BRVKENTHAL. ACTA MVSEI

XVIII. 3

MINISTERUL CULTURII

MUZEUL NAŢIONAL BRUKENTHAL

BRVKENTHAL

ACTA MVSEI

XVIII. 3

Sibiu / Hermannstadt, 2023

ISSN: 2285-9470 **ISSN-L: 1842-2691**

Muzeul Naţional Brukenthal

Editura Muzeului Naţional Brukenthal

Începând cu anul 2009, revista a fost indexată în baze de date internaţionale astfel:
2009 – INDEX COPERNICUS http://www.journals.indexcopernicus.com/karta.php?action=masterlist&id=4759
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Începând din anul 2011, publicaţia este vizibilă şi pe platforma editorială **SCIPIO** (http://www.scipio.ro/web/brukenthal.acta-musei).

Starting with 2009, the publication is indexed in the following international date-bases:
2009 – INDEX COPERNICUS:http://www.journals.indexcopernicus.com/karta.php?action=masterlist&id=4759
2010 – EBSCOHOST http://www.ebscohost.com/titleLists/tnh-coverage.htm
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2015 – ERIH PLUS https://dbh.nsd.uib.no/publiseringskanaler/erihplus/periodical/info?id=484924
Starting with 2011, the publication is to be found on **SCIPIO** editorial platform (http://www.scipio.ro/web/brukenthal.acta-musei).

Orice corespondenţă referitoare la această publicaţie rugăm a se adresa la:
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THE CATALOGUE OF THE KIMAKOWICZ MALACOLOGICAL COLLECTION FROM THE NATURAL HISTORY MUSEUM IN SIBIU (PART IV)

Ana-Maria PĂPUREANU*

Abstract. *The Kimakowicz Mollusca Collection is part of the Natural History Museum in Sibiu collections since 1967. The collection was developed by Moritz and Richard von Kimakowicz. In 2023, our museum has commemorated Richard von Kimakowicz and his legacy to science. The following paper is the result of the curatorial activity held in the Kimakowicz collection between 2021 and 2022, listing 788 specimens identified as 78 species within 35 genera. The specimens belong to the families Triviidae, Pediculariidae, Cypraeidae, Ovulidae, Cancellariidae, Capulidae, Cerithiidae, Batillariidae, Potamididae and Newtoniellidae. The study also discusses the historical value of the specimens considering their origin.*
Keywords*: Kimakowicz Malacological collection, catalogue, Natural History Museum Sibiu.*

Rezumat*. Colecția de moluște Kimakowicz face parte din colecțiile Muzeului de Istorie Naturală din Sibiu începând cu 1967. Colecția a fost dezvoltată de Moritz și Richard von Kimakowicz. În 2023, muzeul nostru l-a comemorat pe Richard von Kimakowicz și moștenirea sa pentru știință. Următoarea lucrare este rezultatul activității curatoriale desfășurate în colecția Kimakowicz între 2021 și 2022, enumerând 788 de exemplare identificate ca 78 de specii aparținând la 35 de genuri. Exemplarele aparțin familiilor Triviidae, Pediculariidae, Cypraeidae, Ovulidae, Cancellariidae, Capulidae, Cerithiidae, Batillariidae, Potamididae și Newtoniellidae. Studiul discută și valoarea istorică a exemplarelor având în vedere originea lor*.
Cuvinte cheie*: colecţia malacologică Kimakowicz, catalog, Muzeul de Istorie Naturală Sibiu.*

Introduction

In 2023, we commemorate 50 years since the passing of Richard Emanuel von Kimakowicz-Winnicki (1875-1973) (Fig. 1). He was borne in the family of Mauritius Hieronymus and Marie von Kimakowicz-Winnicki (Fig. 2 a, b, c) on January, 6th 1875, in Hermannstadt (Sibiu, Romania). His grandparents, from his father side, Anton and Teresa, came to Hermannstadt in 1850 from Klobouky u Brna (a town in Břeclav District, South Moravian Region, today Czech Republic).

Richard v. Kimakowicz attended the Brukenthal Gymnasium, one of the oldest schools from present day Romania. He studied to become an engineer at the Mannheim University of Applied Sciences or Hochschule Mannheim (Baden-Württemberg, Germany).

After graduation, he returned home to Hermannstadt. He married Ilona and the couple had two daughters Hilda (1915-2016) and Sabine (1921-2000). As his daughters got older, Richard would take them and his wife in his research trips.

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Influenced by his father's passion and work in the field of natural sciences and especially malacology, R. v. Kimakowicz dedicated his spare time to this research field. He published starting, with 1928, the results of his studies (Kimakowicz von, 1928, 1931, 1933a, 1933b, 1935, 1937, 1942, 1942, 1943, 1946, 1962, 1966, 1970). The Natural History Museum in Sibiu, holds a few photos taken by R. v. Kimakowicz representing *Alopia* specimens with hand written observations on the back (Fig. 3).

Moritz and Richard v. Kimakowicz research and molluscs collection are known worldwide, as Coan and Kabat (2019, 6, 933-934) called them „*the father-son team that devoted almost all of their research to the study of a single subgenus Clausilia* (*Alopia*)".

In today's literature there are three *Alopia* species described for the first time in the world by R. v. Kimakowicz starting with *Alopia helenae* R. von Kimakowicz, 1928, originally *Alopia (Alopia) nefasta-helenae*, type locality is Cheile Pârâului Alb, east of Zăganu Peak, Ciucaș Mountains (Kimakowicz von 1928, 119-122). The second species is *Alopia hildegardae* R. von Kimakowicz, 1931, named after his daughter, and the specimens were found by his wife on August 8th, on the rocks near the road to Bărbătești, Vâlcea County, at

an altitude of 1.700 meters. In the original paper R. v. Kimakowicz mentions Florian summit (Kimakowicz von 1931, 41) but that toponym is not found in Romanian geographical description of the area. Bărbătești village is a starting point for the Căpățânii Mountains and Buila-Vânturarița National Park, from here being the shortest distance to Buila Peak and Curmătura Builei. The third species described by R. v. Kimakowicz is *Alopia occulta* R. von Kimakowicz, 1931, type locality the gorge near Pietreni village (Costești comune, Vâlcea County) (Kimakowicz von 1931, 41-42).

According to Aescht and Bisenberger (2019, 659), R. v. Kimakowicz donated 4 paratypes to the Upper Austrian Museum in Linz (Austria). He also donated in the 1960's specimens to the Natural History Museum in Hungary.

The Kimakowicz Mollusca Collection became part of the Natural History Museum in Sibiu heritage in October 1967 (Corocleanu 1969, 145).

R. v. Kimakowicz continued his father's work, until his passing on 26 March 1973, at the age of 98. Plattner (1974), Zilch and Nordsieck (1975, 261-264) paid tribute to his research activity.

The collection is synonym with door snails, some of them endemic to Romania, but the number of exotic specimens found in this collection with important historical and biogeographical value is large. Many of the specimens listed in this paper are the result of collegial exchanges done by Moritz von Kimakowicz.

Material and results

Until 2022, as a result of the curatorial activity, 1644 inventory numbers, over 5000 specimens, belonging to 56 families have been catalogued and updated according to today's taxonomy (Păpureanu 2013, 469-486; Păpureanu 2019, 629-656; Păpureanu 2021, 643-662).

This paper continues the list of species researched from the Kimakowicz Mollusca collection starting with inventory number 1645 to 1824. For each number it is mentioned:

- the new inventory number and written in parenthesis the old inventory numbers;

- current scientific name of the specimens catalogued under that number;

- scientific name of the species as it is written on the original label;

- number of specimens found under that inventory number;

- name of the collector if it is written;

- collecting year or when it entered the collection, if it is mentioned;

- the collecting sites.

The specimens are kept in the museum collections in the original wooden boxes and the small specimens are in glass tubes. The personalized labels are hand written, the majority, by Moritz von Kimakowicz (Fig. 4).

The names of the collectors or the source of the exchange are abbreviated.

To facilitate the use of the list, the collecting sites names, originally written in German according to 1800 toponymy, were updated.

World Register of Marine Species (WoRMS) (Appeltans *et al*. 2023) and MolluscaBase (2023) was used for the binomial nomenclature and classification.

Fehse (2002, 1-48; 2017, 240-287) was used to identify specimens belonging to the family *Triviidae*, Fehse and Grego (2010, 21-61) for to the genus *Ellatrivia.* For family *Cancellariidae*, especially specimens from Australia, Garrard (1975, 1-62) was consulted.

As many of the species originated from the Red Sea, scientific literature related to the area was consulted according to Van Gemert (2017, 2-81), Dekker & Orlin (2000, 3-46), Janssen *et al*. (2011, 373-509), Janssen & Taviani (2015, 511-529).

Some of the specimen's shells, like the ones belonging to the genera *Pustularia*, *Cancellaria* or *Cerirhium*, are eroded or incomplete making it difficult to establish the species.

Class *Gastropoda*
Subclass *Caenogastropoda*
Order *Littorinimorpha*
Superfamily *Velutinoidea*
Family *Triviidae*
Genus *Ellatrivia*

1645 (10709; 5463-5467) *Ellatrivia merces* (Iredale, 1924), label *Trivia australis* Lam., 5 specimens, Gr. Oz., Port Jackson (Australia).

Genus *Pseudopusula*

1646 (6746; 5468) *Pseudopusula californiana* (J. E. Gray, 1827), label *Trivia californica*, 1 specimen, T.L. Bulhon, 1879, California (U.S.A);
1652 (6758; 5486) *Pseudopusula fusca* (J. E. Gray, 1832), label *Trivia fusca*, 1 specimen, Thoms., 1884, California;
1674 (6753; 5535) *Pseudopusula antillarum* (Schilder, 1922), label *Trivia subrostrata*, 1 specimen, 1884, Cuba.

Genus *Discotrivia*

1647 (6747; 5469) *Discotrivia depauperata* (G. B. Sowerby I, 1832), label *Trivia depauperate*, 1 specimen, Bielz, 1884, California (U.S.A).

Genus *Trivia*

1649 (2251; 5471-5480) *Trivia monacha* (da Costa, 1778), label *Trivia europaea*, 10 specimens, Hele., 1886, Ireland;
1650 (6751; 5481) *Trivia monacha* (da Costa, 1778), label *Trivia europaea coccinella*, 1 specimen, Slang., Red Sea;
1651 (6750; 5482-5485) *Trivia monacha* (da Costa, 1778), label *Trivia europaea*, 4 specimens, Iordan., 1882, Portugal;
1663 (1433; 5509-5517) *Trivia mediterranea* (Risso, 1826), label *Trivia pullex*, 9 specimens, Ancey, 1883, Mediterranean Sea, Provence.

Genus *Niveria*

1653 (6752; 5487) *Niveria nix* (Schilder, 1922), label *Trivia nivea*, 1 specimen, Thoms., 1884, Cuba;
1661 (6754; 5500-5503) *Niveria quadripunctata* (J. E. Gray, 1827), label *Trivia quadripunctata*, 4 specimens, Irdan., 1882, West Indian Ocean;
1672 (6749; 5532-5533) *Niveria suffusa* (J. E. Gray, 1827), label *Trivia suffusa*, 2 specimens, Iordan., 1882, Galápagos Islands;
1673 (6748; 5534) *Niveria suffusa* (J. E. Gray, 1827), label *Trivia suffusa*, 1 specimen, 1884, Antilles.

Genus *Trivirostra*

1654 (6757; 5488) *Trivirostra hordacea* (Kiener, 1844), label *Trivia hordacea*, 1 specimen, Ri., 1884, Réunion, Indian Ocean;
1655 (10710; 5489-5492) *Trivirostra hordacea* (Kiener, 1844), label *Trivia insecta*, 4 specimens, Honolulu, Hawaii;
1659 (6755; 5497-5498) *Trivirostra oryza* (Lamarck, 1810), label *Trivia oryza*, 2 specimens, Iordan., 1882, Indian Ocean;
1660 (6756; 5499) *Trivirostra oryza* (Lamarck, 1810), label *Trivia oryza*, 1 specimen, Rigac., 1884, Réunion, Indian Ocean;
1665 (6759; 5523) *Trivirostra pellucidula* (Reeve, 1846), label *Trivia pellucidula*, 1 specimen, 1884, Réunion, Indian Ocean.

Genus *Triviella*

1656 (6742; 5493) *Triviella neglecta* F. A. Schilder, 1930, label *Trivia oniscus*, 1 specimen, Hesse., 1882, Gqeberha (Port Elizabeth), Eastern Cape province of South Africa.

Genus *Pusula*

1657 (6745; 5494-5495) *Pusula pediculus* (Linnaeus, 1758), label *Trivia pediculus*, 2 specimens, Thoms., 1884, Gulf of Mexico;
1658 (6744; 5496) *Pusula pediculus* (Linnaeus, 1758), label *Trivia pediculus*, 1 specimen, 1884, Antilles;
1666 (6743; 5524) *Pusula radians* (Lamarck, 1810), label *Trivia radians*, 1 specimen, Schneider,Veracruz, Gulf of Mexico.

Genus *Dolichupis*

1662 (3926; 5504-5508) *Dolichupis producta* (Gaskoin, 1836), label *Trivia producta*, 5 specimens, Jick., 1880, Suakin, Red Sea;
1664 (6760; 5518-5522) *Dolichupis producta* (Gaskoin, 1836), label *Trivia producta*, 5 specimens, Jick., 1880, Red Sea, Massawa.

Genus *Purpurcapsula*

1671 (6761; 5531) *Purpurcapsula exigua* (Gray, 1831), label *Trivia tremeza*, 1 specimen, Rig., 1884, Réunion, Indian Ocean.

Class *Gastropoda*
Subclass *Caenogastropoda*
Order *Littorinimorpha*
Superfamily *Cypraeoidea*

Family *Cypraeidae*

Subfamily *Erosariinae*

Genus *Ipsa*

1648 (6741; 5470) *Ipsa childreni (J. E. Gray, 1825)*, label *Cypraea childreni* J. E. Gray, 1825, 1 specimen, collected by Thmos., Pacific Ocean.

Genus *Nucleolaria*

1668 (6738; 5526) *Nucleolaria nucleus* (Linnaeus, 1758), label *Trivia nucleus*, 1 specimen, 1884, Pacific Ocean.

Genus *Staphylaea*

1669 (6736; 5527) *Staphylaea limacina* (Lamarck, 1810), label *Cypraea limacine*, 1 specimen, Indian Ocean;

1670 (6733; 5528-5530) *Staphylaea staphylaea consobrina* (Garrett, 1879), label *Trivia staphylaea*, 3 specimens, Iordan., 1882, Indian Ocean;
1675 (6734; 5536) *Staphylaea staphylaea* (Linnaeus, 1758), label *Trivia staphylaea cypraea*, 1 specimen, East Africa;
1676 (6735; 5537-5538) *Staphylaea staphylaea* (Linnaeus, 1758), label *(Cypraea) Trivia staphylaea var limacina*, 2 specimens, Jick., 1880, Red Sea, Dahlak Archipelago.

Genus *Naria*

1682 (5993; 5551-5553) *Naria poraria* (Linnaeus, 1758), label *Trivia luponia*, 3 specimens, 1899, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia.

Family *Cypraeidae*
Subfamily *Pustulariinae*
Genus *Pustularia*

1677 (5992; 5539) *Pustularia sp*., label *Cypraea (Trivia) pustular*, 1 specimen, 1899, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia;
1679 (12230; 5545-5546) *Pustularia sp.*, label *Trivia cypraea*, 2 specimens, 1905, Indian Ocean;
1678 (8029; 5540-5544) *Pustularia cicercula* (Linnaeus, 1758), label *Cypr. (Pustularia)*, 5 specimens, 1899, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia;
1680 (6739; 5547-5548) *Pustularia cicercula* (Linnaeus, 1758), label *Trivia cicercula*, 2 specimens, Schneider, 1884, Mauritius Island;
1681 (6740; 5549-5550) *Pustularia globulus* (Linnaeus, 1758), label *Trivia globulus*, 2 specimens, Indian Ocean;
1683 (6732; 5554), 1684 (5990; 5555), 1685 (10653; 5556), 1686 (12243; 5557), 1687 (12244; 5558) *Pustularia sp*., label *Trivia cypraea*, 5 specimens, 1899, Port Jackson, Australia, Pacific Ocean.

Family *Pediculariidae*
Subfamily *Cypraediinae*
Tribe *Pseudocypraeini*
Genus *Jenneria*

1667 (6737; 5525) *Jenneria pustulata* (Lightfoot, 1786), label *Trivia pustulata*, 1 specimen, Blz., 1884, Strait of Magellan.

Genus *Pedicularia*

1697 (6769; 5579) *Pedicularia sicula* Swainson, 1840, label *Pedicularia sicula*, 1 specimen, Po., 1884, Mediterranean Sea.

Family *Ovulidae*
Subfamily *Prionovolvinae*
Genus *Pseudosimnia*

1688 (6763; 5559) *Pseudosimnia adriatica* (G. B. Sowerby I, 1828), label *Ovula adriatica*, 1 specimen, Bielz., 1884, Adriatic Sea;
1689 (1434; 5560-5564) *Pseudosimnia carnea* (Poiret, 1789), label *Ovula carnea*, 5 specimens, Ancey., 1885, Mediterranean Sea, Algeria.

Genus *Calpurnus*

1691 (6764; 5566-5568) *Calpurnus verrucosus* (Linnaeus, 1758), label *Calpurnus verrucosus*, 3 specimens, Schneider, Ambon Island;
1693 (5994; 5570-5572) *Calpurnus verrucosus* (Linnaeus, 1758), label *Calpurnus verrucosus*, 3 specimens, 1899, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia.

Family *Ovulidae*
Subfamily *Ovulinae*
Genus *Ovula*

1690 (6762; 5565) *Ovula ovum* (Linnaeus, 1758), label *Ovula ovum*, 1 specimen, Maluku Islands.

Genus *Phenacovolva*

1694 (6766; 5573-5574) *Phenacovolva birostris* (Linnaeus, 1767), label *Birostra volva*, 2 specimens, Iordan, 1882, China.

Family *Ovulidae*
Subfamily *Simniinae*
Genus *Cyphoma*

1692 (6765; 5569) *Cyphoma gibbosum* (Linnaeus, 1758), label *Cyphoma gibbosa*, 1 specimen, Bielz, Antilles.

Genus *Simnia*

1700 (6768; 5582-5586) *Simnia spelta* (Linnaeus, 1758), label *Birostra spelta*, 5 specimens, 1896, Adriatic Sea, Split;
1701 (6767; 5587) *Simnia spelta* (Linnaeus, 1758), label *Birostra spelta*, 1 specimen, 1884, Panama.

Class *Gastropoda*
Subclass *Caenogastropoda*
Order *Neogastropoda*
Superfamily *Volutoidea*
Family *Cancellariidae*
Genus *Scalptia*

1695 (6770; 5575) *Scalptia scalarina* (Lamarck, 1822), label *Cancellaria scalarina*, 1 specimen, Jick., Red Sea, Massawa;
1696 (6771; 5576-5578) *Scalptia scalarina* (Lamarck, 1822), label *Cancellaria scalarina*,

3 specimens, Jick., Red Sea, Dahlak Archipelago;
1703 (6774; 5589) *Scalptia crenifera* (G. B. Sowerby I, 1832), label *Cancellaria crenifera*, 1 specimen, Panama;
1705 (5259; 5591-5592) *Scalptia scalata* (G. B. Sowerby I, 1832), label *Cancellaria scalata*, 2 specimens, Schneider, 1884, Mauritius Island.

Family *Cancellariidae*
Subfamily *Cancellariinae*
Genus *Cancellaria*

1698 (6775; 5580), 1699 (6776; 5581) *Cancellaria sp*., 2 specimens, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia;
1702 (6772; 5588) *Cancellaria sp*., label *Cancellaria concellata*, 1 specimen, Panama;
1704 (6773; 5590) *Cancellaria reticulata* (Linnaeus, 1767), label *Cancellaria reticulata*, 1 specimen, Bielz, Indian Ocean.

Class *Gastropoda*
Subclass *Caenogastropoda*
Order *Littorinimorpha*
Superfamily *Capuloidea*
Family *Capulidae*
Genus *Ariadnaria*

1706 (4216; 5593) *Ariadnaria borealis* (Broderip & G. B. Sowerby I, 1829), label *Trichotropis borealis*, 1 specimen, Great Britain.

Class *Gastropoda*
Subclass *Caenogastropoda*
Order *Caenogastropoda*
Superfamily *Cerithioidea*
Family *Cerithiidae*
Subfamily *Cerithiinae*
Genus *Clypeomorus*

1707 (12231; 5594-5596) *Clypeomorus batillariaeformis* Habe & Kosuge, 1966, label *Cerithium moniliferum*, 3 specimens, Wolf., Adriatic Sea, Istria;
1708 (6798; 5597-5604) *Clypeomorus batillariaeformis* Habe & Kosuge, 1966, label *Cerithium moniliferum*, 8 specimens, Jick., 1880, Red Sea, Suez;
1709 (6808; 5605-5606) *Clypeomorus batillariaeformis* Habe & Kosuge, 1966, label *Cerithium moniliferum*, 2 specimens, Dr. Koblk., Mumbai;
1710 (6810; 5607) *Clypeomorus batillariaeformis* Habe & Kosuge, 1966, label *Cerithium moniliferum*, 1 specimen, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia;
1711 (6809; 5608) *Clypeomorus batillariaeformis* Habe & Kosuge, 1966, label *Cerithium moniliferum*, 1 specimen, Bielz, 1884, Indian Ocean;
1713 (6826; 5611) *Clypeomorus brevis* (Quoy & Gaimard, 1834), label *Cerithium rugosum*, 1 specimen, Blz., 1884, Hawaiian Islands;
1718 (6813; 5617) *Clypeomorus bifasciata* (G. B. Sowerby II, 1855), label *Cerithium morus*, 1 specimen, Madagascar;
1757 (10665; 5793-5803) *Clypeomorus clypeomorus* Jousseaume, 1888, label *Cerithium sp.*, 11 specimens, Jick., Red Sea, Massawa;
1758 (10666; 5804-5810), 1759 (10658; 5811-5817), 1760 (10657; 5818-5823), 1761 (10660; 5824-5829), 1762 (10659; 5830-5838), 1763 (10661, 5839-5849), 1764 (10662; 5850-5854), 1765 (10670; 5855-5872), 1766 (10672; 5873-5877), 1767 (10671; 5878-5882), 1768 (10668; 5883-5894), 1769 (10663; 5895-5904), 1770 (10664; 5905), 1771 (10667; 5906-5908), 1772 (10669; 5909-5919) *Clypeomorus brevis* (Quoy & Gaimard, 1834), label *Cerithium sp.*, 116 specimens, Jick., 1880, Red Sea, Massawa;
1773 (6803; 5920-5922) *Clypeomorus clypeomorus* Jousseaume, 1888, label *Cerithium sp.*, 3 specimens, Viskrl., Adriatic Sea, Ragusa, Italy;
1794 (6802; 6146-6160) *Clypeomorus sp.*, label *Cerithium variegatum*, 15 specimens, Jick., 1880, Red Sea, Massawa.

Genus *Cerithium*

1712 (6811; 5609-5610) *Cerithium sp*., label *Cerithium gallapaginis*, 2 specimens, Jick., 1880, Red Sea, Suez;
1714 (6827; 5612) *Cerithium punctatum* Bruguière, 1792, label *Cerithium alveolus*, 1 specimen, Bielz, 1774, Hawaiian Islands;
1715 (6821; 5613-5614) *Cerithium gallapaginis* A. Adams, 1855, label *Cerithium gallapaginis*, 2 specimens, 1884, Réunion, Indian Ocean;
1717 (6812; 5616) *Cerithium stercusmuscarum* Valenciennes, 1832, label *Cerithium ocellatum*, 1 specimen, Bielz., 1884, Peru;
1719 (6794; 5618) *Cerithium rueppelli R. A. Philippi, 1848*, 1 specimen, Jick., 1880, Red Sea, Massawa;
1720 (6795; 5619-5646) *Cerithium caeruleum* G. B. Sowerby II, 1855, label *Cerithium caeruleum*, 28 specimens, Jick., 1880, Red Sea, Massawa;

1721 (6795; 5647-5656) *Cerithium caeruleum* G. B. Sowerby II, 1855, label *Cerithium caeruleum*, 10 specimens, Jick., 1880, Red Sea, Massawa;
1722 (6796; 5657) *Cerithium caeruleum* G. B. Sowerby II, 1855, label *Cerithium caeruleum*, 1 specimen, Jick., 1880, Red Sea, Dahlak Archipelago;
1723 (6797; 5658-5659) *Cerithium caeruleum* G. B. Sowerby II, 1855, label *Cerithium caeruleum*, 2 specimens, Jick., 1880, Red Sea, Suez;
1724 (6825; 5661) *Cerithium rostratum* G. B. Sowerby II, 1855, label *Cerithium sp.*, 2 specimens, Jick., 1880, Jick., 1880, Red Sea, Dahlak Archipelago;
1725 (6817, 5662) *Cerithium caeruleum* G. B. Sowerby II, 1855, label *Cerithium*, 1 specimen, Jick., 1880, Red Sea;
1726 (6824; 5663) *Cerithium rostratum* G. B. Sowerby II, 1855, label *Cerithium sp.*, 1 specimen, Jick., 1880, Red Sea, Massawa;
1727 (6823; 5664-5665) *Cerithium caeruleum* G. B. Sowerby II, 1855, label *Cerithium sp*., 2 specimens, Jick., Red Sea, Jeddah;
1729 (6801; 5667-5693) *Cerithium rueppelli* R. A. Philippi, 1848, label *Cerithium sp.*, 27 specimens, Jick., 1880, Red Sea, Massawa;
1730 (6014; 5694) *Cerithium rostratum* G. B. Sowerby II, 1855, label *Cerithium sp.*, 1 specimen, 1899, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia;
1731 (10655; 5695-5696) *Cerithium echinatum* Lamarck, 1822, label *Cerithium sp.*, 2 specimens, Adriatic Sea, Split;
1732 (6789; 5697-5702) *Cerithium rueppelli* R. A. Philippi, 1848, label *Cerithium ruppeli*, 6 specimens, Red Sea, Massawa;
1733 (6814; 5703-5704) *Cerithium rueppelli* R. A. Philippi, 1848, label *Cerithium ruppeli*, 2 specimens, Jick., Red Sea, Dahlak Archipelago;
1734 (6788; 5705-5708) *Cerithium rueppelli* R. A. Philippi, 1848, label *Cerithium ruppeli*, 4 specimens, Jick., 1880, Red Sea, Suez;
1735 (6785; 5709-5714) *Cerithium columna* G. B. Sowerby I, 1834, label *Cerithium columna*, 6 specimens, Red Sea, Massawa;
1736 (12246; 5715-5719) *Cerithium lividulum* Risso, 1826, label *Cerithium mediterraneum*, 5 specimens, Ri., Adriatic Sea, Rijeka or Fiume;
1737 (12245; 5720-5731) *Cerithium scabridum* R. A. Philippi, 1848, label *Cerithium scabridum*, 12 specimens, Jick., 1880, Red Sea, Massawa;
1738 (6784; 5732-5734) *Cerithium columna* G. B. Sowerby I, 1834, label *Cerithium columna*, 3 specimens, 1899, Pacific Ocean, Port Jackson, Sydney, New South Wales, Australia;
1739 (6783; 5735) *Cerithium columna* G. B. Sowerby I, 1834, label *Cerithium columna*, 1 specimen, Philippines;
1740 (6787, 5736) *Cerithium columna* G. B. Sowerby I, 1834, label *Cerithium columna*, 1 specimen, Indian Ocean;
1741 (6790; 5737) *Cerithium uncinatum* (Gmelin, 1791), label *Cerithium uncinatum*, 1 specimen, Rigac., Réunion;
1742 (5271; 5738-5740) *Cerithium atratum* (Born, 1778), label *Cerithium atratum*, 3 specimens, Puerto Rico;
1743 (6782; 5741-5749) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum*, 9 specimens, Schneider, 1883, Adriatic Sea, Ragusa;
1744 (1435; 5750-5752) *Cerithium lividulum* Risso, 1826, label *Cerithium fuscatum*, 3 specimens, Ancey, 1885, Mediterranean Sea, Provence;
1745 (5267; 5753-5756) *Cerithium litteratum* (Born, 1778), label *Cerithium literatum*, 4 specimens, Schneider, Cuba;
1746 (6786; 5757-5758) *Cerithium columna* G. B. Sowerby I, 1834, label *Cerithium columna*, 2 specimens, Jick., 1880, Red Sea, Dahlak Archipelago;
1747 (10654; 5759-5723*) Cerithium sp.*, label *Cerithium sp*., 15 specimens, Jick., 1880, Red Sea, Jeddah;
1748 (6819; 5774) *Cerithium sp.*, label *Cerithium vulgatum*, 1 specimen, Jick., 1880, Red Sea, Suakin;
1749 (6792; 5775) *Cerithium nodulosum* Bruguière, 1792, label *Cerithium nodulosum*, 1 specimen, Borcherd., Indian Ocean;
1750 (6793; 5776-5779) *Cerithium echinatum* Lamarck, 1822, label *Cerithium sp*., 4 specimens, Jick., 1880, Red Sea, Massawa;
1751 (6777; 5780) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum*, 1 specimen, Madagascar;
1752 (6778; 5781-5782) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum*, 2 specimens, Klec., Adriatic Sea, Zadar;
1753 (10656; 5783) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum*, 1 specimen, Dr. Vogl., July 1907, Mediterranean Sea, Montpellier;

1754 (6779; 5784) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum var gracile*, 1 specimen, Adriatic Sea, Zadar;
1755 (6780; 5785-5791) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum var. minor*, 7 specimens, Viskril., Adriatic Sea, Ragusa;
1756 (6781; 5792) *Cerithium vulgatum* Bruguière, 1792, label *Cerithium vulgatum*, 1 specimen, Klec., Adriatic Sea, Zadar;
1775 (5260; 5927-5930) *Cerithium coralium* Kiener, 1841, label *Cerithium granosum*, 4 specimens, Schneider, Hong Kong;
1776 (6532; 5931-5932) *Cerithium zebrum* Kiener, 1841, label *Cerithium sp*., 2 specimens, Mauritius Island;
1777 (6818; 5933) *Cerithium zebrum* Kiener, 1841, label *Cerithium sp*., 1 specimen, Jick., 1880, Red Sea;
1779 (5262; 5935-5938) *Cerithium lutosum* Menke, 1828, label *Cerithium bermudae*, 4 specimens, Schneider, Cuba;
1780 (6820; 5939-5940) *Cerithium zebrum* Kiener, 1841, label *Cerithium aspersum*, 2 specimens, 1884, Réunion, Indian Ocean;
1781 (6799; 5941-5943) *Cerithium scabridum* R. A. Philippi, 1848, label *Cerithium sp.*, 3 specimens, Jick., 1880, Red Sea, Dahlak Archipelago;
1782 (10674; 5944-5953) *Cerithium sp*., label *Cerithium sp*., 10 specimens, Jick., Red Sea, Massawa;
1783 (10673; 5954) *Cerithium sp*., label *Cerithium sp*., 1 specimen, Jick., Red Sea, Dahlak Archipelago;
1784 (10675; 5955-5958) *Cerithium sp*., label *Cerithium sp*., 4 specimens, Jick., Red Sea, Massawa;
1785 (3533; 5959-5960) *Cerithium sp*., label *Cerithium sp*., 2 specimens, Hele., 1888, Mauritius Island;

1786 (6800; 5961-5970) *Cerithium scabridum* R. A. Philippi, 1848, label *Cerithium sp.*, 10 specimens, Jick., Red Sea, Massawa;
1791 (6804; 5982) *Cerithium nesioticum* Pilsbry & Vanatta, 1906, label *Cerithium papillosum*, 1 specimen, 1884, Réunion, Indian Ocean;
1792 (10677; 5983-6070) *Cerithium sp*., label *Cerithium sp*., 88 specimens, Jick., Red Sea, Jeddah;
1793 (10676; 6071-6145) *Cerithium sp*., label *Cerithium sp*., 75 specimens, Jick., Red Sea, Dahlak Archipelago;
1795 (6791; 6161-6168) *Cerithium lividulum* Risso, 1826, label *Cerithium mediterraneum*, 8 specimens, Viskril., Adriatic Sea, Ragusa, Italy;
1796 (12236; 6169-6170) *Cerithium sp*., label *Cerithium sp*., 2 specimens, Ji., 1880, Red Sea, Massawa;
1797 (12238; 6171) *Cerithium balteatum* R. A. Philippi, *1848*, label *Cerithium sp*., 1 specimen, Mel., 1899, Port Jackson (Australia);
1798 (12232; 6172-6173) *Cerithium scabridum* R. A. Philippi, 1848, label *Cerithium sp*., 2 specimens, Wolf., Adriatic Sea, Split;
1799 (12234; 6174-6184) *Cerithium sp*., label *Cerithium sp*., 11 specimens, Ji., 1880, Red Sea, Massawa;
1800 (12233; 6185-6189) *Cerithium sp*., label *Cerithium sp*., 5 specimens, Ji., 1880, Red Sea;
1801 (12235; 6190) *Cerithium sp*., label *Cerithium sp*., 1 specimen, Ji., 1880, Red Sea, Massawa;
1802 (12237; 6191-6196) *Cerithium sp*., label *Cerithium sp*., 6 specimens, Mel., 1899, Port Jackson (Australia).

Genus *Colina*

1774 (6816; 5923-5926) *Colina pinguis* A. Adams, 1855, label *Cerithium contractum*, 4 specimens, Jick., 1880, Red Sea, Massawa.

Genus *Pseudovertagus*

1803 (6829; 6197) *Pseudovertagus aluco* (Linnaeus, 1758), label *Vertagus aluco*, 1 specimen, Philippines;
1804 (6828; 6198) *Pseudovertagus clava* (Gmelin, 1791), label *Vertagus maculosum*, 1 specimen, Galápagos Islands;
1807 (6832; 6202) *Pseudovertagus aluco* (Linnaeus, 1758), label *Vertagus cumingii*, 1 specimen, Indian Ocean.

Genus *Rhinoclavis*

1805 (6830; 6199-6200) *Rhinoclavis vertagus* (Linnaeus, 1767), label *Vertagus vertagus*, 2 specimens, Irodan., 1882, Maluku Islands;
1806 (6831; 6201) *Rhinoclavis vertagus* (Linnaeus, 1767), label *Vertagus procerus*, 1 specimen, Indian Ocean;
1808 (6834; 6203-6207) *Rhinoclavis fasciata* (Bruguière, 1792), label *Vertagus fasciatus*, 5 specimens, Red Sea, Dahlak Archipelago;
1809 (6833; 6208-6210) *Rhinoclavis fasciata* (Bruguière, 1792), label *Vertagus pharos*, 3 specimens, Red Sea, Massawa;
1810 (5269; 6211-6213), 1811 (5270; 6214) *Rhinoclavis aspera* (Linnaeus, 1758), label

Vertagus lineatus, 4 specimens, Mauritius Island;
1812 (6835; 6215-6219) *Rhinoclavis aspera* (Linnaeus, 1758), label *Vertagus asper*, 5 specimens, Red Sea, Massawa;
1813 (6836; 6220-6230) *Rhinoclavis kochi* (R. A. Philippi, 1848), label *Vertagus kochi*, 11 specimens, Red Sea, Massawa;
1814 (10678; 6231) *Rhinoclavis aspera* (Linnaeus, 1758), label *Vertagus asper*, 1 specimen, Red Sea, Dahlak Archipelago;
1815 (10679; 6232-6233) *Rhinoclavis kochi* (R. A. Philippi, 1848), label *Vertagus kochi*, 2 specimens, Red Sea, Dahlak Archipelago;
1816 (4109; 6234-6244) *Rhinoclavis sp*., label *Vertagus elegans*, 11 specimens, Jick., 1880, Red Sea, Massawa;
1818 (6838; 6246) *Rhinoclavis sinensis* (Gmelin, 1791), label *Vertagus obeliscus*, 1 specimen, Indian Ocean;
1819 (6839; 6247-6252) *Rhinoclavis sinensis* (Gmelin, 1791), label *Vertagus obeliscus*, 6 specimens, Jick., Red Sea, Massawa;
1820 (5261; 6253-6255) *Rhinoclavis sinensis* (Gmelin, 1791), label *Vertagus cedonulli*, 3 specimens, Schneider, Mauritius Island.

Genus *Clavocerithium*

1817 (6837; 6245) *Clavocerithium taeniatum* (Quoy & Gaimard, 1834), label *Vertagus implicatus*, 1 specimen, Jick., 1880, Red Sea, Massawa.

Family *Cerithiidae*
Subfamily *Bittiinae*
Genus *Bittium*

1787 (6806; 5971-5976) *Bittium sp.*, label *Cerithium lacteum*, 6 specimens, Jick., Red Sea, Massawa;
1788 (6805; 5977-5979) *Bittium sp.*, label *Cerithium lacteum*, 3 specimens, Jick, 1880, Suakin, Red Sea;
1789 (3531; 5980) *Bittium lacteum* (R. A. Philippi, 1836), label *Cerithium lacteum*, 1 specimen, Hele., 1888, Mauritius Island;
1790 (6807; 5981) *Bittium sp.*, label *Cerithium lacteum*, 1 specimen, Jick., 1880, Red Sea, Dahlak Archipelago;
1821 (4122; 6256) *Bittium filosum esuriens* Carpenter, P.P., 1864, label *Bittium filosum*, 1 specimen, F. L. Button., California;
1822 (4110; 6260-6264) *Bittium reticulatum* (da Costa, 1778), label *Bittium afrum*, 3 specimens, Blz., 1884, Adriatic Sea, Zadar;
1823 (4111; 6260-6264) *Bittium sp.*, label *Bittium ferrugineum*, 5 specimens, Kleč., Adriatic Sea, Zadar;
1824 (4124; 6265-6266) *Bittium sp.*, label *Bittium rudely*, 2 specimens, Rigac., Samoan Islands.

Family *Batillariidae*
Genus *Lampanella*

1716 (6822; 5615) *Lampanella minima* (Gmelin, 1791), label *Cerithium nigrescens*, 1 specimen, 1884, Jamaica.

Family *Potamididae*
Genus *Tympanotonos*

1778 (6815; 5934) *Tympanotonos fuscatus* (Linnaeus, 1758), label *Cerithium granulatum*, 1 specimen, Blz., 1884, Port Adelaide, Australia.

Class *Gastropoda*
Subclass *Caenogastropoda*
Order *Caenogastropoda*
Superfamily *Triphoroidea*
Family *Newtoniellidae*
Subfamily *Ataxocerithiinae*
Genus *Ataxocerithium*

1728 (3530; 5666) *Ataxocerithium serotinum* (A. Adams, 1855), label *Cerithium serotina*, 1 specimen, Hele., 1888, Mauritius.

Conclusions

The list comprises 788 specimens catalogued under 179 inventory numbers. The specimens belong to the families *Triviidae, Pediculariidae, Cypraeidae, Ovulidae, Cancellariidae, Capulidae, Cerithiidae, Batillariidae, Potamididae, Newtoniellidae* divided to 35 genera and 78 species (Tab.1.1).

The origin of the specimen, according to the labels, encompasses various regions around de globe, but the majority are from the Red Sea (Dahlak Archipelago, Massawa, Suakin, Jeddah), respectively 556 specimens (Fig. 5) collected by Carl Friedrich Jickeli (1850-1925). The specimens entered the Kimakowicz collection in 1880 (Fig. 6). Jickeli also donated specimens to the Natural History Museum in Sibiu general Mollusca collection starting with 1896. Bought Moritz von Kimakowicz and Jickeli were members and colleagues in the *Transylvanian Society for Natural Sciences from Sibiu (Siebenbürgische Verein für*

Naturwissenschaften zu Hermannstadt) the museums founding society.

Jickeli is the one who wrote M. von Kimakowicz obituary in 1922 (Jickeli 1922, 58-62). Jickeli spent a lot of time at the Kimakowicz house, he recalls that it was welcoming, a place dedicated to researchers and taxidermists, that *in the laboratory there were always stuffed animals, skulls and skeletons, alcohol specimens, cockroaches and snails*.

C. F. Jickeli is one of the main contributors to the development of the Kimakowicz exotic Red Sea molluscs collection, enlisted between the inventory numbers 1 to 1824 (inventoried until today).

According to labels, Moritz von Kimakowicz also exchanged specimens with Eduard Albert Bielz (1827-1898), another founding father of the museum in Sibiu. His name appears on Adriatic Sea, Indian Ocean, some Australian and Hawaiian Islands specimens (Fig. 7).

César-Marie-Felix Ancey (1860-1906) sent specimens from the Mediterranean Sea, in 1883 and 1885 (Fig. 8).

The correspondence held by M. v. Kimakowicz with various specialists from Europe, and not only, has enriched the collection considerably. Even if the Kimakowicz father and son publications concerned molluscs from Romania, the collection specimens are from diverse geographical locations.

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Tab. 1. The families, genus and number of species listed.

Family	Genera	Number of species
Triviidae	*Ellatrivia*	1
	Pseudopusula	3
	Discotrivia	1
	Trivia	2
	Niveria	3

	Trivirostra	3
	Triviella	1
	Pusula	2
	Dolichupis	1
	Purpurcapsula	1
Pediculariidae	*Jenneria*	1
	Pedicularia	1
Cypraeidae	*Ipsa*	1
	Nucleolaria	1
	Staphylaea	3
	Naria	1
	Pustularia	2
Ovulidae	*Pseudosimnia*	2
	Calpurnus	1
	Ovula	1
	Phenacovolva	1
	Cyphoma	1
	Simnia	1
Cancellariidae	*Scalptia*	3
	Cancellaria	1
Capulidae	*Ariadnaria*	1
Cerithiidae	*Clypeonorus*	4
	Cerithium	19
	Colina	1
	Pseudovertagus	2
	Rhinoclavis	5
	Clavocerithium	1
	Bittium	3
Batillariidae	*Lampanella*	1
Potamididae	*Tympanotonos*	1
Newtoniellidae	*Ataxocerithium*	1

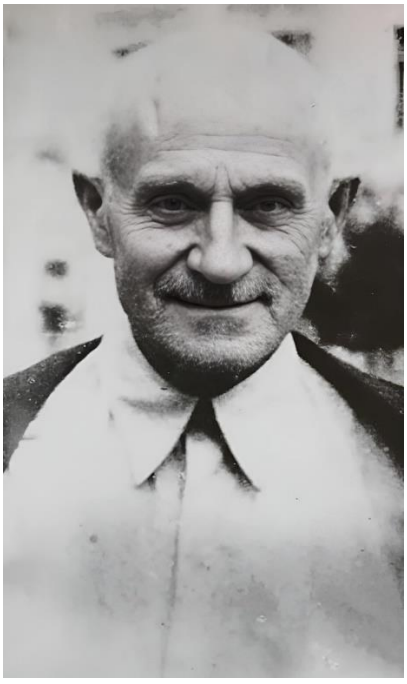

Fig. 1. Richard Emanuel von Kimakowicz-Winnicki (1875-1973) (private photographs of Ioana Kirculescu von Kimakowicz).

a.

b.

Fig. 2. (a). Moritz von Kimakowicz; (b). Marie von Kimakowicz (right); (c). Richard and Moritz von Kimakowicz (Photo Natural History Museum Archaive, Ioana Kirculescu von Kimakowicz donation, private photographs of Ioana Kirculescu von Kimakowicz).

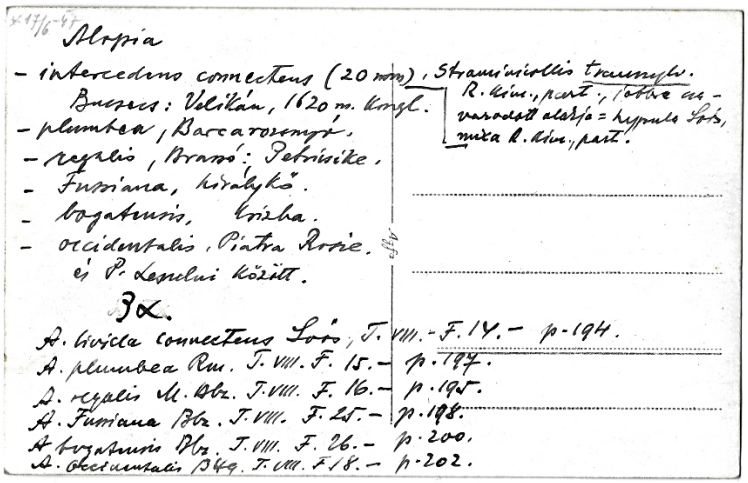

Fig. 3. Richard von Kimakowicz hand written notes (Photo Natural History Museum Archaive, Ioana Kirculescu von Kimakowicz donation).

Fig. 4. General appearance of the Kimakowicz collection.

