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MAPLES (GENUS *ACER* L.) OF "ALEXANDRU BELDIE" HERBARIUM

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Abstract

Herbaria provide useful information for studies related to anatomy, morphology, systematics and taxonomy of plants. In Romania, sixteen herbaria collections exist, the one hosted by "Marin Drăcea" National Institute for Research and Development in Forestry being among them. The aim of this paper was to provide an overview of the representatives of genus Acer of "Alexandru Beldie" Herbarium (Code: BUCF). Each sample provided the following information: the scientific and popular names of the species, the taxonomic classification of the species, the place of collection, the date of collection, summary data about the biotope of the harvested plant and the name of the person who collected the plant. Every sample was evaluated and the degree of conservation was assessed. 333 paper sheets and thirty one taxa belonging to genus Acer were sampled. The collection contains several subspecies and varieties of some of the most common maple species across Romania (e.g. field maple), and also some rare species native to China or Japan. The vast majority of samples are in a good conservation phase, representing a valuable database for future interdisciplinary research.

Key words*: Aceraceae, biological material, herbaria, maple, plant specimens.*

INTRODUCTION

A herbarium contains a collection of dried plants specimens (vouchers) labeled and stored in an organized manner that is used for a broad range of scientific studies (Enescu et al., 2018).
In order to be preserved from fungal infestations and consumption by larvae and insects, the samples are treated with chemical compounds, such as mercury dichloride ($HgCl_2$) (Cabassi et al., 2020). In the last years, herbaria provided primary data source for several studies related to anatomy and morphology, anthropology, biogeography, climate change, ecology, economic botany, ethnobotany, environment variation, genetics, history of plants, phylogenomics, systematics, taxonomy and teaching (Enescu et al., 2018; Jang et al., 2020; Nevill et al., 2020; Sugita et al., 2020).
Particularly, herbaria were used for quantitative assessment of accumulation of certain metals (*e.g*. cobalt, manganese, nickel and zinc) into specific parts of hyperaccumulator plants (Do et al., 2020) or to study the chemical diversity of preserved plants (Resende et al., 2020).
Sixteen herbaria exist in Romania. Among them, one of the oldest is the herbarium founded in 1882 by Professor Dimitrie Brândza that is hosted by "Dimitrie Brândza" Botanical Garden, University of Bucharest (Urziceanu et al., 2017). After half a century, Professor Alexandru Beldie founded another representative collection, which nowadays is hosted by "Marin Drăcea" National Institute for Research and Development in Forestry. "Alexandru Beldie" Herbarium (Code: BUCF) incorporates a collection of 60.000 samples of preserved specimens of trees, shrubs, mosses, lichens, ferns and plants (Enescu et al., 2018) harvested preponderantly from mountain areas (Deleanu et al., 2019).
Al. Beldie, Al. Borza, P. Cretzoiu, C.C. Georgescu, M. Haret, N. Iacobescu, I. Morariu, S. Paşcovschi, M. Petcuț, I. Pop, I. Prodan and E.I. Nyarady were among the Romanian botanists who contributed to the collection (Dincă et al., 2017).
Due to their importance, diversity and large distribution range across Romania, the representatives of Genus *Acer* L. (maples) are

very well represented within BUCF and in other herbaria worldwide.

Maples are distributed in the Northern Hemisphere, in Europe, North America, North of Africa, but especially in China (Asadi et al, 2019; Li et al., 2019). Being a species-rich genus, several opinions among taxonomists regarding the exact number of species exist. According to several studies (Chen, 2010; Contreras et al, 2018; Suh et al., 1996; Suh et al., 2000) the number of maple species varies from 129 to 200 or even more (Harris et al., 2017). Among them, there are several species with restricted distribution range, such as *Acer yangbiense* Y.S. Chen & Q.E. Yang and *A. griseum* (Franch.) Pax in China (Tao et al., 2020; Wang et al., 2017; Zhao et al., 2011), *A. pseudowilsonii* Y.S. Chen in Thailand (Chen, 2010) *A. miyabei* Maxim. in northern Japan (Saeki et al., 2018) or *A. binzayedii* Rehder in Jalisco State, Mexico (Vargas-Rodriguez, 2017). Other species, such as box elder (*A. negundo* L.), are considered to be invasive (Abramova, 2019).

Several maple species have high ornamental value, such as Amur maple (*A. ginnala* Maxim.) (Yang et al., 2020) or *A. pseudoplatanus* "Atropurpureum" (Kostić et al., 2019) being widely used in gardens, as hedges or as urban trees. For example, along Timișoara Boulevard from Bucharest, one third of the total tree species is represented by five maple species, silver maple (*A. saccharinum* L.) and Norway maple (*A. platanoides* L.) being the most common ones (Badea et al., 2016).

Some maple species have other uses, such as in afforestation of degraded lands (Drzewiecka et al., 2019; Enescu, 2015), treating a wide range of diseases (Bi et al., 2016) and/or providing wood and sap (Bilek et al., 2016).

