WHAT CAN WE LEARN FROM ALEXANDRU BELDIE HERBARIUM? *EUPHORBIA* GENUS

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Abstract. *Through its content and focus on Euphorbia Genus, the present article intends to acknowledge the existence and importance of this impressive plant collection – Alexandru Beldie Herbarium, hosted by the National Forestry Research-Development Institute from Bucharest. Furthermore, the article presents some curiosities regarding the Euphorbia Genus, what we can learn from the systematization of this genus and the most important characteristics of this genus in the herbarium. As such, the paper presents the method in which the Euphorbia Genus collections are organized, represented by the organization system that was used and applied for organizing the Euphorbia Genus from Alexandru Beldie Herbarium. At this chapter is also presented an excerpt of Euphorbia Genus inventory with the criterions used. The most important species are described together with their importance and the most representative species present in the herbarium. A figure representing photos with Euphorbia plants conserved in the herbarium is also presented. The quantitative characteristics of the Euphorbia Genus from the herbarium as number of species, number of exemplars and number of exemplars of the most important species are also presented. The article also presents the harvesting years of Euphorbia species synthesizing periods in which they were harvested most exemplars, and presenting the oldest Euphorbia from the herbarium. The periods were presented graphically from ten to ten years. A map representing the places from Romania wherefrom the Euphorbia specie were collected, was also realised. More than that, the organization of Euphorbia collections has allowed to identify the name of each Romanian or foreign specialists who have contributed through their work in creating this collection by harvesting or determining plants. Also the paper is containing a short presentation of the most important herbariums from the world that also contain Euphorbia species collections. The conclusions presents the most important outputs of the paper in terms of "what we can learn from Alexandru Beldie herbarium" regarding Euphorbia genus.*

Keywords*: plants, herbarium, genus, areal*

INTRODUCTION

„Marin Drăcea" National Institual.,te for Research and Development in Forestry from Bucharest hosts an herbarium named after the renowned Romanian botanist, Alexandru Beldie. This herbarium is inscribed in Index Herbariorum and contains approximately 40.000 plates organized in 600 drawers (CHISĂLIȚĂ et al., 2017). For example, the Herbarium contains 112 *Hieracium* species (DINCĂ L. et al., 2017), 69 *Potentilla* species (CRIȘAN et al., 2017), 19 *Androsace* species (DINCĂ MARIA et al., 2017), 19 *Centaurea* species (DINCĂ L. et al., 2017), 15 *Ornitogalum* species (ENESCU RALUCA et al., 2017), 15 *Veronica* species (DINCĂ L. et al., 2017), 6 Vaccinium species (SCĂRLĂTESCU V. et al., 2017), 41 *Poligonum* species (VECHIU EMILIA et al., 2018) and 16 *Abies* species (ENESCU C. M. et al., 2018).

MATERIAL AND METHODS

How can a collection from an herbarium be organized? *Euphorbia* Genus from Alexandru Beldie Herbarium – materials used and work method

A renowned organization system that was also used and applied for organizing the *Euphorbia* Genus from Alexandru Beldie Herbarium is exemplified in Table number 1. In order to create a database, collection vouchers and Excel spreadsheets were used as materials. The systematization was obtained for each sample from the collection, based on the harvesting year, place and the person who has collected them. This kind of organization allows a further analysis regarding the periods in which the plants were collected and in which the collection was developed, as well as the creation of maps showcasing the harvesting places for the studied genus as can be seen in the following paragraphs.

Table 1

Euphorbia Genus Inventory from Al. Beldie Herbarium, INCDS București (excerpt)

Drawer number	Voucher number	Herbarium/ Botanic collection/ Institution	Species name	Harvesting date	Harvesting place	Collected/ Determined by:	Conservation Degree (1..4)
53	4	Polytechnics School Herbarium, Bucharest, Botanic Labotatory	*Euphorbia agraria* M. Bieb	1938.05.16	Durostor	C. C. Georgescu	1
53	31	Flora Romaniae Exsiccata A Museo Botanico Universitatis Clusiensis (in Timisoara)	*Euphorbia agraria* M. Bieb	1938.05.26	Iasi	M. Ravarut	1
53	7	F. Schultz et F. Winter, Herbarium normale. Phanerogamia. Cent. 2	*Euphorbia amygdaloid es* L.	1868.06.10	North-East of Kaiserslautern	F. Schultz	2
53	13	Forestry Research Institute Herbarium	*Euphorbia amygdaloid es* L.	1973.05.05	Snagov Park	V. Leandru	1
53	2	Museum Botanicum Universitatis, Cluj Flora Romaniae exsiccata	*Euphorbia angulata* Jacq.	1922.06	Cluj	I. Prodan	1
53	34	Dr. C. Baenitz, Herbarium Europaeum	*Euphorbia bivonae* Steud.	-	Palermo	Dr. H. Ross	2

RESULTS AND DISCUSSIONS

What *Euphorbia* species are there and what is their importance?