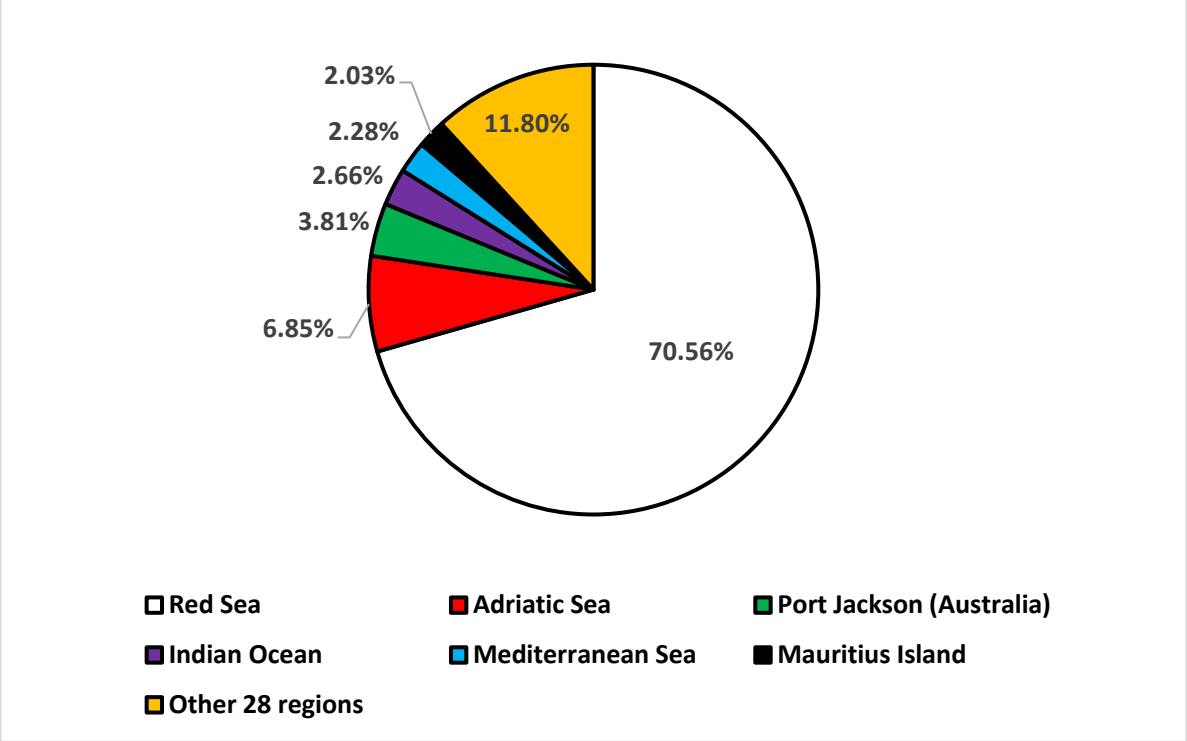

Fig. 5. Number of specimens according to the collecting sites.

Fig. 6. Specimens collected by C. F. Jickeli found in the Kimakowicz Collection.

Fig. 7. Specimens resulting from exchanges with E.A. Bielz.

Fig. 8. Mediterranean Sea specimens sent by C. F. Ancey.

PHARMACISTS MEMBERS OF THE *TRANSYLVANIAN SOCIETY FOR NATURAL SCIENCES IN SIBIU* (*SIEBENBÜRGISCHEN VEREINS FÜR NATURWISSENSCHAFTEN ZU HERMANNSTADT*) BETWEEN 1849 AND 1861

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Abstract. *Between 1849 and 1861 the Transylvanian Society for Natural Sciences in Sibiu enlisted as permanent members twenty-six pharmacists from present day Romania. Most of them were from Transylvania. They contributed to the development of the Natural History Museum and of the Pharmacy History Museum in Sibiu. This paper presents the professional and scientific activity of these pharmacists.*
Key words: *Transylvanian Society, pharmacists, natural sciences, pharmacy history*

Rezumat. *Între 1849 și 1861 Societatea Transilvană de Științe ale Naturii din Sibiu a înscris ca membri permanenți douăzeci și șase de farmaciști din România de astăzi. Majoritatea erau din Transilvania. Au contribuit la dezvoltarea Muzeului de Istorie Naturală și a Muzeului de Istorie a Farmaciei din Sibiu. Această lucrare prezintă activitatea profesională și științifică a acestor farmaciști.*
Cuvinte cheie: *Societatea Transilvăneană, farmaciști, științe naturale, istoria farmaciei*

Introduction

The Siebebürgishen Vereins für Natur-wissenschaften zu Hermannstadt (*The Transyl-vanian Society for Natural Sciences in Sibiu*) was officially established on May 4th, 1849. The Society had the following objectives: to study natural specimens and to present the results of these studies during their monthly meetings; to gather natural history collections by means of its one members or by acquisition and trade with researchers and institutions from around the world; to buy different scientific journals and books related to the field and start a society library; to publish the results of the studies in the society journal *Verhandlungen und Mittheilungen der Sieben-bürgischen Vereins für Naturwissenschaften zu Hermannstadt* (Schneider, Stamp 1970, 38).

In this journal, each month, were listed the society's new members, in alphabetical order. Among them were pharmacists from Romania. The members from previous years will be listed together with the new ones in each number of the journal.

Also, in the journal is presented a section related to the donations made annually by the members including the pharmacists. Many of the donated specimens are still found today in the collections.

The names of the pharmacists are also found in the museum archives that include correspondence between the Society members from Sibiu and the pharmacists around Romania.

All of the pharmacists, members of the *Transylvanian Society*, working in current day Romania, the majority are from Transylvania.
For some of pharmacists, identified as members, it has been difficult to identify the location where they worked, considering the historical context of the country. There are also members from the south of the current day Romania, *Walachei* as it is called in the archives, including București.

At the beginning of the 19th century, many pharmacists from Transylvania migrated south. The causes that generated this emigration were multiple. First of all, in the 18th century, there were many private pharmacies in Transylvania, in comparison to other areas of present-day Romania. In Transylvania, pharmacists, organized according to the system of guilds, managed to limit the number of pharmacies through the local authorities, and thus to open new private pharmacies was no longer allowed. In the 18th

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and 19th century, many pharmacists graduated from universities in Austria and Hungary. Those originally from Transylvania, returning home, did not open new pharmacies because of the guild or they did not find a place to work in the already existing pharmacies, and thus they were forced to leave the region. The Romanian principalities, at that time, were a favourable place for the profession, there were only a few private pharmacies, and thus here they were encouraged to open new establishments (Maior and Roth 1968, 5-8). As a result, many pharmacists, that practiced in the south region of today Romania, were from Transylvania and were involved in the scientific movement from back home and they were aware of the *Transylvanian Society* activity.

The following research is dedicated to the pharmacists that contributed to scientific research in Romania and to the development of the collections found today in the Natural History Museum from Sibiu.

First of all, we have to mention that two active members of the *Transylvanian Society for Natural Sciences* and founding fathers of the Natural History Museum in Sibiu were pharmacists: Philipp Johann Ferdinand Schur (1799-1878) (Fig. 1) and Gustav Adolf Kayser (1817-1878) (Fig. 2).

The life and scientific achievements of F. Schur (Römer, 1894, 1-18; Heltmann, 1966, 115-118; Doltu and Schneider-Binder, 1970, 215-262; Speta, 1994, 334 S; Heltmann, 1998, 375-376; Heltmann, 2007, 66-70) and G. A. Kayser (Trausch 1870, 244-245; Fabritius 1986, 83-90; Fabritius 1989, 85-89; Drăgulescu 1998, 128; Schneider 2003, 6; Schneider 2007, 76-78) were researched by numerous botanists and scientists.

Little is known regarding the other pharmacists' members of the *Siebenbürgischen vereins für naturwissen schaften zu Hermannstadt* society and their contributions to the museum collections in Sibiu. This paper attempts to identify the pharmacists that were members of the *Transylvanian Society* and acknowledge their activity as professionals and as researchers in the field of natural sciences.

Results

The life and research activity of the Transylvanian pharmacists have shaped the scientific and museum institutions found in present day Sibiu, as it is the case of Gustav Adolf Kayser.

The Pharmacy History Museum from Sibiu was opened to the general public in 1972, in the place where G. A. Kayser and his family worked for years. His legacy as a botanist is still remembered today. The *Kayser Herbarium*, left to the *Transylvanian Society* by testament, is found at the Natural History Museum in Sibiu. The Herbarium is composed of 14.000 pages with 9800 species of cryptogams and phanerogams from Transylvania (Drăgulescu 1998, 128).

Gustav Adolph Kayser was borne on 24 September 1817 in Sibiu. His father was the pharmacist Johann Georg Kayser (19.11.1786-17.05.1820) married to Josepha Kayser (born Haffner) (1787-12.07.1852). His father graduated in 1804 from the University in Pesta. He did his required practice at the „*Imperial Eagle"* pharmacy (*Imperial Adler Apotheke*) in Hermannstadt, between 1804 and 1809, under the supervision of the pharmacist Francisc Anton Issekutz.

In 1809, the Kayser family bought the pharmacy located in the Small Square of Sibiu at number 421 (today 26) and named it the pharmacy „*At the Black Bear"* (*Zum Schwarzen Bären*).

Unfortunately, on 17 May 1820, at only 34 years, Johann Georg Kayser dies, living behind four children, Gustav Kayser was three years old. The pharmacist Friedrich Schuster, owner of the „*Crown Pharmacy"* (*Zur Krone Apotheke*) was married to Christina Haffer the sister of Kayser's mother. The Schuster family stepped forward in helping out. They hired the pharmacist Josef Friedrich Mauksch to administrate the Pharmacy „*At the Black Bear*".

Even since he was a young child, Gustav A. Kayser, attending the Evangelic Gymnasium in Sibiu (today called the „Samuel von Brukenthal" National College), he showed a great interest in chemistry and botany and wanted to follow in his father's footsteps (Schneider 2007, 76-78). After finishing the gymnasia, he started learning the profession from the renowned pharmacist and botanist Friedrich Chladny (1792-1871) head pharmacist of the „*Imperial Eagle"* pharmacy between 1838 and 1858. Chladny also influenced young Kayser toward the research of botany.

In 1839, at 22 years of age, Kayser enrolled at the *Imperial and Royal Polytechnic Institute* from Viena (today *Technische Universität* or *TU Wien*). Here, his professor of technical chemistry was Paul Traugott Meissner (1778-1864, born in Mediaș, Sibiu County). In 1842, Kayser obtained his *Magister der Pharmazie* (*Magister of Pharmacy*) diploma with the thesis *Benzoic acid and its preparation* (*Benzoesäure und ihre Herstellung*) under the supervision of Meissner.

In 1843, Kayser enrolled at the *Preussischen Friedrich-Wilhelms-Universität* from Berlin (today *Humboldt-Universität zu Berlin* or *HU Berlin*), to study analytical chemistry under Karl Friedrich August Rammelsberg (1813-1899). He influenced Kayser into researching the double salt of oxalic acid, the result was his first published paper *Oxalsäure Doppelsalze*, in the 1844 *Poggendorfs Annalen für Physik und Chemie*. During the winter semester of 1843 and 1844, Kayser studied organic chemistry in the laboratory of Justus von Liebig (1803-1873) at the *University of Gießen* (today *Justus Liebig University Gießen*) (Schenider 2007, 76-78).

G.A. Kayser obtained his PhD in Philosophy (today the equivalent of a doctor in science) from the *Friedrich-Wilhelms-Universität* in May 1844, with a doctoral thesis on chemical tests on the Jalap resin called *Chemische Untersuchungen über das Jalappa – Harz*.

While Kayser was gone to finish his studies, the Pharmacy the *„Black Bear"* in Sibiu was managed by the pharmacist Josef Friedrich Mauksch since 1835 until 1847, who later married G.A. Kayser's oldest sister.

Soon after finishing his studies in Berlin, Kayser returned to Sibiu. He started attending in 1847 the natural sciences reading circle (Schneider & Stamp 1970, 42) held by the *Transylvanian Society for Natural Sciences in Sibiu* being passionate about this area of study. Kayser also continued his research in field of chemistry.

During the 1848 Revolution, G. A. Kayser became the leader of the Târgu Mureș brigade. He was captured by the Hungarian revolutionaries and sent to a concentration camp where he contracted tuberculosis. After the revolution he returned in Sibiu.

In 1849 he became a member of the *Transylvanian Society*, as one of his main interests was botany. He became one of the founding fathers of the Natural History Museum in Sibiu (Verhandlungen, 1849).

Because of his health problems, he left for the South of France, where during his long walks he researched the local flora (Schneider 2007, 76-78).

Since 1852 he takes under his management the family legacy, the Pharmacy „*At the Black Bear*". He became a member of the local medical commission. Under his care the pharmacy was a model of good-practice. As a result, after five years, the pharmacy was registered with legal right under governor's decree number 25.033 from 7 January 1857.

On June 6th, 1851, Kayser accompanied Michael Fuss and F. Schur to research the flora from Transylvania, enriching the *Transylvanian Society* herbarium (Verhandlungen 1852, 81).

Kayser also published papers related to physics or chemistry subjects (Kayser 1853, 68-71).

With age, his fragile state of health, did not allow him to work to much in the pharmacy and thus he hired for short periods of time other pharmacists to replace him. On 10 January 1878, at 61 years old, G. A. Kayser passed away (Verhandlungen, 1879).

In 1849, the *Transylvanian Society* journal (Verhandlungen 1849, 2-4) listed as members the following pharmacists from present day Romania (in the parenthesis it is mentioned the name of the place they worked in German, Hungarian and Romanian considering the historical period):

1. Friedrick Acker (Eisenmarkt/ Vajdahunyad/ Hunedoara, Hunedoara County),

   In 1851, the Society journal states that pharmacist F. Acker donated in January 1851, two petrographic specimens from Lăpugiu (Verhandlungen 1851, 10).

2. Samuel Benkner (Craiova, Dolj County)

   According to Angelescu (1904, 113), Samuel Benkner founded the „*Aurora*" pharmacy in Craiova, Dolj county, in 1826. He donated in 1851, molluscs from the south of current day Romania (Verhandlungen 1851, 10). He donated also aquatic molluscs to the Society collection in 1853 (Verhandlungen 1853, 34).

3. Johann Friedrich Binder (Heltau/ Nagydisznód/ Cisnădie, Sibiu County) was born in Sibiu in 1801. He obtained his diploma in 1821 in Pest, where he practiced for a year. Then he returned to Sibiu for two years. Between 1825-1828 he worked as provisional pharmacist under the command of pharmacist Becker. He worked with the pharmacist Kayser, at the „*Black Bear*" pharmacy in Sibiu between 1828 and 1831. In 1831 he acquires the pharmacy concession in Cisnădie and opens a branch in Ocna Sibiului (Sibiu county) between 1845 and 1851. For eight years he enjoyed his professional achievements because, unfortunately, in 1859 he died, at the age of 58.

4. Friedrich Berwerth (Schäßburg/ Segesvár/ Sighișoara, Mureș County) was born in 1820, Sighișoara (Mureș county). He graduated in 1841 from Vienna. He worked between 1841 and 1846 in Brașov with pharmacist Hornung and in Sighișoara with pharmacist Henrich. In 1846 he became the owner of the „*Eagle*" pharmacy in Sighișoara.

5. Carl Misselbacher (Schäßburg/ Segesvár/ Sighișoara, Mureș County) was also borne in Sighișoara (Mureș County) in 1815. He finished his studies at Vienna in 1839. In the records, he is mentioned directly as the owner of the „*Lion*" pharmacy in Sighișoara, between 1844 and 1856.

6. Carl Horung (Kronstadt/ Brassó/Brașov, Brașov County), was born in November 1815 in today Brașov. He studied at Pesta. In 1838 he was working at „*Arab*" pharmacy in Brașov becoming the owner of the establishment between 1838 and 1840, after this date there is no mentions regarding his activity as a pharmacist in the museum archive. He died in November 1904 (Roth 1970, 43).

7. Ferdinand Jekelius (Kronstadt/ Brassó/ Brașov, Brașov County) (1817-1877) graduated in Pesta. Between 1841 and 1843 he lived in Sibiu, working at the „*Blak Bear*" pharmacy. He moved back to Brașov to practice under the supervision of pharmacist Greissing for seven years, until 1850. His big break came that same year when he opened a pharmacy called „*Speranța*" (*Hope Pharmacy*) in Brașov. He is mentioned as owner of this pharmacy until 1877.

8. Peter Schnell (Kronstadt/ Brassó/Brașov, Brașov County) was born in Brașov, on June 1812. He practiced his entire career only in Brașov after obtaining his diploma. Together with Stenner Friedrich (1810-1894), they were the owners of the „*Golden Lion*" pharmacy in Brașov.

   Schnell reported in 1852, 1854, 1855 and 1856 the results regarding chemical analysis of the mineral waters from Vâlcele (Covasna County), Borsec (Harghita County), Slănic-Moldova (Bacău County), Zizin (Brașov County), Salzburg (Austria) and Geoagiu (Hunedoara County) (Verhandlungen 1852, 149; Verhandlungen 1854, 121, 159-172, 179-183; Verhandlungen 1855, 5-16, 17-20, 168-180; Verhandlungen 1858, 22-32, 43-48).

9. Joseph Sterzing (Fogarasch/ Fogaras/ Făgăraș, Brașov County) was born in 1808, place of birth unknown in our records. He obtained his degree at Vienna. Since 1830 he is mentioned as owner of the „*Hygea*" pharmacy in Făgăraș until 1867.

10. Gabriel Wolff (Thorenburg/ Kolozsvár/ Cluj-Napoca, Cluj County) is mentioned in the *Transylvanian Society* journal as pharmacist in Cluj-Napoca, but our records from the Pharmacy History Museum show that he actually worked and owned a pharmacy in Turda until 1892.

    In 1854 and 1857, Wolff communicated to the Transylvanian Society his observation regarding the flora from Cluj area (Verhandlungen 1854, 158; Verhandlungen 1857, 17).

11. Joseph Felmer (Hermannstadt/ Nagyszeben/Sibiu, Sibiu County) appears in the archive under the name of Carl Felmer, born on 30 October 1803, in Sibiu. He graduated from Vienna in 1827. He worked, according to Maior (2014, 267) between 1866 and 1868 at the „*Crown*" pharmacy in Sibiu. Felmer died in 1873.

12. Josef Jickeli (Hermannstadt/ Nagyszeben/ Sibiu, Sibiu County) was the owner of the „*Crown*" Pharmacy in Sibiu, between 1836 and 1870.

13. Friedrich Chladny (Hermannstadt/ Nagyszeben/ Sibiu, Sibiu County) (1792-1871) was a renowned pharmacist and botanist in Sibiu. His name is written in the archives also as Kladny. He was the main pharmacist at the „*Imperial Eagle*" in Sibiu from 1838 to 1858, when he left to Vienna, his home town. He played an important role in the development of G. A. Kayser as a botanist as it is mentioned before. According to Maior (2014, 333) Chladny was a remarkable pharmacist during the twenty years he

managed the „*Imperial Eagle*" pharmacy the establishment developed and was well known in the area. He also collaborated with Ludwig Reissenberger (1819-1895), another member of the *Transylvanian Society*, in building aerometers, thermometers and barometers.

On June 9th 1849 there was a big hail storm in Sibiu followed by a one-hour rain. After the rain, all around Sibiu there were puddles and floating on the water was a yellow – oily powder. At first the local authorities considered it was a sulphured rain, like the one documented in Rastadt (Germany) in May 1801. Chladny was called to analyse the yellow substance. As it turned out it was pine flower pollen brought in large quantities from the nearby forests where the hail must have been bigger and the wind more violent. Chladny gave examples of the same types of pine pollen found after storms from Copenhagen in 1804 and Bordeaux in 1761 (Chladny 1850, 33-36).

Before leaving for Vienna, Chladny sold his herbarium to the Transylvanian Society (Verhandlungen 1858, 88).

14. Carl Müller (Hermannstadt/ Nagyszeben/ Sibiu, Sibiu County) (1813-1904) was a member of the famous family of pharmacists Müller from Sibiu. It all started with his uncle Samuel Friedrich Müller (1784-1828). S. F. Müller remained in the history of the city of Sibiu not thanks to his activity at the "*Black Eagle*" pharmacy, but thanks to the social relations he established especially with Baron Samuel von Brukenthal (1721-1803). Even if, at that time, Samuel von Brukenthal no longer held the position of Governor of the Grand Principality of Transylvania, his political and social influence helped S. F. Müller to bring the family to a high social rank, by becoming a member of the council of centumvirs. As a result, the financial but also social legacy left to his nephew the pharmacist Carl Müller contributed to the further growth and development of the pharmacy. Carl Müller, unlike his uncle, devoted himself "body and soul" to the pharmacist profession, becoming the best-known pharmacist in Transylvania. He worked as a pharmacist until his death, for over 40 years. In the archives of the Pharmacy History Museum in Sibiu there are manuscripts signed by C. Müller, concerning studies of botany, anatomy, equipment from the pharmaceutical laboratory and lists of remedies prepared by him, dated 1836-1837, probably some from his student period (Fig. 3 a, b, c, d). The „*Black Eagle*" pharmacy, the oldest in current day Romania, remained in the Müller family until 1949 when the place was nationalised by the communists. But the family donated to the Brukenthal Museum numerous objects, including the furniture ordered from Vienna in 1902 displayed today in the Pharmacy History Museum.

In the 1850 number of the Society journal (Verhandlungen, 1850, 49) were listed as new members pharmacists Traugott Ritter (Cluj-Napoca, Cluj county) and Albert Schlotes (Turda, Cluj county) but we did not find records of these pharmacists in our archive. The same journal mentiones that pharmacist A. Schlotes donated in 1850 geological specimens (Verhandlungen 1850, 99).

On May 5, 1852, pharmacist Reckert Carl Daniel was listed as new member. He was borne in Bistrița and studied at Vienna graduating in 1860. Between 1871 and 1879 he was the owner of the „*Lion*" pharmacy in Orăștie (Broos/ Szászváros, Hunedoara County). In 1855, he communicated to the Transylvanian Society members and published the paper *Ausflug auf des Gebirge Koron bei Rodna* (Verhandlungen 1855, 17-20). Reckert researched the Chinese sugar cane and donated to the *Transylvanian Society* three numulite limestone and two pieces of hematite from Rodna Mountains in 1859 (Verhandlungen 1859, 89, 135).

In November, 1852, two new pharmacists joined the society (Verhandlungen 1852, 81): Martin Emerich (Görgen, Sankt-Emrich/ Görgényszentimre/ Gurghiu/ Sântimbrul Gurghiului, Mureș County) and Eduard Julius Rissdörfer. Rissdörfer was born in 1822, in Brașov, studied at Vienna. After graduating in 1848 he went to Bucharest and opened the pharmacy „*Golden Lion*" being the owner until his death in 1897.

Friedrich Folberth (Mediasch/ Medgyes/ Mediaș, Sibiu County, Romania) became a member of the Society in November 11, 1855 (Verhandlungen, 1855, 170). Was born in Mediaș and after graduating from Vienna in 1854 he obtained his PhD in chemistry in 1856 from the university in Giesen. He was the owner of the „*Black Eagle*" pharmacy in

Mediaș between 1858 and 1892. According to Țigău (2017, 56; 2019, 43-46) the Folberth family ran the pharmacy from Mediaș for three generations between 1858 and 1949, when the pharmacy was nationalised by the communists. Folberth researched the proprieties of

the mineral waters from Transylvania especially from Bazna (Sibiu County) (Verhandlungen 1855, 105-120) and the mineral waters from Rodna Mountains (Verhandlungen 1859, 32-40, 43-57). He communicated in 1857 to the *Transylvanian Society* his results after performing a chemical analysis of the mineral nagyagite (Verhandlungen 1857, 99-101). His research continued in 1860 with the mineral waters from Covasna (Verhandlungen, 1860, 78-100).

In 1880, the *Transylvanian Carpathian Society* (*Siebenbürgischer Karpatenverein*) was initiated and F. Folberth was a member in the organization committee (Ștefu 2017, 72).

The last pharmacist to join the Society on December 1855, was Karl Wagner (Hötzing/ Hátszeg/ Hațeg, Hunedoara County, Romania) (Verhandlungen, 1855, 186). He leased the „*Black Eagle*" pharmacy in Hațeg from 1848 to 1859.

Between 1860 and 1861, three new pharmacists are mentioned as new members:

1. Gustav Adolf Binder (Cisnădie, Sibiu County) (1836-1898) lived all of his life in Cisnădie. He graduated from Vienna in 1858 and after two years of practice at the town's pharmacy Binder became its owner in 1860 until his death.
2. Eduard Fischer from Alba Iulia (Alba County) is not included in our archives.
3. Wilhelm Platz (Sibiu, Sibiu County) (1828-1893) (1828-1893), his activity is well documented by Roth (1970, 70). Between 1845-1846 Platz worked as assistant in the pharmacy in Cisnădie. He did not graduate yet his studies. In 1846 he was sent to Ocna Sibiului to run the Binder pharmacy section from there. He stayed there until 1848. That same year he moved to Sibiu and got employed at the „*Imperial Eagle*" pharmacy. After two years in Sibiu, he decided to get his degree and studied at Vienna. Between 1852 and 1855 he did his required practical work with pharmacist Tiller from Stockerau (Austria). In 1858 he returned in Sibiu and leased the „*Imperial Eagle*" pharmacy until 1885.

In conclusion, between 1849 and 1861 the *Transylvanian Society* enlisted twenty-six pharmacists who actively contributed to the development of the *Transylvanian Society*.

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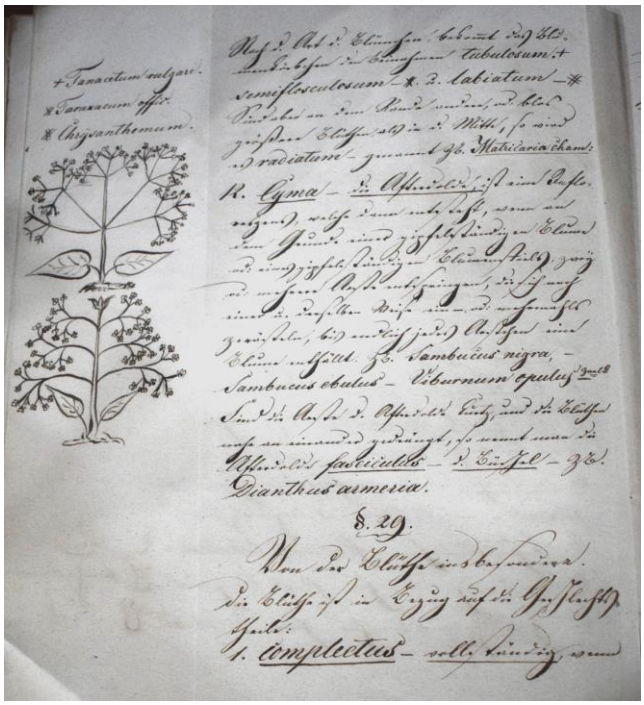

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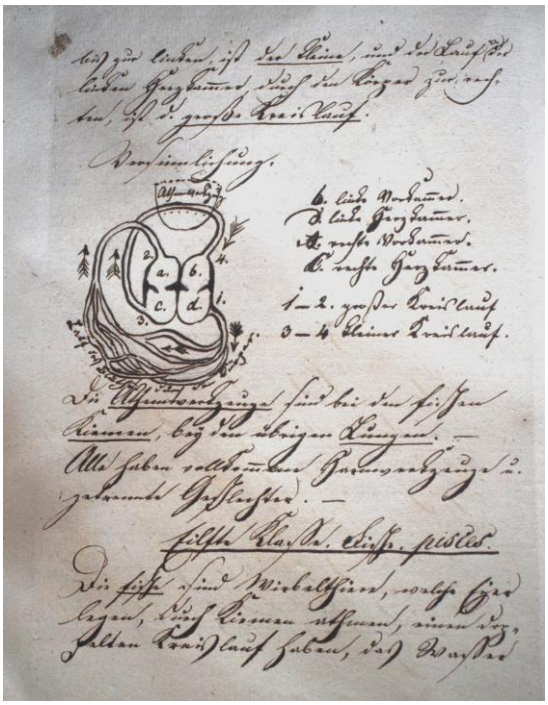

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A COMPARATIVE ANALYSIS ON THE SPIDER (ARACHNIDA: ARANEAE) AND ANT (HYMENOPTERA: FORMICIDAE) COMMUNITIES IN A RESTORED SAND QUARRY AND AN UNAFFECTED AREA IN THE MOHU LOCALITY (SIBIU)

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Abstract*. Restoring surface mining that were previously subjected to economic exploitation creates valuable habitats for invertebrates. These habitats, in turn, serve as important indicators of the progress and quality of post-mining restoration efforts. This study focuses on examining ant (Hymenoptera: Formicidae) and spider (Araneae) communities in an abandoned sand quarry and its surrounding area in the village of Mohu, Șelimbăr commune, Sibiu county. We conducted analyses of tree coverage and characteristics of the grass layer both within the quarry boundaries and in the adjacent control area. In total, we identified 14 species of spiders and 4 species of ants. Our findings suggest that both spider and ant species diversity was higher within the former quarry boundaries. This can be attributed to the greater heterogeneity of the quarry habitat, which includes wetland areas, exposed slopes without trees, and acacia plantations. Additionally, the advanced stage of restoration, characterized by the presence of black locust trees over 10 years old, contributes to the increased species diversity.*
Keywords*: bioindicators, Araneae, Formicidae, quarry, black locust.*

Rezumat. *Carierele de suprafață scoase din circuitul de exploatare economică devin, odată cu restaurarea, habitate importante pentru nevertebrate. La rândul lor, nevertebratele reprezintă buni bioindicatori, abundența și diversitatea lor evidențiind stadiul și calitatea procesului de restaurare a unei zone în faza post-minerit. Studiul de față se concentrează pe comunitățile de furnici (Hymenoptera: Formicidae) și păianjeni (Araneae) dintr-o carieră de nisip abandonată și restaurată și împrejurimile acesteia din satul Mohu, comuna Șelimbăr, județul Sibiu. Am analizat acoperirea cu arbori și caracteristicile stratului ierbos atât în perimetrul carierei, cât și în zona martor din vecinătatea carierei. Per total, am colectat 14 specii de păianjeni și 4 specii de furnici. Rezultatele noastre indică faptul că atât diversitatea speciilor de păianjeni, cât și a celor de furnici a fost mai ridicată în perimetrul fostei cariere. Acest fapt se datorează eterogenității superioare a biotopului carierei (zonă umedă, pante expuse fără arbori, plantație de salcâmi), dar și stadiului avansat de restaurare (arborii de salcâm cu vârste de peste 10 ani).*
Cuvinte cheie: *bioindicatori, Araneae, Formicidae, carieră, salcâm.*

Introduction

Quarries are typically described as intermittently disrupted and extremely varied terrains, characterized by harsh abiotic conditions and limited productivity. (Tropek *et al.*, 2010). Given the continued significance of outdoor exploitations as a crucial economic activity, and acknowledging that biological conservation alone cannot entirely mitigate the adverse effects on biodiversity, ecological restoration is increasingly acknowledged as an indispensable approach for conservation objectives. (Alignan *et al*., 2018; Walker, Del Moral, 2003).

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In light of the current circumstances, ecological restoration is increasingly imperative as a conservation tool, enabling the expedited recovery of deteriorated ecosystems. (Dobson *et al.*, 1997).

Traditional approaches to recovery and restoration efforts have primarily emphasized the establishment of plant communities. The monitoring and evaluation processes associated with these approaches have typically focused on studying vegetation, which is useful for assessing the stability of plant communities. However, such studies may not provide comprehensive insights into the progression and effectiveness of naturally functioning ecosystems (Wheater *et al.*, 2000).

In ecosystems, the presence of invertebrate communities is crucial, and their monitoring is integrated into the assessment of recovery and restoration method. (Wheater *et al.*, 2000). By

serving as bioindicators, invertebrates play a vital role in monitoring and assessing habitat quality. They possess the potential to monitor and evaluate the overall health and condition of habitat (Borges *et al.*, 2021).

Due to their reliance on environmental structure and distinct characteristics, spiders exhibit exceptional sensitivity to changes in vegetation structure. Consequently, they serve as excellent organisms for obtaining insights into the ecological significance of habitat structure. (Wheater *et al.,* 2000). Moreover, being top predators in the invertebrate food chain, they are also responsive to the composition and abundance of prey communities (Wheater *et al.,* 2000).

According to various studies, habitat quality emerges as the primary determinant affecting the distribution of species. Among the factors that display the strongest correlation with the variation in spider species composition across different locations are the extent of vegetation cover, the level of grassland development, and the availability of prey. (McIver *et al.,* 1992).

The presence of a rich forest canopy has a major influence on the microclimate conditions at the forest floor. The ground-level habitat of a forest is characterized by more consistent conditions compared to the open area. Light, humidity, temperature, and wind fluctuate with less amplitude in the forest environment, allowing the colonization and persistence of species with limited tolerance for extreme environments (McIver *et al.,* 1992).

Traditional approaches to recovery and restoration have primarily emphasized the establishment of plant communities. However, the subsequent monitoring and evaluation efforts have mainly centered on studying vegetation, which, while valuable for assessing the stability of plant populations, may not provide a comprehensive understanding of the development and overall health of naturally functioning ecosystems. (Wheater *et al.,* 2000).

In ecosystems undergoing recovery and restoration (Wheater *et al.,* 2000), the significance of invertebrate communities cannot be overstated, and they are now integrated into monitoring techniques. Invertebrates, with their potential as bioindicators, play a vital role in monitoring and evaluating habitat quality (Borges *et al.,* 2021).

Given the dependence of spiders on environmental structure and their distinctive traits, they display a remarkable sensitivity to alterations in vegetation arrangement. Thus, they offer valuable insights into the ecological significance of habitat structure (Wheater *et al.,* 2000). Moreover, spider communities prove to be highly responsive to various environmental elements, including habitat structure (Uetz, 1991), habitat type, wind exposure, humidity, and temperature (Rushton *et al.,* 1987). As apex predators in the invertebrate food chain, they are also keenly affected by the organization and abundance of prey communities (Wheater *et al.,* 2000).

Numerous studies have consistently found that habitat quality stands as the primary determinant affecting species distribution. When examining variations in spider species composition across different locations, the key factors that show the closest correlation are the extent of coverage, grassland development, and the availability of prey. (McIver *et al.,* 1992).

The abundance of a dense forest canopy exerts a considerable impact on the microclimate of the forest floor. In contrast to open areas, the ground-level ecosystem within the forest experiences relatively stable conditions. Factors such as light, humidity, temperature, and wind undergo minimal fluctuations in the forest environment, creating a suitable habitat for species with limited tolerance to extreme conditions to thrive and persist. (McIver *et al.,* 1992).

Ants (Hymenoptera: Formicidae) represent another taxonomic group that proves highly valuable for long-term monitoring of the analyzed system and evaluating land management actions (Underwood, Fisher, 2006). Due to their abundance and significant role in various terrestrial ecosystems, ants are excellent bioindicators (Majer, 1983).

Their sensitivity and responsiveness to changing environmental conditions, along with their specialized nature, further enhance their suitability as indicators (Majer, 1983).Notably, ants play vital functional roles at different trophic levels (Alonso, 2000), including soil structure maintenance through aeration and drainage (Lobry de Bruyn, Conacher, 1994) and nutrient cycling (Lal, 1988). Additionally, they contribute to plant protection, seed dispersal, predation (Christian, 2001), pollination, and serve as a food source for other predators, making them essential components of the food chain (Bisevac, Majer, 1999). Ants have been consistently utilized in the mining industry, particularly in Australia since the

mid-1970s, to monitor restoration efforts (Andersen, Majer, 2004). The patterns of species richness and ant community composition in restored mining sites reflect the recolonization of habitats by other invertebrate groups (Majer, 1983).

Furthermore, study by Andersen, Sparling (1997) indicate a positive correlation between ants and soil microbial biomass, providing additional support for employing ants as indicators in restoration assessments.

Ant functional groups show changes over time since restoration (Andresen, 1997), with species richness being affected by various factors such as plant species richness, time since rehabilitation, plant and litter cover percentage, and the presence of large logs (Majer, 1983). Bisevac and Majer (1999) found a positive correlation between species richness and time since rehabilitation, noting that the species richness in restored lands can eventually exceed that of undisturbed lands (Jackson, Fox, 1996). In their study, it took approximately 11 years for species richness in restored lands to surpass that of undisturbed lands, and within five years, restored systems achieved ant species richness levels comparable to undisturbed ones. Moreover, the diversity of ant populations in restored lands can also be influenced by the location within the landscape and its surrounding land matrix due to the proximity to specific habitats (Underwood, Fisher, 2006).

Ants can be found inhabiting various environments such as soil, litter, wood, and vegetation. Understanding their habitat preferences is crucial in determining the effectiveness of different sampling methods for capturing specific ant species. The commonly used Barber traps are quite efficient in collecting ants that live in and on the soil, but they tend to overlook other habitats.

A study conducted by King and Porter (2005) compared the effectiveness of Barber traps in collecting ant species with those collected from litter. Surprisingly, both methods yielded similar results, capturing approximately 69% and 61% of the total species richness, respectively.

The aim of this study is to assess the resemblance of the invertebrate community structure, particularly spiders and ants, in a restored site to that of an undisturbed reference area where subsurface resource exploitation does not occur.

Study area

The current study was quarry out near the Mohu locality in the Șelimbăr commune, Sibiu county, specifically at an abandoned ballast quarry. The village of Mohu is situated in the Sibiu Depression, along the Cibin River until it meets the Hârtibaciu River. The quarry itself is terraced and situated on a geological substrate dominated by Quaternary sands and gravels.

Within the confines of the former quarry, a monoculture of *Robinia pseudoacacia* has been planted, with the trees having a maximum age of 15 years and spaced approximately 1.5 meters apart. The herbaceous layer within the quarry is relatively uniform and reaches a maximum height of 10 cm. The main species found in this layer are *Erigeron, Thlaspi*, *Stellaria, Viola*, and *Gallium.*

On the other hand, the control area, located near the quarry, has a different geological substrate composed of marls, sands, and Pliocene gravels. The dominant tree species is also *R. pseudoacacia*, but it occurs naturally through colonization. The age of the *R. pseudoacacia* trees in this area varies, ranging from young saplings to those over 15 years old. As for the herbaceous layer in the control area, it is characterized by species from the genera *Gallium, Viola, Stellaria, Veronica*, and *Glechoma hirsuta.*

Observations made in the control area include numerous fallen trunks of *R. Pseudoacacia.*

Material and methods

In both the career and control areas, we established three collection sites, each consisting of nine pitfall, resulting in a total of 54 traps. The decision to use Barber traps was based on their high efficiency in capturing epigeal invertebrates. These traps are designed as plastic containers buried in the soil with an opening at ground level. To enhance their effectiveness, each container was filled to one-third capacity with a solution of antifreeze diluted in water, which acts as a preservative and attractant. Research has shown that traps containing a mixture of propylene glycol/water collect significantly more ants compared to those filled solely with water (Calixto *et al.,* 2007). To ensure the integrity of the samples, we covered the containers with metal lids, preventing any contamination from plant material or other substances.

The deployment of the traps took place on March 12th, 2023, and after 10 days, we retrieved 53 out of the 54 traps. Each container was labeled with calc paper tags, indicating the station number and

the corresponding trap number they originated from. Once in the laboratory, the collected biological material underwent sorting and was then preserved in a 96% ethyl alcohol solution.

To identify the adult spider specimens, we employed standard taxonomic keys (Nentwig *et al.*, 2021), with nomenclature based on the World Spider Catalog (Platnick, 2023). As for the juvenile spiders, we could only identify them to the genus level. For the ants, we used taxonomic keys from the books "The Ants of Central and North Europe" (Seifert, 2018) and "The Ants (Hymenoptera, Formicidae) of Poland" (Czechowski *et al.*, 2002).

Simpson and Menhinick index were employed to analyze species diversity, while the equitability index was utilized to assess population uniformity. Principal Component Analysis (PCA) was utilized to examine the composition of spider/ant communities and their species preferences

Results and Discussions

Arachnida: Aranee

A total of 186 arachnid individuals were collected, comprising 14 different species across 6 families in two distinct habitats: the quarry and the control zone (unaffected area). Out of the 14 species, 7 were found in both habitats, while 4 species (*Evarcha laetabunda* (C. L. Koch, 1846) , *Alopecosa pulverulenta* (Clerck, 1757), *Alopecosa fabrilis* (Clerck, 1757), and *Xysticus cristatus* (Clerck, 1757)) were exclusively present in the quarry, and 3 species (*Oedothorax apicatus* (Blackwall, 1850), *Alopecosa trabalis* (Clerck, 1757) , and *Pachygnatha degeeri* Sundevall, 1830) were found only in the control area.

Notably, the species *Trochosa terricola* Thorell, 1856 was the dominant species in both the quarry and the control zone, accounting for approximately 35.45% and 85.79% of the total species in each respective habitat. This indicates that *Trochosa terricola* is well-adapted to various types of habitats and thrives in both environments.

In contrast, the species *Zelotes petrensis* (C. L. Koch, 1839) exhibited significant abundance in the quarry, representing approximately 13.17% of the total species. Meanwhile, the species *Pachygnatha degeeri* was the second most abundant species in the control zone, constituting approximately 9.8% of the total species. These findings suggest that species preferences and adaptability can vary based on the specific characteristics of each microhabitat.

A. fabrilis was exclusively present in the restored quarry, occupying about 11.14% of the total species in the quarry. This indicates its affinity for dry and sandy habitats and suggests successful adaptation to the conditions of the restored area.

The remaining species found in both zones exhibited low abundance, which may suggest that they have specific habitat preferences and are not as adaptable as the dominant species mentioned earlier.

In conclusion, these findings provide valuable insights into the distribution and habitat preferences of invertebrate species in both the quarry and the control zone.

The variation observed among spider communities can be attributed to the physical structure of their habitats, which profoundly affects their food sources. Additionally, vegetation structure, including height and density, play a crucial role in influencing spider diversity and abundance (Wheater *et al.*, 2000). Moreover, habitat complexity is linked to the diversity of spider communities, with more species found in areas with greater habitat diversity (Uetz, 1991).

In the restored quarry, there is high species diversity (inverted Simpson index: 0.721), indicating a positive aspect with diverse habitats and favorable conditions for species coexistence.

The restored quarry shows greater species richness (Menhinick index: 1.35) compared to the control area, indicating a more diverse and suitable environment for spiders.

The restored quarry exhibits a very uniform distribution of spider species (Evenness index: 0.824), indicating equal presence of species without dominance, while the control area has less uniform distribution (index: 0.489), suggesting variation in spider abundance and possible different influencing factors.

The analysis (PCA) revealed two distinct groups: the C.Z. group and the R.Q. group (Fig. 1).

In the control area, the spider communities displayed a remarkable similarity, implying that they share common traits and preferences concerning factors such as habitat, available resources, or other relevant aspects.

Conversely, the restored area exhibited a broader spectrum of spider community structures,

indicating a higher diversity of spider species and their preferences in this region. Notably, the " R.Q.3" and " R.Q.2" stations, characterized by habitats with moderate humidity, displayed a unique community structure compared to the other stations.

Hymenoptera: Formicidae

After conducting the field campaign, a total of 222 Formicidae individuals were collected and four species were identified. Among them, 116 specimens were collected from the restored quarry, while the remaining 106 were gathered from the control zone.

Analyzing the abundance spectrum for the quarry area, it was observed that the most prevalent species was *Lasius platythorax* (Seifert, 1991), constituting 87% of the total collected individuals. Following this species were *Myrmica ruginodis* (Nylander, 1846) making up 8% of the specimens, and *Tetramonium cf. caespitum* (Linnaeus, 1758) (5%).

In contrast, the control zone also exhibited *L. platythorax* as the dominant species, comprising 66% of the total individuals collected. The subsequent most abundant species were *T. cf. caespitum*, accounting for 25%, and *Tapinoma erraticum* (Latreille, 1798), representing 9% of the specimens in the control area.

The study examined four ant species in two areas: the restored quarry and the control area. Two species, *L. platythorax* and T*etramorium cf. caespitum* (Linnaeus, 1758), were found in both locations, while *T. erraticum* was only in the control area, and *M. ruginodis* was only in the restored quarry.

T. cf. caespitum was more abundant in the restored quarry due to its preference for sandy soil in xerothermophilic habitats, which the restored area provided.

L. platythorax was highly abundant in both areas, likely due to its ecological affinity for nesting in dead wood and its occurrence in various deciduous forests.

T. erraticum was exclusively found in the control area, which has a clay substrate, avoiding sandy soils typical of its continental distribution.

Both areas showed relatively low ant diversity, each hosting only three species. However, the restored quarry exhibited higher diversity, indicating a greater variety of ant species according to the Simpson diversity index in the form of inverse probability.

The restored quarry also displayed a more uniform distribution of species abundance, while the control area showed larger differences in species abundance, as indicated by the evenness index.