Last but not least, maples are regarded as key forest elements (Mohtashamian et al., 2017) with interesting reproductive models that include monoecy, dioecy, trioecy, andro-monoecy, androdioecy, and andropolygamy (Rosado et al., 2018). Thanks to their importance in forestry and due to the fact that superior genetic material is needed, 79 seed sources of sycamore maple (*A. pseudoplatanus* L.) were recently designated (Rebrean et al., 2019) across Romania and other studies for the establishment of a new seed orchards are ongoing (Marin et al., 2012).

The purpose of this paper was to provide an overview of the representatives of genus *Acer* of "Alexandru Beldie" Herbarium.

MATERIALS AND METHODS

Each labeled sample provided the following data: the scientific and popular names of the species, the taxonomic classification of the species, the place of collection, the date of collection, summary data about the biotope of the harvested plant and the name of the person who collected the plant.

Every sample was evaluated and the degree of conservation was assessed by using the following scale: 1 = well preserved plant (whole plant) properly attached to the sheet, 2 = plant detached from the sheet with detached, but existing parts, 3 = plant detached from the sheet with missing parts and 4 = detached and fragmented plant with over 50% missing parts (Enescu et al., 2018).

RESULTS AND DISCUSSIONS

A total of 333 paper sheets and thirty one taxa belonging to Genus *Acer* were sampled, namely pointed-leaf maple (*A. argutum* Maxim.), *A. austriacum* Tratt (sin. *A. campestre* infrasp. *campestre*), Campbell's Maple (*A. campbellii* Hook. f. & Thomson), field maple (*A. campestre* L. *sensu lato* or *A. campestris* L.), silver maple (*A. dasycarpum* Enhr.), devil maple (*A. diabolicum* Blume ex K.Koch), Amur maple (*A. ginnala* Maxim.), Iranian maple (*A. insigne* Boiss.), *A. italum* Pax (sin. *A. opaluss* ssp. *Italum*), *A. laetum* C.A.Mey (sin. *A. cappadocicim* Gled.), smooth maple (*A. laevigatum* Wall.), bigleaf maple (*A. macrophyllum* Pursh), *A. martini* Jordan [sin. *A. monspessulanum* subsp. *Martini* (Jordan) P. Fourn.], Montpellier maple (*A. monspessulanum* L.), box elder (*A. negundo* L.), *A. obtusatum* Waldst. & Kit. Ex Willd. [sin. *A. opalus* subsp. *Obtusatum* (Waldst. & Kit. Ex Willd.) Gams], *A. opulifolium* Vill. (sin. *A. opalus* Mill.), palmate maple (*A. palmatum* Thunb.), striped maple (*A. pensylvanicum* L.), yellow-paint maple (*A. pictum* Thunb.), Norway maple (*A. platanoides*

L.), sycamore maple (*A. pseudoplatanus* L.), red maple (*A. rubrum* L.), sugar maple (*A. saccharum* Marshall), silver maple (*A. saccharinum* L.), *A. semenovii* Regel et Herd. [sin. *A. ginnala* subsp. *semenovii* (Regel & Herder) Pax or *A. tataricum* subsp. *semenovii* (Regel & Herder) A.E. Murray], mountain maple (*A. spicatum* Lam.), Tatar Maple (*A. tatarica* L. or *A. tataricum* L.), Manchurian striped maple (*A. tegmentosum* Maxim) and other five undetermined taxa.

Almost three quarters of samples consisted in biological material of field maple (38%), Tatar maple (17%), sycamore maple (10%) and Norway maple (7%), respectively.

Among the 30 sampled *A. campestre sensu stricto* biological materials, two originated from France and one from Bulgaria, while the rest were collected from forests across its distribution range in Romania, such as: Slobozeanu Mare Forest and Trei Izvoare Forest (Buzău County), Comana Forest (Giurgiu County), Stejeret Forest (Dâmbovița County), Tufele Grecului Forest, Băneasa Forest and Râioasa Forest (Ilfov County) and Casa Verde Forest (Timiș County), respectively. The oldest one was sampled in 1882, in Nancy (France).

Another 95 *A. campestre sensu lato* individuals were sampled across well-known forests across Romania. For example, from Ciolpani Forest (Ilfov County), the fallowing taxa were collected: *A. campestre* ssp. *eucampestre* var. *lobatum* f. *affine*, *A. campestre* ssp. *eucampestre* var. *normale* f. *hederifolium* H. Braun., *A. campestre* ssp. *hebecarpum* var. *normale* f. *molle*, *A. campestre* ssp. *leiocarpum* var. *normale* f. *hederifolium* H. Braun and *A. campestre* ssp. *marsicum* var. *subtrilobum* f. *hungaricum*, respectively.

Another example is Lunca Stăneşti Forest (Vâlcea County), where *A. campestre* ssp. *eucampestre* var. *normale* f. *leiophyllum*, *A. campestre* ssp. *leiocarpum* var. *normale* f. *lasiophyllum* and *A. campestre* var. *normale* f. *lasiophyllum* were identified.

Last, but not least, other two examples of famous forests among specialists, both located in Tulcea County, are represented by Ciucurova Forest and Valea Fagilor Forest, where *A. campestre* ssp. *marsicum* var. *subtrilobum* and *A. campestre* ssp. *hebecarpum* var. *marsicum* f. *subtrilobum* were sampled.