Euphorbia is a very large and diverse genus of flowering plants, commonly called spurge, from the spurge family (*Euphorbiaceae*). Euphorbias range from tiny annual plants to large and long-lived trees. The genus has approximately 2000 members, making it one of the largest genera of flowering plants (https://en.wikipedia.org).

Euphorbia pulcherrima (Poinsettia pulcherrima) is one of the most spectacular species from this genus and is magnificent to be seen during winter. Originating from Mexico and Central America, the plant is commercialized during winter holidays, its popular name ("Craciunita" or "Chirstmas Star") representing a worldwide symbol for this time of year (https://www.botanistii.ro).

Another interesting plant is *Euphorbia milii*, also known as Christ's Wreath, Jesus's Plants or Thorn Wreath due to its thorn stem. It belongs to the *Euphorbiaceae* Family and is an interior plant highly appreciated for its resistance and flowers. The stem's sap is white-milky and toxic (http://www.flowertime.ro).

As can be seen, the *Euphorbia* plants have both an aesthetic and decorative purpose, together with a medicinal one. A number of researches have emphasized the effects of different remedies and essences created from these plants. As such, Galvez et al (1993) has emphasized the anti-diarrheal activity of the *Euphorbia hirta* extract and the isolation of an active flavonoid constituent (GALVEZ et al., 1993); Lanhers et al (1991) have investigated analgesic, antipyretic and anti-inflammatory properties of *Euphorbia hirta* (LANHERS et al., 1991), while Natarajan et al (2005) have written about the anti-bacterial activity of *Euphorbia fusiformis* (NATARAJAN et al., 2005). Cytotoxic and antiviral activities of Colombian medicinal plant extracts of the *Euphorbia* genus were emphasized in researches conducted by Betancur-Galvis et al in 2002 (BETANCUR-GALVIS et al., 2002), while Johnson et al (1999) has highlighted the diuretic effect of *Euphorbia hirta* by experimenting on mouse (JOHNSON et al., 1999).

After the *Euphorbia* collections were organized, 146 vouchers were analysed (Figure 1) with samples belonging to 49 species. The most number of samples belong to *Euphorbia cyparissias* L. – 25 samples. Other species well represented within the herbarium are *Euphorbia amygdaloides* L. (23 samples) and *Euphorbia polychroma* L. (12 samples).

Fig. 1. Vouchers with *Euphorbia* samples present in "Alexandru Beldie" Herbarium (*E. carniolica* (left up), *E. chamaesyce* (right up), *E. lucira* (left down), *E. polychroma* (right down)

When *Euphorbia* species from "Alexandru Beldie" Herbarium were harvested?

The answer to this question was found out after the data present in the Herbarium was analysed based on the above-mentioned methodology. As such, as can be observed in Figure number 2, the number of harvested *Euphorbia* samples has increased progressively, recording a maximum during the inter-war period. The oldest *Euphorbia* representative present in the herbarium is a *Euphorbia exigua* L. harvested in 1859 by Wolff, while the newest sample is represented by a *Euphorbia pilosa* L. harvested in 1997 from Austria.

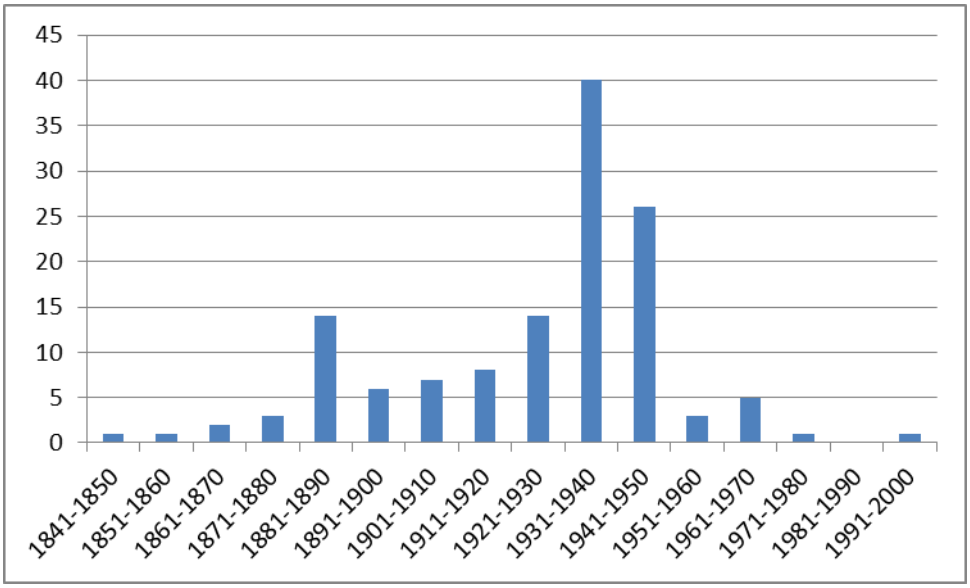

Fig. 2. Harvesting period of *Euphorbia* samples from "Alexandru Beldie" Herbarium