The diversity and distribution of ant species can be negatively influenced by various abiotic factors, including weather, water availability, and soil characteristics, as noted by Rosson (2004). In the areas under study, the presence of the invasive species *R. pseudoacacia*, also known as black locust in Romania, significantly shapes the environmental conditions.

According to Li et al. (2022), *R. pseudoacacia* can cause soil compaction and poor irrigation by reducing soil particle distribution heterogeneity. This invasive species generally outcompetes native plants, leading to reduced growth, fitness, and abundance of native species, thereby decreasing the diversity of local plant communities, as observed by Zhang et al. (2019). These changes in vegetation impact invertebrate communities, including ants.

The ecological relevance of the black locust colony's age is highlighted by the presence of *M. ruginodis*, a forest-dwelling species of myrmicine ants. This species is found in the control area where older trees with a diameter greater than 30 cm and undisturbed substrate exist. In contrast, it is absent in the quarry, likely due to the strong anthropogenic impact on the habitat, which is not suitable for this particular ant species, unlike its related species *M. rubra*, as explained by Seifert (2018).

The PCA analysis results have revealed two distinct clusters: the C.Z. group and the R.Q. group, each characterized by specific ant species (Fig. 2). Within the C.Z. cluster, *M. ruginodis* and *.s platytorax* dominate, and the composition of stations shows similarity, indicating uniformity in this area. On the other hand, within the R.Q. cluster, *T. cf. caespitum* and *T. erraticum* are the prevailing species, and there is greater variation among stations.

Conclusions

The abandoned surface mining sites serve as vital sanctuaries for a diverse range of invertebrates. When these areas are properly restored, they give rise to varied habitats comprising wetlands, vegetation-scarce steep slopes, and forested terraces. This diversity within the habitats leads to a greater variety of invertebrates. The way ant species are distributed in the quarry, in

comparison to the control area, indicates an advanced stage of restoration in the former. Similarly, for spiders, the presence of certain species exclusively within the quarry and a higher species diversity compared to the control area underscores the habitat's heterogeneity, which directly correlates with the progress of restoration efforts.

Acknowledgements

The authors are grateful for the reviewers (Ioan Tăușan, Urák István), comments on the first version of the manuscript.

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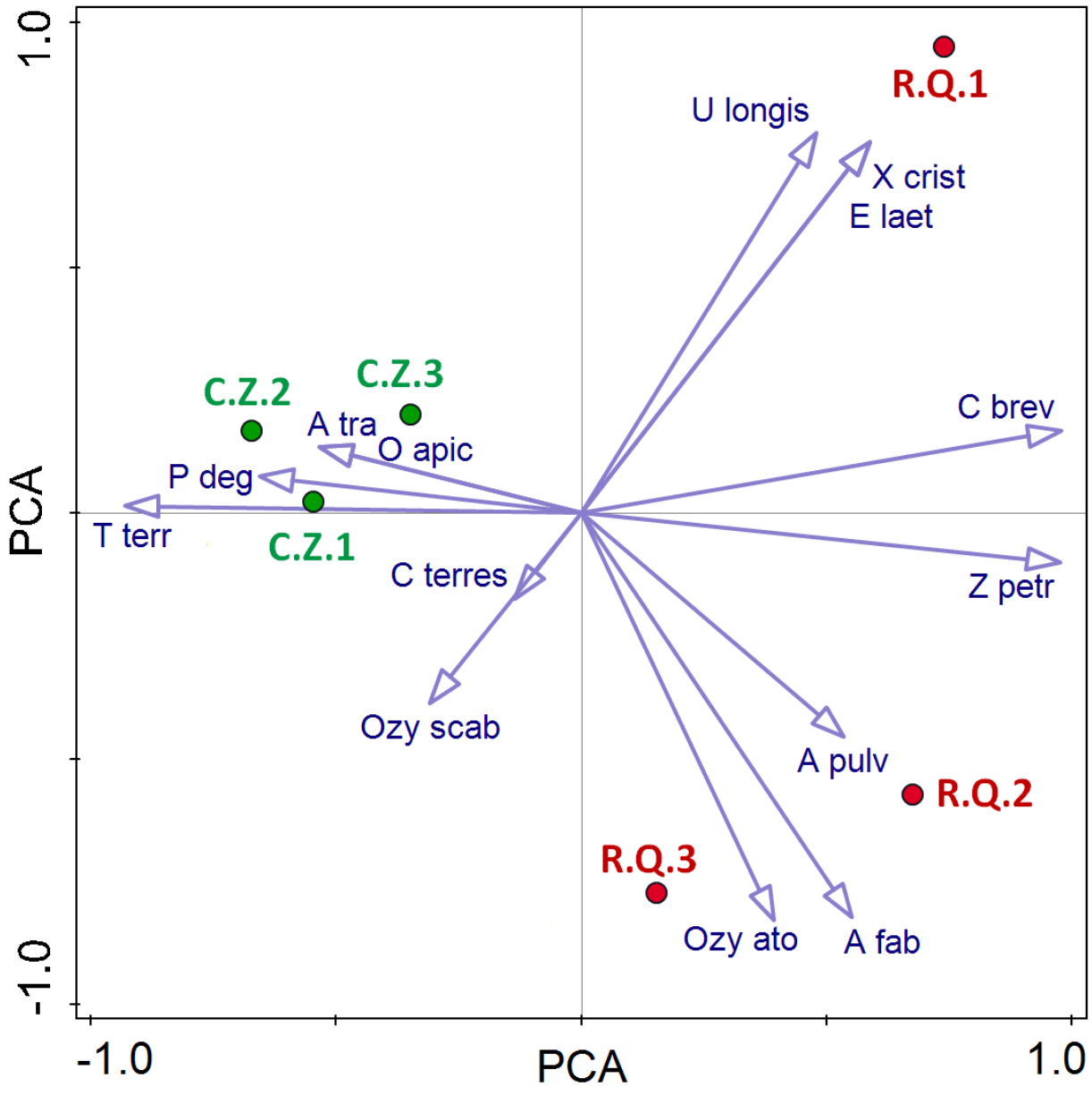

Figure 1 Principal Component Analysis (PCA) The position of spider species in relation to sites.; restored quarry (E.Q.), control zone (C.Z.); U longis-*Urocoras longispin*, X crist-*Xysticus cristatus*, E laet- *Evarcha laetabunda*, C brev- *Ceratinella brevis*, Z petr- *Zelotes petrensis*, A pulv-*Alopecosa pulverulenta*, A fab-*Alopecosa fabrilis*, Ozy ato-*Ozyptila atomaria*, Ozy scab-*Ozyptila scabricula*, C terres-*Coelotes terrestris*, T terr-*Trochosa terricola*, P deg-*Pachygnatha degeeri*, A tra-*Alopecosa trabalis*, O apic- *Oedothorax apicatus*

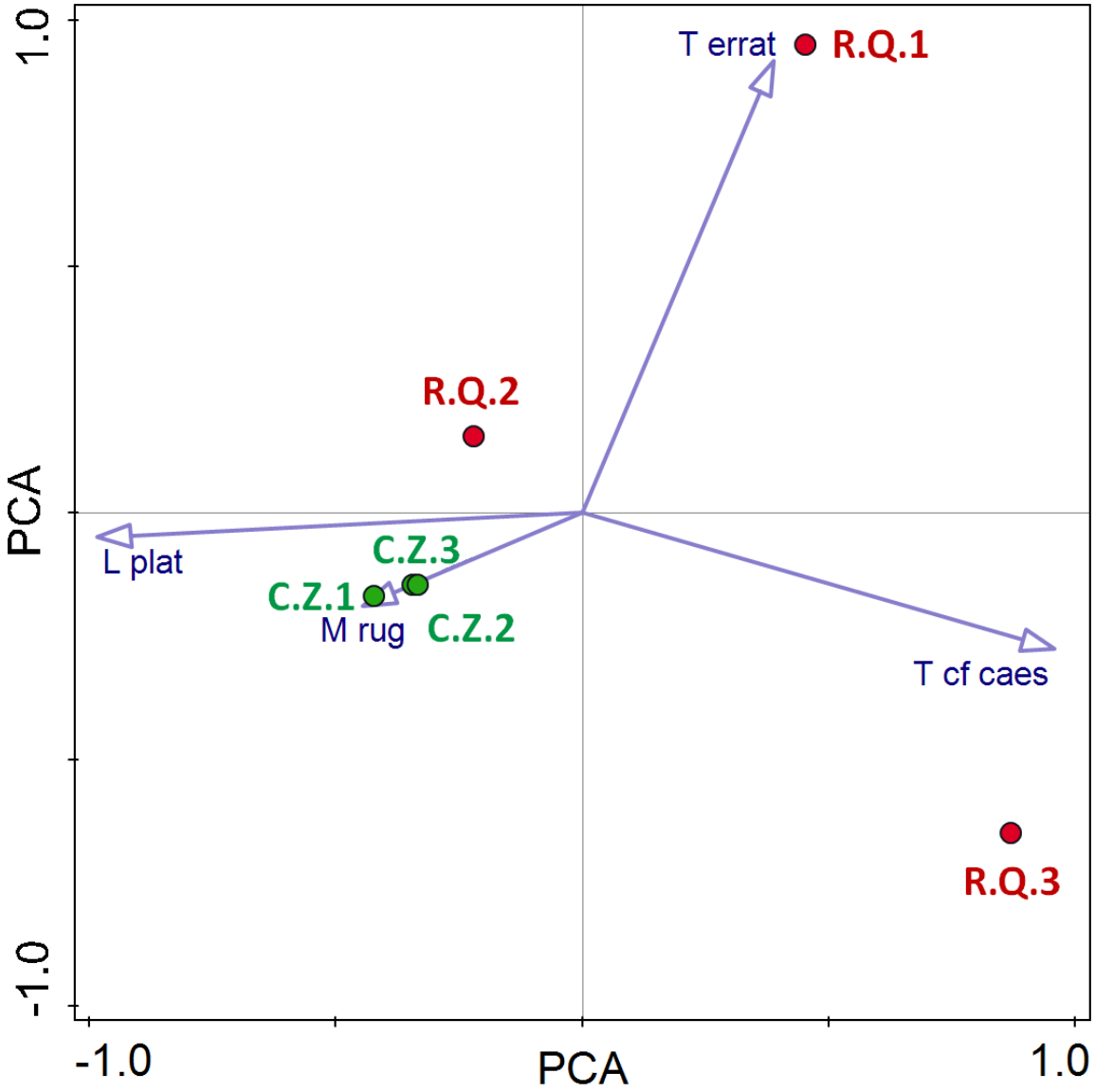

Figure 2. Principal Component Analysis (PCA) The position of ant species in relation to sites; restored quarry (E.Q.), control zone (C.Z.); T errat-*Tapinoma erraticum*, T cf caes-*Tetramorium cf. caespitum*, M rug-*Myrmica ruginodis*, L plat-*Lasius platytorax*

Figure 3. Restored quarry (R.Q.)

Figure 4. Control zone (C.Z.)

Table 1. Relative abundance of ant and spider species collected at each station.

Taxon	R.Q.1	R.Q.2	R.Q.3	C.Z.1	C.Z.2	C.Z.3
Hymenoptera: Formicidae						
Lasius platytorax (Seifert, 1991)	0.2308	0.8022	0	1	0.7368	0.8393
Myrmica ruginodis(Nylander, 1846)	0	0	0	0	0.2105	0.0893
Tapinoma erraticum (Latreille, 1798)	0.3846	0.0659	0	0	0	0
Tetramorium cf. caespitum (Linnaeus, 1758)	0.3846	0.1319	1	0	0.0526	0.0714
Arachnida: Araneae						
Alopecosa fabrilis (Clerck, 1757)	0	0.1795	0.1429	0	0	0
Alopecosa pulverulenta (Clerck, 1757)	0	0.0256	0	0	0	0
Alopecosa trabalis (Clerck, 1757)	0	0	0	0	0.0357	0
Ceratinella brevis (Wider, 1834)	0.1818	0.1538	0.0714	0	0	0.0513
Coelotes terrestris(Wider, 1834)	0	0.0256	0	0	0.0357	0
Evarcha laetabunda (C. L. Koch, 1846)	0.0909	0	0	0	0	0
Oedothorax apicatus(Blackwall, 1850)	0	0	0	0	0.0714	0
Ozyptila atomaria (Panzer, 1801)	0	0.0513	0.0357	0.0244	0	0
Ozyptila scabricula (Westring, 1851)	0	0	0.0357	0.0488	0	0
Pachygnatha degeeri Sundevall, 1830	0	0	0	0.1707	0.0714	0
Trochosa terricola Thorell, 1856	0.3636	0.3846	0.5714	0.7073	0.7857	0.8718
Urocoras longispina (Kulczyński, 1897)	0.0909	0	0	0.0244	0	0
Xysticus cristatus (Clerck, 1757)	0.0909	0	0	0	0	0
Zelotes petrensis (C. L. Koch, 1839)	0.1818	0.1795	0.1429	0.0244	0	0.0769

FIRST RECORD OF *Bothriomyrmex corsicus* Santschi, 1923 (HYMENOPTERA: FORMICIDAE) IN DOBROGEA (ROMANIA)

Ioan TĂUȘAN*

Abstract. *Bothriomyrmex corsicus Santschi, 1923 is a stenotopic ant species that occurs in Europe, but more often in the southern part. There is poor knowledge about the species ecology and biology. Moreover, scarce data on its distribution is available. Thus, new data adds value to knowledge. In Romania, there have been only few previous records, most of them being in the south-western part of the country. We present the first record of this species in Dobrogea and some insights regarding its ecology.*
Keywords*: habitat preferences, Dobrogea, new records, stenotopic species.*

Rezumat. *Bothriomyrmex corsicus Santschi, 1923 este o specie stenotopă care este distribuită în Europa, dar cu precădure în sudul continentului. Există puține date privind ecologia și biologia speciei. Mai mult, specia este cunoscută din puține locații. Astfel, contribuțiile aduse sunt valoroase. În România au existat doar câteva semnalări ale speciei, cea mai mare parte fiind localizate în partea sud-vestică a țării. Astfel, prezentăm prima semnalare a speciei în Dobrogea și câteva aspecte privind ecologia speciei.*
Cuvinte cheie*: preferințe de habitat, Dobrogea, noi semnalări, specii stenotope.*

Bothriomyrmex Emery, 1869 occurs in a wide variety of habitats, including grasslands, savanna woodlands, mallee forests, and lowland rain forests. Nests occur in the soil (with or without covering) or in rotten wood, and workers are known to forage on trees (Shattuck 1992).

All *Bothriomyrmex* are supposed to found their colonies in a temporary socially parasitic way in species of the genus *Tapinoma* (Seifert 2012).

Lloyd *et al.* (1986) found that the pygidial glands of *Bothriomyrmex syria* Forel, 1910 queens and the *Tapinoma simrothi* Krausse, 1911, host workers contained the same ketone, and they suggested that this aids the queen in gaining access to the *Tapinoma* colony. All the known species have diminutive queens, so temporary social parasitism could be the mode of colony founding for the whole genus. The nutrition is probably largely by trophobiosis with different groups of Homoptera (Aphidina, Coccina and Tettigometridae are explicitly reported; Bernard 1967).

All *Bothriomyrmex* of the West Palaearctic are thermophilous.The Central European species do not spread into the northern parts of the distributional ranges of their *Tapinoma* hosts (Seifert 2012).

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The genus *Bothriomyrmex* contains about 33 described Palaearctic and one Neotropical species and 11 subspecies (Bolton *et al.* 2007).

According to the Fauna Europaea database (2022), 17 species are reported from Europe. The following species are: *Bothriomyrmex adriacus* Santschi, 1922, *B. atlantis* Forel, 1894, *B. communistus* Santschi, 1919, *B. corsicus* Santschi, 1923, *B. costae* Emery, 1869, *B. dimorphus* Roszler, 1935, *B. gallicus* Emery, 1925, *B. gibbus* Soudek, 1925, *B. hispanicus* Santschi, 1922, *B. jannonei* Menozzi, 1936, *B. laticeps* Emery, 1925 *B. menozzii* Emery, 1925, *B. meridionalis* Roger, 1863, *B. modestus* Radchenko, 1985, *B. saundersi* Santschi, 1922 *B. syrius* Forel, 1910 and *B. turkomenicus* Emery, 1925 alongside different subspecies.

Seifert (2012) in an exhaustive review on the genus, clearly distinguished four species occurring in Europe, namely *B. meridionalis*, *B. atlantis*, *B. communistus* and *B. corsicus*. Amongst this species *B. corsicus* (Figure 1is one of the most widespread species. However, data is lacking regarding the species distribution.

In Romania, the species was previously recorded as *B. meridionalis* (Markó *et al.* 2006). However, based on Seifert (2012) review, the species occurring in Romania was confirmed as *B. corsicus.* The species was previously recorded only from several sites. Most of the data published so far was recorded in the south-western part of

Romania (Paraschivescu, 1967, Paraschivescu 1975, Fromunda *et al.* 1967) and there is one record from the center of Romania (Seifert 2012). Our data is a novel record from Dobrogea region (Figure 2).

The species prefers open xerothermous grassland often in karst regions. It is the second most abundant species of the genus in Europe (Seifert 2018).

We collected the ant material from on open karstic grassland with *Carpinus orientalis* (Figure 3).

Therefore, the species, despite being localized, may be more common than previously known. Yet, the stenotopic characteristics of the habitat is of a great importance in finding the species.

Acknowledgements

I would like to thank Doris Maria Peana for the help in the field while collecting the ant material and Maria Stănciugelu for compiling the distribution map of the species. Finally, I am in debt to Dr. Sergiu Török for his useful comments on the manuscript.

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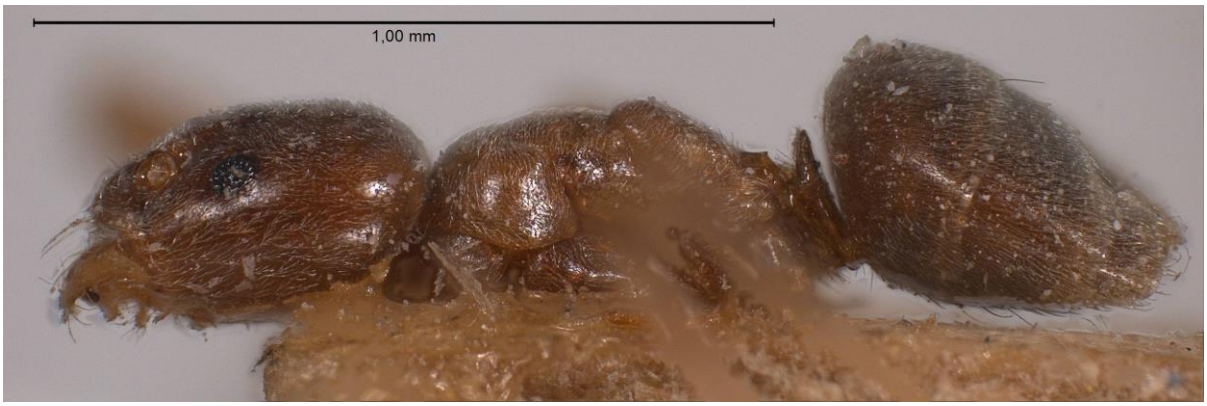

Figure 1 Worker of *Bothriomyrmex corsicus* – lateral and frontal view (photo credit: Roland Schultz, https://www.antweb.org/)

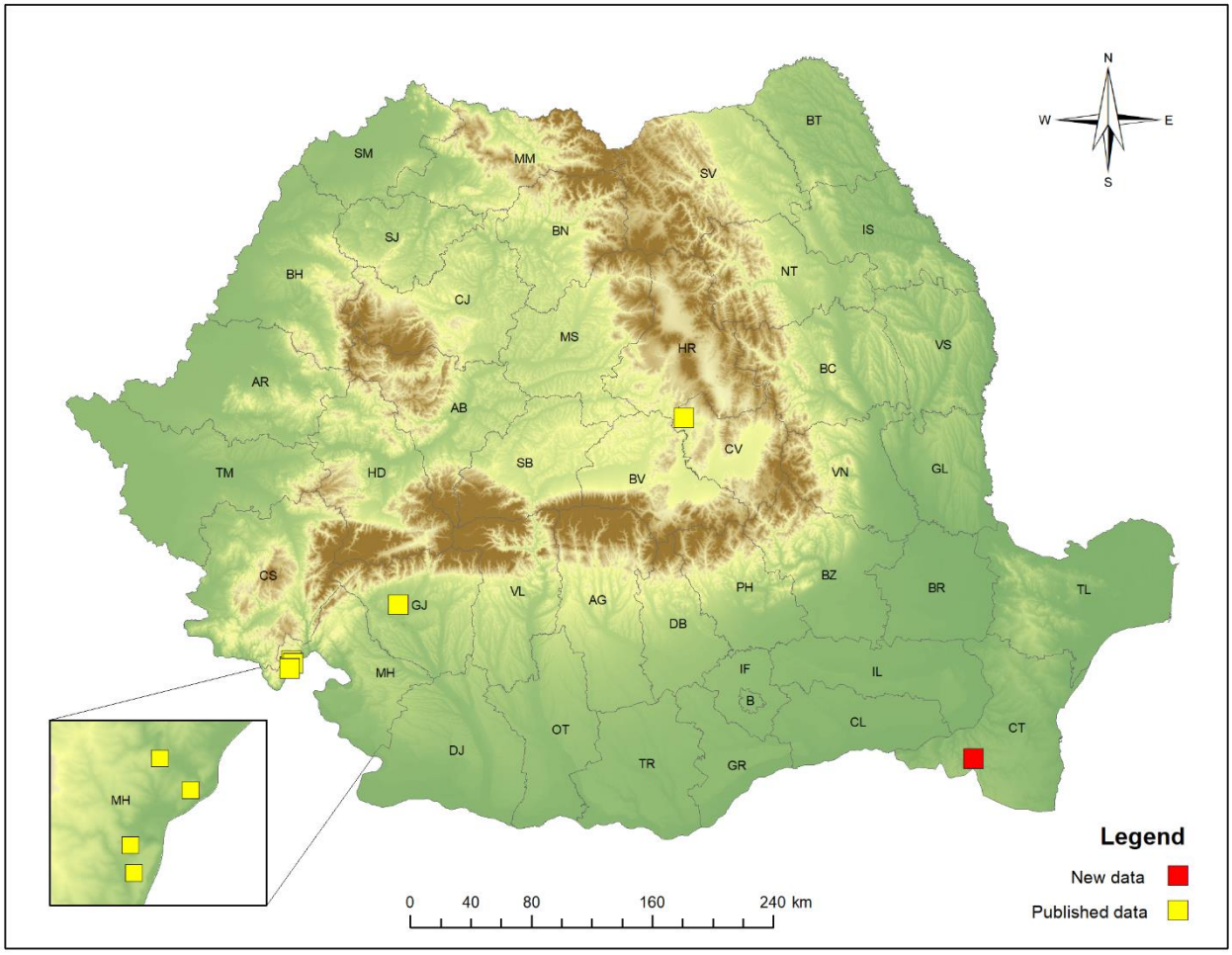

Figure 2 The known distribution of *Bothriomyrmex corsicus* in Romania

Figure 3 The habitat overview of *Bothriomyrmex corsicus*

THE CATALOGUE OF THE ORNITHOLOGICAL COLLECTION PRESERVED AT MEDIAȘ MUNICIPAL MUSEUM

Sergiu-Cornel TÖRÖK*

Abstract: *This article presents the Ornithological collection from Mediaş Municipal Museum, Sibiu County, Romania. The collection is composed of 236 bird specimens, belonging to 118 species, which are included in 41 different families and 16 different orders. The specimens were sampled during a 62-year period, namely from 1943 to 2005, by 43 collectors. Almost all specimens originated from two Romanian regions: Transylvania and Dobrudja. In the same collection we can encounter two Romanian rarities, namely: Podiceps grisegena (Boddaert, 1783) and Mergellus albellus (Linnaeus, 1758).*
Keywords*: Aves, collection, Mediaș Municipal Museum, ornithology, Danube Delta.*

Rezumat. *Acest articol prezintă colecţia Ornitologică de la Muzeul Municipal Mediaş, judeţul Sibiu, România. Colecţia cuprinde 236 specimene, aparţinând la 118 specii incluse în 41 familii diferite şi 16 ordine diferite. Perioada de colectare a specimenelor este de 62 de ani, între 1943 şi 2005, acestea au fost colectate de către 43 de persoane. Aproape toate specimenele provin din două regiuni geografice româneşti: Transilvania şi Dobrogea. Colecţia cuprinde printre altele şi două raritǎţi avifaunistice şi anume: Podiceps grisegena (Boddaert, 1783) şi Mergellus albellus (Linnaeus, 1758).*
Cuvinte cheie*: Aves, colecţie, Muzeul Municipal Mediaş, ornitologie, Delta Dunării.*

The Museums ornithological collections, like this from Mediaș Municipal Museum, are important because they provide information about the distribution of different bird species, or based on the collection specimens several types of studies can be undertaken, like the studies on their anatomy and morphology, systematics, taxonomy, zoogeography, population biology, migration, and wildlife management (Remsen, 1995; Winker *et al*., 2010).

Even though the ornithological collection from Mediaș Municipal Museum (Figure 1), is a rather small collection, it possesses some unique properties, it covers a long time, the specimens were collected from numerous Romanian counties, by different collectors and belong to many species, families, and orders.

Regarding the history of this collection, the earliest specimens were introduced into the collection by Wilhelm Hermann. Afterwards through numerous acquisitions, donations or from the material he had collected during his field works, the collection has grown substantially. During this period most of the material was also prepared by the Mediaș Museum employees, such as Wilhelm Hermann and Natalia Birț, other specimens were sent for taxidermical preparation at Timișoara or Târgul Mureș. Peter Weber continued to enlarge the collection, through numerous field trips, he had added many new specimens to the collection.

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He was very passionate about the bird species from Dobrogea, writing numerous articles about the bird's species from this region (Weber, 1972; Weber, 1978; Weber, 1983), also his PhD thesis is referring to the birds' fauna from Histria region, Danube Delta (Weber, 2000). During these field trips he had meet the collector Doru Bădrățan, from which Peter Weber has bought numerous specimens, almost all of them were collected from Danube Delta.

The aim of this study is to systematically verify the species identification and afterwards to provide for the first time, a catalogue of bird specimens from Mediaș Municipal Museum, which will incorporate the systematical list, the age of the specimen, the state in which it can be found in the collection (bird skin or naturalized), information about the collection data (date, place and collector) and their Status in The Romanian Red List of species (O. nr. 2.015/2022).

Material and methods

Every specimen from the Ornithological collection from Mediaș Municipal Museum, was analysed and identified using different bird guides (Linţia 1954; Linţia 1955; Bruun *et al*., 1999; Delin, Svensson 2016; Svensson *et al*. 2017), also the scientific names of the taxa were updated according to the one published in different bird guides and in the Handbook of the Birds of the World and Bird Life International Taxonomic Checklist v. 5 (2020). At the same time, I have

read all the data labels and documented the sampling locality, data, name of the collector and the museum's inventory number. When possible, the age and sex of the specimen were determined, as well as the condition it can be found in the collection, namely: bird skin or naturalized. Following this phase all the specimens were photographed, and the collections digital catalogue was updated.

Results and discussions

Overall, the bird collection from Mediaș Municipal Museum contains 236 specimens (Tab.1.), belonging to 118 species, which are included in 41 different families and 16 orders. The most numerous orders in specimens (Figure 2) are Passeriformes (54 specimens), followed by Anseriformes (39 specimens), Falconiformes (31 specimens) and Charadriiformes (26 specimens). From the species richness point of view the hierarchy is almost the same (Figure 2), the difference is that the Charadriiformes order (16 species) has more species than the Falconiformes order (10 species).

Regarding the age, almost all specimens are adults, the majority of which are naturalized, only 11 specimens were prepared as bird skins.
The specimens from bird collection were collected during a 62-year period, namely from 1943 to 2005 (Figure 3), unfortunately 70 specimens have no collection date.

All the specimens have been sampled from Romania, but the interesting fact is that most specimens were collected from Dobrudja region, Tulcea and Constanţa counties (Figure 4), 103 specimens, and only 48 specimens were collected from Transylvania, in the collection we can also encounter 7 specimens from Moldova (Suceava county), 5 specimens from Banat (Timiş county) and 2 specimens from Bucharest. For 72 specimens I have not found any sampling location.

Only one specimen, belonging to the *Ciconia ciconia* species, has a metal ornithological ring. On the ring it is noted "DDR B 3496 Vogelwart Hiddensee" (Figure 5), Hiddensee is an island in the Baltic Sea, in the northern part of Germany, very far from where the specimen was collected, Biertan locality in Sibiu County.
In total 43 collectors have gathered or prepared the birds from the museum's collection, a large part of the collections, namely 95 specimens, do not have a collector written on their labels (Tab.1.).

From the Romanian Red List status point of view, 86 species have a Least Concern status, for 15 species the status was Not Evaluated, and 7 species, namely: *Accipiter gentilis* (Linnaeus, 1758), *Aquila pomarina* C. L. Brehm, 1831, *Lanius excubitor* Linnaeus, 1758, *Cinclus cinclus* (Linnaeus, 1758), *Bubo bubo* (Linnaeus, 1766), *Ixobrychus minutus* (Linnaeus, 1766) and *Podiceps nigricollis* C.L. Brehm, 1831 are Near Threatened (Tab.1.).

Six species were included in the Vulnerable category, these species are: *Lanius minor* Gmelin, 1788, *Limosa limosa* (Linnaeus, 1758), *Gallinago gallinago* (Linnaeus, 1758), *Vanellus vanellus* (Linnaeus, 1758), *Branta ruficollis* (Pallas, 1769) and *Glareola pratincola* Linnaeus, 1766. We can find two Endangered species in Romania, *Podiceps grisegena*, which is a summer migrant, can be encountered in Danube Delta in greater numbers (Baciu, 2020), but in the Mediaş region it is a very rare species (Mitruly, 2002). Also, in the collection we encounter two Critically Endangered species, *Anser erythropus* (Linnaeus, 1758) and *Mergellus albellus*, two winter guests. The *Mergellus albellus* specimens from the collection are male and female and have been collected from Maliuc and Crişan in the Danube Delta by Paloma Gică (Tab.1.).

Acknowledgments

The author wants to thank his colleagues from Mediaş Municipal Museum, Dr. Viorel Ştefu, Diana Macarie and Aurica Bacea for all their assistance during the writing of this paper. Special thanks go to Dr. Anikó Mitruly and Dr. Ioan Tăuşan for all their good advice and suggestions. The author is also grateful for the recommendations from the anonymous reviewers which have greatly improve this manuscript.

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LIST OF ILLUSTRATIONS

LISTA ILUSTRAȚIILOR

Tab 1. The list of the bird specimens from Mediaş Municipal Museum indicating their: species, the value from the museum's inventory, age (and sex), preservation method of the specimen (B. – bird skin or N. - naturalized), sampling data, sampling location, name of the collector and their status from The Romanian Red List of bird species (O. nr. 2.015/2022).

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
Order Anseriformes								
Family Anatidae								
1.	*Anas acuta* Linnaeus, 1758	3924	♀ Ad.	N.	14.03. 1982	Sarinuf (TL.)	Șelaru Sabin	NE
2.		3923	♂ Ad.	N.	14.03. 1988	Sarinuf (TL.)	Șelaru Sabin	

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
3.	*Anas crecca* Linnaeus, 1758	2299	♂ Ad.	N.	30.11. 1979	Somova (TL.)	Weber Peter	NE
4.		3915	♀ Ad.	N.	14.03. 1991	Crişan (TL.)	Gică Paloma	
5.		3916	♂ Ad.	N.	22.02. 1989	Somova (TL.)	Șelaru Sabin	
6.	*Anas clypeata* Linnaeus, 1758	3919	♂ Ad.	N.	20.12. 1990	Murighiol (TL.)	Șelaru Sabin	NE
7.		3920	♂ Ad.	N.	26.12. 1986	Somova (TL.)	Doru Bădrățan	
8.	*Anas penelope* Linnaeus, 1758	3925	♀ Ad.	N.	10.03. 2003	Chilia Veche (TL.)	Timofte Nicolae	NE
9.		3926	♂ Ad.	N.	05.03. 1981	Murighiol (TL.)	Șelaru Sabin	
10.	*Anas platyrhynchos* Linnaeus, 1758	261	♀ Ad.	N.	-	-	-	LC
11.		262	Ad.	N.	-	-	-	
12.		281	Ad.	Skull	-	-	-	
13.		2280	♂ Ad.	N.	26.08. 1980	Crişan, Mila 23 (TL.)	Weber Peter	
14.	*Anas querquedula* Linnaeus, 1758	3917	♀ Ad.	N.	10.03. 2003	Chilia Veche (TL.)	Timofte Nicolae	LC
15.		3918	♂ Ad.	N.	14.03. 1988	Murighiol (TL.)	Șelaru Sabin	
16.	*Anas strepera* Linnaeus, 1758	3930	♂ Ad.	N.	06.02. 1989	Murighiol (TL.)	Șelaru Sabin	NE
17.	*Aythya ferina* (Linnaeus, 1758)	2281	♂ Ad.	N.	20.11. 1979	Somova (TL.)	Weber Peter	LC
18.	*Aythya fuligula* (Linnaeus, 1758)	241	♂ Ad.	N.	-	-	-	LC
19.		2282	♂ Ad.	N.	01.12. 1979	Somova (TL.)	Oțel V.	
20.		3921	♀ Ad.	N.	10.03. 1991	Maliuc (TL.)	Gică Paloma	
21.		3922	♂ Ad.	N.	24.02. 1984	Murighiol (TL.)	Șelaru Sabin	
22.	*Aythya nyroca* (Güldenstädt, 1770)	2283	♀ Ad.	N.	25.11. 1979	Somova (TL.)	Weber Peter	NE
23.		3914	♂ Ad.	N.	28.02. 1987	Somova (TL.)	Șelaru Sabin	
24.		3929	♂ Ad.	N.	15.03. 1998	Chilia Veche (TL.)	Timofte Nicolae	
25.	*Netta rufina* (Pallas, 1773)	3927	♂ Ad.	N.	10.03. 1983	Somova, Parcheș (TL.)	Șelaru Sabin	LC
26.		3928	♀ Ad.	N.	06.02. 1989	Somova (TL.)	Șelaru Sabin	
27.	*Mergellus albellus* (Linnaeus, 1758)	3933	♂ Ad.	N.	10.03. 1981	Crişan (TL.)	Gică Paloma	CR
28.		3934	♀ Ad.	N.	10.03. 1991	Maliuc (TL.)	Gică Paloma	
29.	*Mergus merganser* Linnaeus, 1758	4081	♀ Ad.	N.	08.05. 1985	Caraorman (TL.)	Danilov Dionisie	LC

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
30.		4082	♂ Ad.	N.	05.03. 1985	Crișan (TL.)	Ștefanov Vasile	
31.	*Mergus serrator* Linnaeus, 1758	4083	♀ Ad.	N.	09.03. 1996	Chilia Veche (TL.)	Gică Paloma	NE
32.		4084	Ad.	N.	28.03. 1985	Caraorman (TL.)	Danilov Dionisie	
33.	*Tadorna tadorna* (Linnaeus, 1758)	3931	♀ Ad.	N.	23.11. 1987	Murighiol (TL.)	Șelaru Sabin	LC
34.		3932	♂ Ad.	N.	20.03. 1995	Caraorman (TL.)	Șelaru Sabin	
35.	*Anser anser*	246	Ad.	N.	-	-	-	LC
36.	(Linnaeus, 1758)	3936	Ad.	N.	14.03. 1987	Crișan, Caraorman (TL.)	Danilov Dionisie	
37.	*Anser erythropus* (Linnaeus, 1758)	2492	Ad.	-	10.01. 1992	Istria (CT.)	-	CR
38.		3989	♂ Ad.	N.	10.01. 1998	Istria (CT.)	-	
39.	*Branta ruficollis* (Pallas, 1769)	3940	♀ Ad.	N.	16.01. 1991	Crișan (TL.)	Gică Paloma	VU
Order Galliformes								
Family Phasianidae								
40.	*Coturnix coturnix*	255	Ad.	N.	-	-	-	LC
41.	(Linnaeus, 1758)	3988	Ad.	N.	20.10. 1991	Ceatalchioi (TL.)	Stoian Nicu	
42.	*Perdix perdix* (Linnaeus, 1758)	3987	Ad.	N.	16.12. 2005	Mediaş (SB.)	-	LC
43.	*Gallus gallus domesticus* (Linnaeus, 1758)	301	Juv.	N.	27.07. 1957	Mediaş (SB.)	Wein Ecaterina	-
44.	*Tetrao urogallus* Linnaeus, 1758	2496	Ad.	N.	10.10. 1995	Vărşag (HR.)	-	LC
45.		3986	Ad.	N.	02.05. 2002	Vărşag (HR.)	-	
46.	*Bonasa bonasia* (Linnaeus, 1758)	2497	♀ Ad.	N.	10.09. 2000	Vărşag (HR.)	Weber Peter	LC
47.	*Phasianus colchicus* Linnaeus, 1758	4088	♂ Ad.	N.	-	-	-	NA
48.		4114	♀ Ad.	N.	1990	Metiș (SB.)	Ionică Raț	
Order Gaviiformes								
Family Gavidae								
49.	*Gavia arctica* (Linnaeus, 1758)	2483	Ad.	N.	09.12. 1954	Mediaş (SB.), Târnava Mare valley	-	NE
50.		4110	Ad.	B.	-	-	-	
Order Pelecaniformes								
Family Ardeidae								
51.	*Ardea alba* Linnaeus, 1758	3935	Ad.	N.	15.03. 1990	Caraorman (TL.)	Danilov Dionisie	NE
52.	*Ardea cinerea* Linnaeus, 1758	300	Ad.	N.	17.07. 1957	Mediaş (SB.)	Emil Walter	LC

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
53.	*Ardea purpurea* (Linnaeus, 1766)	311	Ad.	N.	-	-	-	LC
54.		321	Ad.	N.	20.06. 1959	Mediaş (SB.)	-	
55.	*Ardeola ralloides* (Scopoli, 1769)	3937	Ad.	N.	15.04. 1986	Beştepe (TL.)	Șelaru Sabin	LC
56.	*Botaurus stellaris* Linnaeus, 1758)	3939	♀ Ad.	N.	12.03. 1991	Caraorman (TL.)	Danilov Dionisie	LC
57.	*Ixobrychus minutus* (Linnaeus, 1766)	277	Ad.	N.	07.07. 1954	Timişoara (TM.)	-	NT
58.		3938	♂ Ad.	N.	15.06. 1986	Murighiol, Colina (TL.)	Savin Cornel	
59.	*Nycticorax nycticorax* (Linnaeus, 1758)	3899	♂ Ad.	N.	18.06. 1987	Murighiol (TL.)	Șelaru Sabin	LC
60.		3900	Ad.	N.	04.08. 1987	Murighiol (TL.)	Șelaru Sabin	
61.	*Egretta garzetta* (Linnaeus, 1766)	3901	♂ Ad.	N.	07.09. 1989	Beştepe (TL.)	Șelaru Sabin	LC
62.		3981	♀ Ad.	N.	15.03. 1990	Iazurile (TL.)	Savin Cornel	
Family Phalacrocoracidae								
63.	*Phalacrocorax carbo* (Linnaeus, 1758)	2490	Ad.	N.	01.09. 1988	Mediaș, Ighiș Lake (SB.)		LC
64.		3895	♀ Ad.	N.	15.01. 1993	Eforie Sud (CT.)	Weber Peter	
65.	*Microcarbo pygmeus* (Pallas, 1773)	2491	Ad.	N.	15.01. 1993	Eforie Sud (CT.)		LC
66.		3896	Ad.	N.	08.02. 1996	Nufăru (TL.)	Gică Paloma	
67.		3897	Ad.	N.	05.02. 1996	Caraorman (TL.)	Gică Paloma	
68.		3898	Ad.	N.	05.02. 1996	Caraorman (TL.)	-	
Order Ciconiiformes								
Family Ciconiidae								
69.	*Ciconia ciconia* (Linnaeus, 1758)	3982	Ad.	N.	01.09. 1995	Biertan (SB.)	-	LC
Order Podicipediformes								
Family Podicipedidae								
70.	*Podiceps cristatus* (Linnaeus, 1758)	3903	♂ Ad.	N.	05.05. 1983	Murighiol (TL.)	Șelaru Sabin	LC
71.		3904	♂ Ad.	N.	04.04. 1988	Dunăvățu de Jos (TL.)	Șelaru Sabin	
72.		4090		N.	-	-	-	
73.	*Podiceps grisegena* (Boddaert, 1783)	3905	♀ Ad.	N.	01.04. 1995	Nufăru (TL.)	Ivanov Vasile	EN
74.		3906	Ad.	N.	22.02. 1982	Murighiol (TL.)	Șelaru Sabin	
75.		4097	Ad.	N.	-	-	-	
76.	*Podiceps nigricollis* C.L. Brehm, 1831	3907	Ad.	N.	22.12. 1982	Murighiol (TL.)	Șelaru Sabin	NT
77.	*Tachybaptus ruficollis*	3908	♀	N.	22.12.	Murighiol	Șelaru Sabin	LC

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
	(Pallas, 1764)		Ad.		1982	(TL.)		
			Order Falconiformes					
			Family Accipitridae					
78.	*Accipiter nisus*	260	Ad.	N.	-	-	-	LC
79.	(Linnaeus, 1758)	3964	Ad.	N.	24.01. 1986	Dunăvățu de Jos (TL.)	-	
80.		3965	Ad.	N.	24.01. 1986	Dunăvățu de Jos (TL.)	Șelaru Sabin	
81.		291	Ad.	N.	25.02. 1943	-	Cabadin Iacky	
82.		4100	Ad.	N.	-	-	-	
83.		4103	Ad.	B.	-	-	-	
84.	*Accipiter gentilis* (Linnaeus, 1758)	302	Ad.	N.	24.02. 1957	Mediaș (SB.)	Moldovan Gheorghe	NT
85.	*Aquila pomarina* C. L. Brehm, 1831	2484	Ad.	N.	10.05. 1965	Bazna (SB.)	-	NT
86.	*Buteo buteo* (Linnaeus, 1758)	247	Ad.	N.	-	-	-	LC
87.		297	Ad.	N.	-	-	-	
88.		494	Ad.	B.	06.02. 1957	Botorca (MS.)	Gojzak	
89.		495	Ad.	B.	29.01. 1957	Micăsasa (SB.)	Lazlo	
90.		1795	Ad.	N.	20.09. 1977	Ighișu Nou (SB.)	Zekes K.	
91.		3645	♂ Ad.	N.	09.03. 2004	Dupuș (SB.)	Vasile Baciu	
92.		3646	♀ Ad.	N.	01.02. 2005	Dupuș (SB.)	-	
93.		3984	Ad.	N.	20.03. 1994	Mediaș (SB.)	-	
94.		3985	♀ Ad.	N.	01.03. 2004	Ațel (SB.)	-	
95.	*Circus aeruginosus* (Linnaeus, 1758)	141	♀ Ad.	N.	-	-	-	LC
96.	*Circus cyaneus* (Linnaeus, 1766)	3912	♂ Ad.	N.	25.11. 1988	Dunăvățu de Jos (TL.)	-	LC
			Family Falconidae					
97.	*Falco columbarius*	152	Ad.	N.	-	-	-	NE
98.	Linnaeus, 1758	3910	Ad.	N.	31.10. 1988	Sarinasuf (TL.)	Ignat Ioan	
99.	*Falco subbuteo* Linnaeus, 1758	319	♀ Ad.	N.	24.05. 1959	Șaroș pe Târnave (SB.)	Roth Martin	LC
100.		320	♀ Ad.	N.	16.05. 1959	Mediaș (SB.)	Hermann Wilhelm	
101.		4105	Ad.	N.	-	-	-	
102.	*Falco vespertinus* Linnaeus, 1766	3911	♀ Ad.	N.	13.06. 1988	C.A. Rosetti (TL.)	Bârlădeanu Nicu	LC
103.	*Falco tinnunculus*	312	Ad.	N.	-	-	-	LC

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
104.	Linnaeus, 1758	313	♀ Ad.	N.	09.05. 1958	Valea Lungă – Blăjel (SB.)	Roth Martin	
105.		3909	♀ Ad.	N.	11.12. 1988	Dunăvățu de Jos (TL.)	Ignătescu Barbu	
106.		4099	♂ Ad.	N.	26.01. 1993	Dunăvățu de Sus (TL.)	Ignătescu Boris	
107.		4104	Ad.	N.	-	-	-	
108.		4100	Ad.	N.	-	-	-	
			Order Gruiformes					
			Family Rallidae					
109.	*Gallinula chloropus* (Linnaeus, 1758)	317	♀ Ad.	N.	02.05. 1959	Mediaş (SB.)	Costea Ioan	LC
110.	*Fulica atra* Linnaeus, 1758	3943	♀ Ad.	N.	20.01. 1982	Dunăvățu de Jos (TL.)	Ignătescu Boris	LC
111.	*Rallus aquaticus* Linnaeus, 1758	3976	Ad.	N.	20.10. 1984	Sabangia (TL.)	Șelaru Sabin	LC
112.		3977	Ad.	N.	20.10. 1984	Sabangia (TL.)	Șelaru Sabin	
113.		4113	Ad.	N.	-	-	-	
			Family Gruidae					
114.	*Grus grus* (Linnaeus, 1758)	3983	Ad.	N.	25.09. 1998	Istria (CT.)	-	NE
			Order Charadriiformes					
			Family Recurvirostridae					
115.	*Recurvirostra avosetta* Linnaeus, 1758	3942	Ad.	N.	18.11. 1991	Dunăvățu (TL.)	Vlad Aurel	LC
116.	*Himantopus himantopus* (Linnaeus, 1758)	3941	♀ Ad.	N.	25.08. 2001	Istria (CT.)	-	LC
			Family Scolopacidae					
117.	*Calidris pugnax* (Linnaeus, 1758)	3948	Ad.	N.	28.09. 1987	Murighiol (TL.)	Șelaru Sabin	NE
118.	*Limosa limosa* (Linnaeus, 1758)	2284	Ad.	N.	25.08. 1980	Crişan, Mila 23 (TL.)	Weber Peter	VU
119.	*Scolopax rusticola*	250	Ad.	N.	-	-	-	LC
120.	Linnaeus, 1758	3944	Ad.	N.	15.04. 1981	Pardina (TL.)	Șelaru Sabin	
121.		1626	Ad.	N.	30.04. 1977	Axente Sever (SB)	Weber Peter	
122.		4095	Ad.	B.	-	-	-	
123.	*Gallinago gallinago*	242	Ad.	N.	-	-	-	VU
124.	(Linnaeus, 1758)	3945	Ad.	N.	20.10. 1988	Sarichioi, Sabangia (TL.)	Șelaru Sabin	
125.		4077	Ad.	N.	29.09. 1994	Sarichioi, Sabangia (TL.)	Ignătescu Boris	
126.	*Tringa ochropus* Linnaeus, 1758	3946	Ad.	N.	20.10. 1983	Valea Nucarilor, Agighiol (TL.)	Șelaru Sabin	-

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
127.	*Tringa nebularia* (Gunnerus, 1767)	3947	Ad.	N.	20.10. 1988	Sarichioi, Sabangia (TL.)	Șelaru Sabin	-
	Family Charadriidae							
128.	*Vanellus vanellus* (Linnaeus, 1758)	323	♂ Ad.	N.	06.06. 1959	Mediaș (SB.)	-	VU
129.		4089	♀ Ad.	N.	06.10. 1983	Iernut (MS.)	Kánya Istvan	
	Family Laridae							
130.	*Chlidonias hybrida* (Pallas, 1811)	3979	♂ Ad.	N.	30.09. 1982	Dunăvățu de Jos (TL.)	Șelaru Sabin	LC
131.		3980	Juv.	N.	10.10. 1989	Murighiol (TL.)	Vlad Aurel	
132.	*Sterna hirundo*	254	Ad.	N.	-	-	-	LC
133.	Linnaeus, 1758	3978	Ad.	N.	09.10. 1985	Murighiol, Plopu (TL.)	Șelaru Sabin	
	Family Turdidae							
134.	*Turdus merula*	150	Ad.	N.	-	-	-	LC
135.	Linnaeus, 1758	244	Ad.	N.	-	-	-	
136.	*Turdus pilaris*	243	Ad.	N.	-	-	-	LC
137.	Linnaeus, 1758	3952	♂ Ad.	N.	18.03. 2000	Maliuc (TL.)	Vasile Ștefanov	
138.	*Turdus philomelos* C. L. Brehm, 1831	3953	♂ Ad.	N.	27.11. 1999	Cârjelari (TL.)	Velemorschi Cornel	LC
139.	*Turdus viscivorus* Linnaeus, 1758	4106	Ad.	N.	17.01. 1985	Voievodeni (MS.)	Sárkany K. A.	LC
	Family Glareolidae							
140.	*Glareola pratincola* Linnaeus, 1766	3913	Ad.	N.	31.03. 1980	Iazurile (Calica) (TL.)	Doru Bădrățan	VU
	Order Columbiformes							
	Family Columbidae							
141.	*Columba palumbus* Linnaeus, 1758	3949	Ad.	N.	12.11. 1991	Tulcea (TL.)	-	LC
142.	*Columba oenas* Linnaeus, 1758	3950	Ad.	N.	12.10. 1991	Tulcea (TL.)	Șelaru Sabin	LC
143.	*Streptopelia decaocto*	259	Ad.	N.	-	-	-	LC
144.	(Frivaldszky, 1838)	3951	Ad.	N.	12.11. 1991	Tulcea (TL.)	Bădraţan Doru	
145.	*Streptopelia turtur*	257	Ad.	N.	-	-	-	LC
146.	(Linnaeus, 1758)	258	Ad.	N.	02.04. 1956	-	Ialomov ?	
	Order Cuculiformes							
	Family Cuculidae							
147.	*Cuculus canorus* Linnaeus, 1758	285	Ad.	N.	-	-	-	LC
	Order Strigiformes							
	Family Strigidae							
148.	*Bubo bubo* (Linnaeus, 1766)	324	♂ Ad.	N.	-	-	Hermann W.	NT
149.		325	♀	N.	-	-	Hermann W.	

