examine it thoroughly. In order to avoid damaging the bone, the matrix was not removed. The ulnar mid-shaft is incomplete, where a portion is missing medially and another piece is missing dorsally, near to the proximal end. Other than these missing portions, the ulnar diaphysis is largely straight.

• *Cranial view*. The radial diaphysis is slightly wider than the ulnar diaphysis, while ventrally, the radial diaphysis is narrower than the ulnar diaphysis. The medial side of the ulnar diaphysis narrows and forms a crest. The olecranon and anconeal process are missing. The proximal radius articulation for the humerus consists of a wide, strongly concave lateral articular surface and a narrower, less concave medial articular surface. A small trochlear incision separates the two surfaces. The radius and ulna are fused under the metaphysis of the proximal epiphysis and under the distal epiphysis, and the interosseus space is biconvex between the two diaphysis. The radial diaphysis is slightly arched toward the external side, narrows towards the midshaft, and then widens near the proximal part. At its narrowest point (8.69 mm), the radius is just half as wide as the ulna (16.92 mm). A parasagittal crest originates from the distal epiphysis of the radius and subsequently decreases near the midshaft. Due to the absence of some bone fragments, this crest is only discernible at the epiphysis throughout the proximal half. The ulna has a pronounced anterior crest that extends to the shaft's midshaft. There is a slight concavity trended along the crest that can be found in close proximity to the distal epiphysis. Due to the absence of too many fragments, the proximal end cannot be studied adequately. The entire posterior ulnar portion is smooth and slightly arched toward the distal metaphysis.

• *Lateral inner view*. There is a variation in leveling: the ulna is 8 mm higher than the radius. The crest is positioned centrally, is slightly curved at the epiphysis, and divides the ulna into two symmetrical portions, with the exception of the proximal epiphysis, where a prominent cavity is visible laterally.

• *Caudal view*. The radius curvature follows the curving of the bone from the distal epiphysis to the proximal epiphysis. The distal half of the ulna displays a crest, and the proximal half, towards the base of the olecranon, reveals the ulnar tuberosity, which is separated from the posterior crest by a wide cavity. Close to the proximal epiphysis, the radius displays a slight furrow.

• *Proximal articular view*. The lack of the olecranon allows us to discern just the strongly concave articulation surface, which is divided into two sides by the suture line.

Table 1: Measurements (mm) of the ulna (BBU-PC SDRU1) compared to the same bone of *Eotheroides clavigerum* (CGM 60551) in Zalmout & Gingerich (2012) and *Halitherium taulannense* (RGHP C066) in Sagne (2001a).

Measurement	Ulna (BBU-PC SDRU1)	Ulna (CGM 60551)	Ulna (C066)
Greatest length of the preserved portion	122.49	146	148
Breadth across the coronoid process	16.65	35	27
Height from the coronoid process to the distal epiphysis	120.63	110	20
Circumference of midshaft	45	61	N/A
Width of the distal epiphysis	20	21	N/A
Length of the distal epiphysis	22.94	29	N/A

Table 2: Measurements (mm) of the radius (BBU-PC SDRU1) compared to the same bone of *Eotheroides clavigerum* (CGM 60551) in Zalmout & Gingerich (2012) and *Halitherium taulannense* (RGHP C066) in Sagne (2001a).

Measurement	Radius (BBU-PC SDRU1)	Radius (CGM 60551)	Radius (C066)
Greatest length	127.09	120	N/A
Minimum length	112.22	112	125
Breadth of the proximal surface	19.33	28	25
Breadth across the humeral articular surface	17.55	24	25
Maximum width at mid shaft	14.81	19	18
Minimum width at mid shaft	6.57	12	N/A
Circumference of the mid shaft	42	55	N/A
Greatest breadth of the distal radial end	24.81	24	22
Breadth of the distal articular surface	19.05	22	N/A
Epiphysis height	15.20	N/A	14
Interosseus space	11.12	7–8	N/A

• *Distal articular view*. The surface is rugose, and the approximate 15° twisting of the radius could well be measured.