Among the less common identified taxa within herbarium, two originated from Japan, namely pointed-leaf maple (Figure 1) and devil maple (Figure 2).

Figure 1. Sample of pointed-leaf maple

Maple specimens included in the herbarium were sampled between 1842 and 1996. Among the oldest ones, there were five samples of sycamore maple collected by P. Cretzoiu in 1842. Two of them were well-preserved, while three were detached from the sheet with detached, but existing parts.

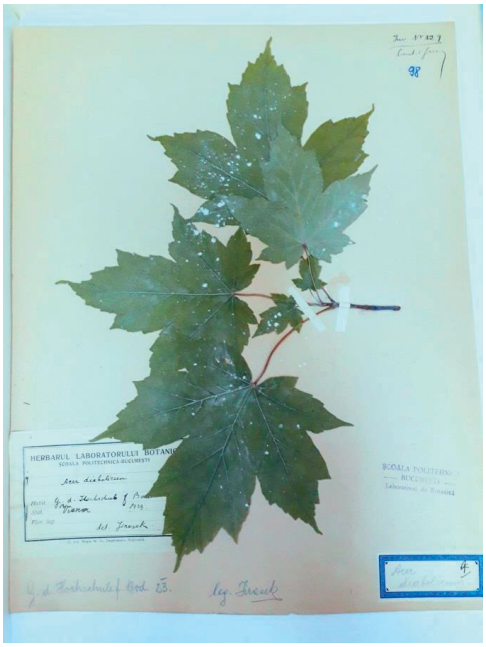

Figure 2. Sample of devil maple

More than half of the biological material (for 315 samples out of the total of 333, this information was also available) was sampled between 1941 and 1960, with the peak in 1948, with 62 samples (Figure 3).

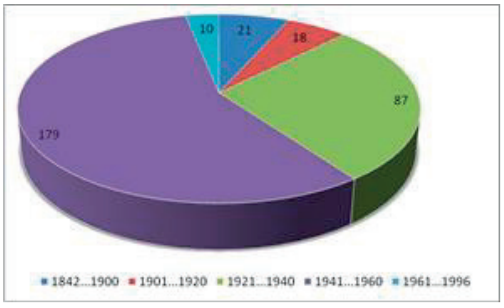

Figure 3. Timeframes of sampling the biological material

As regards their conservation status, more than a half (*i.e.* 57%) of the sampled biological material was well preserved, the whole plant being properly attached to the sheet. Another 36% were detached from the sheet with detached, but existing parts and only a few had missing parts (Figure 4).

"Alexandru Beldie" Herbarium contains also some species with interesting characteristics among the maples, such as smooth maple (Figure 5). This species, native to China, has pinnately veined simple and evergreen leaves.

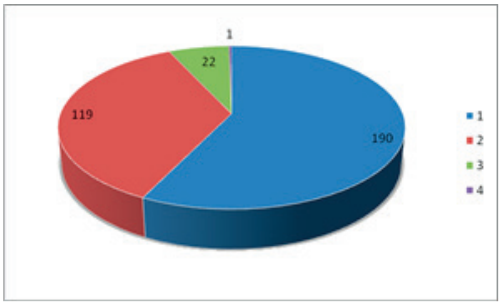

Figure 4. Shares of degrees of conservation of the sampled biological material

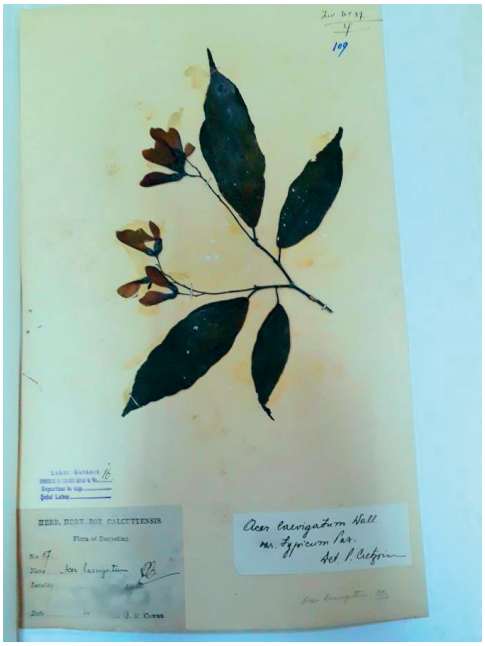

Figure 5. Sample of smooth maple

CONCLUSIONS

In spite of the fact that most of sampled biological material was preserved seven or eight decades ago, or even more, the vast majority of them are in a good conservation phase.

The diversity of maple species from "Alexandru Beldie" Herbarium is high, the collection containing even very rare or endemic species sampled from different countries across Asia.

The collection also provides information regarding the leaf morphological diversity of some of the most common maple species (*e.g.* field maple) that represents a solid database for further research. Moreover, the herbarium contains different subspecies or varieties of the same species that were sampled from the same forest stands that could represent a good starting point for designation of new forest genetic resources, especially in the current context of climate change.

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