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
			Ad.					
150.	*Asio otus* (Linnaeus, 1758)	307	♀ Ad.	N.	-	-	Hermann W.	LC
151.	*Strix aluco*	149	Ad.	N.	-	-	Hermann W.	LC
152.	(Linnaeus, 1758)	4112	Ad.	N.	1990	Metiș (SB.)	Ionică Raț	
153.	*Strix uralensis* Pallas, 1771	296	♂ Ad.	N.	-	-	-	LC
154.		4112	Ad.	N.	1990	Metiș (SB.)	Ionică Raț	
155.	*Athene noctua*	251	Ad.	N.	-	-	-	LC
156.	(Linnaeus, 1758)	4079	Ad.	B.	-	-	-	
	Family Tytonidae							
157.	*Tyto alba* (Scopoli, 1769)	2493	Ad.	N.	12.07. 1991	Mănărade (AB.)	-	LC
158.		3990	Ad.	N.	17.04. 1991	Mediaș (SB.)	-	
159.		4102	Ad.	N.	1990	Metiș (SB.)	Ionică Raț	
	Order Apodiformes							
	Family Apodidae							
160.	*Apus apus* (Linnaeus, 1758)	292	♂ Ad.	N.	15.06. 1957	Mediaș (SB.)	-	LC
	Order Coraciiformes							
	Family Alcedinidae							
161.	*Alcedo atthis*	731	Ad.	N.	-	-	-	LC
162.	(Linnaeus, 1758)	3959	♂ Ad.	N.	06.02. 1986	Dunăvățu de Sus (TL.)	Vlad Aurel	
	Family Meropidae							
163.	*Merops apiaster*	256	Ad.	-	-	-	-	LC
164.	Linnaeus, 1758	288	♂ Ad.	N.	10.06. 1957	București (B.)	-	
165.		3961	♂ Ad.	N.	12.05. 1995	Cârjelari (TL.)	Velemorschi Cornel	
166.		3962	♂ Ad.	N.	12.05. 1995	Cârjelari (TL.)	Velemorschi Cornel	
167.		4110	Ad.	N.	-	-	-	
	Family Coraciidae							
168.	*Coracias garrulus* Linnaeus, 1758	273	Ad.	N.	01.08. 1956	Timişoara (TM.)	Nadra Emil	LC
169.		4076	Ad.	N.	10.10. 1990	Iazurile (TL.)	Savin Cornel	
	Family Oriolidae							
170.	*Oriolus oriolus* (Linnaeus, 1758)	274	♀ Ad.	N.	05.05. 1954	Timişoara (TM.)	-	LC
171.		3963	♂ Ad.	N.	08.05. 1990	Cârjelari (TL.)	Velemorschi Cornel	
	Family Upupidae							
172.	*Upupa epops* Linnaeus, 1758	2289	♂ Ad.	N.	26.07. 1981	Dupuș (SB.), orchard in Dupuș valley	Weber Peter	LC
173.		3960	♀ Ad.	N.	10.02. 1998	Cârjelari (TL.)	Velemorschi Cornel	
	Order Picimorphes							
	Family Picidae							

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
174.	*Dendrocopos major*	249	Ad.	N.	-	-	-	LC
175.	(Linnaeus, 1758)	3957	♂ Ad.	N.	20.02. 2002	Tulcea (TL.)	Bădrățan Doru	
176.		3958	♂ Ad.	N.	10.01. 1990	Vicovu de Sus (SV.)	Nistor Doru	
177.		4091	Ad.	N.	-	-	-	
178.	*Dryocopus martius* (Linnaeus, 1758)	3954	♂ Ad.	N.	08.03. 1985	Somova (TL.)	Șelaru Sabin	LC
179.		3955	♂ Ad.	N.	04.05. 1995	Cârjelari (TL.)	Velemorschi Cornel	
180.	*Picus canus* Gmelin, 1788	3956	♂ Ad.	N.	10.02. 1998	Maliuc (TL.)	Petrescu Eugen	LC
181.		4107	Ad.	N.	06.12. 1985	Toldal (MS.)	Sárkany K. A.	
182.	*Picus viridis* Linnaeus, 1758	294	Ad.	-	-	-	Sárkany K. A.	LC
			Order Passeriformes					
			Family Alaudidae					
183.	*Galerida cristata* (Linnaeus, 1758)	290	♂ Ad.	N.	03.01. 1957	Mediaș (SB.)	-	LC
			Family Sturnidae					
184.	*Sturnus vulgaris* Linnaeus, 1758	275	♀ Ad.	N.	27.06. 1956	Timișoara (TM.)	Anton Gheorghe	LC
185.		3969	Ad.	N.	06.02. 2002	Maliuc (TL.)	Petrescu Eugen	
			Family Corvidae					
186.	*Corvus corax*	318	Juv.	N.	-	-	-	LC
187.	Linnaeus, 1758	4094	Ad.	N.	1990	Metiș (SB.)	Ionică Raț	
188.	*Corvus cornix (Linnaeus, 1758)*	4091	Ad.	N.	18.05. 1995	Cârjelari (TL.)	Velemorschi Cornel	LC
189.		4093	Ad.	B.	-	-	-	
190.		245	Ad.	N.	19.03. 1955	-	-	LC
191.		295	♂ Ad.	N.	20.07. 1957	Mediaș (SB.)	-	
192.	*Corvus monedula*	142	Ad.	N.	-	Sibiu (SB.)		LC
193.	(Linnaeus, 1758)	248	Ad.	N.	-	-	-	
194.		289	Ad.	N.	20.05. 1957	București (B.)	Nadra Emil	
195.	*Corvus frugilegus*	252	Ad.	N.	-	-	-	LC
196.	Linnaeus, 1758	4096	Ad.	N.	16.04. 1991	Sarichioi, Sabangia (TL.)	Șelaru Sabin	
197.	*Garrulus glandarius*	240	Ad.	N.	-	-	-	LC
198.	(Linnaeus, 1758)	284	Ad.	N.	03.01. 1957	Mediaș (SB.)	Hermann Wilhelm	
199.		310	♀ Ad.	B.	-	-	-	
200.		3902	Ad.	N.	10.01. 1984	Vicovu de Sus (TL.)	Nistor Vasile	
201.		4080	Ad.	B.	-	-	-	
202.		4085	Ad.	N.	-	-	-	

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
203.	*Pica pica* (Linnaeus, 1768)	278	Ad.	B.	05.07. 1956	Timişoara (TM.)	Nadra Emil	LC
204.		293	♂ Ad.	N.	02.07. 1957	Mediaș (SB.)	-	
205.		4087	Ad.	B.	-	-	-	
206.		4086	Ad.	N.	-	-	-	
207.	*Nucifraga caryocatactes* (Linnaeus, 1758)	4078	Ad.	N.	-	-	-	LC
			Family Emberizidae					
208.	*Emberiza citrinella* Linnaeus, 1758	497	-	N.	-	-	-	LC
			Family Laniidae					
209.	*Lanius excubitor* Linnaeus, 1758	492	♀ Ad.	N.	-	-	-	NT
210.		493	♂ Ad.	N.	-	-	-	
211.	*Lanius collurio* Linnaeus, 1758	253	Ad.	N.	-	-	-	LC
212.		287	♂ Ad.	N.	03.01. 1957	Mediaș (SB.)	-	
213.		3966	♂ Ad.	N.	17.05. 2000	Somova (TL.)	Petrescu Eugen	
214.	*Lanius minor* Gmelin, 1788	3967	♂ Ad.	N.	04.06. 1987	Dunăvățu de Sus (TL.)	Vlad Aurel	VU
			Family Motacillidae					
215.	*Motacilla alba* Linnaeus, 1758	2488	Ad.	N.	01.09. 1988	Mediaș, Ighiș Lake (SB.)	Weber Peter	LC
216.		2489	Ad.	N.	01.09. 1988	Mediaș, Ighiș Lake (SB.)	Weber Peter	
217.		3970	Ad.	N.	06.05. 1991	Gălănești (SV.)	Nistor Doru	
			Family Fringillidae					
218.	*Carduelis carduelis* (Linnaeus, 1758)	3971	Ad.	N.	11.12. 1989	Dunăvățu de Sus (TL.)	Ignătescu Boris	LC
219.	*Coccothraustes coccothraustes* (Linnaeus, 1758)	3991	Ad.	N.	10.09. 1985	Capu Codrului (SV.)	Brumă Vestru	LC
220.	*Chloris chloris* (Linnaeus, 1758)	140	Ad.	N.	07.11. 1985	Târgu Mureş (MS.)	Cioloboc Ioan	LC
221.	*Loxia curvirostra* Linnaeus, 1758	489	Ad.	N.	06.06. 1959	Mediaș (SB.)	-	LC
222.		490	Ad.	N.	-	-	-	
			Family Paridae					
223.	*Parus major* Linnaeus, 1758	147	♀ Ad.	N.	-	-	-	LC
224.		239	♀ Ad.		-	-	-	
225.		3972	Ad.	N.	26.02. 1995	Vicovu de Sus (SV.)	Nistor Doru	
226.	*Poecile palustris* Linnaeus, 1758	3973	Ad.	N.	01.03. 1985	Vicovu de Sus (SV.)		LC

Nr. Crt.	Taxon	Inv. Nr.	Age	B./N.	Data	Sampling locality	Name of collector	R. L.
227.	*Cyanistes caeruleus* (Linnaeus, 1758)	3974	Ad.	N.	20.02. 1985	Vicovu de Sus (SV.)	Nistor Vasile	LC
228.		3975	Ad.	N.	20.02. 1985	Vicovu de Sus (SV.)	Nistor Vasile	
Family Passeridae								
229.	*Passer domesticus* (Linnaeus, 1758)	238	Ad.	N.	-	-	-	LC
230.		279	Ad.	N.	-	-	-	
231.		496	Ad.	N.	-	-	-	
Family Cinclidae								
232.	*Cinclus cinclus* (Linnaeus, 1758)	4098	Ad.	N.	-	-	-	NT
Family Sylviidae								
233.	*Phylloscopus collybita* (Vieillot, 1817)	2487	Ad.	N.	30.09. 1988	Mediaş, Lacul Ighiş (SB.)	Weber Peter	LC
234.		4108	Ad.	N.	31.10. 1985	Iernut (MS.)	Sárkany K. A.	
Family Panuridae								
235.	*Panurus biarmicus* (Linnaeus, 1758)	3968	♂ Ad.	N.	12.02. 1990	Ceatalchioi (TL.)	Lazarencu Ivan	LC
Family Sittidae								
236.	*Sitta europaea* Linnaeus, 1758	4109	Ad.	N.	-	-	-	LC

Figure 1. Bird specimens from Mediaş Municipal Museum ornithological collection

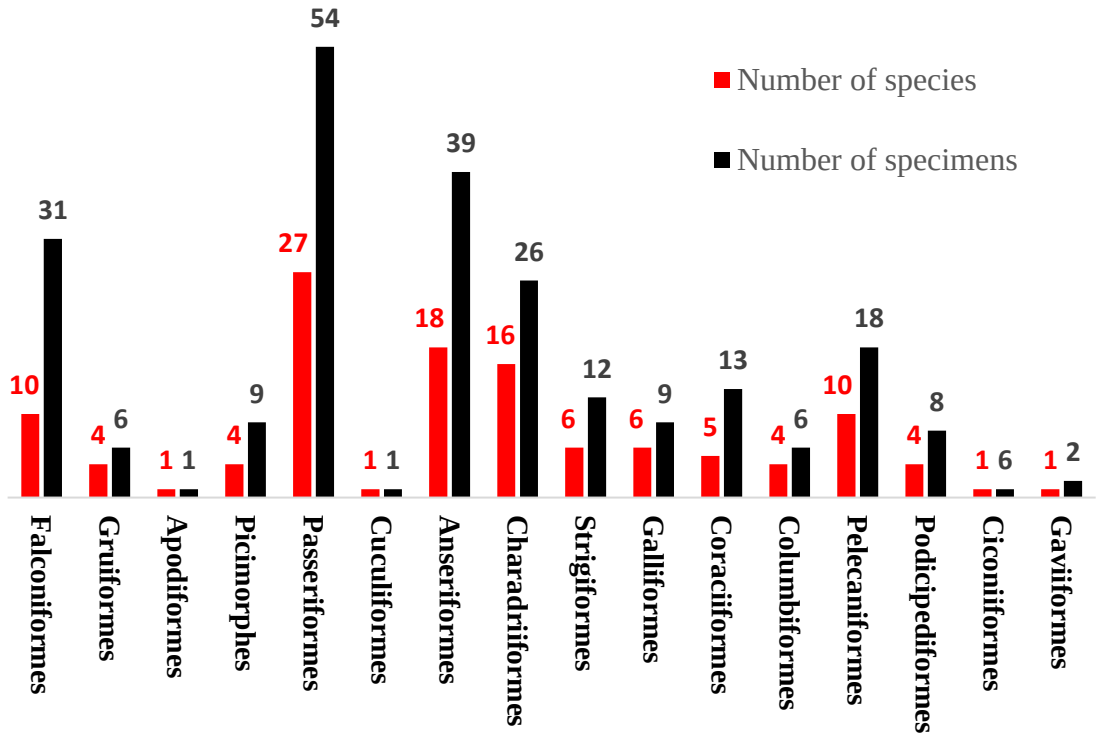

Fig. 2. Total number of specimens and species per order represented in the ornithological collection of Mediaş Municipal Museum

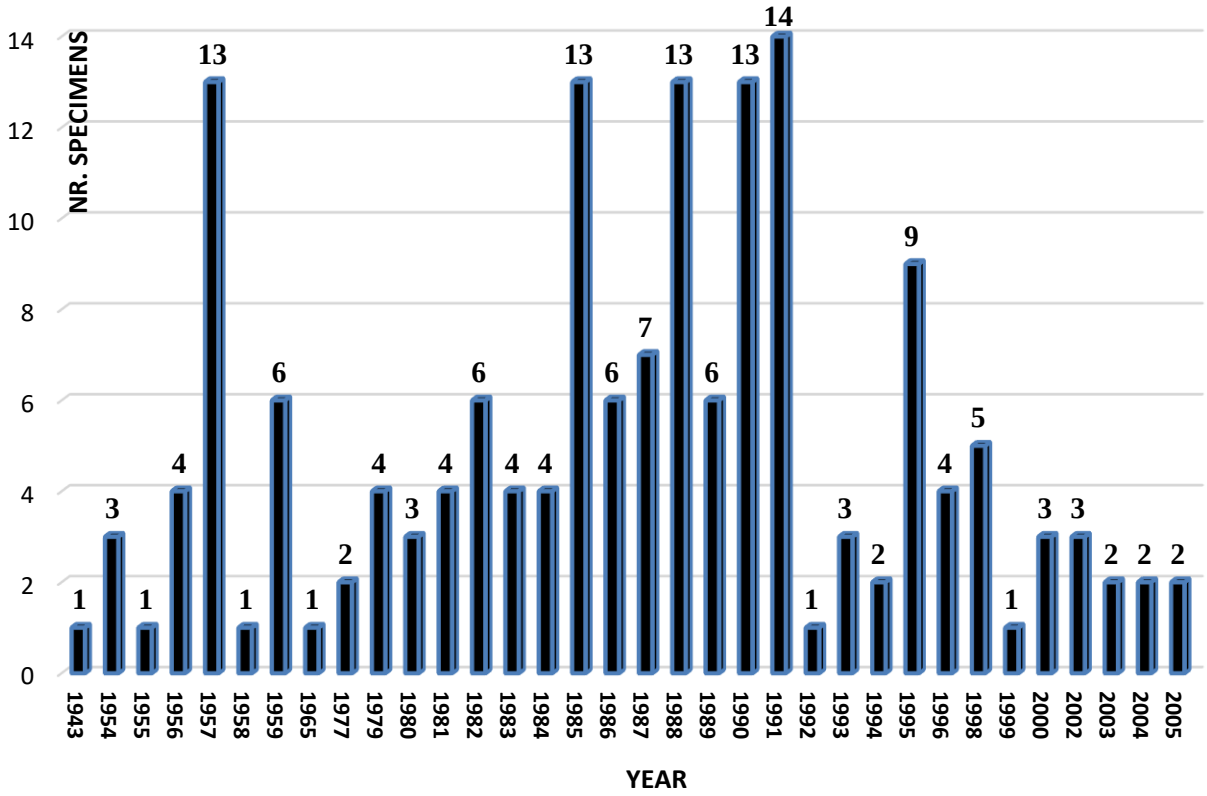

Fig. 3. The temporal distribution of the bird specimens from Mediaş Municipal Museum

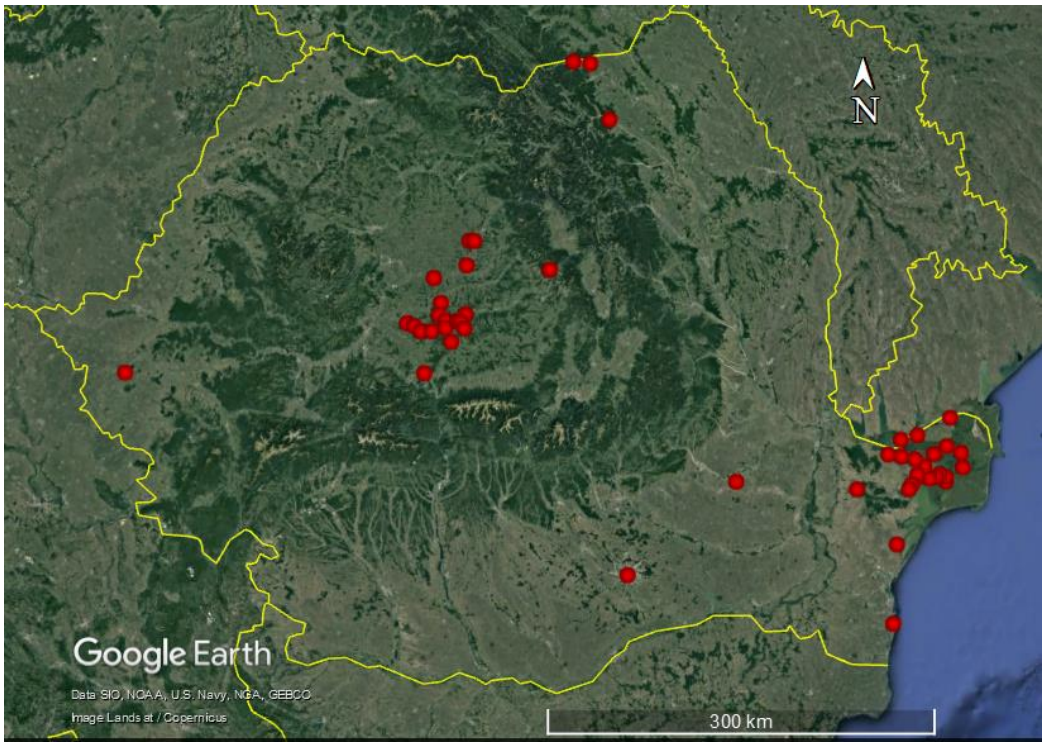

Fig. 4 The geographical distribution of the bird specimens from Mediaș Municipal Museum modified from maps.google.

Fig. 5. *Ciconia ciconia* specimen with metal ornithological ring, the only one specimen in the collection with ornithological ring

ANALYSIS OF MELLIFEROUS FLORA FROM SIBIEL LOCALITY (SIBIU COUNTY)

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Iuliana ANTONIE**
Cristina STANCĂ-MOISE**
Roxana RUSU**

Abstract. *The study includes data related to melliferous plants inventory found in the vicinity of apiaries within Sibiel village area. The objective of the study was to identify plant species with melliferous potential, and estimate, classify and present the melliferous resources and their optimal use. The results have shown that the environmental conditions and floristic biodiversity included in the area are of high natural value for farming (HNV), habitats with high natural flora, making it as one of the regional areas recommended for beekeeping.*
Keywords*: melliferous plants, apiaries, conservation, biodiversity.*

Rezumat. *Studiul cuprinde date legate de inventarierea bazei melifere din jurul a patru stupine aflate pe raza localității Sibiel. Obiectivul studiului a reprezentat identificarea speciilor cu potențial apicol, estimarea bazei melifere, clasificarea şi prezentarea resurselor melifere și posibilități de valorificare superioară a resurselor melifere. Condițiile de mediu și biodiversitatea floristică au încadrat zona studiată la habitate cu înaltă vloare naturală, ceea ce o include în topul zonelor recomandate apiculturii.*
Cuvinte cheie: *plante melifere, stupine, conservare, biodiversitate.*

Introduction

In the plants world, the pollen transportation is done through a complex mechanism and various vectors and the flower is the specialized organ in this important function – pollination (Corbet 1991; James *et al*. 2008). The identification of rich habitats with melliferous species is a good premise for beekeepers.

Plants from spontaneous flora are adapted to local soil and climates and the best sources of nectar and pollen for pollinators. Moreover, the native plants often need less water than cultivated ones and don't need fertilizers (Albu *et al*. 2021; Popescu 2017). In generally, spontaneous melliferous species can be identified within many habitats (Fundația Adept 2015 a, 2015 b). The meadow flora gives us melliferous resources during a long period of time but usually the quality of the resulted honey is medium or low, with a maximum during late summer, as resources develop. An area with wildflowers, principal melliferous plants, for the duration of the blooming period, is the main source for beekeepers, even in those areas with poor floral diversity (Ciocârlan 2009; Lee-Mader *et al*. 2009).

Indentifing the melliferous species from the wildflora in order to support the local beekepers is an important aspect for the local development of the trade and economy. The list of melliferous plant species identified in an area, their phenology, land-cover and land-use are directly corelated to the level and development pace of the bee families.

Material and methods

During the entire period of study, the wild flora was identified in the vicinity of four apiaries, from Sibiel village. These apiaries belong to local owners: the Săroiu Daniel family (apiary 1), the Moga Ilie family (apiary 2), the Someşan Maria family (apiary 3) and the Ciorgodă Sorin family (apiary 4) (Fig. 1).

The researched area was restricted to 100 square meters (10 x 10 meters), the apiary beeing positioned in the middle of the studied plot. All the plant species around the apiaries were identfied using Ciocârlan (2009) (Fig. 2).

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The phytocenological method (relevées) was used to describe the habitats. An important aspect was to establish the plots land-use. For each identified species was calculated the abundance – dominance, following the Braun – Blanquet method, as well as their melliferous potential (Călinescu 1960; Cîrlig *et al*. 2023; Cîrnu 1980; Iordache *et al*. 2008; Pop 1982).
Soil moisture (U), air temperature (T) and soil reaction (R) was recorded to establish the phenology of the species (Sanda *et al*. 1983).

Statistical interpretation was run with PAST software package (Hammer *et al*. 2001).

Results

Ensuring a rich habitat in melliferous spontaneous species supports the pollinators. This study highlights the fact that native plants, which are adapted to the climate and local soils in the Sibiel area (575 meters altitude), are the preferred food sources by bees.

During the 2022 vegetation period, were identified in the four study areas (apiaries) a number of 109 plant species, out of which 49 have melliferous potential (Fig. 3).

From an ecological point of view, the floristic analysis indicates the majority of the species are Eurasian elements (Eua 57%), while European elements - Eur were represented by 17%, results that which are in line with the area temperate continental climate (Fig. 4).

Analyzing the phenology of the species, it can be stated that the highest level, for all ecological factors (edaphic-humidity, air-temperature and soil reaction) is located in the middle of environmental preferences scale (medium preferences) followed by amphitolerant species (euryhidric, eurythermic, eriionic) (Fig. 5). Thus, according to soil humidity meso - mesohygrophilous species (U3 - 3.5) are predominated; related to air temperature preferences, micro-mesothermic and moderately thermophilic species (T3 - 3.5) are abundant, and considering the soil reaction, the acid – neutrophils species (R3 - 3.5) are present in larger number. The presence of amphitolerant species can be explained by human activity quite frequent in these studied areas (mostly uncultivated or semi-cultivated gardens).

The semi-natural vegetal carpet existing in the studied areas provides in general for bees a medium or low intensity source of food, but with a long duration and a maximum during the late summer development.

If we analyse the Bioforms spectrum, discovered in the researched area, it can been seen that hemycryptophytes (H) or perennial weeds are the majority (64 %) in this area followed by the annual (Th) and biannual (TH) weeds. At the opposite end with a small percentage are bulbous / tuber plants also called geophytes (G) and shrubby species (N) (Fig. 6). The majority of the plant species identified in the researched field belong to the *Rosaceae* (29.74 %), *Fabaceae* (24.35 %) and *Lamiaceae* (13.51 %) families.

The plants with the lowest abundence (2.7 %) belong to *Brasicaceae, Cucurbitaceae, Fagaceae* and *Violaceae* families (Fig. 7). Thus, among the mentioned families, there were identified several plants with high melliferous potential, round of the researched apiaries from Sibiel locality. These plants are: *Robinia pseudoacacia* L., *Rubus idaeus* L., *Brassica nigra* L., *Cydonia oblonga* Mill., *Stachys sylvatica* L., *Trifolium repens* L., *Trifolium pratense* L., *Trifolium rubens* L., which are plants from I and II category (high melliferous potential) After identifications and analyses made on the melliferous species it resulted that 6 % are from the first category (I - very high meliferous potential), 5 % from the second category (II - high potential), 73 % have medium melliferous potential and 16 % have reduced potential (Fig. 8). Statistical analysis of the floristic diversity was performed using the Principal Components Analisys (PCA).

PCA method provides a graphical comparison between plots (coordinates) which is best fitting considering the data obtained in this study. From the PCA graph (Fig. 9) it can been seen that the squares sum of residuals from all four plots or *relevée*s (RLV), the great similarity of floristic composition is between RLV 2 and RLV 4, followed by the RLV 1. The last plot RLV 3 has a small similarity with the other plots. The PCA graph represents the first two coordinates (component 1 and component 2) which explains about 75 % of the variables (Tab.1). The PCA graph correlates positively three plots (RLV 1, RLV2 and RLV 4) during the first component, which means that they have a similar floristic diversity.

The plant with differential value for similarity of plants community between apiaries was tested from statistical point of view. For this aspect was applied hierarchical clustering paired group

(UPGMA) which refers to *relevée*s classification after similarity index (Fig. 10). Following the UPGMA analysis, the plots, RLV 1 and RLV 4 are the most similar as floral composition (calculated correlation coefficient – 0.9383) and at the opposite pole is the plot RLV 3.

The computed dendrogram with distances between species revealed the existence of two very well differentiated plant clades (Fig. 11). A first group of plants consisting of melliferous species with high potential and abundence: *Fragaria viridis* L., *Lotus corniculatus* L., *Galium verum* L., *Trifolium rubens* L., *Chelidonium majus* L., *Robinia pseudoacacia* L. and *Trifolium pratense* L. In our case, these plants can make the differences between floral compositions around apiaries. The second group, much more numerous, is aggregated on the unweighted arithmetic mean species in general with a small relative abundance.

Discussion

Against the background of temperate continental climate, with oceanic influences, manifested by moderate temperatures and abundant rainfall but also the landforms influence, the percentage of melliferous species is well represented (almost half of plants), compared to the statistical data at the national level.

Following the floristic investigations, it was observed that the reliefs around the apiaries are similar from a floristic point of view, except for relief number 3 (RLV 3), which has a much lower species density than the rest of the reliefs. According to the floristic analysis, it can be stated that the area falls into low-altitude hay habitats (6510) – Arrhenatheretalia with indicator species: *Arrhenatherum elatius* (L.) P. Beauv, *Centaurea jacea* L., *C. Phrygia* L., *Lathyrus pratenis* L., *Geranium pretense* L., *Crepis biennis* L. and *Primula veris* L.

These differential species place the study areas in the category of pre - mountain mesophilic and meso - hygrophilic meadows, considered agricultural systems with high natural value (HNV). The Sibiel locality has habitats with floristic diversity to preserve the natural value. This diversity can cover the raw material requirements for bee families, for the entire vegetation period.

For beekeepers in the Sibiel area, it is very important that these semi-natural meadows comply with certain indications regarding the management of HNV meadows and implicitly the

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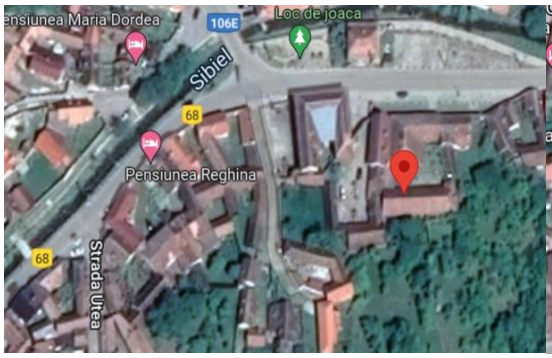
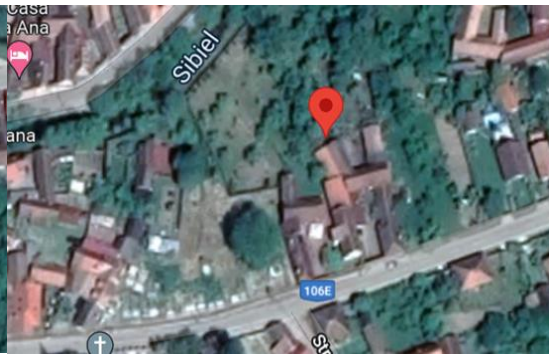
LIST OF ILLUSTRATIONS

LISTA ILUSTRAȚIILOR

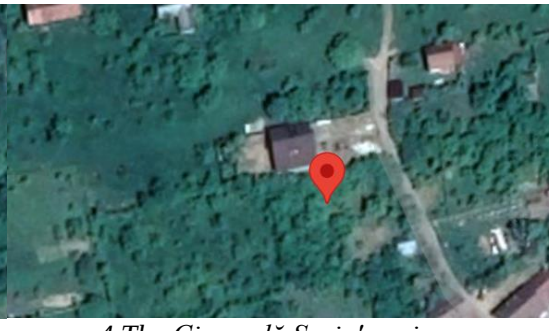


1.The Săroiu Daniel's apiary



2. The Moga Ilie's apiary

3.The Someşan Maria's apiary



4.The Ciorgodă Sorin's apiary

Fig. 1. A satellite image of the apiaries location and the land around them

Fig. 2. Identification of meliferous plants in the field (Sibiel area)

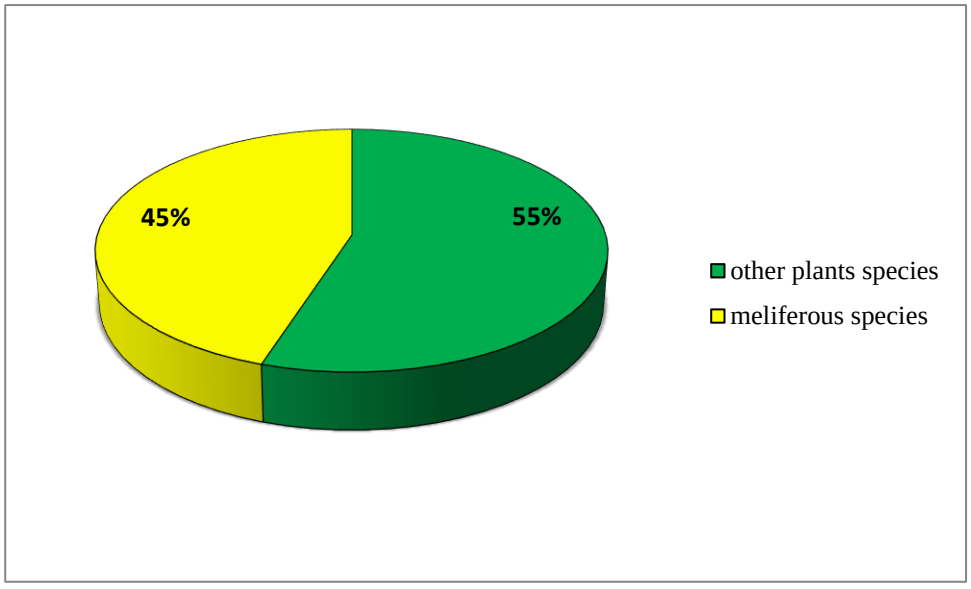


Fig. 3. Meliferous plants distribution in the studied apiaries (Sibiel village, SB)

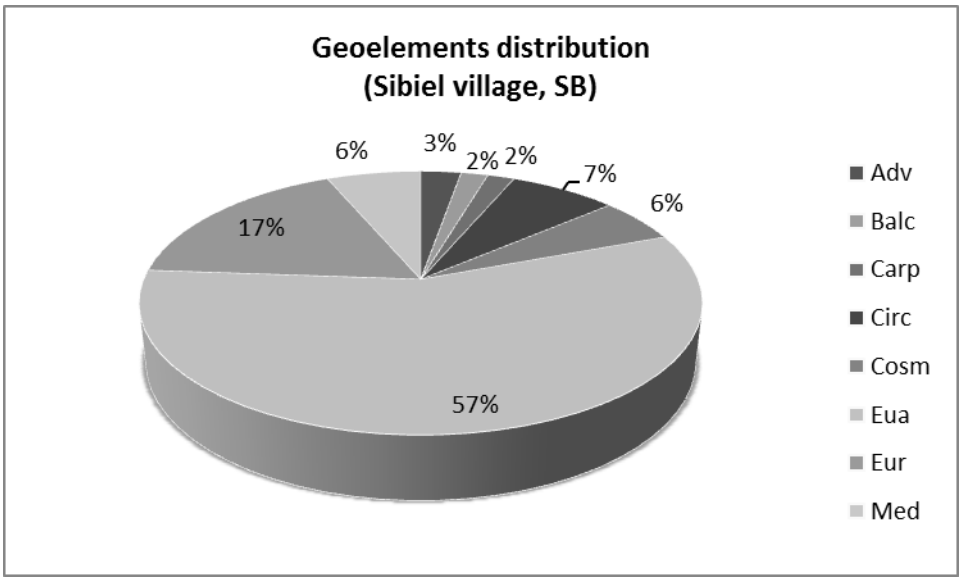


Fig. 4. Floral geoelements distribution around the studied apiaries
(Adventive - Adv; Balcanic – Balc; Carpatic – Carp; Circumpolar – Circ; Cosmopolite – Cosm; Euroasiatic – Eua; European – Eur; Mediteraneen – Med)

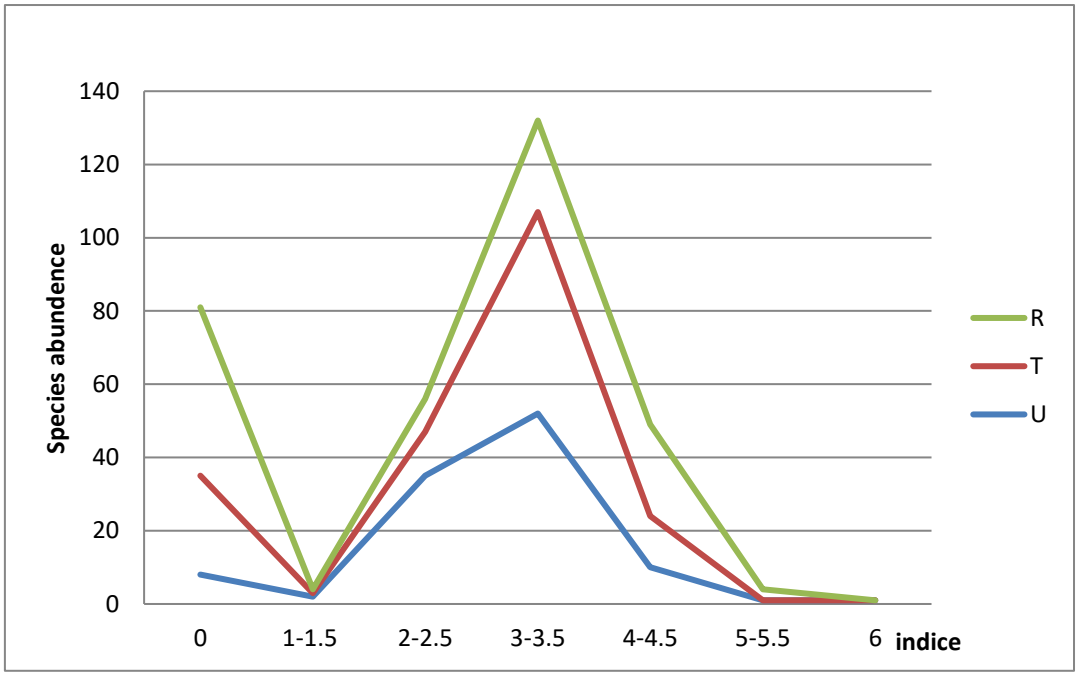


Fig. 5. Plants distribution by ecological condition (humidity – U; temperature – T; soil reaction - R)

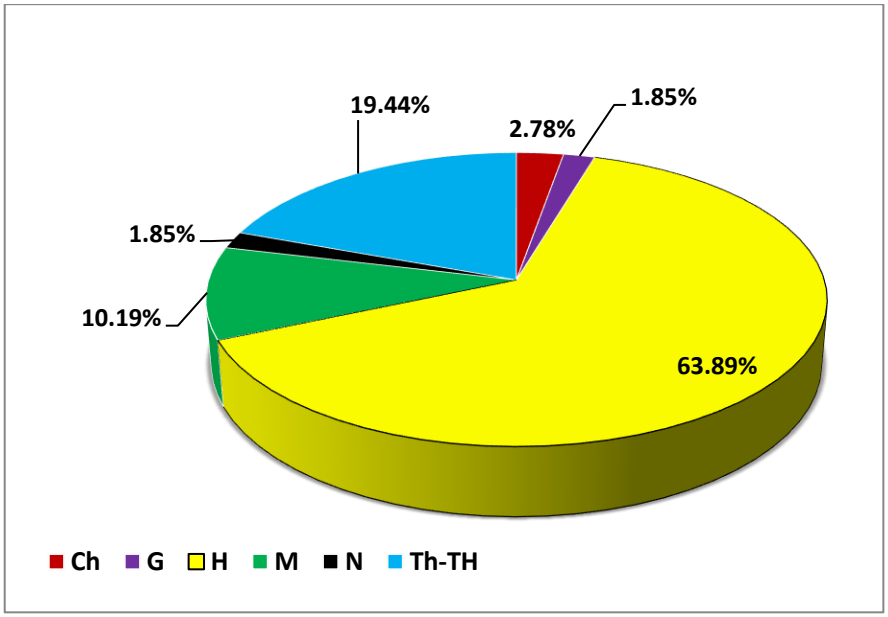


Fig. 6. Bioforms elements distribution
(Chamephyte – Ch; Geophyte – G; Hemicriptophyte – H; Phanerophyte Mega – M and Nano – N; Therophyte annual and biannual – Th-TH)

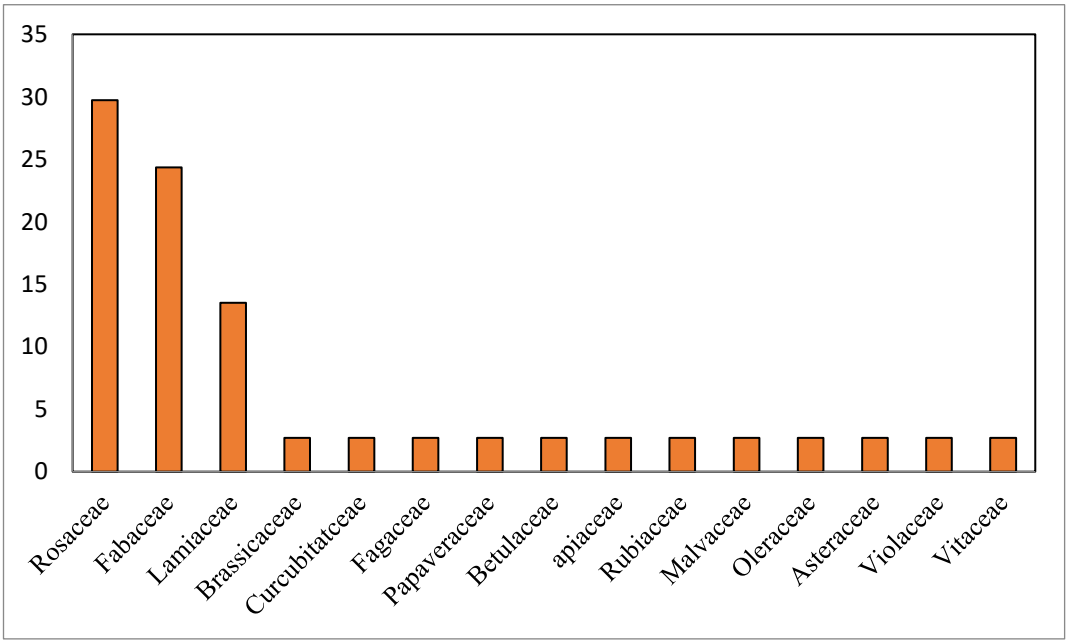


Fig.7. Relative abundence of inventored families of plants in the studied area (Sibiel Village, SB)

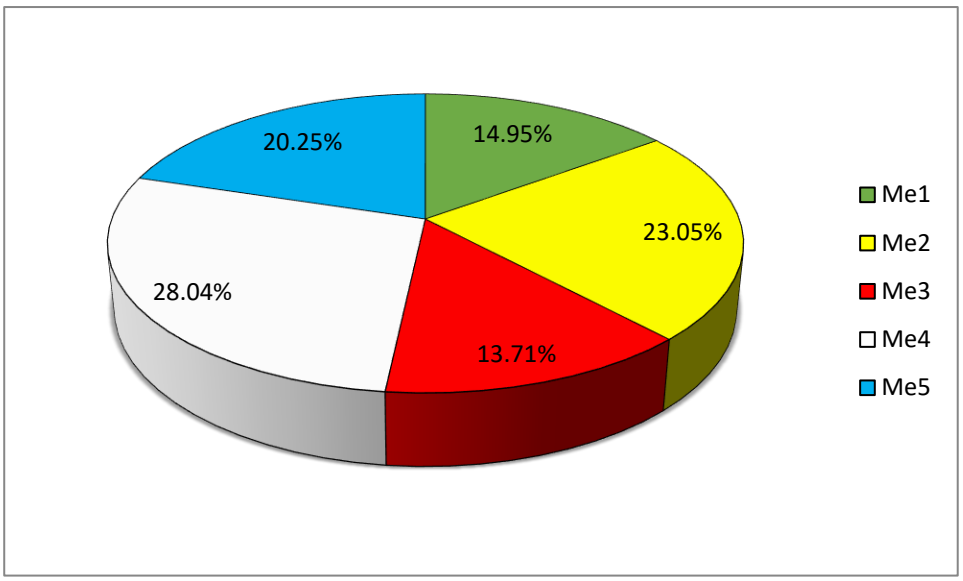


Fig. 8. Relative abundence of melliferous plants from the studied area (Sibiel Village, SB) (Very high melliferous potential - Me1; high melliferous potential – Me2; medium melliferous potential – Me3; small melliferous potential – Me4; insignificant melliferous potential – Me5)

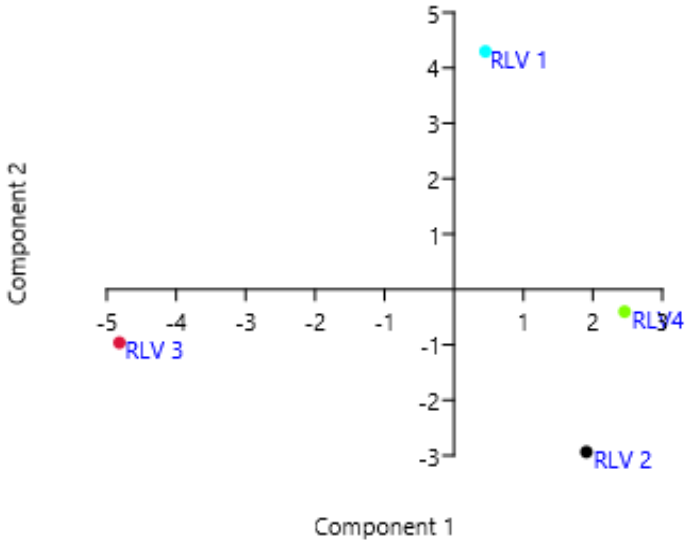


Fig. 9. Diferences of the floristic biodiversity among the studied apiaries with PCA method

Tab. 1. Variance – covariance matrix based on presence – absence species.