2. Pelvis (BBU-PC SDP1)
Measurements: see Table 3.

• *Cranial view*. Except for the sacral area, which is rugose, the proximal half of the pelvis has a smooth surface. The sacral articulation is semicircular. It is positioned 24 mm from the ilium's proximal end. The dorsoventral diameter of the midshaft reveals the diaphyseal narrowing. The midshaft is convex dorsally and slightly concave medially. The pubis is missing several pieces. The obturator foramen can be distinguished, but is not measurable because of its fragmentary state. The ischium is completely lost.

Table 3: Measurements in millimeters of the pelvis bone (BBU-PC SDP1).

Measurements	Pelvis bone (BBU-PC SDP1)
Ilium length	98.34
Ilium dorsoventral diameter at midshaft	17.98
Ilium mediolateral diameter at midshaft	27.79
Ilium circumference	70.00
Maximum height of the proximal end of the ilium dorsoventrally	26.52
Maximum width of the proximal end of the ilium mediolaterally	34.88
Length of the sacral articulation surface with the sacrum	17.10
Height of the sacral articulation surface with the sacrum	16.16
Pubic line length	23.02
Symphysis length	9.31
Acetabulum diameter	13.73
Acetabulum external diameter	17.10
Acetabulum depth	4.00
Total length (fragmentary)	165.00

• *Dorsal view*. Due to the lack of the ischium, the overall length listed in Table 3 does not accurately represent the total length of the pelvis. The midshaft again demonstrates the gradual shortening of the diaphysis towards the midshaft, compared to the proximal end's mediolateral diameter. In contrast to other individuals, the proximal end of this bone is not acuminate.

• *Lateral view:* Beginning in the midshaft of the ilium and ending at the proximal end, the bone surface is slightly eroded, resulting in a rugose or hardened sponge-like surface. At the proximal end of the ilium is the acetabulum and in the case of our fossil, the cranial rim is encrusted with a layer of pyrite and galenite.

3. Ribs (BBU-PC SDR1, SDR2, SDR3, SDR4)

Four rib fragments are the remaining fossils recovered at the Someș-Dig site. The BBU-PC SDR1 is a portion of one of the posterior ribs' distal ends. We think it to be a posterior rib due to the dorsoventral flattening of the bone, a characteristic that is primarily present on posterior ribs. The same might be said of the BBU-PC SDR4 fragment. The remaining two rib fragments, BBU-PC SDR2 and BBU-PC SDR3, are represented by their midsections; however, it is impossible to determine what ribs they belong to. While BBU-PC SDR2–4 indicate highly advanced pachyosteosclerosis, the BBU-PC SDR1 specimen has a slight sponge-like structure at the tip; this may indicate that the individual had osteoporosis or did not develop sufficient pachyosteosclerosis, or that the porosity was caused by alteration prior to the initial burial.

Discussions

Paleogene deposits in Cluj County have yielded dozens of sirenian postcranial fossils. Throughout the course of 150 years of geological research on the city's environs, numerous indications of the existence of these marine mammals have been unearthed. The placement of the ribs and vertebrae discovered in 'the Upper Coarse Limestone Horizon' (Priabonian) from the Cheile Baciului site, near Cluj-Napoca, under the genus *Halitherium* is one example of the difficulty encountered when establishing the genus. Today, it is commonly known that

Halitherium is Oligocene (Domning, 1994), hence we cannot speak about this genus in the Eocene. This issue was also reported by Tulogdy (1944), Șuraru & Codrea (1988), and Fuchs (1990). Since no skull fragments have ever been published from this locality, determining the genus and species with precision has been problematic. Another issue emerges from the fact that the Paleontological Museum in Cluj-Napoca no longer possesses (probably since World War II) some fossils that have been meticulously documented and described, despite the fact that these fossil remains were once part of the museum's collection. On the other hand, paleontologists such as Herman Fuchs and Matei 'Mátyás' Vremir did not donate many of the sirenian fossils they discovered to the Museum. More than that, the first of them never returned any of the items he lent from this collection. This made it impossible to compare them to subsequent fossil discoveries from throughout the world. First, we bring up the sirenian teeth described by Koch (1886, 1894) and Tulogdy (1944). The argument that few investigations have been conducted on postcranial fragments, despite the fact that the important analysis points have been explicitly specified (Domning, 1994) and completed (Sagne, 2001a), makes it impossible to make anatomical comparisons at this time. Because of these issues, the description of the fossil fragments used in this study (the radius, ulna, pelvis, and ribs) is based on merging it with the study criteria of other researchers from published articles: Domning (1994, 1996), Sagne (2001a), and Zalmout & Gingerich (2012).

