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THE BUCF HERBARIUM DATABASE OF ALLOCHTHONOUS OAKS

Plești Bogdan-Ionuț[1*], Scărlătescu Virgil[1], Plești Ioana Maria[1]
1 National Institute for Research and Development in Forestry "Marin Drăcea", Romania
[*] *Correspondence author. E-mail*: bogdanplesca@yahoo.com

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ABSTRACT

The BUCF Herbarium stores 253 specimens of allochthonous oaks species belonging to 33 accepted taxa. Amongst the representatives, Quercus rubra has the most recordings. Moreover, three species classed as near threatened on the IUCN Red List were identified. The most significant contribution was made by the botanist S. Pașcovschi who amassed approximately one-third of the collection. The specimens were collected between 1872 and 1987, with a maximum activity between 1940 and 1949. The majority of the specimens were sampled from dendrological parks and botanical gardens in Romania, the Bazos Dendrological Park remarking itself with one of the most diverse collections of cultivated oaks. A considerable number of specimens were received from donations and exchanges with several herbaria. Most of the herbarium material is very well-preserved having high potential for future investigations.

INTRODUCTION

Worldwide *Quercus* L. includes approximately 600 species (Bargali et al. 2014) with a majority distribution in the European and Asian areas, but also with a large number of representatives on the American continent (Loreto, 2002; Nixon, 2006). Oaks non-native to the European area were introduced starting from the 18th century (Nicolescu et al. 2020). At the national level, the genus *Quercus* L. is represented by seven native species (Beldie 1953). In Romania, non-native oak species were introduced later, for ornamental purposes at the end of the 19th century and experimentally at the beginning of the 20th century (Haralamb 1967). Some of them showed a special interest in forestry, especially *Quercus rubra* L., being present in smaller or larger areas throughout the country with a higher proportion in the west parts (Sofletea & Curtu 2007; Dincă & Dincă 2021). The decorative role of allochthonous species is recognized, usually, the species *Q. rubra* is used in alignments and arrangement of green spaces due to the species' resistance to pollution (Iliescu 2008; Ildico 2009; Dobrescu & Georgescu 2015).

Herbariums represented a source of conservation of the diversity of botanical species, and currently represent true databases (Rhoads & Thompson 1992; Schmidt et al. 2005).

The "*Alexandru Beldie*" herbarium includes a collection of approximately 60,000 systematized and unsystematized vouchers in distinct folders that include genera or genera groups of woody and non-woody species. It is registered in the Index Herbariorum along with 17 other herbaria in the country under the identification

code BUCF. The oak maps stored in the collection include a number of over 2500 vouchers, being systematized by autochthonous, non-native, and hybrid species, among which approximately 10% are allochthonous species.

The main object of this study was to update the database of allochthonous oak species conserved in the BUCF Herbarium.

MATERIAL AND METHODS

The information provided on the voucher labels (taxon name, collection location, the date and place of collection, the person(s) who collected and determined the specimen) were centralized into a database. In addition, each voucher was analyzed to establish the conservation status. Thus, the degree of preservation was assessed according to a previously defined scale as follows: 1 = very well preserved plant, kept in its entirety and correctly attached to the voucher, 2 = plant detached from the voucher, with detached parts but still present, 3 = plant detached from the voucher, with missing parts and 4 = detached and fragmented plant, with over 50% of its parts missing. Furthermore, the scientific nomenclature of all taxa was verified with international databases (http://wcsp.science.kew.org/, http://www.worldfloraonline.org/, http://ipni.org/,) and where nomenclature was changed, the current name was assigned. Subsequently, the database was used to establish the number of specimens corresponding to each taxon, the main collectors, the periods with the most intense harvesting activities, the main places of harvesting and the locations of collections.

RESULTS

The database of the BUCF Herbarium revealed that the collection comprises 253 specimens of allochthonous oaks corresponding to 46 different taxa (Table 1). However, this amount is more than the number of accepted taxa because multiple names are synonyms for the same species, other taxa were moved to another genus or the nomenclature is still not validated. Specifically, 11 taxa are considered synonyms, 5 of these species being elevated from intraspecific level (varieties), 3 taxa were transferred to related genera and 1 species does not have a valid status (Table 1). On top of that, 11 specimens do not have assigned an identification name. Consequently, only 33 of the preserved allochthonous *Quercus* taxa are internationally accepted.