PC	*Eigen value*	*% variance*
1	*11.0239*	*40.704*
2	*9.38887*	*34.667*
3	*6.67057*	*24.63*

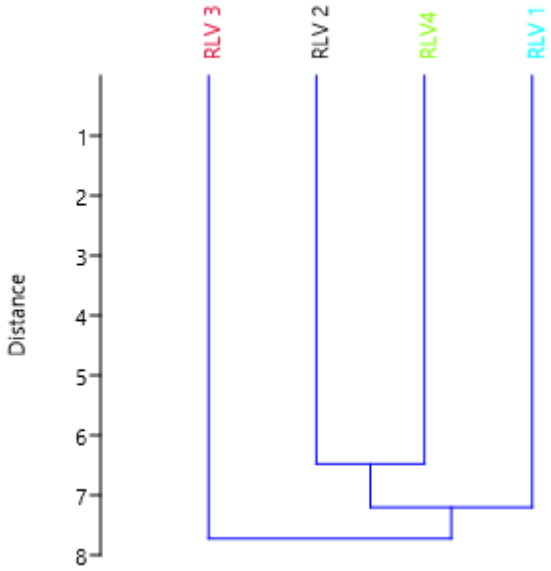


Fig. 10. Hierarchical clustering of studied plots with UPGMA method (Cophen corr. 0.93). (Relevees – RLV 1, RLV 2; RLV 3; RLV 4)

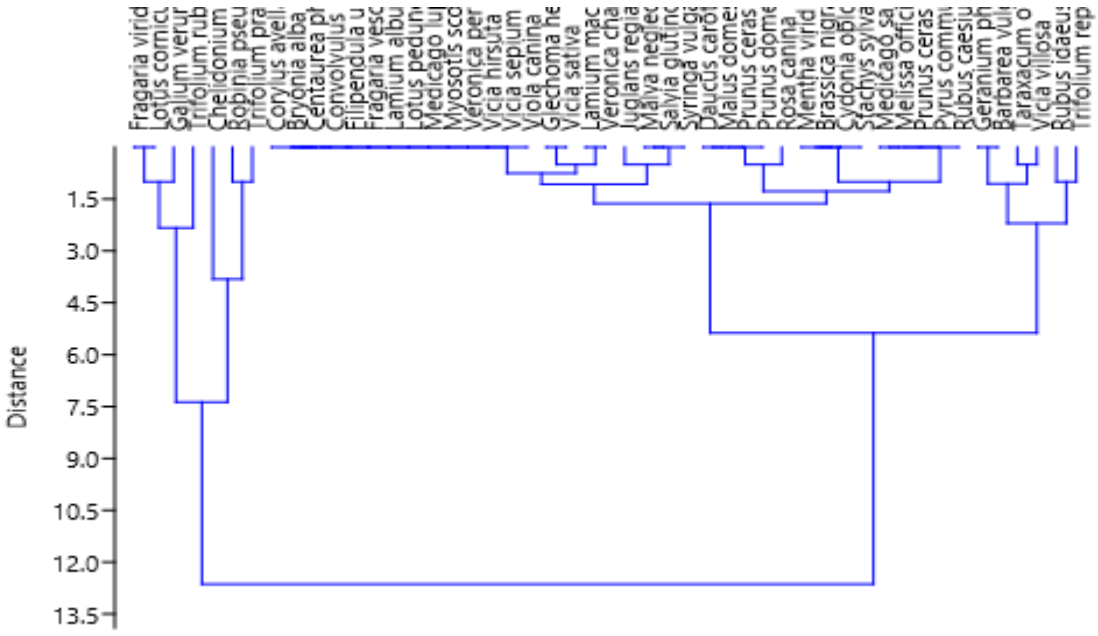


Fig. 11. Hierarchical clustering of species with UPGMA method (Cophen corr. 0.78)

"WILD TĂLMĂCEL" - A BIODIVERSITY SURVEY ON ANIMAL COMMUNITIES IN A MOSAIC HABITATS FROM TRANSYLVANIA

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Raul CIOC*
Ioan TĂUȘAN*

Abstract*. We investigated the fauna of Tălmăcel surroundings (Sibiu County) focusing on three main groups, namely invertebrates, herpotofauna and mammal fauna, with an emphasis on Natura 2000 species. Altogether we recorded 9 invertebrate species, 13 amphibian and reptile species, and 8 mammal species. The area has a great potential for biodiversity and needs further investigations and conservation assessment to efficiently preserve its wildness.*
Keywords*: mammals, amphibians, reptiles, invertebrates, Natura 2000 species.*

Rezumat. *Am investigat fauna din împrejurimile localității Tălmăcel (județul Sibiu), concentrându-ne pe trei mai grupe, și anume specii de nevertebrate, herpetofauna și fauna de mamifere cu accent pe speciile protejate Natura 2000. În total am identificat 9 specii de nevertebrate, 13 specii de amfibieni și reptile, dar și 8 specii de mamifere. Zona prezintă potential foarte mare pentru biodiversitate, în acest sens fiind necesare cercetări și evaluări privind conservarea habitatelor și a speciilor în vederea păstrării gradului de sălbăticie.*
Cuvinte cheie: *mamifere, amfibieni, reptile, nevertebrate, specii Natura 2000.*

Introduction

Maybe the most unique feature of Earth is the existence of life, and the most extraordinary feature of life is its biodiversity. Approximately 9 million types of plants, animals, protists, and fungi inhabit the Earth (Cardinale *et al.* 2012). Biodiversity effects seem to be remarkably consistent across different groups of organisms, among trophic levels and across the various ecosystems that have been studied.

Therefore, biodiversity loss influences ecosystem functions, and the impacts that this can have on the goods and services ecosystems provide (Cardinale *et al.* 2012).

Probably the two most urgent and interlinked environmental challenges humanity faces are climate change and biodiversity loss (Shin *et al.* 2022).

The last decade has seen increased concerns about biodiversity loss, with multiple lines of evidence that nature and its contributions to people are declining globally at unprecedented rates (Diaz *et al*. 2019, IPBES 2019, WWF 2020).

Herein, we give insights from a biodiversity survey on invertebrates, reptiles, amphibians, and mammals from a mosaic of habitats in center Romania.

Study area, material, and methods

We carried out biodiversity surveys in the habitats near Tălmăcel town, which is in the vicinity of Tălmaciu city, in an area surrounded by a landscape consisting of deciduous and coniferous forests and many types of grasslands (45°38′49″N; 24°14′33″E) (Figure 1).

Between July and October of 2022, we carried out a biodiversity mapping activity that focused on the species of mammals, reptiles, and amphibians, but also on terrestrial invertebrates belonging to the Natura 2000 network, in Talmăcel locality, Sibiu County (Figure 1).

The fieldwork was composed of eight field campaigns. We applied the transect method for all groups. For each group, distinct transects were applied and the occurrence of any species belonging to one of the three groups (invertebrates, amphibians, and mammals) was recorded.

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Transects were made and recorded using the free LocusMap application, in which a series of polygons were delineated.

Results and discussions

Based on the data that was collected from the field we highlight three main groups of animals (see Tab. 1 for more details):

Natura 2000 Invertebrate assemblages (Figure 2)

Altogether we identified 9 Natura 2000 invertebrate species, namely:

Lycaena dispar (Haworth, 1802*), Maculinea teleius* (Bergsträsser, 1779); *Euplagia quadripunctaria* (Poda, 1761), *Morimus funereus* Mulsant, 1863; *Lucanus cervus* Linnaeus, 1758; *Carabus variolosus* Fabricius, 1787; *Pholidoptera transsylvanica* (Fischer, 1853); *Drobacia banatica* (Rossmässler, 1838); *Helix pomatia* Linnaeus, 1758.

Adding to this observation we identified suitable habitat for the well known Natura 2000 Cerambycidae species *Rosalia alpina* (Linnaeus, 1758).

Five of the species were recorded only from one location: *Morimus funereus, Lucanus cervus, Carabus variolosus, Drobacia banatica* based on exoskeleton or shell remains. All of them, especially *Lucanus cervus*, were associated with wet environments, like secondary watercourses.

Lycaena dispar was also found just in one situ, on the hydrophilic vegetation of a small pond.
Euplagia quadripunctaria, also found in one situ, was seen flying on the roadside of a forest road.

Another interesting observation performed during the study period was the finding of a new, unrecorded, *Maculinea (Phengaris) teleius* population.

Amphibian and reptile communities (Figure 3 & Figure 4)

Herpetological community identified in the study area is composed of:

Seven amphibians species: *Bufo bufo* (Linnaeus, 1758); *Bufo viridis* (Laurenti, 1768); *Rana dalmatina* Fitzinger in Bonaparte, 1839; *Rana temporaria* Linnaeus, 1758; *Bombina variegata* (Linnaeus, 1758); *Hyla arborea* (Linnaeus, 1758); *Salamandra salamandra* (Linnaeus, 1758).

Six reptiles species: *Anguis colchica* (Nordmann, 1840); *Lacerta agilis* Linnaeus 1758; *Lacerta viridis* Laurenti, 1768; *Podarcis muralis* (Laurenti, 1768); *Natrix natrix* (Linnaeus, 1758); *Zamenis longissimus* (Laurenti, 1768)

Mammal communities (Figure 5)

We identified 8 species of mammals*:*
Apodemus sylvaticus (Linnaeus, 1758); *Sciurus vulgaris* Linnaeus, 1758; *Talpa europaea* Linnaeus, 1758; *Capreolus capreolus* (Linnaeus, 1758); C*ervus elaphus* (Linnaeus, 1758); *Sus scrofa* Linnaeus, 1758; *Meles meles* (Linnaeus, 1758); *Ursus arctos* Linné, 1758.

Most of the mammal observation was based on traces, feces, corpses, or other elements that confirm the presence of the species. The direct observation of alive and active individuals was recorded only on wood mice (*Apodemus sylvaticus*), red squirrels (*Sciurus vulgaris*) and on red deer (C*ervus elaphus*).

A possible explication for these results is that most of the species recorded are more active during the night, some of them, like the Eurasian badger (*Meles meles*) are almost exclusively active at night (Kowalczyk *et al.* 2003).

Conclusions

This study provides valuable and relevant information regarding the conservation and management of natural habitats. By examining invertebrate, mammal, and herpetofauna species, it provides a comprehensive understanding of the overall ecosystem's health.

Each group of organisms has unique requirements, and presence, absence, or of such requirementscan reveal vital information about the environment's condition and potential disruptions. Moreover, the existence of large mammals like *Ursus arctos, Vulpes vulpes, Sus scrofa*, and *Cerbus elaphus* might indicate trophic chain stability and availability of food resources.

Based on the species listed in the study, several conclusions can be drawn; The Tălmăcel area boasts significant biodiversity of invertebrates, including diverse species such as *Pholidoptera transsylvanica, Helix pomatia, Drobacia banatica, Carabus variolosus, Morimus funereus, Lucanus cervus, Euplagia quadripunctaria, Maculinea teleius*, and *Lycaena dispar*.

This diversity suggests a well-developed ecosystem capable of supporting various invertebrates. The presence of specific habitats *for Rosalia alpina* also indicates suitable conditions

for the conservationally important and protected species in the Tălmăcel region.

Furthermore, the presence of mammals like *Apodemus sylvaticus, Capreolus capreolus, Cervus elaphus, Sciurus vulgaris, Sus scrofa, Talpa europaea, Ursus arctos*, and *Vulpes vulpes* highlights the area's suitability as a habitat for a variety of mammals, including those of ecological and hunting interest.

The study underscores the significance of wetlands and suitable habitats for the herpetofauna species found in the Tălmăcel area, such as *Bufo bufo, Lacerta agilis, L. viridis, Natrix natrix, Rana dalmatina, R. temporaria, Bombina variegata, Hyla arborea, Zamenis longissimus* and *Salamandra salamandra*.

Overall, the Tălmăcel area demonstrates substantial ecological value and serves as an essential habitat for conserving biodiversity, housing representative species from various taxonomic groups.

The data collected in this study lays the groundwork for future research. A more profound understanding of the present species, their interactions, and the environmental factors can inspire new investigations and analyses, contributing to the advancement of knowledge in biology and ecology.

Such studies provide fresh insights into the invertebrate, mammal, and amphibian species found in a specific region, including aspects related to ecology, behavior, and interactions with the surrounding environment.

This data holds valuable potential for conservation initiatives, enabling the identification of areas with significant biodiversity and the formulation of strategies to protect and preserve impacted habitats.

Acknowledgements

The authors are grateful for the reviewers' comments on the first version of the manuscript.

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LIST OF ILLUSTRATIONS

LISTA ILUSTRAȚIILOR

Fig. 1 The investigated area în the surroundings of Tălmăcel

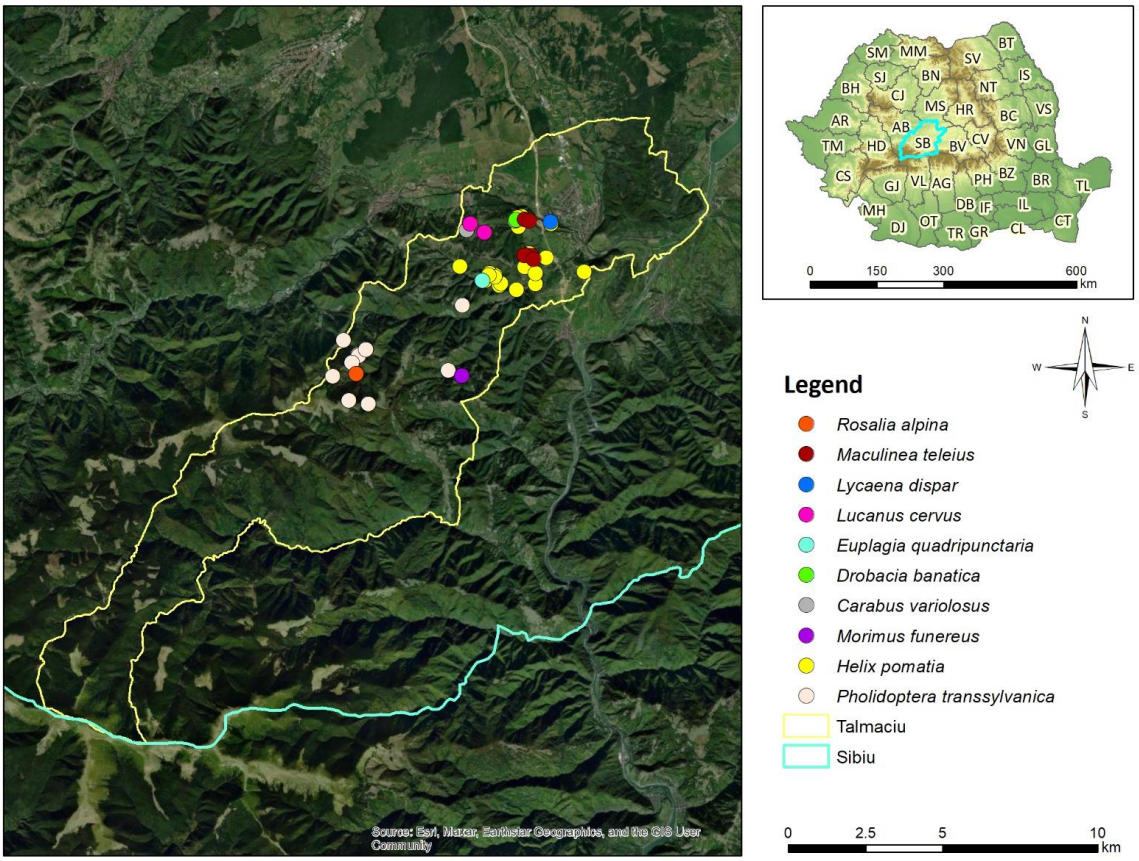

Fig. 2 Distribution map of the protected invertebrate species from Tălmăcel

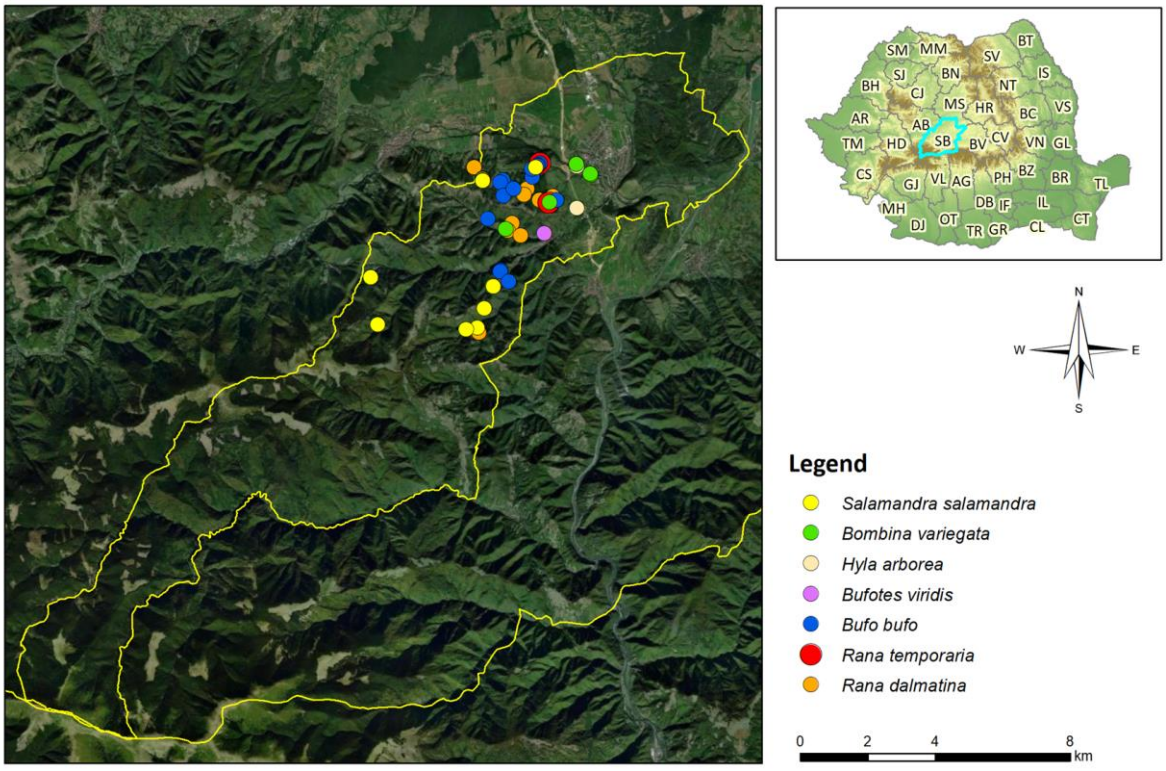

Fig. 3 Distribution map of the protected amphibian species from Tălmăcel

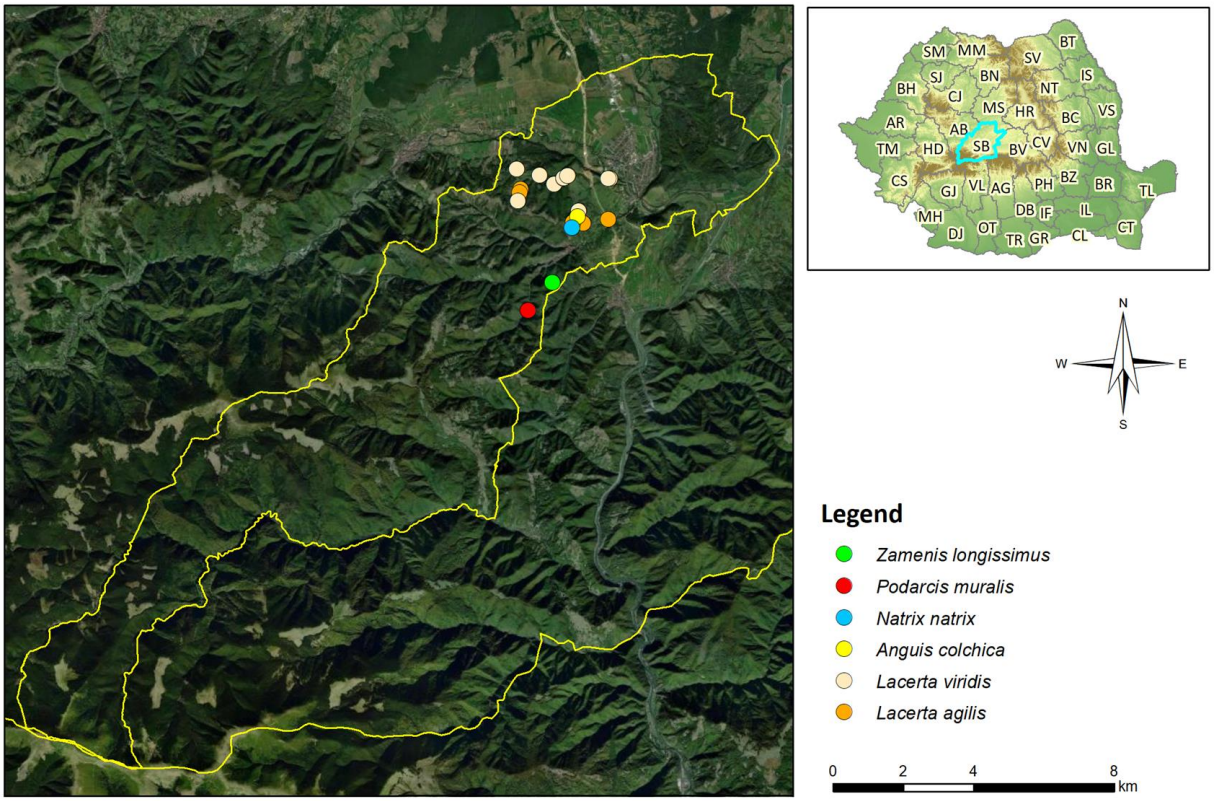

Fig. 4 Distribution map of the protected reptile species from Tălmăcel

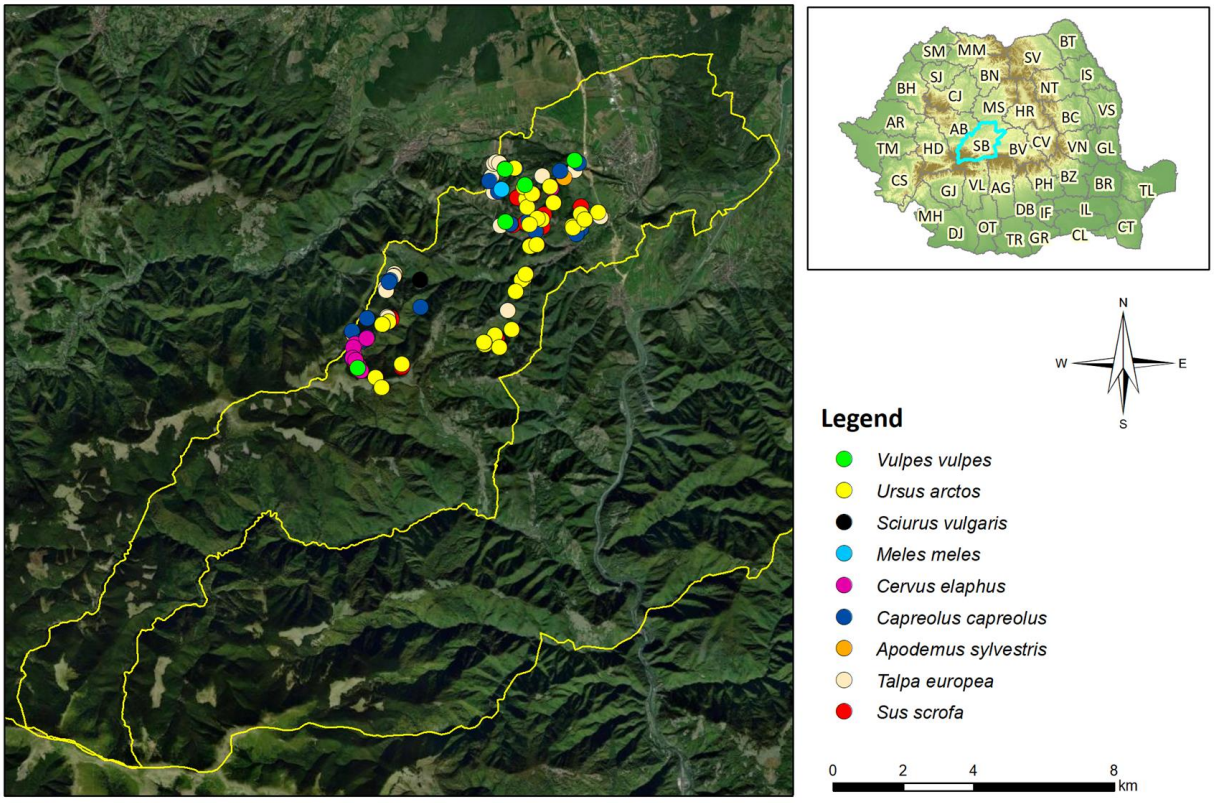

Fig. 5 Distribution map of the protected mammal species from Tălmăcel

Tab. 1. List of the protected animal species observed in Tălmăcel surroundings

Species	**Occurrence type**			
Natura 2000 species (*)	**Direct observation**	**Organism ramanins**	**Traces of activities**	**Habitat (just for invertebrates)**
INSECTA				
Pholidoptera transsylvanica *****	X			X
Lucanus cervus *****		X		X
Carabus variolosus *****		X		
Rosalia alpina *****			X	X
Morimus funereus *****		X		
Euplagia quadripunctaria *****	X			
Lycaena dispar *****	X			
Maculinea teleius *****	X			X
MOLLUSCA				
Helix pomatia	X	X		X
*Drobacia banatica******		X		X
AMPHIBIA				
*Bombina variegate **	X	X		
Bufo bufo	X			
Bufotes viridis		X		
Hyla arborea	X			
Rana dalmatina	X			
Rana temporaria	X			
Salamandra salamandra	X			
REPTILIA				
Anguis colchica	X			
Lacerta agilis	X			

Lacerta viridis	X			
Natrix natrix	X			
Podarcis muralis	X			
Zamenis longissimus	X			
MAMMALIA				
Talpa europeae			X	
Apodemus sylvaticum	X			
Sciurus vulgaris	X			
Capreolus capreolus	X	X	X	
Cervus elaphus	X		X	
Sus scrofa		X	X	
Meles meles			X	
Ursus arctos *			X	
Vulpes vulpes		X	X	

EXCEPTIONAL PRESERVATION OF SOME GASTROPODS FROM THE EOCENE OF TURNU ROȘU (TRANSYLVANIAN BASIN), ROMANIA

Nicolae TRIF *

Abstract. *Some fossil gastropods from the Eocene of Turnu Roșu, Sibiu County, found in the collection of the Natural History Museum Sibiu, show an exceptional state of preservation. Along with the integrity of the shell, some species also preserve their colour patterns. Considering that only a small number of fossils from this locality have been found in this state of preservation and also taking into consideration their age, I decided to develop the subject by describing and illustrating the specimens. Along with a series of previous articles, this one is part of the research project "Fossil invertebrates from the Transylvanian Basin and the adjacent areas".*
Keywords*: Velates, Mollusca, shell, colour, preservation*

Rezumat. *Câteva gasteropode fosile provenind din Eocenul de la Turnu Roșu, Județul Sibiu, prezente în colecțiile Muzeului de Istorie Naturală din Sibiu prezintă un grad de conservare excepțional. Alături de integritatea cochiliei, unele speciemene pastrează și culoarea. Având în vedere vechimea acestora precum și raritatea gradului de conservare pentru fosilele provenind din aceasta localitate am decis dezvoltarea subiectului prin descrierea și ilustrarea specimenelor. Alături de o serie de articole precedente și cel de față face parte din proiectul de cercetare 'Nevertebrate fosile din Bazinul Transilvaniei și bazinele adiacente'.*
Cuvinte cheie: *Velates, Molusca, cochilie, culoare, conservare*

Introduction

The fossil fauna from Turnu Roșu, Sibiu County, undoubtedly owes its fame to the vertebrates, more specifically to the fish teeth for which it has been known since the second half of the 19th century (Neugeboren, 1850, 1851). Along with this group, however, the locality has also been known for a large variety of invertebrates, especially for the Phylum Mollusca. Aside from the first report (Akner, 1850), several works from the 1960s, and the 1970s mention molluscs either in the form of lists (Mészáros, 1960), or in the form of episodic contributions published in the magazine of the Museum of Natural History in Sibiu (Mészáros & Ianoliu, 1972, 1973). Less frequently cited, nautiloids are also present in this locality, for now only in the form of rhyncholites (Șuraru, 1963). Unfortunately, after consulting the above-mentioned works in detail and after comparing them with more recent pieces of literature, it quickly becomes apparent that most of the names are not used in current taxonomy, and the material is in a dire need of revision. Now we do not intend to correct these inconsistencies, we only aim at pointing them out so that on the one hand the readers are informed and on the other hand they are provoked to a more in-depth study of this rich mollusc fauna.

The fossil collections of the Museum of Natural History Sibiu hold a large number of molluscs from the locality of Turnu Roșu. The overwhelming majority of these molluscs are preserved in the form of calcareous internal moulds. A small part, however, are exceptionally preserved in the form of the actual shell. Although it is obvious in the case of some specimens that they have been affected by diagenesis, the external morphological characteristics are very well preserved. Moreover, some specimens also preserve the external pattern of the shell, a rare detail for the Paleogene shells.

Some of the specimens of *Velates perversus* belong to the oldest part of the palaeontology collections of the museum. These collections were gathered before the beginning of the 20th century. Aside from these specimens, the internal notes from the museum and the catalogue of the collection show that during the 1990s fossil molluscs were still being collected from Turnu Roșu. Among them are a few other specimens preserved in this exceptional way.

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Geological settings

The Paleogene Basin of Transylvania is a well-known post-Cenomanian (?latest Maastrictian) sedimentary basin developed in the central part of Romania. The sedimentary formations are placed on a mixed foundation, made up of Paleozoic crystalline units, volcanic deposits and sedimentary rocks with an age in the Triassic-mid Cretaceous interval (Ciupagea et al., 1970; Săndulescu & Visarion, 1978; Krezsek & Bally, 2006; Codrea & Godefroit 2008). The studied fossils are part of the Paleogene depositional sequence of this basin. The north-western part of the basin preserves the Paleogene sequence very well, while in the southwest and south of the basin the deposits are fragmented and only some reduced areas are conserved in the form of erosional patches. One of these erosional patches is found near the village of Turnu Roșu (also known in the old geological literature as Porcesd or Porcești). A number of geologists have successively researched the area, trying to establish the age of the sedimentary succession as precisely as possible. The general Eocene age has been established in the first studies (Neugeboren, 1850, 1851; Hauer & Stache, 1863; Popescu-Voitești, 1927), but subsequent research indicated various stages of the Eocene (Bombiță, 1963; Tătărâm, 1967, 1970; Mészáros & Ianoliu, 1972, 1973; Bucur & Ianoliu, 1987) and even the probable presence of the Oligocene (Mészáros & Ianoliu, 1971). Mészáros (1996) tries to summarize the stratigraphic sequence from Turnu Roșu and lists three stratigraphic units from this area, encompassing the Ypresian-Oligocene interval in an article published in a minor publication. Unfortunately, neither the journal where he published the work, nor the structure of the article meet the minimum criteria for the definition of stratigraphic units, so their use could only be provisional. To sum it up, until now, previous studies indicate a complete Eocene sequence followed by a possible presence of the Oligocene.

Material and methods

The described material belongs to the collection of the Natural History Museum Sibiu (NHMS). The specimens described in this work have been photographed with a Nikon 5300 equipped with a Sigma 105 mm lens. A focus stacking technique has been used to obtain better images. Data related to the topography or to the stratigraphy of the collection site are not known. For the description of the shell we use the terminology of Woods & Saul (1986), while for the synonymy we use Plaziat (2012).

Systematic paleontology

Order: Archaeogastropoda Thiele, 1925

Family: Neritidae Rafinesque, 1815

Genus: *Velates* Montfort, 1810

Velates perversus (Gmelin, 1791)

Without going into too many details on the synonyms used over time, we must note the very detailed work of Plaziat (2012), which clarifies very well all the aspects related to the name of the species and its synonymy; the first author that actually followed the rule of correct binomial naming is Gmelin (1788), so he has naming priority over Walch (1775), Schmidel (1780) and Chemnitz (1786).

Description of the studied specimens:

NHMS 56222 *V. perversus* – width 57 mm, height 45 mm, thickness 34 mm. Fig. 2 (a-c). Internal mould only preserving small parts of the shell. In apertural view are present marks of the ‘teeth’ of the shell (the serrated lip of the margin of the peristome).

NHMS 41825: *V. perversus* – width 112 mm, height 80 mm, thickness 60 mm. Fig. 3 (a-b). Internal mould preserving the shell only in its lower half of the height. The spire and the shoulder are missing.

NHMS 6229: *V. perversus* – width 72 mm, height 58 mm, thickness 61 mm. Fig. 3 (c-d). Well preserved specimen with an almost complete shell. Only part of the shell margin is missing. Some bioerosional traces are present in the form of small perforations placed at equal distances. The shell shows an inscription made in black ink, *'Velates schmidelianus*, Portsechs' one of the synonymous names of *V. perversus* as well as the old name of the locality of origin (Porcești).

NHMS 6177: *V. perversus* – width 75 mm, height 71 mm, thickness 49 mm. Fig. 3 (e-f). This is another well preserved specimen but slightly crushed before fossilization hence a number of vertical cracks of the shell. The spire is very well highlighted.

NHMS 25843: *V. perversus* – width 122 mm, height 94 mm, thickness 77 mm. Fig. 3 (g). A very large specimen, well preserved in general but the spire and shoulder are missing. A small geode is present in the apical part, covered by small, colorless, calcite crystals.

NHMS 41806: *V. perversus* – width 70 mm, height 52 mm, thickness 41 mm. Fig. 4 (a-c). This one is yet another well preserved specimen, only a small part of the labral margin is missing. This is the only specimen where the callus is very quite well highlighted. The brown bands of color are visible but a little bit blurred by the erosion of the outer layers of the shell.

NHMS 6300: *V. perversus* – width 40 mm, height 36 mm, thickness 19 mm; Fig. 4 (d-e). A small specimen that we interpret as a juvenile stage. The shell is very well-preserved despite being very thin. An old label indicates another synonym of *V. perversus*, namely *Nerita conoidea*.

NHMS 25837: *V. perversus* – width 115 mm, height 89 mm, thickness 41 mm; Fig. 5 (a-b). The sample includes a second specimen, under the same number: width 100 mm, height 82 mm, thickness 70 mm that is placed underneath it (see Fig. 4b). NHMS 25837 is a specimen that preserved very well the brown color bands although, again, the spire from the apical region is missing. A small geode covered with calcite crystals is visible at the top of the shell.

Discussions

Velates perversus is a gastropod commonly found at Turnu Roșu. We observed its presence in virtually all the strata from this locality. However, the presence of the shell is rare and most of the time it is reduced to small fragments adherent to the internal mould of the gastropod. The presence of the shell complete with colour is due both to perfect conditions of fossilization and to the perfect erosion that freed the fossil from the rock. All the specimens are 'prepared' by nature, none was prepared in the laboratory.

The specimens from the collection allow us to see various preservation stages of the shell. For example, NHMS 56222 (Fig. 2a-c) only preserves small shell fragments that are attached to the internal mould. Other specimens are far better preserved. NHMS 41825 (Fig. 3a-b) preserves its shell in part, but, in this naturally sectioned specimen, we can observe a strong variation in the thickness of the shell. Thus, if at the extremity of the labral margin the shell barely reaches 1 mm in thickness, in the ablabral margin above the callus it exceeds 5 mm. The specimens NHMS 6177 (Fig. 3e-f), NHMS 6229 (Fig. 3c-d), NHMS 25843 (Fig. 3g) and NHMS 6300 (Fig. 4d-e) preserve their shell almost completely. We should note the shell size of NHMS 25843, with a width of no less than 121 mm, quite close to the largest cited specimens of the species (150 mm, in Savazzi, 1992). The specimens NHMS 41806 (Fig. 4a-c) and NHMS 25837 (Fig. 5a-b) are the ones that preserve the colour pattern of the shells. Parallel with the growth lines there are darker bands, of brown and light brown colour.

The colour is quite rarely found in fossil shells of such age (Paleocene-Eocene). Some specimens from the Paris Basin (France) or from Dudar (Hungary) show very interesting patterns in terms of colour ornamentation. These patterns can vary from shapes resembling flames, to longitudinal trapezoids, zig-zag shapes or alternating bands of colour, both longitudinal and transverse (Strausz, 1966, pl. 23 & 24; Caze & Pacaud, 2012; Plaziat, 2012, fig. 13; Dulai, 2019, p. 48). In the case of the specimens from Turnu Roșu, the colored ornamentation is much simpler, consisting of darker bands alternating with lighter areas in irregular intervals.

The stratigraphic range in which this gastropod is found is quite extended. There are reports of this species from the Thanetian all the way to the Upper Priabonian (Cossman, 1886; Villatte, 1962; Okan & Hosgor, 2009; Petrova et al., 2013; Plaziat, 2012; Gursoy & Gormus, 2020). There are also some reports of this species from the Oligocene, but it is most likely a material of uncertain origin (see Plaziat, 2012, p. 37 & 39).

In Romania, *V. perversus* is reported from several localities and formations. Its presence is known from the Căpuș Formation (Lutetian-lowermost Bartonian) from the Căpușul Mare locality (Mészáros, 1957; Tătărăm, 1963). We also had the opportunity to observe the species, in the same formation, at Vărai, Sălaj County. It is reported in large numbers from the Inucu Formation and Văleni Limestone Formation (both Bartonian), the latter also being known as 'The *Velates* limestone' (Rusu et al., 2004). The species is also known under the name of *Nerita schmideliana* from Săvădisla locality (Cluj County) – the Mortănușa Formation (Bartonian-Priabonian) (Koch, 1894). *Velates perversus* is also present in the Cluj Limestone Formation (Priabonian) (Rusu, 1995).

An unexpected report is made by Ciobanu (1977) from the Oligocene of Pietricica (Piatra Neamț, Neamț County). The author indicates the perfect similarity of his material with the specimens illustrated by Mészáros (1957). Unfortunately, the particularly poor illustration does not allow us to confirm his identification. In any case, we consider that it is not impossible that the material be reworked from the Priabonian, as it was previously

reported for other molluscs from the Oligocene Flysch (see Ionesi, 1971).

Conclusions

Turnu Roșu continues to be a particularly important site for the Paleogene of the Transylvanian Basin, not only for the vertebrate fauna, for which it is better known, but also for the invertebrate fauna. Progress in this direction is still slow, but new groups of invertebrates have been studied in recent years (see Dulai et al., 2021 ; Hyžný & Trif, 2021; Carrasco & Trif, 2021, 2023). The reopening to field research and to systematic collection will certainly bring to attention new taxa and will undoubtedly establish the provenance of some invertebrates that are already known. *Velates perversus* will surely be counted amongst them. We hope that the new stratigraphic data will shed light on the provenance of these exceptionally well-preserved specimens and, also, we are looking forward to collecting new others, equally or better preserved.

Acknowledgements

The author wishes to thank the two reviewers, Alfred Dulai (Department of Palaeontology and Geology, Hungarian Natural History Museum, Budapest) and Liana Săsăran (Babeș-Bolyai University Paleontology-Stratigraphy Museum in Cluj Napoca) for their constructive comments that brought much appreciated input to the manuscript. Thanks are also due to Ms. Aurelia Fuciu for the correction of the English language.

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Fig. 1 The use of terminology for the shell of *Velates perversus* (after Woods and Saul, 1986 – simplified). A – Apertural view showing apertural surface; B - abapertural view showing spiral surface; C - spiral view of whorl profile; 1. ablabral margin; 2. anterior (used for the abspiral end of aperture and shell margin); 3. callus; 4. inner lip edge; 5. labral margin; 6. outer lip; 7. posterior (used for the adspiral end of aperture and shell margin); 8. shoulder; 9. spire; 10. teeth; 11. height; 12. width.