By examining the sediment and taphonomic characteristics of some fossils from BBU-PC that were ascribed as being discovered near or at Someș-Dig, we found that they are identical to those that we uncovered, leading us to think that the fossils in the museum are from the same locality. Included in the museum's collection are three vertebrae, the proximal end of a humerus, skull fragments, fragmentary and complete ribs, and a smaller humerus lacking its distal end. We will discuss these fossils in a future study since we need additional data about them, as they have not yet been published.

The fossils from the Someș-Dig site can be distinguished by the following features, based on morphological observations and measurements:

1. The BBU-PC SDRU1 radius and ulna originate from a young individual, which can be deduced from the relatively small size of the bones and the fact that they have not developed the robustness of adult bones.
2. Similarly to *Halitherium taulannense*, the radius exhibits a slight twisting in comparison to the ulna. Sagne (2001a) reported that such a radius bending is only evident in young specimens.
3. Even though the distal half of the ischium is eroded, the pelvis is comparable to that of *Eotheroides clavigerum* in terms of length and postero-dorsal width; however, our specimen lacks a medial twisting. The remnants of the ischium that we currently possess are devoid of rugosity and tuberosity. The ilium is comparable to that of *H. taulannense*, but it is longer and has a flatter distal end. Due to the fractured portion of the bone, neither the size of the obturator foramen nor the exact length of the ilium can be measured. In contrast to *H. taulannense* and *E. clavigerum*, however, in our specimen the articulation of the sacroiliac joint is deeply concave and nearly circular.

Concluding remarks

This paper details a few postcranial sirenian fossil bones discovered at Cluj-Napoca Someș-Dig locality (Romania). The fossils were found in the Cluj Limestone Formation (Late Eocene, Priabonian). Even though it is impossible to assign them to species or even genus, their significance is highlighted by the fact that some of them (the radius and ulna associated in anatomical connection, as well as the pelvis) are firstly documented in Romania. The described fossils belonged to several

individuals of different ages. The potential of the fossil site for sirenian and other vertebrate remains, such as crocodilians, turtles, sharks, and fish, is undeniable, as Codrea et al. (1997) underlined before. Unfortunately, from now on it is likely that we will not be able to retrieve any additional fossils from this location, due to the construction works carried on the Someșul Mic riverbanks. Therefore, the absence of diagnostic cranial elements requires careful excavations in additional locations where the same top level of the Cluj Limestone is available.

Acknowledgements. One of the authors (VAC) is thankful to dr. Claire Sagne (Muséum national des Sciences Naturelles Paris) who kindly gave him her PhD thesis, a valuable document for this study.

Funding. This work was supported by the grant of the Ministry of Research, Innovation and Digitization CNCS – UEFISCDI, project number PN-III-P4-PCE-2021–0351, within PNCDI III.

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Plate 1: Radius and ulna in anatomical connection, BBU-PC SDRU1 in: cranial (a), distal (b), caudal (c), and proximal (d) views.

Plate 2: Pelvis, BBU-PC SDP1 in: cranial (a), dorsal (b), lateral (c), and caudal (d) views.

Plate 3: Rib fragments: a–b. BBU-PC SDR1 in: cranial (a), lateral (b) views; c–d. BBU-PC SDR2 in: cranial (c), lateral (d) views; e–f. BBU-PC SDR3 in: cranial (e), lateral (f); g–h. BBU-PC SDR4 in: cranial (g), lateral (h) views.

MUSEOLOGY

MARISIA, Natural Sciences 2022, II: p. 99–104

The artificial cave from the Museum of Oltenia Craiova (Romania)

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Abstract: The artificial cave from the Natural Sciences Department of the Oltenia Museum of Craiova (Romania) was realized built-up at during the end of 2007 and the beginning of 2008 through a project with European pre-accession funds, a project that provided for the development of a larger exhibition space. On a relatively small space it was possible to build a cave with the basic elements and many of the speleothems that are found in natural caves. The beauty of the speleothems, the discreet lighting, the adequate sound system makes the artificial cave one of the highlights of the permanent exhibition of the Natural Sciences Department of the Oltenia Museum of Craiova.