Table 1

Allochthonous oaks species' in the BUCF Herbarium

Species name	Species name on http://wcsp.science.kew.org/	No. of specimens
Quercus spicata	*Lithocarpus elegans* (Blume) Hatus. ex Soepadmo	1
Quercus fenestrata Roxb.	*Lithocarpus fenestratus* (Roxb) Rehder	1
Quercus falcata Michx.	*Quercus falcata* Michx.	7
Quercus benderi Benitz	*Quercus* × *benderi* Baen.	1
Quercus fontanesii Guss.	*Quercus* × *fontanesii* Guss.	1
Quercus acutissima Carruthers	*Quercus acutissima* Carruth.	3
Quercus alba L. / *Quercus alba* Grafrath / *Quercus alba* var. *latiloba* Grafrath	*Quercus alba* L.	14
Quercus bicolor Wild.	*Quercus bicolor* Willd.	7
Quercus mirbeckii	*Quercus canariensis* Willd.	1
Quercus castaneaefolia	*Quercus castaneifolia* C.A.Mey.	3
Quercus coccifera L.	*Quercus coccifera* L.	3

Species name	Species name on http://wcsp.science.kew.org/	No. of specimens
Quercus coccinea Muench.	*Quercus coccinea* Münchh.	11
Quercus griffithi Hook. F. Et Th.	*Quercus griffithii* Hook.f. & Thomson ex Miq.	1
Quercus strandjensis	*Quercus hartwissiana* Steven	4
Quercus ilex L.	*Quercus ilex* L.	11
Quercus ilicifolia	*Quercus ilicifolia* Wangenh.	1
Quercus imbricaria Michx.	*Quercus imbricaria* Michx.	8
Quercus lobata Née	*Quercus lobata* Née	2
Quercus macrocarpa Michx.	*Quercus macrocarpa* Michx.	27
Quercus marilandica Muenchh	*Quercus marilandica* (L.) Münchh.	6
Quercus prinus L.	*Quercus michauxii* Nutt.	6
Quercus palustris L.	*Quercus palustris* Münchh.	15
Quercus phellos L.	*Quercus phellos* L.	1
Quercus pseudosuber	*Quercus* × *hispanica* Lam.	2
Quercus pyrenaica Willd	*Quercus pyrenaica* Willd.	13
Quercus borealis Miehx. var. *maxime* Sarg/*Quercus borealis* Miehx. /*Quercus rubra* L.	*Quercus rubra* L.	47
Quercus shumardii Bud.	*Quercus shumardii* Buckley	2
Quercus stellata Wang./ *Quercus stellata* Wang. var. *anormala* Sarg.	*Quercus stellata* Wangenh	13
Quercus suber L. / *Quercus suber* L. var. *occidentalis* Gay. / *Quercus occidentalis* Gay	*Quercus suber* L.	5
Quercus variabilis Bl. / *Quercus serrata* Thumb.	*Quercus variabilis* Blume	3
Quercus velutina Lam. / *Quercus velutina* Lam. var. *missouris* Sarg.	*Quercus velutina* Lam.	13
Quercus wislizenii A. Dc. var. *frutescens* Engelm.	*Quercus wislizeni* var. *frutescens* Engelm.	1
Quercus lamellosa S.	*Quercus lamellosa* Sm.	1
Quercus lanceifolia Roxb.	*Castanopsis lanceifolia* (Oerst.) Hickel & A.Camus	1
Quercus macranthera Alfh. DC.	*Quercus macranthera* Fisch. & C.A.Mey. ex Hohen	1
Quercus montana Willd	*Quercus montana* Willd	4
Quercus viridis Han.	unsolved	1
Quercus sp.	-	11

The greatest number of samples were found for *Q. rubra* (48), *Q. macrocarpa* (27) and *Q. palustris* (15). It is not surprising that *Q. rubra* is prevalent among the collected specimens since it was largely introduced in Romania both in botanical gardens and forests. Furthermore, we found 3 species (*Q. castaneifolia*, *Q. lobata* and *Q. lamellosa*) evaluated as near threatened according to the IUCN Red List (www.iucnredlist.org). In total there are 29 collectors that have gathered and enlarged the allochthonous oaks collection within the BUCF Herbarium. The top contributor to the collection is S. Pașcovschi who collected 79 specimens (Figure 1), almost one-third (30%) of the existing herbarium specimens.