Fig. 2 *Velates perversus,* NHMS 56222 (a-c); a-abapertural view; b-apertural view; c-profile view;

Fig. 3 *Velates perversus* NHMS 41825 (a-b); NHMS 6229 (c-d); NHMS 6177 (e-f); NHMS 25843 (g); a, c, e, g- abapertural views; b, d, f-profile views.

Fig. 4 *Velates perversus* NHMS 41806 (a-c); NHMS 6300 (d-e); a, d-abapertural views; b,e-lateral views; c-posterior view; the black arrows indicate the brown bands of color that are more blurred in this specimen.

Fig. 5 *Velates perversus* NHMS 25837 (a-b); a-abapertural view; b-profile view.

LISTA ILUSTRAȚIILOR

Fig. 1 Folosirea terminologiei pentru descrierea cochiliei de *Velates perversus* (după Woods and Saul, 1986 – simplificat). A – Vedere aperturală cu suprafața aperturală; B – Vedere abaperturală cu suprafața spirală; C – Vedere a profilului turului de spiră; 1. margine ablabrală; 2. anterior (termen folosit pentru capătul abspiral al aperturii și a marginii cochiliei); 3. calus; 4. marginea buzei interioare; 5. marginea buzei; 6. marginea exterioară a buzei; 7. posterior (termen folosit pentru capătul adspiral al aperturii și a marginii cochiliei); 8. umăr; 9. spiră; 10. dinți; 11. înălțime; 12. lățime.

Fig. 2 *Velates perversus,* NHMS 56222 (a-c); a-vedere abaperturală; b-vedere aperturală; c-vedere din profil (vedere laterală);

Fig. 3 *Velates perversus* NHMS 41825 (a-b); NHMS 6229 (c-d); NHMS 6177 (e-f); NHMS 25843 (g); a, c, e, g-vedere abaperturală; b, d, f-vedere din profil.

Fig. 4 *Velates perversus* NHMS 41806 (a-c); NHMS 6300 (d-e); a, d-vedere abaperturală; b,e-vedere din profil; c-vedere posterioară; săgețile negre indică benzile de culoare care în acest specimen sunt mai neclare.

Fig. 5 *Velates perversus* NHMS 25837 (a-b); a-vedere abaperturală; b-vedere din profil.

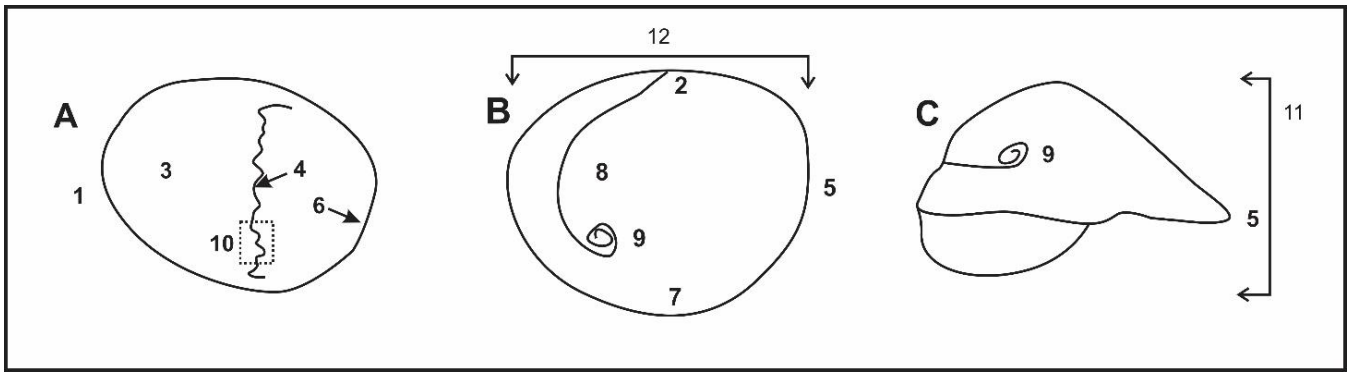

Fig. 1. The use of terminology for the shell of *Velates perversus* (after Woods and Saul, 1986 – simplified)

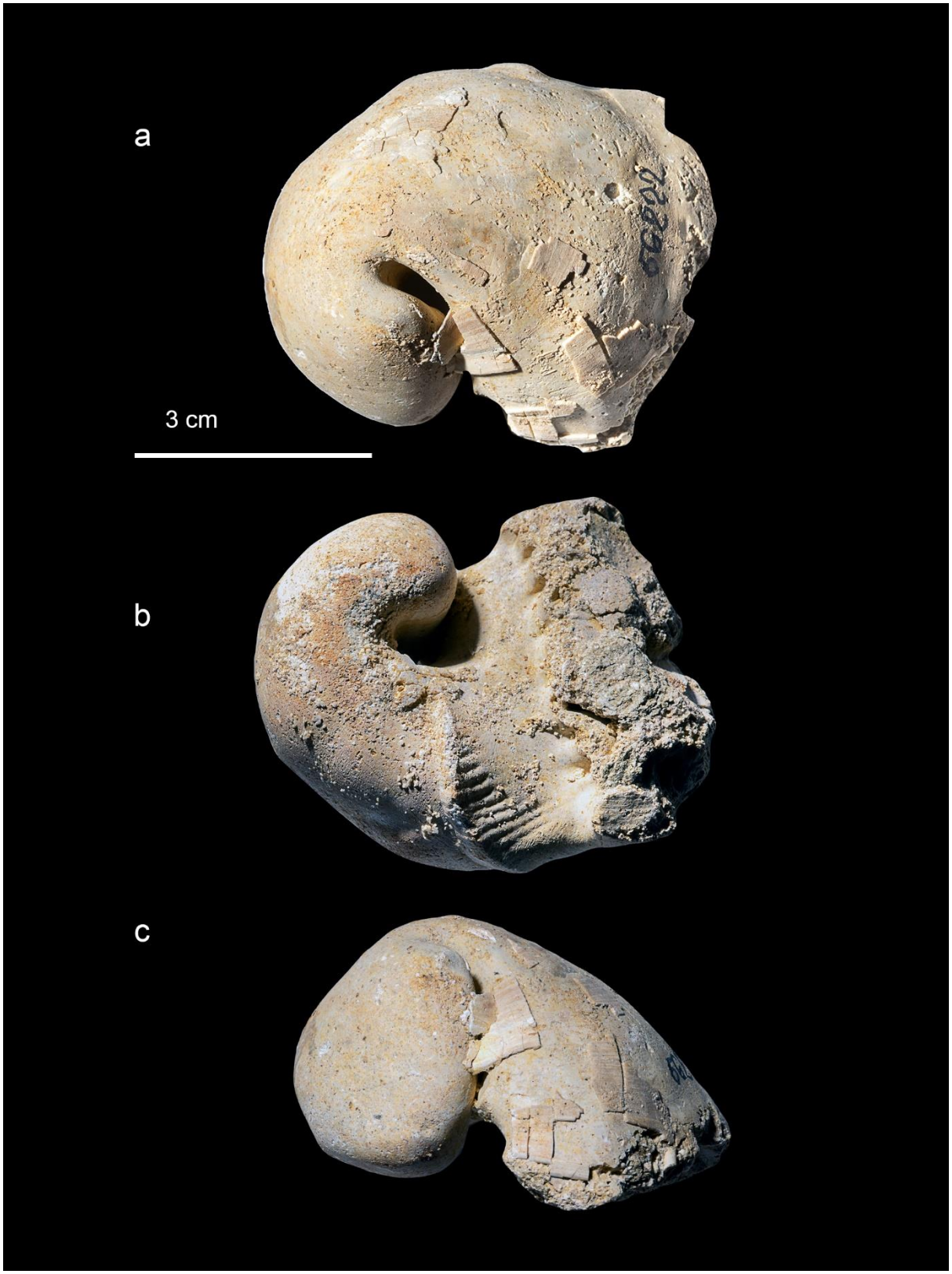

Fig. 2. *Velates perversus*, NHMS 56222 (a-c); a-abapertural view; b-apertural view; c-profile view.

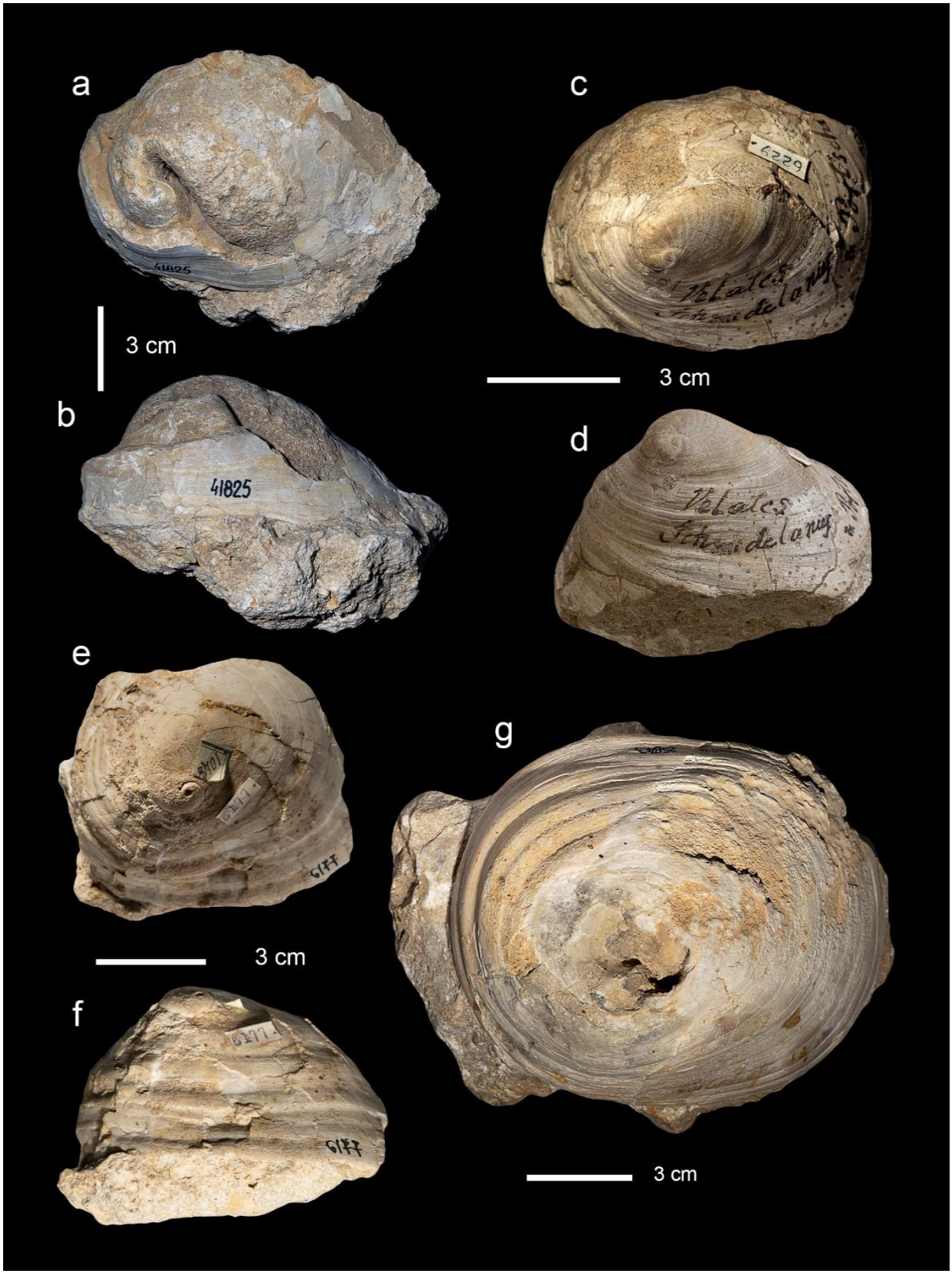

Fig. 3. *Velates perversus* NHMS 41825 (a-b); NHMS 6229 (c-d); NHMS 6177 (e-f); NHMS 25843 (g); a, c, e, g- abapertural views; b, d, f-profile views.

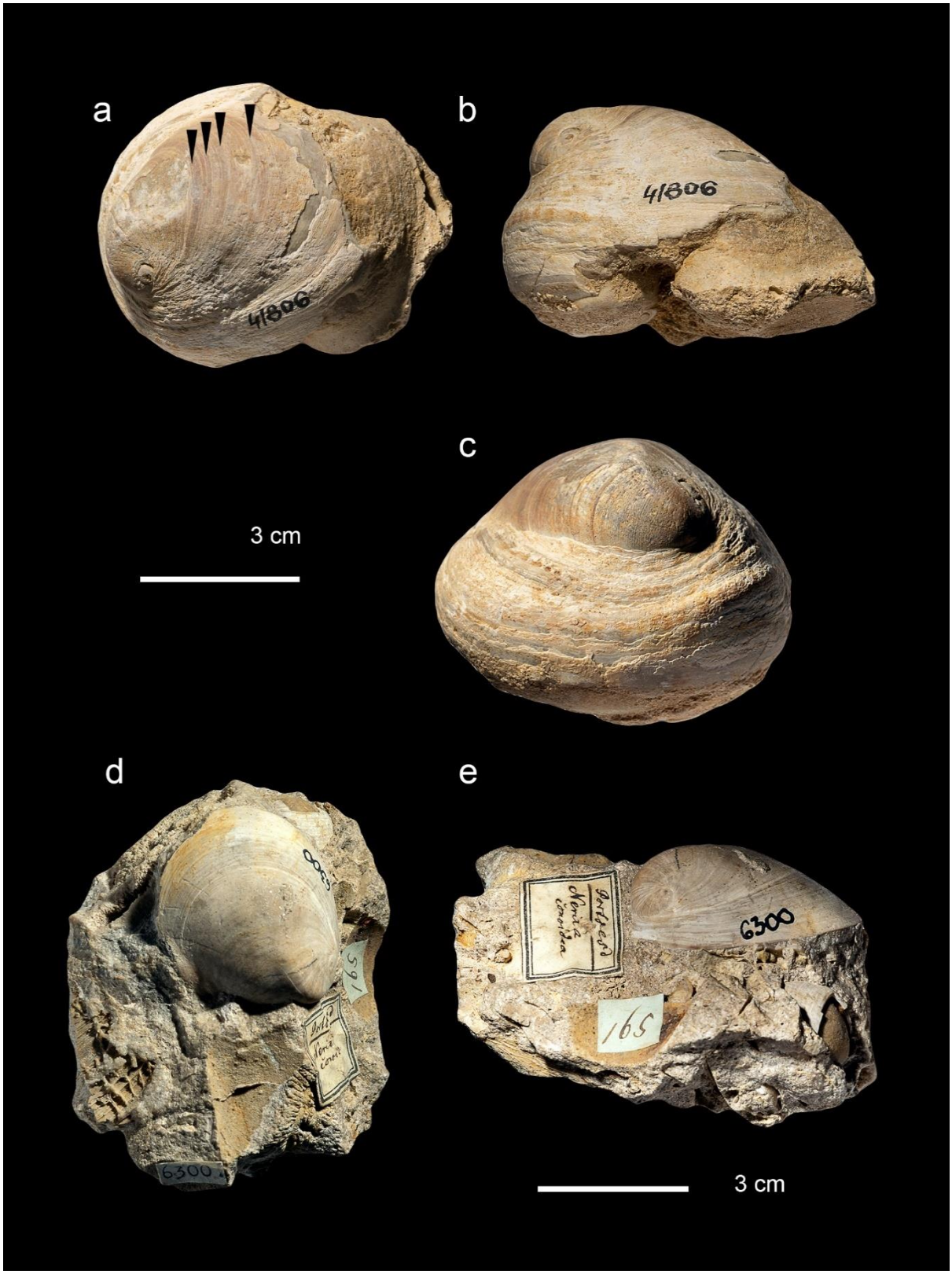

Fig. 4. *Velates perversus* NHMS 41806 (a-c); NHMS 6300 (d-e); a, d-abapertural views; b,e-lateral views; c-posterior view; the black arrows indicate the brown bands of color that are more blurred in this specimen.

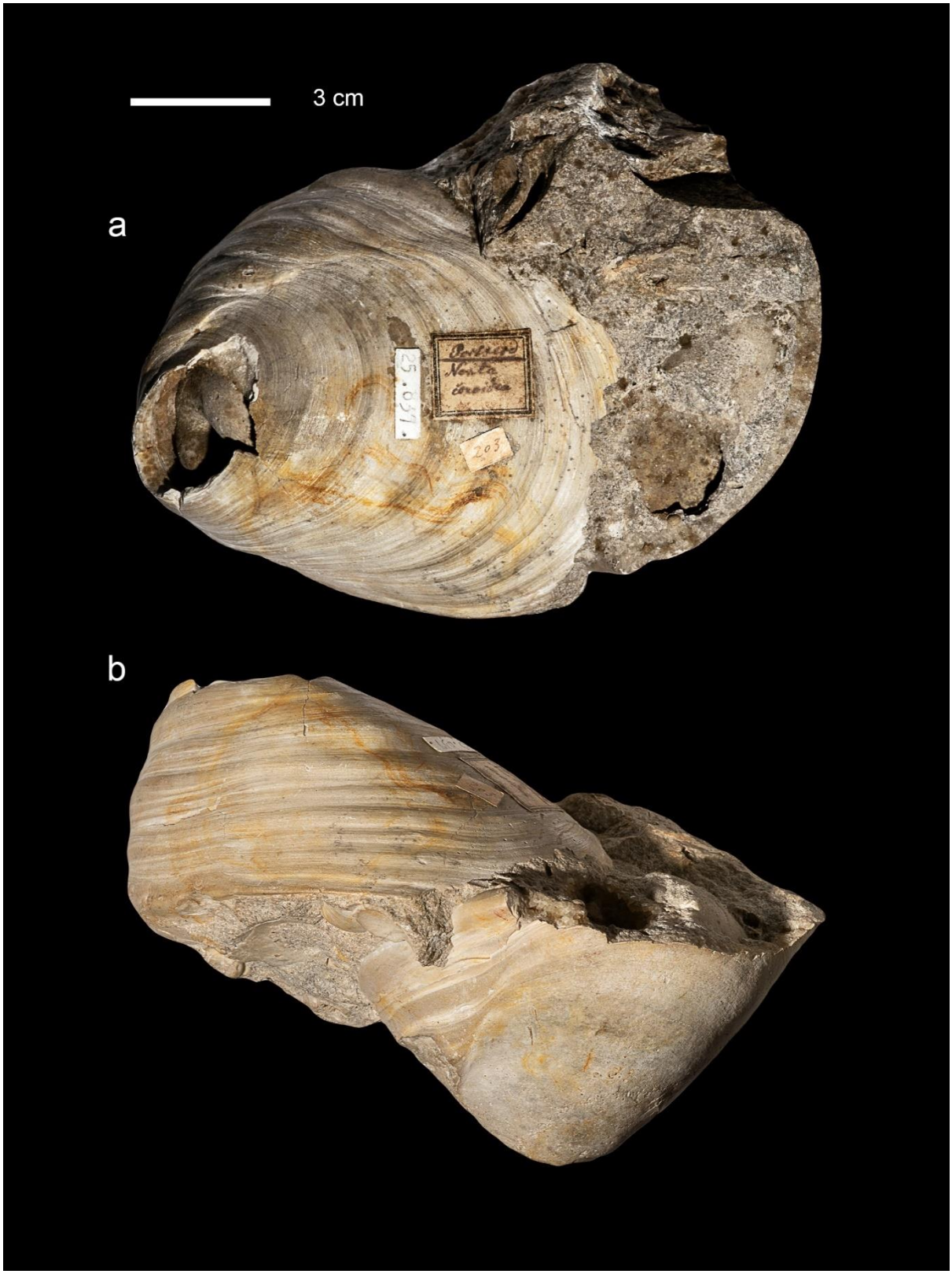

Fig. 5. *Velates perversus* NHMS 25837 (a-b); a-abapertural view; b-profile view.

DINOSAURS FROM RÂPA ROȘIE IN THE COLLECTIONS OF BRUKENTHAL NATIONAL MUSEUM SIBIU (TRANSYLVANIA, ROMANIA)

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Abstract. *Located in South-Western Transylvania (Romania), Râpa Roșie was and still is a controversial outcrop for the researchers which dealt with its deposits. Several opinions about the geological age of these red beds were proposed by diverse authors. We briefly discuss here this aspect, considering that an uppermost Cretaceous age (Maastrichtian) for these deposits is reliable. However, there is still a lot of study to be done in the area in order to clarify once and for all this age aspect of the deposits cropping out there. Herein, we record two sauropod caudal vertebrae which for a long time were 'lost' in the deposits of the Natural History Museum (branch of Brukenthal National Museum in Sibiu). Unfortunately, the specimens are very fragmentary and bear few diagnostic characters. However, we managed to assign these vertebrae to Titanosauria indet., possibly (?)Lithostrotia. Due to this rediscovery the number of museums from Romania which curate Maastrichtian reptiles in their collections increases.*
Keywords*: Maastrichtian, sauropods, Titanosauria, Transylvanian Basin, Romania.*

Rezumat. *Localizată în sud-vestul Transilvaniei (România), Râpa Roșie a fost și este un afloriment controversat pentru cercetătorii care s-au ocupat cu studiul depozitelor de acolo. O serie de opinii cu privire la vârsta geologică a acestor red beds-uri au fost propuse de către diverși autori. Discutăm, pe scurt, în cadrul acestui studiu acest aspect, considerând că o vârsta cretacic terminală (Maastrichtian) pentru aceste depozite este credibilă. Cu toate acestea, mai este mult de studiat în zonă pentru a clarifica odată și pentru totdeauna acest aspect legat de vârsta depozitelor care aflorează aici. Semnalăm în acest studiu două vertebre caudale de sauropod care multă vreme au fost „pierdute" în depozitele Muzeului de Istorie Naturală (secție a Muzeului Național Brukenthal din Sibiu). Din păcate, specimenele sunt foarte fragmentare și păstrează puține caractere diagnostice. Cu toate acestea, am reușit să atribuim aceste vertebre la Titanosauria indet., posibil (?)Lithostrotia. Datorită acestei redescoperiri, numărul muzeelor din România care găzduiesc în colecții reptile maastrichtiene, crește.*
Cuvinte cheie: *Maastrichtian, sauropode, Titanosauria, Bazinul Transilvaniei, România.*

Introduction

Located on the south-western side of the Transylvanian Depression (Fig. 1A-C), ca. 4 kms NE to Sebeș town in bird's-eye view, in Alba County, Râpa Roșie (The Red Ravine) is an exceptionally large outcrop (ca. 800 m in length and heights between 50 and 425 m, at 300 - 425 m altitude; 45°59'15''N, 23°35'29''E) exposing latest Cretaceous (Maastrichtian) *red beds* of terrestrial origin related to the Șard Formation (Codrea, Dica 2005), capped by Middle Miocene (Badenian) marine deposits.

Due to its landscaping (the erosion carved in these rocks a very peculiar relief with vertical pyramids and columns resembling organ tubes, towers, obelisk-like, buttresses etc. (Fig. 2A-B); a control factor was the contrasting lithology, with harder rocks in alternation with softer ones, that led to differential erosion; Codrea 2018) rare in our country, comparable with the 'badlands' of North America as well as for the botanical and geological value, this site was included (1969, 2000) among the protected natural sites in Romania as IUCN III

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rank, on ca. 0.48 km^2 (code RONPA019) (https://ro.wikipedia.org/wiki/R%C3%A2pa_Ro%C8%99ie). There is an obvious esthetic effect of the results of the differential erosion that have generated the pyramids of erosion, as ephemeral as their remanence, as surprising in their geometries, on the visitors, professionals or not. Just ca. 1.5 kms to NW from Râpa Roșie, the geological exposure is completed by Râpa Lancrămului (The Lancrăm Ravine), of smaller surface, where same formations can be observed. The geological researches carried on in the area paid less attention to this outcrop. The site was not declared as a natural reserve, although the value - at least the geological one - is clearly comparable to Râpa Roșie. These sites have attracted the attention of researchers interested in Earth Sciences since the 19th century. Koch (1900) was among the firsts who also illustrates this site.

In the rocks exposed at Râpa Roșie several vertebrate fossils were found, actually housed in public and private museums, possibly private collections, although such status contravenes legislation on protected sites and restrict the access of professionals to these fossils. Some of them originating from this site are housed in the Brukenthal National Museum in Sibiu, as part of the natural sciences collection. This paper focuses on these fossils, until now unknown to the paleontologists and the large public, which were found by one of us (NT) in this collection. They originate from an old find in October 18, 1956. The donors, N. I. Doltu (former manager of the Natural History Museum branch of the Brukenthal National Museum) and Aurel Gerasim, mentioned on the related label that the bones were collected from a "shallow creek in the middle sector of the outcrop". Although these data are scarce, one may presume that they originated from the basal half of the clastic succession. It is well known that there is a difference between the base of the outcrop which is coarser detrital and the top, where there is a clear fining-upward tendency.

Geological setting

The south-western side of the sedimentary basin of Transylvania is an illustrative area for the pre-Cenozoic geological history of this structural unit (Vancea 1960; Ciupagea *et al.* 1970; Krézsek, Bally 2006; Fig. 1C). Uppermost Cretaceous-Paleogene deposits are cropping out on extended areas. In this sector, lithostratigraphic units based on deposits of marine, brackish, but mainly terrestrial origins were coined by Codrea, Dica (2005). In uppermost Cretaceous (?Campanian – Maastrichtian), consequence of the 'Laramide' tectonic pulse, occurred transitions from the deep to shallow marine flysch environments of the Bozeș Formation (Ghițulescu, Socolescu 1941; Bălc *et al.* 2007) to the terrestrial ones of the Șard Formation (Codrea, Dica 2005). Such transition is clearly visible at Petreștii de Jos in the Sebeș riverbed (site discovered in 2003 by Vlad Codrea and Cristina Fărcaș; Codrea *et al.* 2010a; = Petrești-Arini in Vremir *et al.* 2014) where can be noticed the superposition of the terrestrial *red beds* over the marine flysch and shallow water marine and brackish deposits (transition with numerous repetitive flysh-bracking and brackish-terrestrial interbedding) with mollusks and corals. On the right bank of the Mureș River at Vurpăr, this transition involves the thick deltaic deposits of the Vurpăr Formation (Codrea, Dica 2005) interspersed between the Bozeș Formation and the terrestrial *red beds* of the Șard Formation (Codrea, Dica 2005). The sedimentology of the *red beds* reflects their origin from occasional braided fluvial system with pedogenetic levels as overbank deposits and generations of superposed channels filled by coarse and medium associations of pebbles, microconglomerate, sand, weakly cemented, with high weathering tendencies. Pond-like deposits reflecting the possible presence of restricted lacustrine environments are at Oarda de Jos, and levels where concentrate vertebrate, invertebrate fossils and fossil wood were reported in Lancrăm and Oarda B (Codrea *et al.* 2001, 2010a; Solomon *et al.* 2010, 2022a, b and related references). The floodplain was poorly drained and some of the abandoned fluvial channels have been reactivated in the rainy seasons, as in Oarda A (Codrea *et al.* 2013; Solomon *et al.* 2022a, b).

At Râpa Roșie, the basal portion of the outcrop is illustrative for dynamic river flows that accumulated coarse detrital rocks with a source area presumed to be located in the Southern Carpathians, as long as marker rocks as pegmatites of such provenience occur among the reworked pebbles and boulders embedded into the arenites and red clay stones. This basal portion can be interpreted as a proximal alluvial fan. In the upper portion of the outcrop a fining upward tendency is noticeable, dominated by red silty clay mixed with arenites and pebble, reflecting more distal fluvial fans.

In this upper portion, several vertebrate fossils were found, as the giant azhdarchid pterosaur *Hatzegopteryx* documented by an isolated cervical vertebra (Vremir *et al.* 2009; Naish, Witton 2017;

Solomon *et al.* 2020 and references therein), the crocodile *Allodaposuchus* (Nopcsa 1928) or various dinosaurs, the most frequent bones being the ones of sauropods (e.g., Nopcsa 1905; Grigorescu 1987; Jianu *et al.* 1997; Codrea *et al.* 2008), all this assemblage being specific for the so-called 'Hațeg Island'. These fossils are evidence for the extension of this 'island' outside Hațeg, toward NE (Codrea *et al.* 2010a).

Over the latest Cretaceous sequences at Râpa Roșie, Middle Miocene (Badenian) transgressing deposits are capping the succession. Their color is in dominance grayish, in contrast with the red one of the underlying deposits. In the basal portion there are coarse conglomerates, reworking various metamorphic and older sedimentary Cenozoic rocks. Among the last ones there are Paleogene boulders and pebbles of various lithologies (Solomon *et al.* 2010). Based on such presence, one may presume that they originated from deposits of this age that once were unconformably lying over the metamorphic basement on the Southern Carpathians, as in the patches that can be actually observed at Turnu Roșu (= Porcești; Mészáros 1996), Apoldu de Sus (Mészáros *et al.* 1977) or Dobârca (Maxim 1965; Tissier *et al.* 2018), all these localities situated in Sibiu County. These Paleogene deposits have been dismantled, razed by successive erosional events, today meaning strictly local occurrences, as patches capping the old Carpathian basement. At the time of the Badenian transgression, they were certainly by far more extended. It worth to be noticed that their source areas were not located towards N-NW as long as the lithologies of the Priabonian-Rupelian rocks of the Ighiu Formation (Gherman 1943, emended by Codrea, Dica 2005) are rather different from the ones noticed in the boulders at Râpa Roșie. Probably the Ighiu Formation illustrates a transgression occurred in the latest Eocene, with waters transgressing from N-NE.

The geological age of the Râpa Roșie deposits was for long time rather unclear. It was presumed that these *red beds* could be Oligocene (Bleahu, Damian 1967; Bleahu *et al.* 1976; Grigorescu 1987), lowermost Miocene (Vancea 1960; Codrea, Dica 2005; Codrea *et al.* 2010a) or even Middle Miocene (Ciupagea *et al.* 1970). Vremir *et al.* (2009) and Codrea *et al.* (2010b) reconsidered the geological age of the Râpa Roșie *red beds*, considering it as uppermost Cretaceous.

Although this aspect was underlined (Solomon *et al.* 2010; Codrea 2018), it worth to reiterate that the Paleogene boulders (limestones and sandstones) reworked in the Middle Miocene marine deposits actually occur exclusively on the SE extremity of the outcrop, in the other areas apparently missing. These rocks slipped downward on the red mudstone during the heavy rains and were even embedded in the red mudstone. This resulted in an apparent 'autochthony' of these rocks, which has misled a number of geologists. The Paleogene rock boulders, reworked probably from the southern border of the Southern Carpathians (where Paleogene rocks are currently recorded at Turnu Roșu - the former locality Porcești -, Apoldu de Sus or Dobârca, all localities in Sibiu County; Maxim 1965; Mészáros *et al.* 1977; Codrea 2000; Fărcaș 2011; Tissier *et al.* 2018) in Badenian, formed before the Middle Miocene transgression more extended deposits that covered large parts of the mountain border. These Paleogene deposits were dismantled by the transgression as a result of the New Styrian tectogenesis.

The Paleogene rocks reworked in Middle Miocene deposits could be also a reflective subject related on the one hand to the post-Paleogene erosional processes in the southern Transylvanian Basin, and on the other hand in the reconstruction of the paleogeography of the land *vs.* water distribution for the geological age in question. It could offer arguments for upgrading the existing paleogeographic reconstructions (e.g., Saulea *et al.* 1970). For example, on the subject where was the connection between the Transylvanian Basin and the Petroșani Basin, in which stage it became functional?

For years, it was a confusing argument pleading for the Paleogene age of the Râpa Roșie rocks (e.g., Bleahu *et al.* 1976; Codrea, Dica 2005). More than that, the fossil bones collected from the basal portion of the outcrop exposed heavy marks of a long water transport, as it was the case of the fragment of the turtle *Kallokibotion* plastron reported by Codrea, Vremir (1997). For this reason, Grigorescu (1987) considered that the fossil bones and teeth from Râpa Roșie were in fact reworked from older, Maastichtian deposits. Later, the fossils collected from the upper portion of the outcrop demonstrate that a pre-burial rework would have been difficult to accept for spongious and fragile bones, as in the case of the azhdarchid vertebra (Vremir *et al.* 2009, 2013). However, a closer look on the taphonomy of Râpa Roșie is still needed, as well as a richer sample of fossils.

If we consider Sebeș-Glod and Petrești de Jos localities as illustrating the basal portion of the succession that continues at Râpa Roșie, it is obviously clear that these deposits bear uppermost Maastrichtian vertebrates (microvertebrates and large vertebrates) *in situ* (Codrea *et al.* 2010a, b; Solomon *et al.* 2020 and references therein).

A comparison of the Șard Formation with the Jibou Formation (Hoffman 1879) from NW Transylvania leads to different geological patterns. In the first one, the uppermost Maastrichtian concerns a thick pile of *red beds* and other related rocks, while at Jibou the Maastrichtian deposits are probably present just in the basal most portion (Codrea, Godefroit 2008), the following sequences being Paleogene. If lacustrine facies are of Maastrichtian age in Șard Formation, in Jibou Formation all the lake deposits as the ones of Rona-Jibou or Horlacea are Paleogene (Rusu 1995; Gheerbrant *et al.* 1999; Codrea, Dica 2005; Codrea *et al.* 2010b). The top of the Șard Formation was doubtless, subject of aggressive erosion at the beginning of Cenozoic, which razed the sedimentary sequences from its top. Later, the transgressing marine and brackish Upper Priabonian and Lower Oligocene (Rupelian) deposits of the Ighiu Formation capped the uppermost Cretaceous sequences amplifying the erosional effects. But the Paleogene marine transgression was a short event extended only on a restricted area north to Alba Iulia municipality. After, the area became emerged as long as the Oligocene fluvial *red beds* of the Bărăbanț Formation (Codrea, Dica 2005) covered the underlying rocks.

Material and methods

The fossils herein described are represented by two fragmentary vertebrae housed in the Natural History Museum branch of the Brukenthal National Museum in Sibiu (Romania). The methodology (anatomical terminology, systematics) follows Mocho *et al.* (2022) with references therein. Measurements were taken with a digital caliper (precision 0.1 mm). Photographs on the specimens were taken with a D5300 Nikon camera and a 105 mm Sigma lens. Extended-focus images for each specimen were produced using the photo stacking technique. Institutional abbreviations: BM – Brukenthal National Museum Sibiu (Romania).

Systematic paleontology

Dinosauria Owen, 1842
Sauropoda Marsh, 1878
Eusauropoda Upchurch, 1995
Titanosauria Bonaparte and Coria, 1993
Titanosauria indet.

Materials

Two caudal vertebrae, BM 43336 (Fig. 3A-E) and BM 43337 (Fig. 4 A-D).

Locality

Sebeș – Râpa Roșie, Șard Fm.; uppermost Maastrichtian (Codrea *et al.* 2010b, c).

Description. BM 43336 is a fragmentary middle caudal vertebra (Fig. 3A-E). It concerns ca. (?) anterior third of the centrum, broken in the area of the neural arch (Fig. 3A). The neural arch was also broken (the break has a fresh look, probably occurred when the bone was extracted from the matrix rock; the neural canal is still filled by a small amount of the matrix rock represented by coarse gray-whitish quarzitic sand and red silt), only its broken base can be observed (Fig. 3A). At its junction with the centrum, there is an elongated fossa. The neural arch didn't reach the edge of the articular surface. This surface was heavily damaged, probably by the pre-burial hydro-taphonomy (Fig. 3E). Its initial outline is hard to be reconstructed, but one may presume that it was sub circular, wider on mediolateral direction. The lateral face is dorsoventrally concave (Fig. 3C-D). The preserved portion of the ventral face is flat, bounded by two ridges (Fig. 3B). These ridges diverge near their contact with the articular surface, but further they are parallel. The chevron facets cannot be observed; they were probably absent.

BM 43337 (Fig. 4A-D) is a posterior caudal vertebra poorer preserved. Practically no useful morphological details can be observed on this specimen. The articular surface is heavily worn (Fig. 4A-D). The dorsal surface (Fig. 4A) is by far more damaged than the ventral one (Fig. 4B). The ventral face is flat, bounded by two ridges (Fig. 4B) as in BM 43336. The single aspect that worth to be noted concern a couple of circular bite-marks (Fig. 4C-D) on the lateral sides of the centrum (diameters in mm: 11.07 and 9.20) left probably by a crocodile or a theropod dinosaur.

The vertebrae originated from young individuals. Both are extremely poor preserved and it is hard even to establish their clear orientation. If we consider the articular surface in BM 43336 to be the anterior one (in Fig. 3A, trended upward, Fig. 3E), and if we notice a ventral hollow bordered by

the ridges, we may even presume that this vertebra documents a (?)Lithostrotian titanosaur. The presence of such dinosaurs is not surprising, as long as Mocho *et al.* (2022) reported such dinosaurs in various localities from the Metaliferi sedimentary area, in Șard Formation.

Measurements (in mm).

BM 43336:
Mediolateral width of the (?) anterior surface of the centrum: >56.0
Mediolateral width of the centrum: 43.0
Dorsoventral width of the centrum: 43.0

BM 43337:
Mediolateral width of the centrum: 37.0
Dorsoventral width of the centrum: 43.0

Discussions

The sauropod caudal vertebrae herein reported cannot add too many additional knowledge neither concerning the systematics, nor on stratigraphy, due to their fragmentariness and too few preserved characters. However, on the basis of the few preserved characters, we assign these sauropod vertebrae to Titanosauria indet., possibly a (?) Lithostrotian member.

Over and above the seduction caused by erosional processes, the relationships between the sedimentary sequences forming the outcrops in the vicinity of Sebeș has been the subject of controversy since the second half of the 19th century. In solving this problem, the fossil vertebrates and their related taphonomy is of main interest.

It is well known that there was a divergence in the allocation based on several bones recovered from the outcrop, referred by Koch (1900) to "*Aceratherium* cf. *goldfussi* Kaup", but which Nopcsa (1905), who examined them himself, considered to be bones of sauropod limbs (humerus, femur). Unfortunately, our attempt to recover and re-study them remained unsuccessful, the fossils probably being lost or carelessly stored at the college in Sebeș where they were housed. Probably based mainly on this argument Koch considered the deposits at Râpa Roșie as early Miocene, an opinion later shared by Ilie (1955).

Grigorescu (1987) mentioned at this locality fragmentary ankylosaur bones (humerus) showing "obvious reworking signs" and an undetermined tooth of a theropod dinosaur. As a result, he considered that there was an Upper Maastrichtian formation in the region that provided erosional derived material (including vertebrate fossil remains) that was redeposited into Oligocene deposits such as those at Râpa Roșie.

In the last three decades a lot of field works were carried out in this region by different teams (e.g., Codrea *et al.* 2001; Csiki-Sava *et al.* 2016; Solomon *et al.* 2020, 2022a, b and references therein). In a first attempt, the terrestrial Șard Formation (Codrea, Dica 2005) was considered to represent the equivalent of 'the Jibou Formation, the whole lower marine series (Bartonian-Priabonian), the continental Valea Nadășului Formation and the base of Cluj Limestone (Priabonian)'. They considered the Râpa Roșie *red beds* as an Early Miocene formation, laying over the Sântimbru Formation. Sometime later, Codrea, Mărginean (2007) considered the Șard Formation as uppermost Cretaceous, older than the deposits of Râpa Roșie, consequently agreeing with the stratigraphic model proposed by Grigorescu (1987, 1992) with this formation as source of the rocks and fossils reworked at Râpa Roșie.

An argument for such geological ages was also the status of the vertebrate fossils collected from this outcrop, all exposing obvious reworking marks (Codrea, Vremir 1997; Jianu *et al.* 1997; Codrea *et al.* 2008). The discovery of the very large pterosaur *Hatzegopteryx* cervical vertebra (Vremir *et al.* 2009) changed this taphonomic pattern. The authors considered that such bone could not be reworked maintaining its pristine shape and therefore, one may presume that the fossil was autochthonous in this deposit and the hosting *red beds* should be older than presumed, i.e., Maastrichtian. They concluded that 'the informal "Sebeș Formation" must be distinguished within the newly-defined Șard Formation as more energetic alluvial facies, however with a different source area'. This viewpoint was published one year later by Codrea *et al.* (2010a), but in the same year Codrea *et al.* (2010b) reconsidered this viewpoint suggesting that the *red beds* from Râpa Roșie should be included in the Șard Formation. The same viewpoint was underlined by Codrea *et al.* (2010c) and in addition, questioning the continuity of sedimentation of the Șard Formation in the Paleogene. Pre-Priabonian, in the region erosion events occurred and at least a part of the *red beds* were razed. If in NW Transylvania in the Jibou Formation the K/T boundary could be present, in the Metaliferi sedimentary area it is unrealistic to look for this boundary inside the Șard Formation.

For instance, one can consider the *red beds* from Râpa Roșie as part of the Șard Formation as long

as no disconformity was found between the uppermost Cretaceous *red beds* exposed in the Sebeș riverbed and the ones of the Râpa Roșie. But it is also true that in the area there are not sufficient outcrops to allow continuous taphonomic observations in the field. In our opinion, the main difference between the deposits of the Șard Formation exposed on the right bank of the Mureș River and the *red beds* of Râpa Roșie concern the different source areas, i.e., Apuseni Mountains *vs.* Southern Carpathians. From a systematic viewpoint the fossil vertebrates are the same in all these terrestrial sequences.

Concluding remarks

The two sauropod dinosaurs' caudal vertebrae herein described, found in the Brukenthal National Museum collections in Sibiu where they had been forgotten for decades, do not add much to what was known about Sebeș – Râpa Roșie locality. However, if the vertebrae belong to a (?) Lithostrotian, they firstly document the presence of these sauropods in this locality. Such fossils are a challenge for further field investigations, which can certainly add to our understanding of the geological history at the end of the Cretaceous in what is paleogeographically known as 'Haţeg Island'. Moreover, the fossils are important because they increase the number of museums from Romania which curate Maastrichtian reptiles in their collections.

The taphonomy of the sedimentary sequences is far from being clarified. The presence of the giant pterosaur *Hatzegopteryx* vertebra may well argue in favor of the autochthony of that fossil in the sediments, but it may just as well be the result of a short pre-burial transport of fossils from older sedimentary sequences into geological younger rocks that left no evidence of reworking. A topic that worth further investigation is the extent to which there is continuity between the Sebeș riverbed deposits and the Râpa Roșie sedimentary sequences, or whether there is a discontinuity between these deposits. The facies exposed at Lancrăm in the Sebeș riverbed are quite different in appearance from the known lithologies and sedimentation style at Râpa Roșie. A detailed sedimentological study for that outcrop has not yet been carried out by any geologist.

What is unquestionable refers to the basal sequence at Râpa Roșie, which reflects a coarse clastic aspect sedimented in a highly dynamic fluvial environment. Consequently, almost all vertebrate remains collected so far from these rocks show marks of pre-burial water transport. The same is true for the two vertebrae described in this study. Obviously, the palaeontological research should be continued at Râpa Roșie, any additional finds being valuable for the knowledge of the geology and stratigraphy of this challenging area.

Acknowledgements. VAC thanks Dr. Pedro Mocho (University of Lisbon) for his support for this study. We thank Dr. Cristina Fărcaș for drawing the Fig. 1. The authors thank both anonymous reviewers for their critical reading of the manuscript and for their suggestions. The authors supported this research by their own expenses.