Keywords: artificial cave, underground environment, exhibition.

Introduction

Since 2006, the exhibition space of the Natural Sciences Department of the Oltenia Museum (Romania) has been completely reorganized and restored: on the ground floor, there are two exhibition halls – the first (130 m^2) being dedicated to temporary exhibitions, and in the second hall (136 m^2) being arranged in 2011–2012 the permanent exhibition *Oltenia – Terra fossilis*, which includes fossils originating exclusively from Oltenia. In the exhibition space on the second floor, on an area of 250 m^2, in 2012, the Universe and the Solar System exhibition was arranged, as well as a planetarium. The exhibition spaces on the ground floor and the second floor were arranged with funds from the Dolj County Council. The arrangement of the exhibition space on the first floor was made with the help of European funds.

In the period 2006–2008, the project "Growing the tourist attraction of Craiova and Dolj county by the restoration of the basic exposition from the first floor, Section of the Nature Sciences, Museum of Oltenia – Craiova" by the PHARE Project 2001 Economic and Social Cohesion, founded by Dolj County Council, in cooperation with the Museum of Oltenia, was implemented at the Natural Sciences Department of the Oltenia Museum Craiova. The total costs were 338,155 euros, of which 240,141 euros were from PHARE pre-accession funds and 98,014 euros from the Dolj County Council budget. The project was drawn up by the specialists of the Dolj County Council, the specialized part being provided by the curators of the section.

The exhibition on the first floor is entitled *The physical-geographic conditions and ecosystems of Oltenia* and was arranged on an area of 518 m^2, being composed of dioramas representing the complex biodiversity of Oltenia (meadow, dunes, lowland forest, hilly area, mountain area), from panels with data about physical-geographical and climatic conditions, ecological information, etc.

This project included the arrangement of

the Mineral and Rock Collection exhibition of the Oltenia Museum, into a smaller room also on the first floor of the Natural Science Department.

The integration of the artificial cave within the exhibition was at one point in question, the area intended for it being reduced to less than half of that originally proposed, considering (correctly) that the space of the mountain diorama, which is set up next to the artificial cave, is insufficient. Finally, the artificial cave was set up on about 36 m^2. The placement of the artificial cave within the exhibition was taken into account by the entire team that designed the exhibition (Cornelia Chimișliu – head of Department, Adrian Năstase, Mirela Ridiche, Claudia Goga, and myself (Aurelian Popescu), based on the following considerations:

– this type of ecosystem is well represented in Oltenia, where thousands of caves are recorded;

– touristic interest such as the Muierii Cave or the Polovragi Cave, to mention only the arranged ones, which are also the most visited;

– scientific interest – Cloșani Cave – where a research laboratory of the 'Emil Racoviță' Speleological Institute Bucharest is set up or Topolnița Cave, speleological reserve and natural monument;

– last but not least, artificial caves are points of attraction in an exhibition, eloquent being, at that time, the public's interest in the artificial caves in the basic exhibition of the 'Grigore Antipa' Museum of Natural History in Bucharest and that of the Natural Sciences Section of the Argeș County Museum in Pitești.

Material and methods

In order to create the artificial cave, it was necessary to draw up a technical drawing. A room with an area of 36 m^2 and a height of approximately 5.30 m was available. The sketch had to be drawn up in such a way as to correspond to the definition of the cave and to include as many defining elements for a cave as possible. Thus, in the Explanatory Dictionary of the Romanian Language (https://dexonline.ro/), the definition of the cave is as follows: "deep and large natural underground cavity, generated by the dissolution of soluble rocks by infiltration waters". This definition was not very helpful to me:

– there are cavities, sometimes quite large (tens of meters), formed in magmatic rocks, considered caves;

– the term *deep* referring to hollow, cavity, are a bit imprecise, sometimes a depth of 3 meters being considered large, other times being considered negligible.

After some quick documentation, I came up with a cave definition where I put in all the elements to help me draw up the technical drawing: a succession of hollows in the Earth's crust of varying shapes and sizes at least 5 m in total (http://www.speotimis.ro/dictionar-speologic/pestera.html), linked, with the following basic elements: the mouth of the cave, galleries, halls, wells, chimneys, siphons, speleothems. Marcian Bleahu's books (1974, 1982) were also of great help in documentation.