The spreading areal of *Euphorbia* species and the harvesting location of samples from the herbarium

The *Euphorbia* samples present in the herbarium were mainly collected from Romania (Figure 3), as well as from locations from Europe or from previous Romanian territories such as Basarabia, Cernăuţi (Ukraine), Durostor (Bulgaria), Austria, Pelagosa Grande (Italy), Vela Pelagruza (Croatia), Kaiserslautern (Germany), Palermo (Italy), Pressburg (Germany), Bratislava (Slovakia), San Marino, Sarepta (Russia).

As can be seen in Figure number 3, the harvesting areas of *Euphorbia* plants present in "Alexandru Beldie" Herbarium cover the entire Romanian territory, plants from this Genus being harvested from all the geographic areas and regions of Romania.

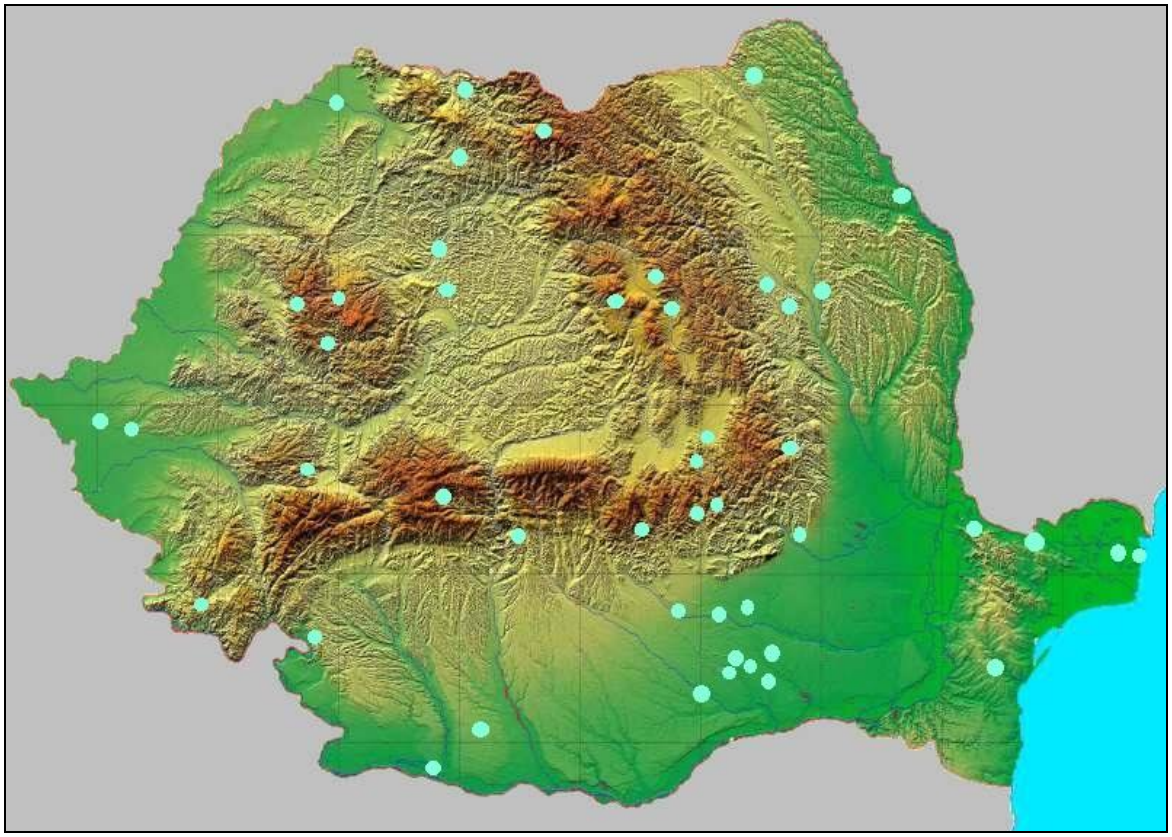

Fig. 3 Harvesting place of *Euphorbia* plants from Romania

Personalities that have contributed to the development of the *Euphorbia* collection present in the Herbarium

The development of the *Euphorbia* collection present in the above-mentioned Herbarium was possible thanks to the professionalism, dedication and service of numerous Romanian and foreign specialists for over one century and a half.