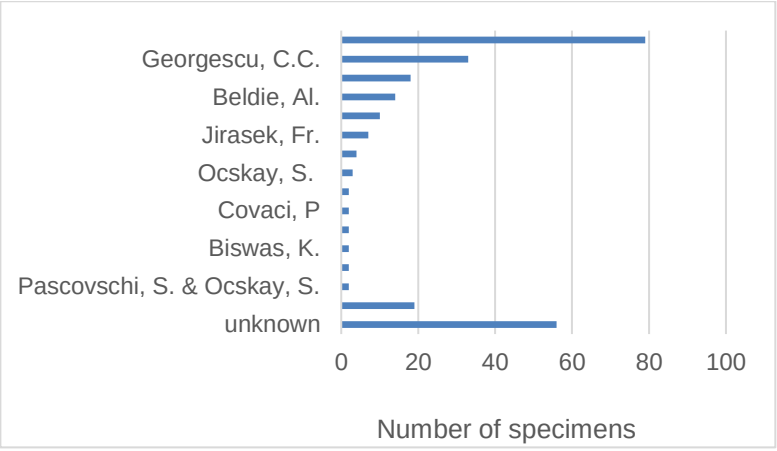

Figure 1. The most prolific collectors of allochthonous oaks within BUCF Herbarium

Also, notable contributions were made by C.C. Georgescu (33 specimens), L. Alexandrescu (18 specimens), Al. Beldie (14 specimens) and M. Ciucă (10 specimens). It should be noted that a large number of vouchers do not hold information on the sample collector (56 vouchers), the time of harvesting (29 vouchers), the place of harvesting (24 vouchers), or the location of the collection (54 vocuhers). The harvesting period of allochthonous oak species extends 115 years. More than 74% of the specimens were harvested after World War II (Figure 2), the collecting activity reaching the highest intensity between 1940-1949.

The first sampled herbarium specimens are the hybrids *Q.* × *fontanesii* and *Q.* × *hispanica* both collected before 1880.

With a few exceptions, the specimens are very well preserved, with 96% of samples being assigned to the 1st or 2nd conservation categories.

We note that the degree of conservation does not depend on the age of the specimens, as less well-preserved categories included specimens dated before 1900 as well as after 1940. Moreover, several over 100-years-old specimens are very well-preserved (eg. *Q. palustris* - collected in 1888, *Q. suber* - collected in 1889, and *Q.rubra* - collected in 1893). The majority of the herbarium material was collected from parks and botanical gardens in Romania (90%), while the rest were from countries such as Austria, France, India, Croatia, and the former Soviet Union. A considerable and diverse number of specimens were collected from the Bazoș Dendrological Park (66 specimens containing 15 species), as it is located in a plain area with a mild climate where the chances of acclimatization of the non-native oak species are high (Chisăliță et al, 2017).

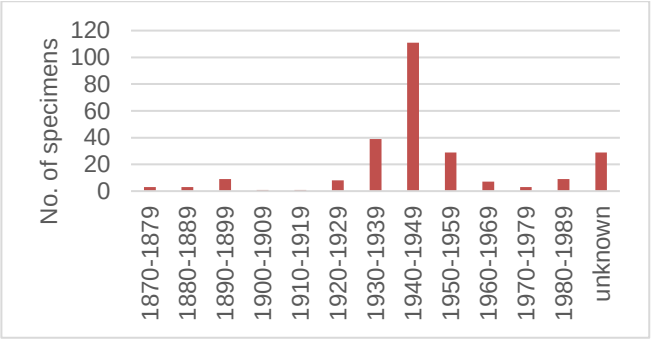

Figure 2. Distributions periods of allochthonous oak species preserved in BUCF Herbarium

Also, a high sampling density was found from Mihăiești Dendrological Park (24 specimens containing 3 species). Additionally, donations and exchanges with similar national and international institutions have enlarged the collection with new specimens. All specimens dated prior to 1900 are the result of donations and exchanges with different herbaria. To the original collection (124 vouchers) were added 62 specimens received from the Bucharest Polytechnic School, 10 specimens received from several foreign herbaria (eg. Herbarium U. Martelli, Flora Bulgarica Exsiccata, Herbier Mailho, etc.), and 3 received from national herbaria (The herbarium of Babeş-Bolyai University and Dr. Gh. Bujorean Herbarium).

CONCLUSIONS

The herbarium database of allochthonous oaks species presented in this study can serve as a starting point future studies. Their presence indicates that their acclimatization is a success and the introduction of such species in the future may be useful for creating new collections or restoring some that are in decline.

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