In opposition to the term *natural*, in the Explanatory Dictionary of the Romanian Language definition, – *artificial* caves are those man-made. But not accidentally! because there are also artificial caves formed by accident, for example, Fort Zverev (Russia). It was built at the end of the 19th century near St. Petersburg, fell into ruin, the Soviet army used it as a napalm warehouse. In 1970, the stored napalm ignited, and the temperature released by burning caused the bricks in the ceiling to melt, which led to its covering with "stalactites" (https://www.atlasobscura.com/places/fort-zverev). The actual materials were proposed by the team of artists (at that time in the budding) – students at the Academy of Arts in Bucharest, led by Valentin Șoachete: polystyrene, wood, clay, burlap, oxides (paint), resins of several types. The tools used: incandescent wire for cutting polystyrene, special hammers

for polystyrene sculpture, putties, compressors for applying resins. To all of this, the elements of sound (cassette player, CD or memory stick, remote control) and lighting (cables, optical fiber) were added.

Results and discussions

As can be seen in the technical drawing, the artificial cave has in its composition almost all the components of a natural cave, except for wells and siphons, which were very difficult to implement in the available space. When designing and executing the elements of the artificial cave, it was taken into account that the great majority of visitors are students, whose groups usually number 30 members. Let's take them one at a time:

– *the mouth of the cave*. Both the entrance and the exit of the cave were designed with shapes and dimensions (approx. 2 m high and 1.5 m wide) in such a way as to ensure relatively easy access for visitors. Students, especially those in the younger classes, tend to flock, driven by the eagerness to learn new things, as well as attracted by the mysterious atmosphere in the cave. At the same time, it was sought to preserve an appearance as close as possible to that of an entrance as close as possible in appearance to one in natural limestone. Figs. 1–3 show the evolution of the execution of the access to the cave: first the installation of the polystyrene blocks and their carving (Fig. 1), then the application of clay and resin (Fig. 2) and, finally, the painting and application of the resin to confer strength and durability (Fig. 3);

Fig. 1: The installation of the polystyrene blocks and their carving (original).

Fig. 2: The application of clay and resin (original).

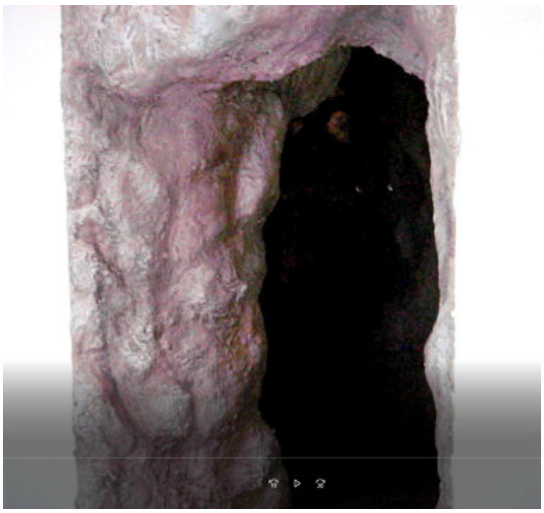

Fig. 3: The painting and application of the resin (original).

– *the access gallery*. Although short (the space did not allow for a longer gallery), the gallery contains enough space for a group of 25 people. Walking through the access gallery offers the visitor interesting and varied information: the formation of the gallery by the action of water, on the walls of the gallery you can see *abrasion wrinkles*, formed as a result of the interaction between the wall and the solid particles carried by the water, and on the ceiling, near the end of the gallery, the *helical chimney* can be seen (Fig. 4), a spectacular element, formed by the action of updrafts from an active gallery. All this information attracts the visitor and makes him more and more curious, preparing him for entering the next compartment of the cave – the main hall;

Fig. 4. The helical chimney (original).

Fig. 5. Aspect of the main hall (original).