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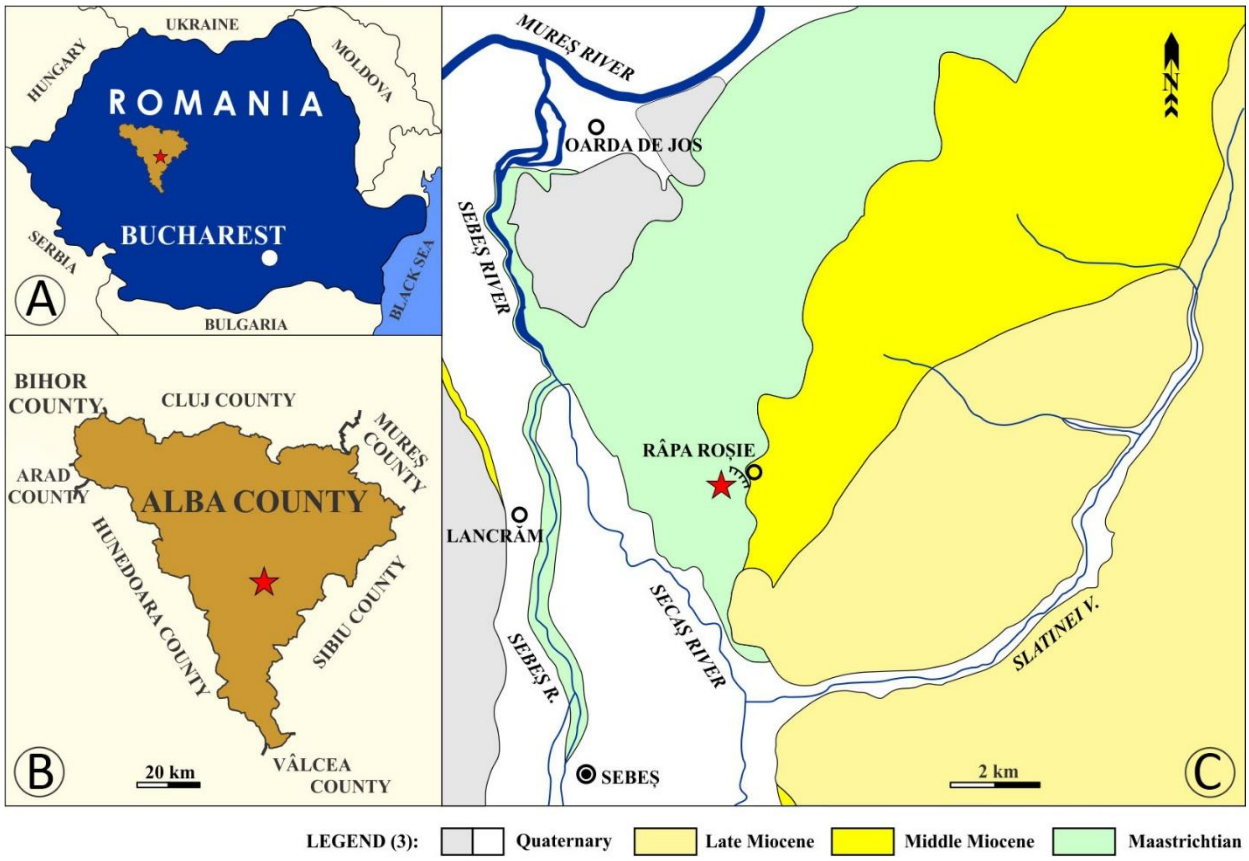

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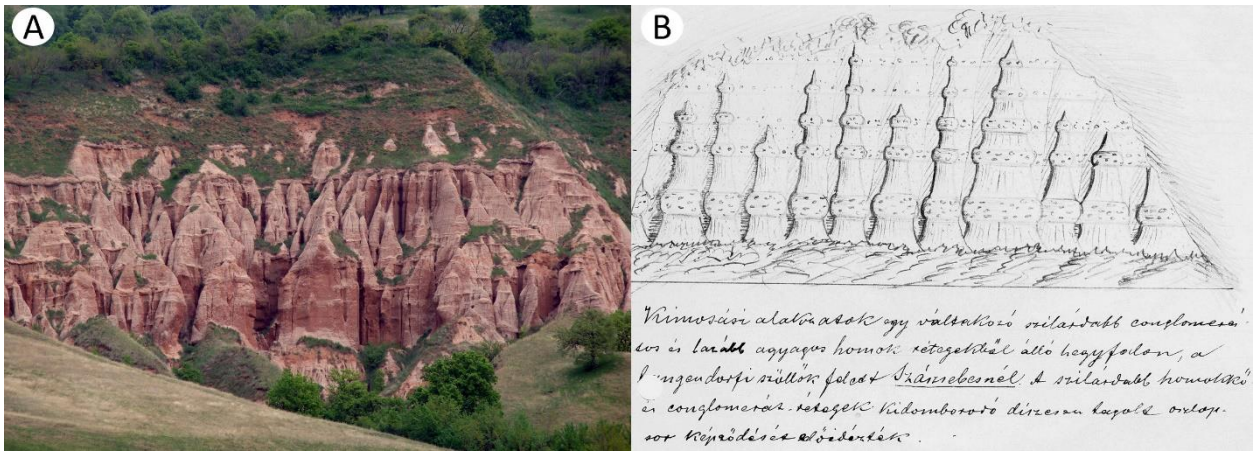

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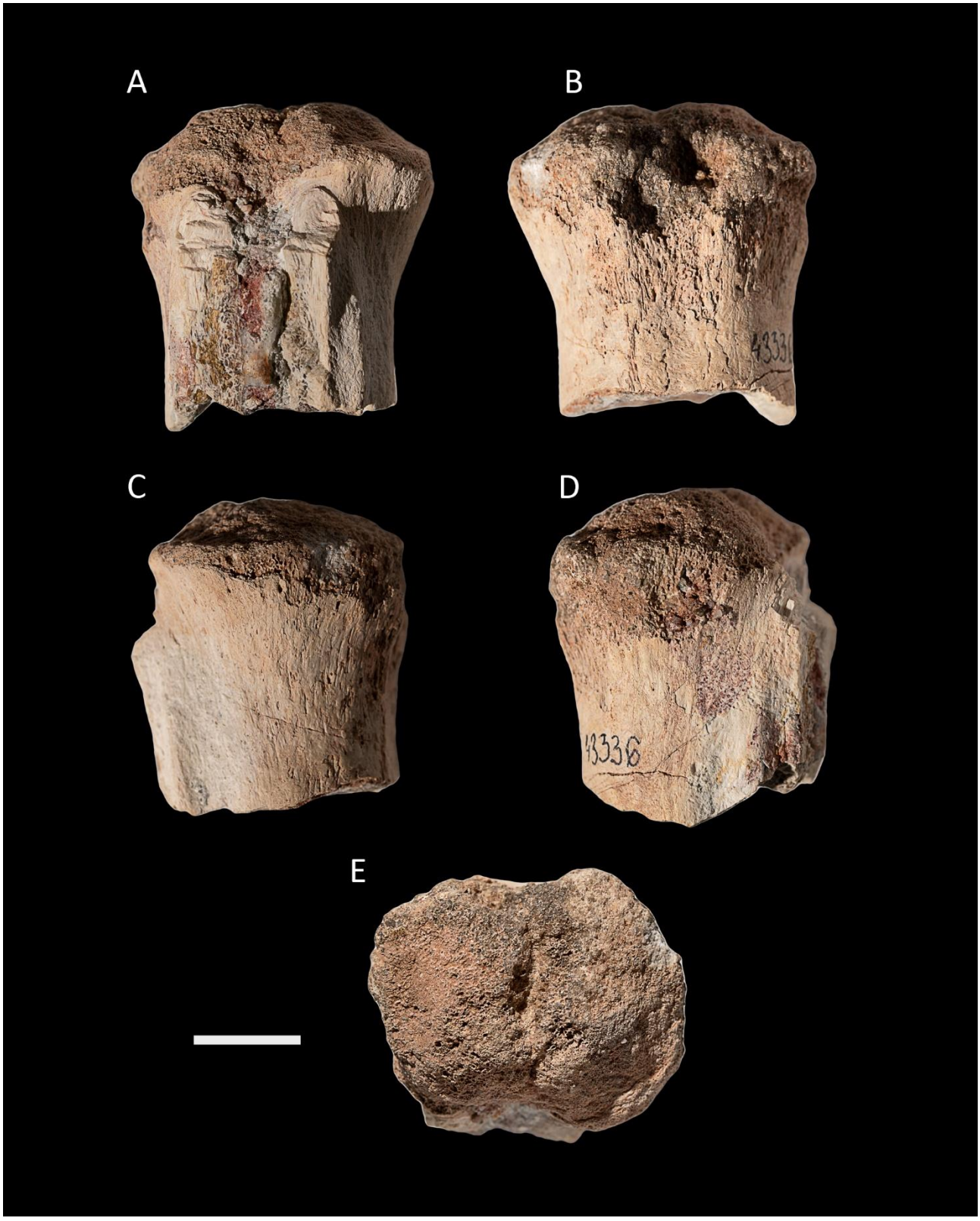

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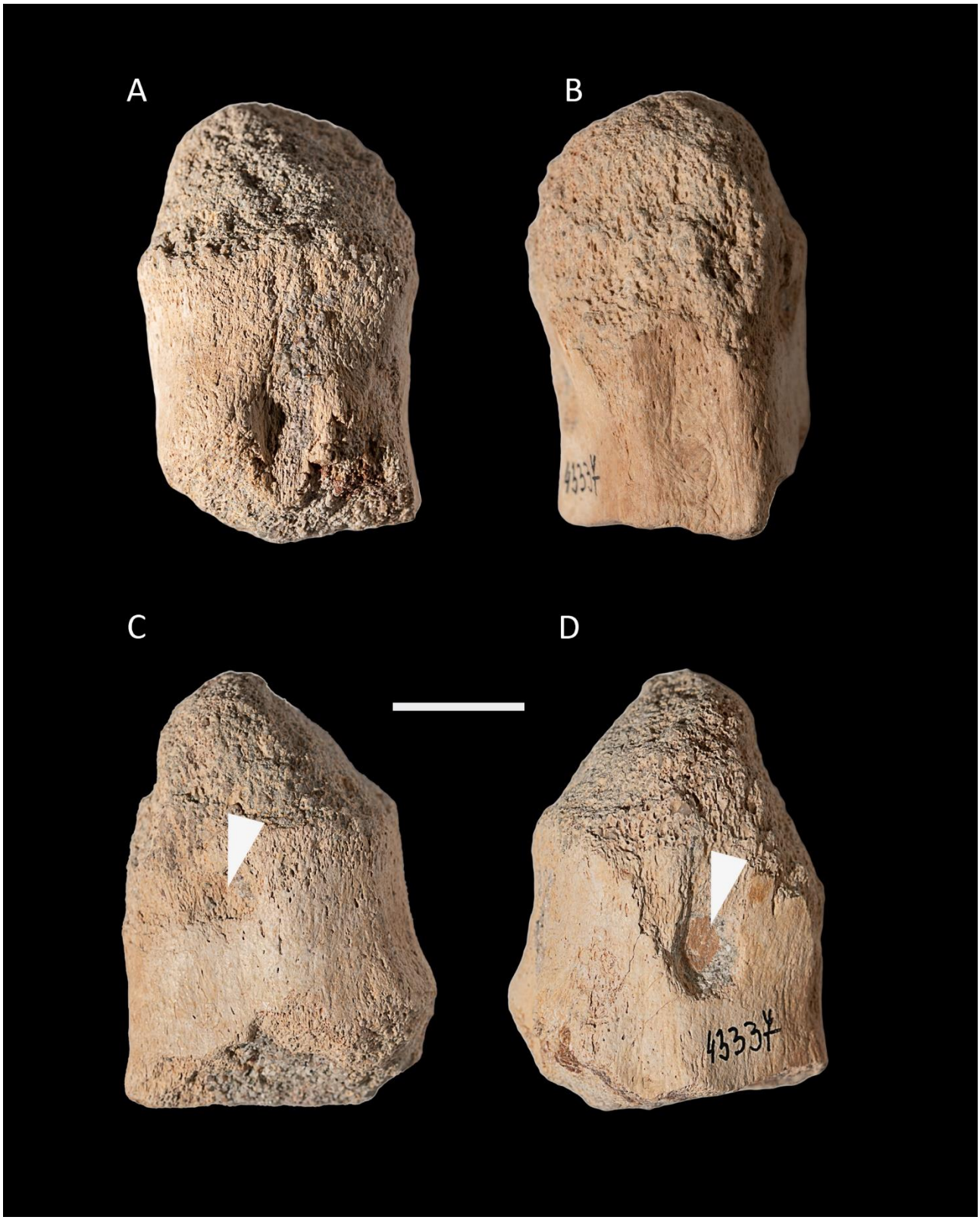

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THE MAIN EXHIBITION OF THE NATURAL HISTORY MUSEUM FROM SIBIU: COMPOSITION, STRUCTURE AND POTENTIALITY OF ORNITHOLOGICAL EXHIBITS

Liviu Răzvan PRIPON*

Abstract. *This paper analyses the qualitative and quantitative aspects of the Main Exhibition of the Natural History Museum of Sibiu in close relation to its potentiality concerning visitor experience. We aim to evaluate the exhibition in relation to the museum collection and the natural context of Romanian fauna. The methodology applied in this study involved the identification of all the exhibits and their taxonomic analysis, but also according to their location in the dioramas. We found a particular structure of the exhibition, resembling the fauna structure but not an equivalent ratio between the two. In contrast, the collection presents the same proportions as the natural context. We pinpoint and describe the specificity of the exhibition and show what it reveals in terms of the exhibition discourses and their meaning for the visitor. The visitor experiences are systematized into 7 categories, briefly described and contextualized. We concluded that the exhibition is constituted of a much lower number of species and specimens than the collection, and the exhibits are selected to best serve the visitor experience and to underline the main features of natural aspects, to provide an aesthetical experience, and to evoke the historical and the local particularity of the museum. The results of this work are relevant regarding the field of museum studies, and the visitor's experience research, as they highlight the potential of the exhibits taken individually, but also of the exhibitions as an ensemble. They can offer a framework in which the potentiality of the exhibition can be evaluated in relation to what one can experience in nature.*
Keywords*: museology, visitor experience, birds, exhibition structure.*

Rezumat. *Lucrarea de față analizează aspectele calitative și cantitative ale Expoziției Principale a Muzeului de Istorie Naturală din Sibiu în strânsă legătură cu potențialul acesteia în ceea ce privește experiența vizitatorului. Ne propunem să evaluăm expoziția în raport cu colecția muzeului și contextul natural al faunei românești. Metodologia aplicată în acest studiu a presupus identificarea tuturor exponatelor și analiza taxonomică a acestora în ansamblu, dar și în funcție de amplasarea lor în dioramele expoziției. Am găsit o structură particulară a expoziției, care seamănă cu structura faunei, dar nu un raport echivalent între cele două. În schimb, colecția prezintă aceleași proporții ca și contextul natural. Evidențiem și descriem specificul expoziției și arătăm ce dezvăluie acesta în ceea ce privește discursurile expoziționale și semnificația lor pentru vizitator. Experiențele vizitatorilor sunt sistematizate în 7 categorii, descrise pe scurt și contextualizate. Am ajuns la concluzia că expoziția este constituită dintr-un număr mult mai mic de specii și exemplare decât colecția, iar exponatele sunt selectate pentru a servi cât mai bine experiența vizitatorului și pentru a sublinia principalele trăsături ale aspectelor naturale. De asemenea, pentru a oferi o experiență estetică și pentru a evoca particularitatea istorică și locală a muzeului. Rezultatele acestei lucrări au relevanță în ceea ce privește domeniul studiilor muzeale, şi cercetare experienţei vizitatorului pentru că evidențiază potențialul exponatelor luate individual, dar și a ansamblelor expoziționale. Totodată, pot oferi un cadru în care poteţialitatea expoziției poate fi evaluată în relație cu ceea ce omul poate experimenta în natură.*
Cuvinte cheie*: muzeologie, experiența vizitatorului, păsări, structura expoziției.*

Introduction

The Natural History Museum from Sibiu, opened its doors in 1895, founded by the Transylvanian Society for Natural Sciences from Sibiu that was established in 1849 (Ciobanu 2010).

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The museum Ornithological Collection comprises of 579 species, from which 307 have Palearctic provenience, 267 have an exotic origin, and 5 are domestic species (Pripon 2015). These species are represented in the Collection of the Natural History Museum from Sibiu by approximately 4000 specimens (Stein, Würdinger 2005) from which only a small proportion is exhibited in the Museum's main Exhibition. Exhaustive taxonomic research on the Ornithological

Collection was published in 2005, conducted by Helga Stien and Irene Würdinger. The collection covers a large part of the Romanian bird fauna (part of the Palearctic fauna), and some groups of exotic species collected from Africa, Asia, Australia and South America (Stein, Würdinger 2005).

Considering that there is no actual complete Exhibition Catalogue, with qualitative and quantitative data published, the aim of this paper targets the identification of all the ornithological specimens, thus determining the structure of the exhibition. In order to identify the structure of the main Exhibition of the Natural History Museum from Sibiu we set three main directions. These directions of study are in relation to: 1. Romanian fauna coverage, 2. the collection composition and 3. the visitor experience. We do not aim here to stress the taxonomic aspect of the exhibition which reveal the concrete natural occurrence of bird species, their historical or ecological importance. Those are topics particular to other papers concerned with ecological and biological aims. Although the majority of the exhibits are shown in previous works, the re-identification was essential since there were more interventions following the settled species complex in the actual exhibition that opened in 2007.

The reason to exclude typically ornithological aims is to focus on museology, and the fact that species reports, historical aspects, and other similar topics are already published in the Catalogus Ornithologicus (Stein, Würdinger 2005), as well in the paper presenting the history of the Ornithological Collection (Pripon 2015). Here, we aim a completely different purpose – the structure of the exhibition towards museology and museum theories. This paper is not faunistic but museology oriented in contrast with most of the research exploiting the same material (collection or exhibition specimens). Studies about museum specimens in exhibitions or mostly in collections (with higher scientific value) are exploited from different approaches but most of them from a zoological point of view. Specimens are used for species confirmation, species signalling or data completion for faunistic purposes. Some examples in the Natural History Museum collections are as follows. More general and exhaustive studies are the inventory of exotic species from Babeș-Bolyai Zoological Museum carried out by Angela Petrescu and Delia Ceuca (Petrescu, Ceuca 2009) or the recent bird skins specimens' catalogue (Osváth *et. al* 2022). More specific one is the confirmation of Baillon's crake in museums collections (Stermin, Pripon 2011). The above examples are related to the ornithological material. Studies about the extinct fish species (Ciobanu 2011) or more specifically sharks types (Trif, Codreanu 2019) exploit the ichthyological material. In those later cases the only material available to determine the species or fauna are specimens found in museums or private collections, except their direct excavations, case in which they will become parts of some collection in the end. Other entomological studies like concrete species confirmation from the collection (Cuzepan, Tăușan 2016) or malacological inventories (Păpureanu 2021) are examples for this inquiry. Museum specimens are useful in ecological or molecular studies as a source of genetic material. In this context studies focusing on museology are extremely rare or totally inexistent. Some research was made in the field of natural history with the example of the educational potential in case of the didactic collection of Faculty of Silviculture and Forest Engineering from Brașov (Pripon *et al.* 2016). Therefore, museology studies in the field of natural history can be welcomed, filling a gap for museology questions and practices.

We underline that, there is nowhere mentioned a total number of exhibits or species presented in the exhibition. That constituted a motivation for our research. Other than analysing the structure of the exhibition, the results can offer a complete view over the exhibition with precise qualitative and quantitative data that can be used in guided tours or even in future restructuration of the exhibition. Also, can be useful for understanding the basis of the actual and old versions of the exhibition. Considering the data here, rational restructuration can be made, by integrating the additions or exclusions knowing the proportions that are modified. Other motivation for conducting this research was the fact that we want to recommend some empiric grounded suggestion for improvement of specimens' localisation in the exhibition to convey the ecological aspects, taxonomic coverage and real fauna structures, as well for an optimal and consistent visitor guidance in the exhibition. At the end of this paper scientific and vernacular names are provided in order to be useful in such guides.

Methodology

The methodology specific to the main activity involved in reaching our aim was the re-identification or even identification of all species

present in the exhibition, in concordance with the actual taxonomy. For identification and taxonomy, we use the HBW and Birdlife International Illustrated checklist of the birds of the world volume 1 (Hoyo, Collar 2012) and volume 2 (Hoyo, Collar 2014) with the latest modification as presented on the online source birdlife international datazone (http://datazone.birdlife.org/). For the vernacular names we integrate the suggestion presented in Birds of the World written by Dimitrie Radu (Radu 1977). We integrate the Romanian names as mentioned in the Hamlyn Guide, the Romanian version (Munteanu 1999) in order to be useful for guided tours that are presented in Romanian language. For collection evaluation in species, we use bibliographical sources such as the Catalogus Ornithologicus (Stein, Würdinger 2005) that presents the entire assemblage of specimens, the Exhibition Guide (Ciobanu 2010) and the historical re-evaluation (Pripon 2015). For the Romanian fauna qualitative analysis, we used the data presented in the Romanian version of the Hamlyn guid with additional information from Avibase/ The World Bird Database (https://avibase.bsc-eoc.org/).

We introduced an index that measures the overlapping species between dioramas. We named this index the mean overlapping degree (mOd). The mean species overlapping degree in one exhibition (mOd) can be calculated by dividing the mean number of species overlaps between dioramas by the total number of species present in the exhibition. The calculation formula of the index is: mOd = $(\sum_1^k n)$/k*N where **N** is the total number of species in the exhibition, **k** is the number of dioramas with common species, and $\mathbf{n_k}$ is the number of common species between two dioramas. The mOd ranges between 0 and 1. The minimal value 0 corresponds to dioramas with no common species between them. The maxim value of mOd is 1 and corresponds to dioramas that contain the same species. These extremes are rarely found in reality. More common, we have a small value, close to 0 or in exceptional cases.

This value stands for an exhibition where some specimens corresponding to the same species can be found in more than one diorama.

Results and Discussions

Composition

Following the re-identification of all specimens present in the Main Exhibition of the Natural History Museum from Sibiu conducted in June 2023, we obtained the data presented in Tab. 1. The number of species identified is 161 (Tab. 1) from which 42 species belong to the exotic fauna, and 119 belong to the Palearctic fauna (Fig. 1). The ratio between the two categories is 26% to 74% (Fig. 1). A quarter of species belong to exotic fauna, with representative taxa in relation to the major bird's phylogenetic groups. Three-quarters belong to the Palearctic taxa, covering mostly autochthon Romanian bird fauna (Fig. 1).

The exotic fauna is represented by 42 species belonging to 6 Orders and 18 Families (Tab. 1). The most represented Family is the Psittacidae with 36% followed by the Thraupidae (12%) and Estrildidae with 7% (Fig. 4), two Passeriformes groups with bright coloured species. Tanagers, belonging to Thraupidae, are one of the most divers and complex group in terms of chromatic aspect. Alongside the parrots (Psittacidae) both taxa compose a powerful aesthetic ambient. Meropidae and Alcedinidae (bee-eaters and kingfishers), both represented by 2% (Fig. 4) can be included in the same category as above, representing strong aesthetic factors in terms of shape and colour. The most representative for this aspect are the Paradisaeidae (2%) with two species of birds of paradise (Fig. 4). All other families are represented by 1% except Icteride (Fig. 4). The assemblage is focused on the diversity of exotic species with an emphasis on their beauty, trying to reflect a diversity of colours and shapes from four continents: Australia, South America, the southern part of Africa, and the southern part of Asia (Fig. 1 – right).

The Palearctic fauna is represented by 119 species from 43 Families belonging to 18 Orders (Fig. 2 and Tab. 1). Most of the species are present in the Romanian Fauna and reflect the local diversity. The others are arctic or northern species. The Palearctic species represent three-quarters of all exhibits (Fig. 1), constituting the main part of the exhibition in terms of visitable space. This assembly aims to present the autochthon fauna in its most exhaustive diversity and to point out most of the emblematic species in addition to the most common ones. Fig. 2 shows that most of the Orders and Families are covered from the Romanian fauna. The lower number of species represented in the exhibition in comparison with the actual fauna reflects the limitation of the former in terms of available space in relation to optimal visitor experience. Also, some similar species were excluded because the exhibition chose to present the local fauna diversity through only some representatives.

The most represented Order in the exhibition is Passeriformes with 36 species, which is also a vast taxon represented in the local fauna. Therefore, the greatest number of species are available to be collected. The above taxon is followed by Accipitriformes with 15 species and Strigiformes with 10 species. These species have big sizes, with charismatic features, thus they are very attractive in the hunting process. Those may be also the reasons for their high representation in the exhibition. The Charadriiformes Order is relatively poorly represented, by 9 species. This is due to the fact that even though there are numerous species belonging to this taxon and therefore the availability for their collecting is high, they are very similar in appearance. Anseriformes and Galliformes are of high hunting interest and follow in row regarding their representation with 8 species each (Tab. 1). Close in value stands Falconiformes Order (6 species). All taxa mentioned before contain species which are similar in preference for hunting and are attractive through their charisma. The Pelecaniformes Order is represented by 7 species with easily hunted species and of high aesthetic value. Gruiformes Order is represented by 4 species similar with Piciformes and Coraciiformes. Coraciiformes Order has one of the highest aesthetic value and interest for collecting. Suliformes Order has a hunting interest similar to Anseriformes but is represented by few species in the fauna, and, therefore, only 3 species in the exhibition. On the last positions enters Podicipediformes (2 species) also with very few species in the Romanian fauna. Still, they have a high interest in hunting, determined by their aesthetic value given by decoration and behaviours that stand out in the wetlands. All other taxa featured in Tab. 1 are represented by singular species because they are monospecific or because they contain few species, which are also rare or cryptic.

In order to understand how the exhibition is organized we must consider the distribution of the exhibits in dioramas. Thus, we have to evaluate the 8 dioramas with ornithological exhibits. We named the dioramas as follows: flightless birds (diorama 1 – assemblage of three separate dioramas), steep fauna (diorama 2), Danube Delta fauna (diorama 3), forest fauna left (diorama 4), forest fauna right (diorama 5), altitudinally distributed fauna (diorama 6), parrot species (diorama 7), Arctic fauna (diorama 8) and Australian fauna (diorama 9). We quantified the species complex for each of them. The mean number of species/dioramas is approximately 20 with few exhibits in diorama 1 (3 sp.) and diorama 8 (5 sp.). Diorama 7, along the two mentioned before, are small extended dioramas in the walking parcourse of the visitors. In contrast with diorama 1 and 8, diorama 7 has a higher concentration of exhibits (18). The higher number of specimens are present in diorama 4 (47 sp.) and diorama 5 (26 sp.). They are the ones that cover a medium distance on the walking parcourse of the visitor. The most extended in the visitor walking parcourse is diorama 6 with medium species concentration (20 species – less than half of diorama 4). Diorama 9 extends on almost half the visitor walking parcourse of diorama 6, but has a higher species concentration (33 sp.). We can estimate the time spent on each diorama, based on the mean time spent on one exhibit. This is determined by the total time spent in the exhibition and the result is presented in Fig. 3. This estimate can help the guide to divide its tour timing for each diorama in order to equivalently and consistently cover its content. We must consider that the time spent/diorama is not in linear relation with the abundance of exhibits in it. Some individual or lax dioramas can captivate more time, while some asphyxiated dioramas can be tiring and can make the walking faster in order to be passed by quicker. Also, the extension of diorama on the walking parcourse can be an important factor for the real time spent on a diorama. The observation of exhibits is related to a specific walking rate which tend to be constant. Hence, the smaller dioramas with high exhibit concentration are constrained to have exhibits ignored or unobserved. We also have to take into account the succession of the dioramas because the attention decreases with the development of the walking parcourse. This is due to the fact that the visitor is progressively becoming more tired, and the time spent on the first dioramas can be longer than for the last ones, which are visited in a hurry. The distribution of exhibits in space, also regarding the diorama abundance is helpful in order to understand or to estimate the rate of detection and experimentation of the exhibits by the visitor. This estimation takes into account the time spent by the visitor in the exhibition, the speed of walking in the exhibition, the degree of abilities, familiarity with the museum speciality (in our case birds) and the familiarity of the visitor with the museum general environment (used to behave, to read material and to feel comfortable in the museum).

Another aspect of the exhibit's distribution in dioramas are the overlapping species. In the analysed exhibition dioramas 4,5 and 6 have the more overlapping species. Dioramas 4 and 5 have 7 overlapping species, dioramas 4 and 6 have 3 overlapping species and dioramas 5 and 6 have 2 overlapping species. These dioramas form a distinct group with common species. Another group is diorama 2 and 3 that have a lower overlapping (3 sp.). The mean number of species overlapping between dioramas is 3.75 and the total number of species is 161, hence, the mOd = 0.023. This is a small value that indicates the low repetition of species between dioramas.

Structure

The structure of the exhibition will take into account the qualitative taxon composition in relation to the hierarchically constitution of each group by the more particular taxa. Taxonomic structure refers not only to species listing and counting but also to the relation of one to another. In other words, we will present the ratio between specific taxa taken as a hole, in the context of the more general taxa. Hence, we will look at Orders composition in families, Orders composition in species and Families composition in species. We will use, as a reference system, the structure of the actual bird fauna in the Romanian region, to pinpoint the naturality aspect of the exhibition (or its artificiality). The naturality/artificiality refers to proportion of representation in exhibition that respects/or not the proportion observed in nature (the actual fauna).

In what concerns the Orders assemblage and their proportion related to the Romanian fauna (Fig. 5 A and C) we noticed a variety of Orders represented (18). Only a few of them are represented by more Families (Fig. 5 B) and Species (Fig. 5 D). Most of them are represented by only one Family and 1or 2 species. The most represented Order is Passeriformes with 35% Families (Fig. 5 B) and 30% species (Fig. 5 D). It is followed by Charadriiformes in terms of Families (9%) and Accipitriformes in terms of species (13%). This is due to the fact that there are more Families in Charadriiformes and only two families in Accipitriformes. In opposition, the number of species is reversed because lesser species are exhibited form Charadriiformes which are more similar and do not have a higher aesthetic impact on the visitor. More species of Accipitriformes (eagles, hawks, buzzards, kites etc) appear in the exhibition because they were more intensively hunted in the past, more easily spotted and more charismatic both from a cultural point of view and an aesthetic one. Hence, the establishers of the exhibition decided to use more Accipitriformes species in the exhibition. This is also in relation to a factor with cultural meaning. A significant member of the museum association (August von Spiess) devoted his interest to birds of prey which became popular in Sibiu through him and his daughters. Anseriformes (7%), Galliformes (7%) and Falconiformes (8%) are well represented in species but not in Families (Fig. 5 B). The Pelecaniformes Order (pelicans and herons) are more represented in Families (7%) but not so much in species (6%) (Fig. 5 D). Other pronounced Orders are Gruiformes (5% Families 3% species) and Suliformes (5% Families 3% species) only slightly outranked by Coraciiformes with 7% Families and 3% species (Fig. 5 B and D). The rest of Orders are 1-2% represented. Regarding the comparison with the fauna, we first noticed the lack of representation of some orders (Phoenicopteriformes, Procellariiformes, Cuculiformes and Pterocliformes). The resemblance in structure is evident but some distinction can be outlined. First of all, the lower percentage of Passeriformes and Charadriiformes in the exhibition than in the actual fauna. The much-pronounced percentage of Accipitriformes, Falconiformes and Strigiformes shows an interest in raptors (diurnal birds of prey as well as nocturnal birds of prey). These groups predominate in species as well as in the size of the exhibits, making them the most visible and of higher impact for the visitor.

If we analyse the structure in terms of Families and their composition in species, we notice a more pronounced distinction between the fauna and the exhibition, maintaining some of the distinctions pointed out above (Fig. 6). Here more taxa are missing in the exhibition and the ratio is more aberrant.

To better understand the situation of the exhibition we must relate it to the Collection from which it is formed and systematically reconfigured (Fig. 7 A and B). In most of the cases, except small museums or public collections, the collection is much more abundant than the exhibition. The Natural History Museum from Sibiu Collection comprises approximately 4000 specimens (Stein, Würdinger 2005) in relation to only 217 specimens exhibited in the present Exhibition. Also, in order to understand this relation, we have to relate the Collection to the fauna to underline the actual potentiality of the collection to generate a certain exhibition. Hence, the collection is almost identical with the fauna in

terms of structure regarding the composition of Families in species (Fig. 7 A) and even if not listed or graphed the same situation applies to the assemblage of Orders and their composition in more specific taxa. In Fig. 7 B we listed the actual coverage percentage of the fauna by the Collection. We can spot some non-represented Families like Procellariidae or Cettidae but also some Families present in the Collection but absent from Romanian fauna like Sullidae (Fig. 7 B). Most of the Families are well covered. However, some Families with many species, the ones with elusive or cryptic ones, as well the ones with small sized species are poorly covered. In the first situation we find the Families with 2 or few species represented in the fauna like Coraciiformes, Apodiformes, Cuculiformes, Otidiformes etc. The medium size Families concerning the number of species present in Romanian fauna are well covered or intermediate. In this situation we can enumerate Ardeidae, Laniidae or Sylvidae. Considering all aspects, we can confirm the collection is highly natural constructed, with a ratio very similar to the fauna. Even if it is not limited by the collection, which has the potentiality to supply with a divers and vast number of species, the exhibition does not keep the naturality, and involves an artificiality, motivated by the promotion of certain visual representation or charismatic species with more impact for visitors and with high aesthetic value (Fig 8).

One of the last aspects discussed here will be the number of specimens represented from each species. We obtained a mean number of 1.4369 (±0.7071, N = 119) with some particularities (Fig. 9 A). Even if most of the species are represented by 1 or 2 specimens, some species, due to various reasons which we will try to point out, have a higher representation. Some particular situations can be noted in case of some bird Families (Fig 9 B, C, D, E, F, G, H). We will discuss them successively. The species with the greatest number of specimens exhibited is tawny owl (*Strix aluco*) with 4 pieces. Five species are represented by 3 specimens. These are: *Phasianus colchicus*, *Buteo lagopus* and *Bombycilla garrulus*. The following species are represented by 2 specimens: *Linaria cannabina*, *Aegithalos caudatus*, *Sitta europaea*, *Garrulus glandarius*, *Corvus monedula*, *Turdus merula*, *Lanius minor*, *Falco peregrinus*, *Coracias garrulus*, *Merops apiaster*, *Tyto alba*, *Otus scops*, *Athene noctua*, *Asio otus*, *Strix uralensis*, *Chlidonias niger*, *Vanellus vanellus*, *Gallinula chloropus*, *Fulica atra*, *Accipiter gentilis*, *Accipiter nisus*, *Hieraaetus pennatus*, *Circaetus gallicus*, *Gypaetus barbatus*, *Haliaeetus albicilla*, *Ardeola ralloides*, *Pelecanus onocrotalus*, *Morus bassanus*, *Perdix perdix*, *Tetrao urogallus*, *Lyrurus tetrix*, *Tetrastes bonasia*, *Tadorna tadorna*, *Anas platyrhynchos*, *Anas crecca*, *Spatula querquedula*. All other species are represented by only one specimen. The taxon with the most specimens/species (2 spec./sp.) is the Strigidae Family (Fig. 9 E) followed by Phasianidae (1.75 spec./sp.) (Fig. 9 C) and Accipitridae (1.64 spec./sp.) (Fig. 9 D). Anatidae (Fig. 9 B) and Falconidae (Fig. 9 F) Families have almost the same mean value of specimens/species (1.5 spec./sp.). Passeriformes Order has a lower mean of specimens per species (1.3 spec./sp.) (Fig. 9 H) than the total mean. The lowest mean was obtained in case of Charadriiformes (1.2 spec./sp) (Fig. 9 G). The reasons for the representation of one species through more than one specimen are distinct morphological appearances within that species. Sexual dimorphism or the distinction between the fledglings, young birds, and adults can be motivations in this sense. Also, the presence of the species in different habitats led to its presence in different dioramas, thus multiple specimens are located throughout the exhibition.

Potentiality for visitor experience

For the following analysis we will consider two conditions. The first one is that the bird specimens and dioramas with birds represent two thirds from the Main Exhibition of the Natural History Museum from Sibiu. The second condition is the time spent in the Exhibition which can vary from 30 minutes to an hour, in addition to 15 to 30 minutes in the Temporary Exhibitions. These time intervals correspond to a maximum of 1:30 up to 2 hours per visit, including visiting the Museum's Garden, accommodation and ticket purchasing. Combining these two factors with the number of bird species (161) we obtain a theoretical time of experimentation/exhibit of 0.18 minutes/exhibit to 0.37 minutes/exhibit. Transformed in seconds, it means that a visitor can allocate 10 up to 22 seconds for an exhibit.

The theoretical value of time spent per exhibit it is not the effective time observed empirically because the visitor tends to ignore most of the specimens or observe them fast-forward. The general visitor stops to experience some more impact generating items. The massive exhibits or evident ones, due to their shape or colour are

consistent stops and intermediary specimens are usually passed by. We also have to take into account the visiting fatigue which is of two natures: physical and mental. First one involves walking in the exhibition, time spent on foot, light condition and particular attitude and posture. The second one consists in informational flux. Both make the visit faster in the last part of the exhibition determining the theoretical time spent by exhibit to be irregular during the entire visit. In this context guided tours should be adapted, and more visits should be encouraged because the exhibition cannot be exhaustively exploited in only one visit.

In only one visit, expressly in the first one, the visitor will be able to experience the frame of the exhibition, the ambient and the general information. Much of the information and the exhibits will escape the visitor experience in this stage. The experience will be of the general context, will capture the assembly, with a few representants experienced in detail. In the following rows we will list some potential features that can be experienced as a surrounding ambience and general assembly as well in case of exhibits taken individually.

1.The architectural aspect: This is the first impact on visitor experience, and it is generated by the exterior size and shape of the building and the interior spatiality of the exhibiting halls. The decorations on the walls (mostly structural on the outside and mostly pictural on the interior) contribute here. This factor generates the environment, implying, suggesting and giving the attitude and habitus of the owner (may be old owners). It will transfer and impose those features to the visitor that has different formations and thus, different approaches in managing the impact. The ambient can be imposing and intimidating. Thus, it has to be well transmitted and communicated in order the visitor to have a pleasant and comfortable visit. This comfort involves less negative and blocking stimuli and responses and more openness and willingness to be inside the environment. Other than common habitual space, aristocratic, cultural and educational superiority can develop interest but also inhibition and intimidation. The objective is to primarily encourage fascination and a sense of accessibility in an environment that is often distinct from the everyday life.

2.The curiosity aspect is the second factor involved in the visitor experience. It refers to the first and very quick impression of an exhibit due to its characteristics (posture, size, shape or colour, sounds etc). This factor has been largely discussed in museology and its importance is highly stressed. It is essential that the structure of the exhibition and all types of guides, mostly live guided tours (by museum staff) have to take into consideration to not diminish this aspect. The reason is that curiosity grounds the visitor attitude for further impacts, mostly educational ones.

3. The aesthetic aspect is the third factor involved in the visitor experience. This is the most direct experience that does not depend on information, only on direct experience. However, it follows the architectural (ambient) and curiosity aspects because comfort and curiosity are needed for the visitor to pay attention and, in consequence allowing the aesthetic experience to be generated. The shape and the colour, the size or the posture first generates curiosity and then aesthetic experience. Literally, the aesthetic factor translates into the pleasure in perception, beauty in the mental imagery, and sensibility generated in the interaction with the exhibits.

We will not use the educational factor or the cultural one as a category because they are artificial constructed from the specific factors. Specific factors must be treated separately because artificial categories can overlap in what they are concerned. In general lines, the educational factor comprises from the taxonomical, ecological/faunistic and historical one. The cultural category comprises from the historic and story-telling factors. We will list the unitary factors in the following rows.

4. The ecological and/or faunistic aspect is the fourth factor involved in the visitor experience. It is an intermediary factor because it involves the direct experience and background experience (knowledge) as well. This status of the factor requires prior experience, geography and ecology knowledge but it can be combined with the actual experience in a way that connects the visitor with the exhibition. Of course, it can function prior or in absence of personal experience or already known information. The museum can and does substitute this lack of experience by delivering information on informative materials. The exhibition can also reveal, as it does in our case, the general physiognomy of landscapes or biomes with their components and general context through particular constructions and decorations.

5. The taxonomic aspect is the fifth factor constructing the visitor experience in a natural history museum. It is the most complex requiring most of background knowledge in zoology and

zoological domains. Due to the particular structure of the exhibition, the methods of exhibiting, the discourse and aim of the exhibition this factor was eliminated in its concrete form. It its only suggested, maintaining some relations between exhibits that reflect their phylogenetic relations, faded in the intention to integrate the species in the landscape context. Some evident and compact examples are the thrushes (Turdidae Family) and crows (Corvidae Family) whose component species are displayed in compact groups, in dioramas more closely located. Other taxa like Strigidae, Accipitridae or Falconidae are more spread but still enclosed to some dioramas and can be experienced as a unitary group reflecting their resemblances and differences. The direct analysis process or guided one (by information or display in the exhibition) of similarities and distinctions in the mental process of category formation can be obtained by experiencing lots of forms at the same time or in short periods of time. This experience is precisely the one exhibition can offer even if the taxonomic factor is eliminated. The zoological taxa are categories generated by analysing differences and similarities in terms of standard scientific rules. This process has a grounding in direct comparisons of forms, usually in high numbers. A visitor can experience this act in the exhibition without conceptual tools as well.

6.The historic aspect is the sixth factor which, in contrast with the above ones, mandatory requires guidance, being of any sort. It can be written on labels and informative panels, catalogues brochures, or exhibition short description paper. It can be verbally delivered by the museum guide or it can be audio/video obtained from audio guides or clips rolled in a special location. The historic factor implies information receiving and attention to informative material as well as to particular exhibits like statues, busts, or bas-reliefs. These are sometimes passed by, given the specifics of the museum. It should be noted that a distinction must be drawn between this factor and the one discussed below (storytelling). The historical factor does not refer to the narrative itself, but to the ways of transfer the observer into the past simultaneously with maintaining actuality in the process of projecting the past into the present. This process has been explained in more detail in another work (Pripon 2022) and we will not reiterate it here but just highlighted it briefly.

7.The storytelling aspect is the seventh factor and it is the one most reliant on the informative materials. Explicative materials are absolute mandatory in this case because the exhibit by itself cannot communicate this aspect. Thus, the visitor needs explication not only direct experience. However, this factor manifests by combining information with the direct observation of the exhibit. In this category are included stories about the life of the exhibit outside and inside of the exhibition. It is connected to its provenience, its collector and their journey involved in the collecting the exhibit, the impact that the object had on nature, particular on animal and human individuals etc. The journey that the exhibit developed in the museum can be of interest in this factor context. A well-known example is The Monna Lisa (painting by Leonardo da Vinci) situation. This painting raised its popularity after it was stollen. Another example, related to the exhibition in discussion here, can be the relation of Spiess family members with birds of prey and their stories that now can be told by some specimens in the exhibition.

Conclusion

We found that the exhibition represents a percentage of 28% species and only 5.4% specimens from the museum collection. In order to best serve the visitor's experience, the capacity of any exhibition and particularly the Natural History Museum from Sibiu Main Exhibition limits the number of exhibits. The exhibition contains far less specimens than the Collection, which aims to optimal conserve the pieces and to preserve them mainly for research purposes. Even if some specimens have lower scientific value they can be used in temporary exhibitions and are kept in the deposit. In this way, exhibiting fewer specimens maintain the exhibition from crowding and from suffocating the visitor experience. The collection grows continuously because it is its aim to accumulate materiality and history, thus cannot be exhibited in its entirety. The exhibition will present what is suited and what convey the mission of the museum at some point. This difference is normal and is not to be accounted as a deficiency as the common opinion often states.

If the collection has a ratio of 53.5% palearctic species and 46.5% exotic species which is more equilibrated in respect to the real fauna, the exhibition is more distorted in this aspect, showing a percentage of 74% palearctic species and 26% exotic ones. This is because the aim of the exhibition discourse is oriented to the ecological and landscape imagery of the Romanian fauna. Hence, it exploits the Palearctic

taxa. In this type of exhibition, we have a lower interest for exotic fauna and an almost absent, at most suggested, taxonomic practice and interest.

We consider that this study is important for audio and printed guides and also for the live guided tours. Our results show that the time spent for each diorama in the Natural History Museum from Sibiu Main Exhibition must be more dedicated to the chamber with the forest diorama by almost 15 minutes (10-12 minutes left and 5-7 minutes right). For the first chamber has to be allocated 10-11 minute from which 1 for flightless birds and 5 minutes each for steep diorama and Danube Delta diorama. Almost 20 minutes must be retained for the last chamber, with an emphasis on the Australian fauna diorama. Approximately 8 minutes are needed for this latter diorama and 5 minutes for the diorama representing altitudinally distributed fauna. A challenge is the parrot diorama which is very restricted in space but involves a minimum of 2 to 5 minutes to be presented.

The importance of our paper can be noted for organising and structuring future exhibitions in the museum, and an argument for the well establishment of the actual exhibition. It also points some better improvements for Exhibitions in the future. As recommendations we can list the following aspects. First one is to rename the Australian Fauna Diorama to Austral Fauna Diorama in order to give the possibility of more species to be exhibited and more relevant pieces from the Collection to be available to the public. We recommend this because a high percentage of relevant species are kept away from the public and can have a major impact on the visitor experience regarding aesthetic values as well as the scientific one. This is possible because most of the species represented by the collected specimens in the collection are distributed in parts of the continents (South America, Australia, the southern part of Africa, and Asia) from the Austral hemisphere of our planet. We also suggest the introduction of the annual visiting permit which allows visitors to systematically visit the museum and not resuming to one or few visits. Considering that one visit covers a small fraction of the exhibition experimentation, numerous visits are needed to cover all exhibits and information. The solution with the annual permit can allow and encourage visitors to make more visits.

Acknowledgements

I want to thank Nicolae Trif for his high support and effort put in determining the specimens from the exhibition, and for the constructive discussions and suggestions that grounded this paper. I am grateful for the reviewers' comments that have improved the manuscript in its writing and its content.