Amongst the Romanian specialists that have brought important contributions to the development of the collection we mention: Pauca, Beldie, Borza, Grintescu, Bujorean, Buia, Prodan, Haralamb, Ciuca, Cretzoiu, Georgescu, Morariu, Coman, Cirtu, Mititelu, Vitalariu, Nicolaescu, Pascovschi, Haralamb, Dimonie, Gusuleac, Iacobescu, Paun, Ravarut, Enculescu, Ularu, Purcelean, Savulescu, Iacob, Bunea, and Leandru.

The foreign specialists that have contributed with numerous *Euphoria* samples to the development of the "Alexandru Beldie" Herbarium are: Becker, Peterffi, Froelich, Ross, Schultz, Gibelli, Arnas, Naret, Holuby, Freyn, Gandoger, Frostner, Penzing, Billiet, Rays, and Wolff.

Worldwide *Euphorbia* collections

Alexandru Beldie Herbarium reunites numerous collections, including the *Euphorbia* one, having an inestimable historical and scientific value. Similar to this, there are numerous other herbariums that contain innumerable genus collections. The following paragraphs mention some of the most important herbariums from the world that contain *Euphorbia* collections.

University of Calgary Herbarium, Calgary's Herbarium has been providing indispensable botanical resources for teaching, research and industry for over 40 years. With an extensive collection of land plants from Alberta and around the world, the herbarium is dedicated to the collection, preservation and documentation of past and present plant biodiversity (https://bio.ucalgary.ca).

Linnaean Herbarium, namely the specimens from the Herbarium of Carl Linnaeus (1707-1778) held at the Linnean Society of London (linnean-online.org/linnaean_herbarium.html).

The Smith Herbarium, the Herbarium of Sir James Edward Smith (1759-1828) held at the Linnean Society of London (linnean-online.org/smith_herbarium.html).

The Burke's Botany Collections are located in the University of Washington Herbarium, also known as the WTU (Washington Territorial University) Herbarium. The Herbarium's collections currently include over 660,000 specimens. Between 5,000–10,000 specimens are added to the collections annually from the field work and extensive exchange programs (https://www.burkemuseum.org).

With ca. 6,000,000 specimens, the herbaria of the Conservatoire et Jardin botaniques de la Ville de Genève (CJB) ranks among the most important botanical collections in the world, inherited from a botanical tradition that dates back to the 18th century. It includes plant and fungal specimens from across the world, with special emphasis on the Mediterranean area, Near- and Middle-East, South America and Europe (https://www.ville-ge.ch).

The University of Florida Herbarium is a unit of the Department of Natural History of the Florida Museum of Natural History. The herbarium and the associated paleo botanical collection have combined holdings of approximately 1/2 million specimens (https://www.floridamuseum.ufl.edu).

The Brown University Herbarium was founded in 1869 when the University acquired the collections of the Providence Franklin Society and Stephen Thayer Olney. Currently, the herbarium includes around 100,000 plant specimens and is an important depository of Rhode Island and New England collections from the late nineteenth and early twentieth century's. It is also rich in western and southern North American plants and includes special sets of historically valuable specimens from early western US expeditions (https://repository.library.brown.edu).

CONCLUSIONS

The present paper covers innovative aspects regarding one of the most impressive herbariums from Romania, focusing on the *Euphorbium* Genus and its short analysis.

As such, the "Alexandru Beldie" Herbarium, one of the most important herbariums from our country, hosts an impressive number of vouchers: 40.000, organized in 600 drawers.

Furthermore, the article allows its readers to understand the way in which a systematization can be done within a herbarium for a genus like *Euphorbia*: an alphabetical ordering after the species' name that also takes into account its harvesting place and year, the specialist who has collected it, the collection to which it belongs, the voucher's and drawer's number as well as its conservation degree.

The above-mentioned genus and the focus of this study has over or about 2000 members, making it one of the largest genera of flowering plants. The "Alexandru Beldie" Herbarium contains a number of 146 vouchers with *Euphorbia* samples, belonging to 49 species.

From the article, we find out that the oldest *Euphorbia* sample dates back to 1850, being a *Euphorbia exigua* L. representative. The majority of plants were harvested between 1930 and 1950, a period in which the *Euphorbia* collections from the herbarium were enriched with valuable samples.

The plants that compose the analysed collections were gathered from all around Romania, as well as from previous Romanian territories or from Europe.

The systematization process has revealed that no less than 31 Romanian specialists and 17 foreign ones are mentioned in the herbarium's vouchers as the persons who have collected and established the collection's samples.

Euphorbia Genus is a reference for all plant collections and herbarium, a fact proven by its presence in vouchers belonging to famous herbariums such as: University of Calgary Herbarium, Linnaean Herbarium, The Smith Herbarium, The Burke's Botany Collections, Conservatoire et Jardin botaniques de la Ville de Genève, The University of Florida Herbarium, or The Brown University Herbarium.

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