– *the main hall* (Fig. 5), the most generous compartment of the cave in terms of the available space, offers the visitor the possibility of a panoramic view of the speleothems located here, as well as of the other compartments of the cave. From here the galleries (access and evacuation) can be easily seen and accessed. The ceiling of the main hall was designed and executed in such a way as to have the greatest height, both to create a spectacular image and to give the impression of a large space. This impression is especially needed for groups of 25 or 30 people because this is where the group makes a longer stop and receives the most explanations. The public is now introduced to the most spectacular forms called *speleothems* created by the depositional action of water. Thus, on the western wall is *the organ* – made up of cylinders formed as a result of the dripping of water droplets loaded with calcite on the wall, and in the niche between the western and northern walls, you can admire a splendid *candle stalagmite*. Stalagmites are speleothems formed as a result of the accumulation of calcite from the water drops that fall from the ceiling of the cave; they grow from the bottom up. Above the candle stalagmite are two complex speleothems: *the canopy* and *the disc*. Their formation requires the fulfillment of complex conditions for the flow of water loaded with calcite.
– on the northern wall there are pools of water called *gurus*. These are practically dams in the way of the water flow, their elevation being progressive;
– on the eastern wall (to the right of the entrance to the cave) we can see a massive *stalagmite dome*, named so because of its resemblance to the roof of a Catholic church. Next to the dome is figured the formation of *columns*. The columns result from the union of *stalagmites* and *stalactites*. Stalactites are speleothems formed on the ceiling of caves. They grow from top to bottom, water moving through them and depositing calcite at the lower end. One of the resulting columns is thinner and simpler, the second is more complex and is called the *"stack of plates" column*.

On the ceiling of the cave, among the numerous stalactites, several bats can be observed: some are resting in the characteristic position, hanging upside down, while others are in flight. Although caves may seem like an environment hostile to life, here we meet life forms of all classes, from bacteria, fungi, worms, and insects, to amphibians, reptiles, birds, and mammals. Many of the species that live in caves suffer adaptations to this peculiar living environment, for example, their lack of color or even eyeless, organs that become useless in the darkness that reigns here.

The mentioned speleothems are highlighted by light guided through optical fibers, which creates an atmosphere of mystery; the

light falls on the speleothems, highlighting them, at the same time allowing the eye, after a short adjustment, to distinguish the access ways well enough, keeping enough discretion so as to give the impression of a cave interior. The sounds made by bats, the flapping of their wings, as well as the sounds made by the water drops falling intermittently, like a metronome, contribute to shaping the atmosphere of the cave. Without the discreet lighting, which only fiber optics can provide, and without the sounds chosen in such a way as to emphasize the sound elements encountered in the caves, the visit to the cave loses more than half its charm.

We are now heading towards the exit gallery. To the right of the gallery, there is a niche of 3 m^2, in its center is a water eye (resin) with a diameter of about 30 cm; on the opposite wall, you can see underground stones, an alternation of ditches and ridges formed by the water eroding the wall. After only a few steps we come out of the wonderful underground world.

Upon exiting the cave, the overwhelming majority of visitors express their satisfaction more or less enthusiastically. The children are tempted to visit the cave again, and the adults promise to return to the museum to better fix the images and information occasioned by the visit. During the visit to the cave, visitors learn information about the formation of the caves, their variety and classification, the characteristic fauna, speleothems, the protection of the caves and the most important caves in Oltenia. It is a visit in a relatively small space, but during which some of the most interesting information is conveyed, here is another reason why the cave in the core exhibition at the Natural Science Department is a favorite attraction for the visiting public.

Conclusions

The cave is part of the project "Growing the tourist attraction of Craiova and Dolj County by the restoration of the basic exposition from the first floor, Section of the Nature Sciences, Museum of Oltenia – Craiova" by the PHARE Project 2001 Economic and Social Cohesion. This project was carried out by the Natural Science Department' specialists in collaboration with those from Dolj County Council.

It is for the first time in Romania that an artificial cave is made with this technology, which allowed reasonable costs (including maintenance) and a modern vision. Although the space is not generous, it is skillfully and intelligently used, which allowed the realization of the most important features of a cave (hall, entrances, galleries, niche) as well as many of the most spectacular speleothems. Accessorizing the cave with fiber optic lighting, with modern sound system, is adding a plus that increases the spectacularism, seducing the visitors. Finally, the artificial cave is a main point of attraction in the exhibition space of the Natural Science Department, like in any museum that can achieve such an objective.

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