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LIST OF ILLUSTRATIONS

LISTA ILUSTRAȚIILOR

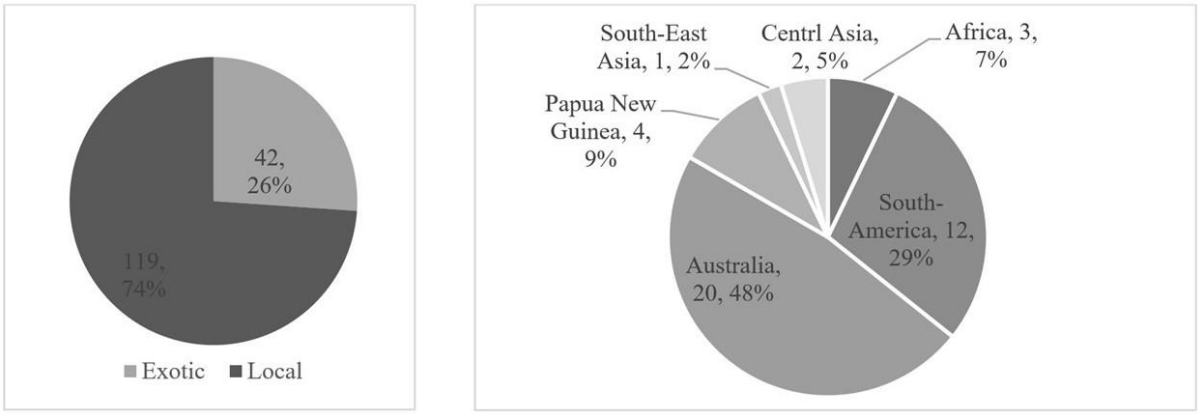


Fig. 1 The number of species represented in the Natural History Museum from Sibiu Main Exhibition regarding their general provenience.

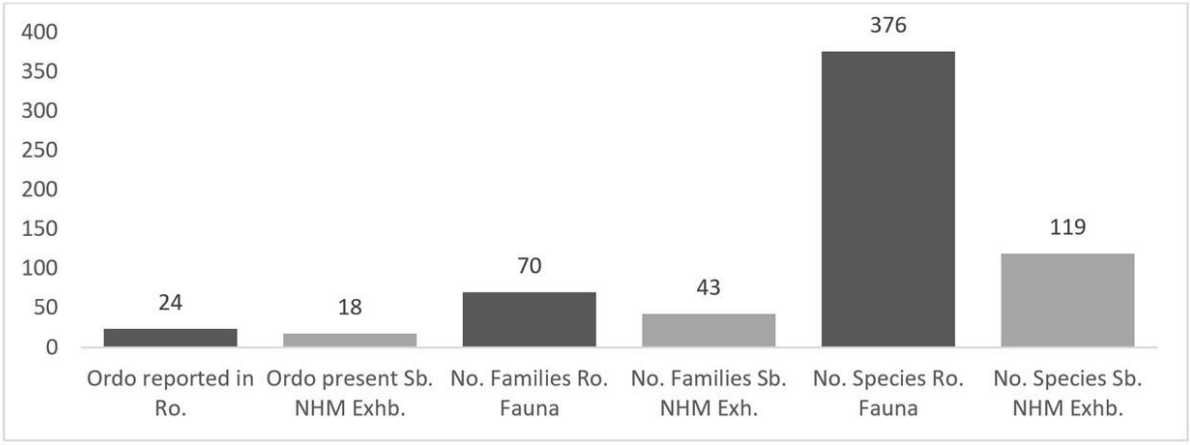


Fig. 2 The comparison between the number of taxa reported in Romania (dark grey) and the one counted in the main Exhibition of the Natural History Museum form Sibiu (light grey) in July, 2023.

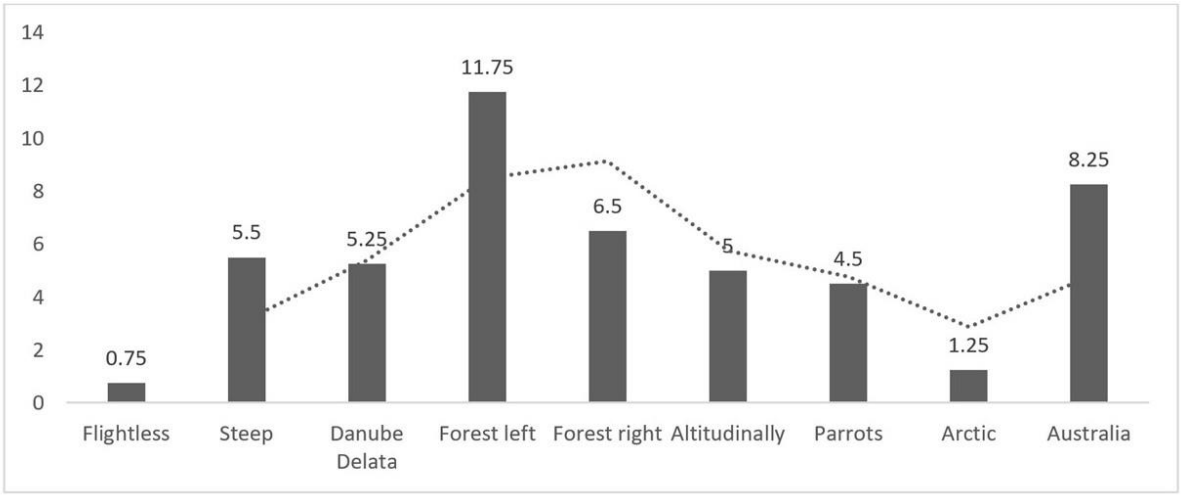


Fig. 3 The theoretical time necessary spent for each diorama in order to cover all exhibits determined by the equivalent (theoretical) time for one exhibit experimentation (in minutes).

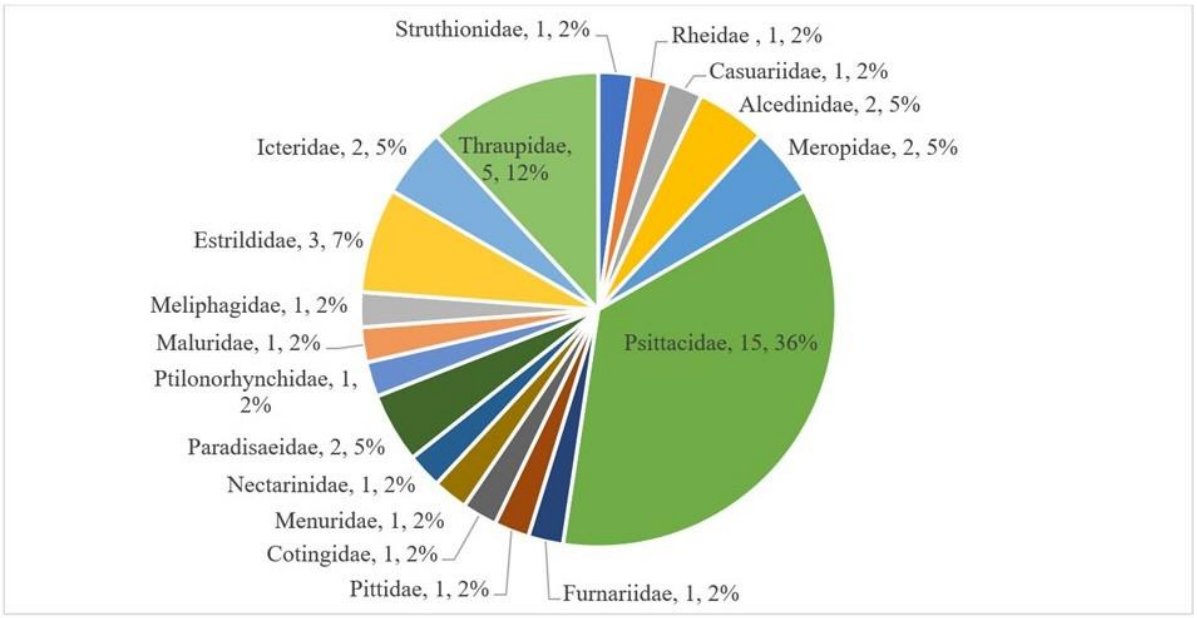


Fig. 4 The amount of species/Family in the assemblage of the exotic specimens.

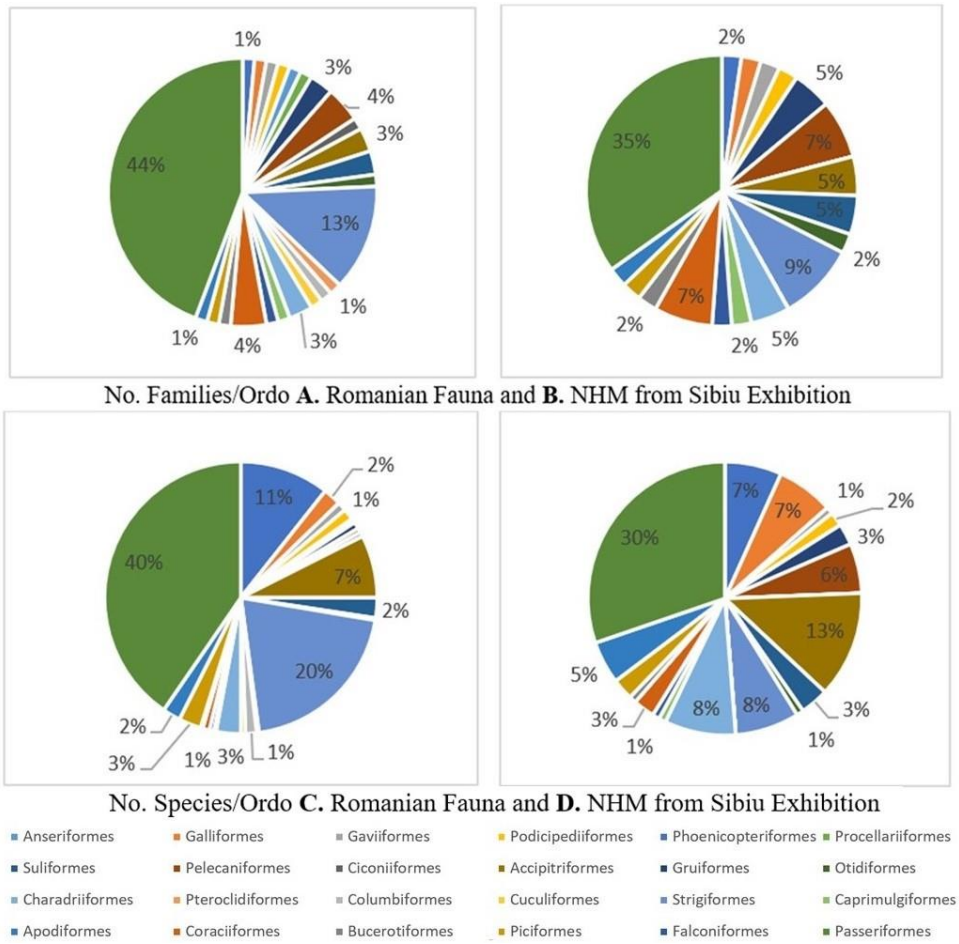


Fig. 5 The taxonomic comparison between Romanian Fauna and Natural History Museum Exhibition in terms of Families/Order and Species/Order.

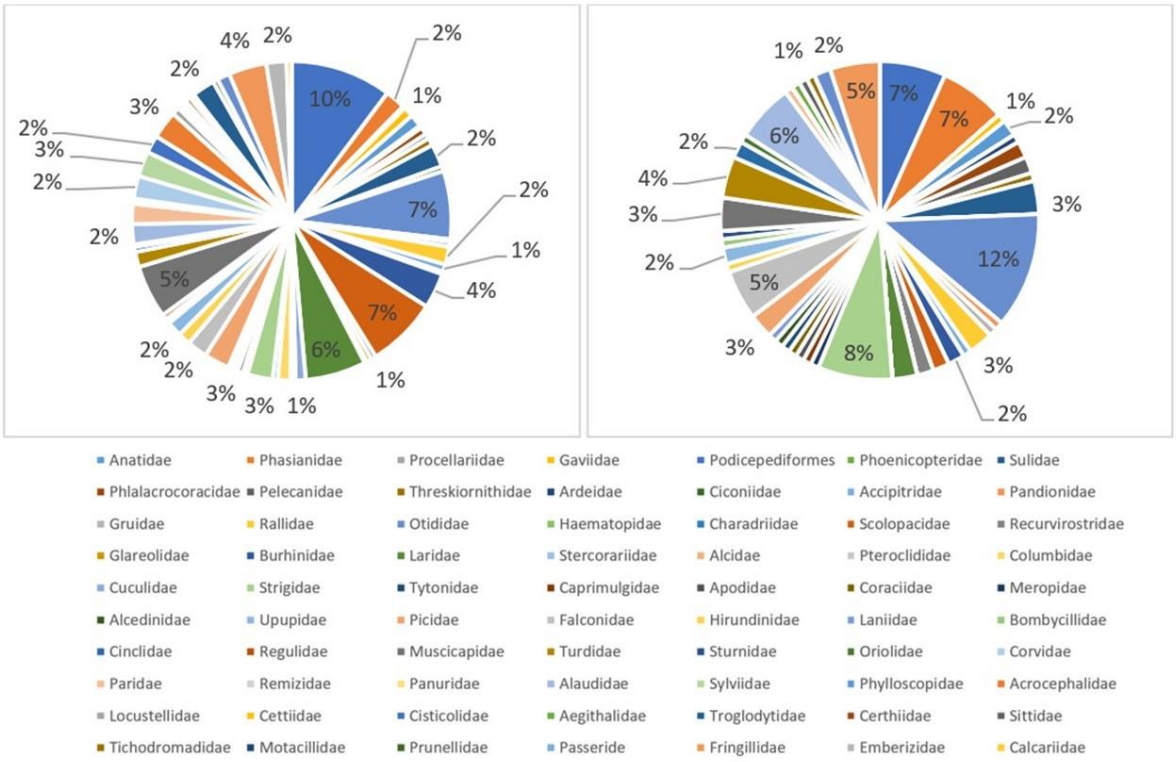
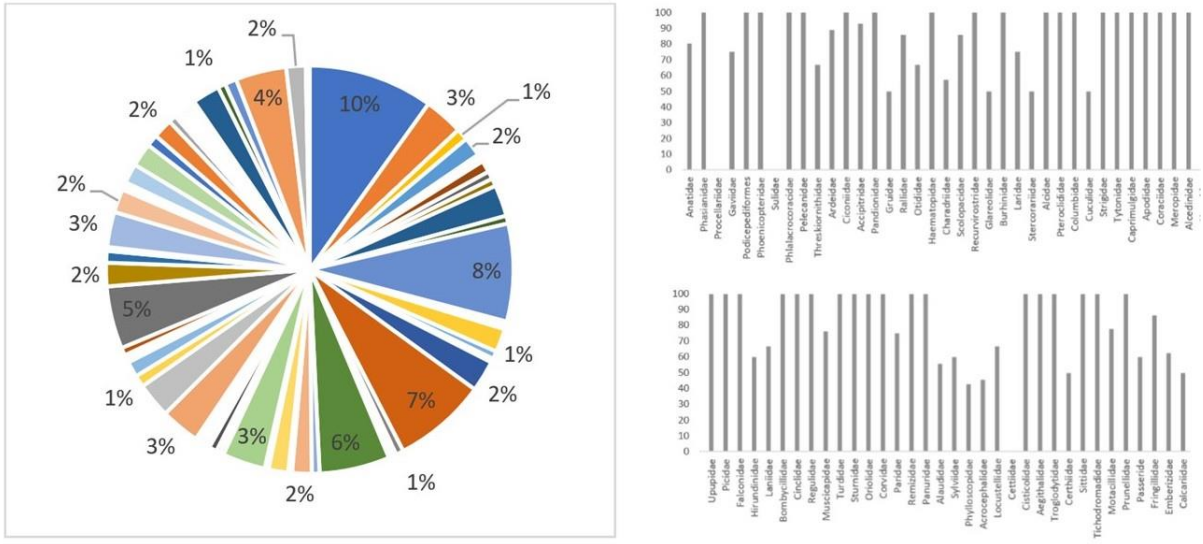


Fig. 6 The taxonomic comparison between Romanian Fauna and Natural History Museum Exhibition in terms of Species/Family.



A. Taxonomic structure of the NHM Collection and **B.** Percentage of coverage of the Collection

Fig. 7 The taxonomic comparison between Romanian Fauna and Natural History Museum Collection in terms of Species/Family.

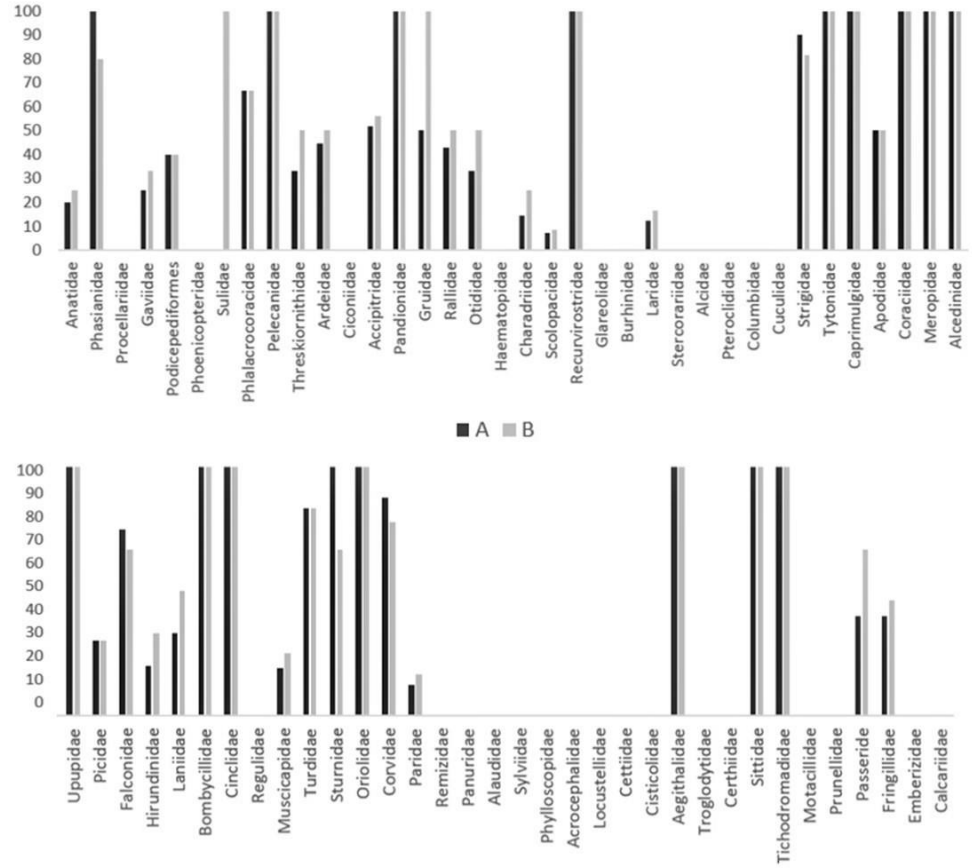


Fig. 8 The taxonomic comparison between the coverage of the Natural History Museum Exhibition from the A. Romanian Fauna and from the B. Natural History Museum Collection.

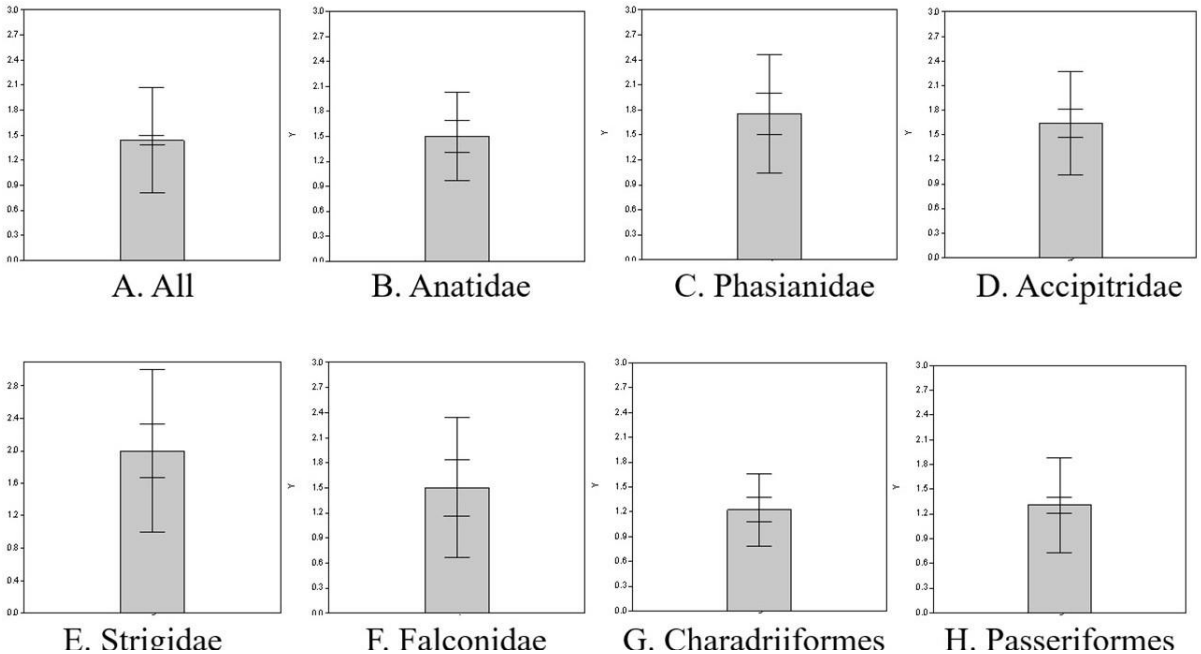


Fig. 9 The mean number of specimens from each species represented in the Exhibition of the Natural History Museum from Sibiu.

Tab. 1 Taxa represented in the Main Exhibition of the Natural History Museum from Sibiu in 2023

nr. crt.	Vernacular nomenclature	Scientific nomenclature	Family	Order
Exotice				
1.	Struț/ Ostrich	*Struthio camelus* Linnaeus, 1758	Struthionidae	Struthioniformes
2.	Nandu/ Greater Rhea	*Rhea americana* (Linnaeus, 1758)	Rheidae	Rheiformes
3.	Emu/ Common Emu	*Dromaius novaehollandiae* (Latham 1790)	Casuariidae	Casuariiformes
4.	Pescăraș cu cap negru/ Black-capped Kingfisher	*Halcyon pileate* (Boddaert, 1783)	Alcedinidae	Coraciiformes
5.	Pescăraș sfânt/ Sacred Kingfisher	*Todiramphus sanctus* (Vigors & Horsfeld, 1827)	Alcedinidae	Coraciiformes
6.	Prigoria stacojie nordică/ Northern Carmine Bee-eater	*Merops nubicus* Gmelin, 1788	Meropidae	Coraciiformes
7.	Prigoria curcubeu/ Rainbow Bee-eater	*Merops ornatus* Latham, 1801	Meropidae	Coraciiformes
8.	Papagal amazonian cu fruntea turcoaz/ Turquoise-fronted Amazon	*Amazona aestiva* (Linnaeus, 1758)	Psittacidae	Psittaciformes
9.	Ara stacojiu/ Scarlet Macaw	*Ara macao* (Linnaeus, 1758)	Psittacidae	Psittaciformes
10.	Corella cu cioc lung/ Long-billed Corella	*Cacatua tenuirostris (Kuhl, 1820)*	Psittacidae	Psittaciformes
11.	Cacatu cu ochi albaștri/ Blue-eyed Cockatoo	*Cacatua ophthalmica* Sclater, 1864	Psittacidae	Psittaciformes
12.	Galah/ Galah	*Eolophus roseicapilla* (Vieillot, 1817)	Psittacidae	Psittaciformes
13.	Nimfă/ Cockatiel	*Nymphicus hollandicus* (Kerr, 1792)	Psittacidae	Psittaciformes
14.	Peruș/ Budgerigar	*Melopsittacus undulatus* (Shaw, 1805)	Psittacidae	Psittaciformes
15.	Rozela estică/ Eastern Rosella	*Platycercus eximius* (Shaw, 1792)	Psittacidae	Psittaciformes
16.	Papagal gulerat Australian/ Australian Ringneck	*Barnardius zonarius* (Vigors & Horsfield, 1827)	Psittacidae	Psittaciformes
17.	Lori de mosc/ Musk Lorikeet	*Glossopsitta concinna* (Shaw, 1791)	Psittacidae	Psittaciformes
18.	Lori curcubeu/ Rainbow Lorikeet	*Trichoglossus moluccanus* (Gmelin, 1788)	Psittacidae	Psittaciformes
19.	Lori mic/ Little Lorikeet	*Parvipsitta pussila* (Shaw, 1790)	Psittacidae	Psittaciformes
20.	Papagal Eclectus/ Moluccan Eclectus	*Eclectus roratus* (Müller, 1776)	Psittacidae	Psittaciformes
21.	Papagalul Lordului Derby/ Lord Derby's Parakeet	*Psittacula derbiana* (Fraser, 1852)	Psittacidae	Psittaciformes
22.	Papagalul marele Alexandru/ Alexandrine parakeet	*Psittacula eupatria* (Linnaeus, 1766)	Psittacidae	Psittaciformes
23.	Pasăre cioc-în-seceră/ Red-billed Scythebill	*Campylorhamphus trochilirostris* (Lichtenstein, 1820)	Furnariidae	Passeriformes
24.	Pitta gălăgioasă/ Noisy Pitta	*Pitta versicolor* Swainson, 1825	Pittidae	Passeriformes
25.	Cotinga bandată/ Banded Cotinga	*Cotinga maculata* (Müller, 1776)	Cotingidae	Passeriformes
26.	Pasărea liră/ Superb Lyrebird	*Menura novaehollandiae* Latham, 1801	Menuridae	Passeriformes
27.	Pasărea soarelui a lui Hunter/ Hunter's Sunbird	*Nectarinia (Chalcomitra) Hunter* (Shelley, 1889)	Nectarinidae	Passeriformes
28.	Pasărea paradisului/ Raggiana Bird-of-paradise	*Paradisaea raggiana* Sclater, 1873	Paradisaeidae	Passeriformes
29.	Pasărea paradisului mică /	*Paradisaea minor*	Paradisaeidae	Passeriformes

	Lesser Bird-of-paradise	Shaw, 1809		
30.	Pasărea de umbrar regent/ Regent Bowerbird	*Sericulus chrysocephalus* (Lewin, 1808)	Ptilonorhynchidae	Passeriformes
31.	Pănțăruș-zână superb/ Superb Fairy-wren	*Malurus cyaneus* (Ellis, 1782)	Maluridae	Passeriformes
32.	Mâncător de miere cu smocuri galbene/ Yellow-tufted Honeyeater	*Lichenostomus melanops* (Latham, 1801)	Meliphagidae	Passeriformes
33.	Astrild zebruță/ Australian Zebra Finch	*Taeniopygia castanotis* (Gould, 1837)	Estrildidae	Passeriformes
34.	Astrild gould/ Gouldian Finch	*Chloebia gouldiae* (Gould, 1844)	Estrildidae	Passeriformes
35.	Mannikin castaniu/ Chestnut-breasted Mannikin	*Lonchura castaneothorax* (Gould, 1837)	Estrildidae	Passeriformes
36.	Trupial de camp/ Campo Troupial	*Icterus jamacaii* (Gmelin, 1788)	Icteridae	Passeriformes
37.	Trupial cu sprânceană albă/ White-browed Blackbird	*Leistes superciliaris* (Bonaparte, 1851)	Icteridae	Passeriformes
38.	Tanagra braziliană/ Brazilian Tanager	*Ramphocelus bresilius* (Linnaeus, 1766)	Thraupidae	Passeriformes
39.	Căutător de miere Turcoaz/ Blue Dacnis	*Dacnis cayana* (Linnaeus, 1766)	Thraupidae	Passeriformes
40.	Căutător de miere cu picioare roșii/ Red-legged Honeycreeper	*Cyanerpes cyaneus* (Linnaeus, 1766)	Thraupidae	Passeriformes
41.	Tanagra rândunică/ Swallow Tanager	*Tersina viridis* (Illiger, 1811)	Thraupidae	Passeriformes
42.	Tanagra cu piept gălbui/ Brassy-breasted Tanager	*Tangara desmaresti* (Vieillot, 1819)	Thraupidae	Passeriformes
Palearctice				
43.	Cocoș de munte/ Western Capercaillie	*Tetrao urogallus* Linnaeus, 1758	Phasianidae	Galliformes
44.	Cocoș de mesteacăn/ Black Grouse	*Lyrurus tetrix* (Linnaeus, 1758)	Phasianidae	Galliformes
45.	Ieruncă/ Hazel Grouse	*Tetrastes bonasia* (Linnaeus, 1758)	Phasianidae	Galliformes
46.	Ieruncă de tundra/ Willow Grouse	*Lagopus lagopus* (Linnaeus, 1758)	Phasianidae	Galliformes
47.	Ieruncă alpină/ Rock Ptarmigan	*Lagopus muta* (Montin, 1776)	Phasianidae	Galliformes
48.	Prepeliță/ Common Quail	*Coturnix coturnix* (Linnaeus, 1758)	Phasianidae	Galliformes
49.	Potârniche/ Grey Partridge	*Perdix perdix* (Linnaeus, 1758)	Phasianidae	Galliformes
50.	Fazan/ Common Pheasant	*Phasianus colchicus* (Linnaeus, 1758)	Phasianidae	Galliformes
51.	Călifar alb/ Common Shelduck	*Tadorna tadorna* (Linnaeus, 1758)	Anatidae	Anseriformes
52.	Rață mare/ Mallard	*Anas platyrhynchos* Linnaeus, 1758	Anatidae	Anseriformes
53.	Rață mica/ Common Teal	*Anas crecca* Linnaeus, 1758	Anatidae	Anseriformes
54.	Rață cârâitoare/ Garganey	*Spatula querquedula* (Linnaeus, 1758)	Anatidae	Anseriformes
55.	Rață lingurar/ Northern Shoveler	*Spatula clypeata* (Linnaeus, 1758)	Anatidae	Anseriformes
56.	Rață cu ciuf/ Red-crested Pochard	*Netta rufina* (Pallas, 1773)	Anatidae	Anseriformes
57.	Ferestraș mare/ Goosander	*Mergus merganser* Linnaeus, 1758	Anatidae	Anseriformes
58.	Ferestraș mic/ Smew	*Mergellus albellus* (Linnaeus, 1758)	Anatidae	Anseriformes
59.	Cufundar polar/ Arctic Loon	*Gavia arctica* (Linnaeus, 1758)	Gaviidae	Gaviiformes
60.	Corcodel mare/ Great Crested Grebe	*Podiceps cristatus* (Linnaeus, 1758)	Podicipedidae	Podicipediformes
61.	Corcodel mic/ Little Grebe	*Tachybaptus ruficollis* (Pallas, 1764)	Podicipedidae	Podicipediformes

62.	Corb de mare/ Northern Gannet	*Morus bassanus* (Linnaeus, 1758)	Sulidae	Suliformes
63.	Cormoran mare / Great Cormorant	*Phalacrocorax carbo* (Linnaeus, 1758)	Phalacrocoracidae	Suliformes
64.	Cormoran mic/ Pygmy Cormorant	*Microcarbo pygmaeus* (Pallas, 1773)	Phalacrocoracidae	Suliformes
65.	Pelican comun/ Great White Pelican	*Pelecanus onocrotalus* Linnaeus, 1758	Pelecanidae	Pelecaniformes
66.	Pelican creț/ Dalmatian Pelican	*Pelecanus crispus* Bruch, 1832	Pelecanidae	Pelecaniformes
67.	Lopătar/ Eurasian Spoonbill	*Platalea leucorodia* Linnaeus, 1758	Threskiornithidae	Pelecaniformes
68.	Egretă mica/ Little Egret	*Egretta garzetta* (Linnaeus, 1766)	Ardeidae	Pelecaniformes
69.	Stârc roșu/ Purple Heron	*Ardea purpurea* Linnaeus, 1766	Ardeidae	Pelecaniformes
70.	Stârc galben/ Squacco Heron	*Ardeola ralloides* (Scopoli, 1769)	Ardeidae	Pelecaniformes
71.	Stârc de noapte/ Black-crowned Night-heron	*Nycticorax nycticorax* (Linnaeus, 1758)	Ardeidae	Pelecaniformes
72.	Zăgan/ Bearded Vulture	*Gypaetus barbatus* (Linnaeus, 1758)	Accipitridae	Accipitriformes
73.	Codalb/ White-tailed Sea-eagle	*Haliaeetus albicilla* (Linnaeus, 1758)	Accipitridae	Accipitriformes
74.	Acvilă de munte/ Golden Eagle	*Aquila chrysaetos* (Linnaeus, 1758)	Accipitridae	Accipitriformes
75.	Acvilă de camp/ Eastern Imperial Eagle	*Aquila heliacal* Savigny, 1809	Accipitridae	Accipitriformes
76.	Acvilă țipătoare mare/ Greater Spotted Eagle	*Clanga (Aquila) clanga* (Pallas, 1811)	Accipitridae	Accipitriformes
77.	Acvilă țipătoare mica/ Lesser Spotted Eagle	*Clanga (Aquila) pomarine* (Brehm, 1831)	Accipitridae	Accipitriformes
78.	Acvilă mica/ Booted Eagle	*Hieraaetus pennatus* (Gmelin, 1788)	Accipitridae	Accipitriformes
79.	Șerpar/ Short-toed Snake-eagle	*Circaetus gallicus* (Gmelin, 1788)	Accipitridae	Accipitriformes
80.	Gaie roșie/ Red Kite	*Milvus milvus* (Linnaeus, 1758)	Accipitridae	Accipitriformes
81.	Erete vânăt/ Hen Harrier	*Circus cyaneus* (Linnaeus, 1766)	Accipitridae	Accipitriformes
82.	Șorecar comun/ Eurasian Buzzard	*Buteo buteo* (Linnaeus, 1758)	Accipitridae	Accipitriformes
83.	Șorecar încălțat/ Rough-legged Buzzard	*Buteo lagopus* (Pontoppidan, 1763)	Accipitridae	Accipitriformes
84.	Uliu porumbar/ Northern Goshawk	*Accipiter gentilis* (Linnaeus, 1758)	Accipitridae	Accipitriformes
85.	Uliu păsărar/ Eurasian Sparrowhawk	*Accipiter nisus* (Linnaeus, 1758)	Accipitridae	Accipitriformes
86.	Uligan pescar/ Osprey	*Pandion haliaetus* (Linnaeus, 1758)	Pandionidae	Accipitriformes
87.	Cocor/ Common Crane	*Grus grus* (Linnaeus, 1758)	Gruidae	Gruiformes
88.	Cristel de câmp/ Corncrake	*Crex crex* (Linnaeus, 1758)	Rallidae	Gruiformes
89.	Găinușă de baltă/ Common Moorhen	*Gallinula chloropus* (Linnaeus, 1758)	Rallidae	Gruiformes
90.	Lișiță/ Common Coot	*Fulica atra* Linnaeus, 1758	Rallidae	Gruiformes
91.	Dropie/ Great Bustard	*Otis tarda* Linnaeus, 1758	Otididae	Otidiformes
92.	Prundăraș de munte/ Eurasian dotterel	*Eudromias (Charadrius) morinellus* (Linnaeus, 1758)	Charadriidae	Charadriiformes
93.	Nagât/ Northern Lapwing	*Vanellus vanellus* (Linnaeus, 1758)	Charadriidae	Charadriiformes
94.	Bătăuș/ Ruff	*Calidris pugnax* (Linnaeus, 1758)	Scolopacidae	Charadriiformes
95.	Culic mare/ Eurasian Curlew	*Numenius arquata* (Linnaeus, 1758)	Scolopacidae	Charadriiformes

96.	Ciocîntors/ Pied Avocet	*Recurvirostra avosetta* Linnaeus, 1758	Recurvirostridae	Charadriiformes
97.	Piciorong/ Black-winged Stilt	*Himantopus himantopus* (Linnaeus, 1758)	Recurvirostridae	Charadriiformes
98.	Chirighiță neagră/ Black Tern	*Chlidonias niger* (Linnaeus, 1758)	Laridae	Charadriiformes
99.	Chiră de baltă/ Common Tern	*Sterna hirundo* Linnaeus, 1758	Laridae	Charadriiformes
100.	Pescăriță mare/ Caspian Tern	*Hydroprogne caspia* (Pallas, 1770)	Laridae	Charadriiformes
101.	Buhă/ Eurasian Eagle-owl	*Bubo bubo* (Linnaeus, 1758)	Strigidae	Strigiformes
102.	Bufnița de zăpadă/ Snowy Owl	*Bubo scandiacus* (Linnaeus, 1758)	Strigidae	Strigiformes
103.	Huhurez mare/ Ural Owl	*Strix uralensis* Pallas, 1771	Strigidae	Strigiformes
104.	Huhurez mic/ Tawny Owl	*Strix aluco* Linnaeus, 1758	Strigidae	Strigiformes
105.	Ciuf de pădure/ Long-eared Owl	*Asio otus* (Linnaeus, 1758)	Strigidae	Strigiformes
106.	Ciuf de camp/ Short-eared Owl	*Asio flammeus* (Pontoppidan, 1763)	Strigidae	Strigiformes
107.	Ciuș/ Eurasian Scops-owl	*Otus scops* (Linnaeus, 1758)	Strigidae	Strigiformes
108.	Cucuvea/ Little Owl	*Athene noctua* (Scopoli, 1769)	Strigidae	Strigiformes
109.	Ciuvică/ Eurasian Pygmy-owl	*Glaucidium passerinum* (Linnaeus, 1758)	Strigidae	Strigiformes
110.	Strigă/ Common Barn-owl	*Tyto alba* (Scopoli, 1769)	Tytonidae	Strigiformes
111.	Caprimulg/ European Nightjar	*Caprimulgus europaeus* Linnaeus, 1758	Caprimulgidae	Caprimulgiformes
112.	Drepnea mare/ Alpine Swift	*Tachymarptis melba* (Linnaeus, 1758)	Apodidae	Apodiformes
113.	Dumbrăveancă/ European Roller	*Coracias garrulus* Linnaeus, 1758	Coraciidae	Coraciiformes
114.	Prigorie/ European Bee-eater	*Merops apiaster* Linnaeus, 1758	Meropidae	Coraciiformes
115.	Pescăraș albastru/ Common Kingfisher	*Alcedo atthis* (Linnaeus, 1758)	Alcedinidae	Coraciiformes
116.	Pupăză/ Common Hoopoe	*Upupa epops* Linnaeus, 1758	Upupidae	Bucerotiformes
117.	Ciocănitoare neagră/ Black Woodpecker	*Dryocopus martius* (Linnaeus, 1758)	Picidae	Piciformes
118.	Ciocănitoare pestriță mare/ Great Spotted Woodpecker	*Dendrocopos major* (Linnaeus, 1758)	Picidae	Piciformes
119.	Ciocănitoare pestriță mica/ Lesser Spotted Woodpecker	*Dryobates minor* (Linnaeus, 1758)	Picidae	Piciformes
120.	Șoim călător/ Peregrine Falcon	*Falco peregrinus* Tunstall, 1771	Falconidae	Falconiformes
121.	Șoimul rândunelelor/ Eurasian Hobby	*Falco Subbuteo* Linnaeus, 1758	Falconidae	Falconiformes
122.	Șoim de iarnă/ Merlin	*Falco columbarius* Linnaeus, 1758	Falconidae	Falconiformes
123.	Vânturel de seară/ Red-footed Falcon	*Falco vespertinus* Linnaeus, 1766	Falconidae	Falconiformes
124.	Vânturel roșu/ Common Kestrel	*Falco tinnunculus* Linnaeus, 1758	Falconidae	Falconiformes
125.	Vânturel mic/ Lesser Kestrel	*Falco naumanni* Fleischer, 1818	Falconidae	Falconiformes
126.	Lăstun de casă/ Northern House Martin	*Delichon urbicum* (Linnaeus, 1758)	Hirundinidae	Passeriformes
127.	Sfrâncioc mare/ Great Grey Shrike	*Lanius excubitor* Linnaeus, 1758	Laniidae	Passeriformes
128.	Sfrâncioc cu frunte neagră/ Lesser Grey Shrike	*Lanius minor* Gmelin, 1788	Laniidae	Passeriformes
129.	Mătăsar/ Bohemian Waxwing	*Bombycilla garrulus* (Linnaeus, 1758)	Bombycillidae	Passeriformes
130.	Pescărel negru/ White-throated Dipper	*Cinclus cinclus* (Linnaeus, 1758)	Cinclidae	Passeriformes
131.	Gușă-vânătă/ Bluethroat	*Luscinia svecica* (Linnaeus, 1758)	Muscicapidae	Passeriformes
132.	Măcăleandru/ European Robin	*Erithacus rubecula* (Linnaeus, 1758)	Muscicapidae	Passeriformes

133.	Codroș de munte/ Black Redstart	*Phoenicurus ochruros* (Gmelin, 1774)	Muscicapidae	Passeriformes
134.	Mierlă de piatră/ Rufous-tailed Rock-thrush	*Monticola saxatilis* (Linnaeus, 1766)	Muscicapidae	Passeriformes
135.	Sturz cântător/ Song Thrush	*Turdus philomelos* Brehm, 1831	Turdidae	Passeriformes
136.	Sturz de vâsc/ Mistle Thrush	*Turdus viscivorus* Linnaeus, 1758	Turdidae	Passeriformes
137.	Cocoșar/ Fieldfare	*Turdus pilaris* Linnaeus, 1758	Turdidae	Passeriformes
138.	Mierlă gulerată/ Ring Ouzel	*Turdus torquatus* Linnaeus, 1758	Turdidae	Passeriformes
139.	Mierlă/ Eurasian Blackbird	*Turdus merula* Linnaeus, 1758	Turdidae	Passeriformes
140.	Graur/ Common Starling	*Sturnus vulgaris* Linnaeus, 1758	Sturnidae	Passeriformes
141.	Lăcustar/ Rosy Starling	*Pastor (Sturnus) roseus* (Linnaeus, 1758)	Sturnidae	Passeriformes
142.	Grangure/ Eurasian Golden Oriole	*Oriolus oriolus* (Linnaeus, 1758)	Oriolidae	Passeriformes
143.	Corb/ Common Raven	*Corvus corax* Linnaeus, 1758	Corvidae	Passeriformes
144.	Cioară grivă/ Hooded Crow	*Corvus cornix* Linnaeus, 1758	Corvidae	Passeriformes
145.	Stăncuță/ Eurasian Jackdaw	*Corvus (Coloeus) monedula* Linnaeus, 1758	Corvidae	Passeriformes
146.	Stăncuță alpină/ Yellow-billed Chough	*Pyrrhocorax graculus* (Linnaeus, 1766)	Corvidae	Passeriformes
147.	Coțofană/ Eurasian Magpie	*Pica pica* (Linnaeus, 1758)	Corvidae	Passeriformes
148.	Gaiță/ Eurasian Jay	*Garrulus glandarius* (Linnaeus, 1758)	Corvidae	Passeriformes
149.	Alunar/ Northern Nutcracker	*Nucifraga caryocatactes* (Linnaeus, 1758)	Corvidae	Passeriformes
150.	Pițigoi moțat/ Crested Tit	*Lophophanes cristatus* (Linnaeus, 1758)	Paridae	Passeriformes
151.	Pițigoi codat/ Long-tailed Tit	*Aegithalos caudatus* (Linnaeus, 1758)	Aegithalidae	Passeriformes
152.	Țiclean/ Eurasian Nuthatch	*Sitta europaea* Linnaeus, 1758	Sittidae	Passeriformes
153.	Fluturaș de stâncă/ Wallcreeper	*Tichodroma muraria* (Linnaeus, 1766)	Tichodromadidae	Passeriformes
154.	Vrabie de casă/ House Sparrow	*Passer domesticus* (Linnaeus, 1758)	Passeridae	Passeriformes
155.	Vrabie negricioasă/ Spanish Sparrow	*Passer hispaniolensis* (Temminck, 1820)	Passeridae	Passeriformes
156.	Scatiu/ Eurasian Siskin	*Spinus (Carduelis) spinus* (Linnaeus, 1758)	Fringillidae	Passeriformes
157.	Sticlete/ European Goldfinch	*Carduelis carduelis* (Linnaeus, 1758)	Fringillidae	Passeriformes
158.	Florinte/ European Greenfinch	*Chloris (Carduelis) chloris* (Linnaeus, 1758)	Fringillidae	Passeriformes
159.	Cânepar/ Common Linnet	*Linaria cannabina* (Linnaeus, 1758)	Fringillidae	Passeriformes
160.	Botgros/ Hawfinch	*Coccothraustes coccothraustes* (Linnaeus, 1758)	Fringillidae	Passeriformes
161.	Forfecuță/ Red Crossbill	*Loxia curvirostra Linnaeus, 1758*	Fringillidae	Passeriformes