

Asperula L. Species Preserved in 'Alexandru Beldie' Herbarium

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Abstract

This paper provides a quantitative and general description of the main representatives of the genus *Asperula* L. present in the 'Alexandru Beldie' Herbarium. Currently, *Asperula* genus comprises 25 different taxa (18 with a status of species and 7 as intraspecific units), harvested mainly from the Romanian forests. The majority of plants are kept in very good conservation conditions (first and second conservation degrees). Two of the species (*Asperula rumelica* Boiss and *A. graveolens* subsp. *graveolens*) present in the Herbarium should be given high conservation priority since they are of national conservation concern, being included on the 'Red List of Superior Plants from Romania'. The *Asperula* genus is widespread across the country and is mostly associated with mesobasic and eubasic forest soils, representatives of this genus having the value of indicator species.

Keywords: *Asperula* L., conservation, herbarium, indicator species, voucher

Introduction

Biological collections of plants contain a vast amount of information about biodiversity and represent a particularly useful source of research material (Lavoie, 2013). Established in 1929, the 'Alexandru Beldie' Herbarium of the 'Marin Drăcea' National Institute for Research and Development in Forestry consists of around 40000 botanical specimens, covering a wide variety of vascular plants. Moreover, is inscribed in *Index Herbariorum* under the unique letter code BUCF (Chisălită *et al.*, 2017; Dincă *et al.*, 2018).

Among the numerous taxa preserved in the collection are found: 69 species of *Potentilla* genus

(Crisan *et al.* 2017), 15 species of *Ornithogalum* genus (Enescu and Dincă 2017), 19 species of *Scorzonera* genus (Dincă and Cântar, 2017), 15 species of *Veronica* genus (Dincă *et al.*, 2017), 7 species of *Lycopodium* genus (Vechiu *et al.*, 2018), 29 species of *Allysum* genus (Cântar *et al.*, 2018), 19 species of *Androsace* genus (Dincă *et al.*, 2017), 16 species of *Abies* genus (Enescu *et al.*, 2018) and 41 species of *Polygonum* genus (Vechiu *et al.*, 2018).

The purpose of the paper is to provide a short description of the main representatives of the genus *Asperula* L. preserved in the 'Alexandru Beldie' Herbarium.

Table 1. *Asperula* Inventory (excerpt from the database)

Drawer number	Plate number	Herbarium/ Botanic Collection/ Institution	Species Name	Harvesting Date	Harvesting Place	Collected/ Determined by:	Conser- vation Degree (1..4)
47	2	Bucharest's Polytechnics School Herbarium, Botanic Laboratory	<i>Asperula capitata</i> Kit. ex Schult.	1947.07.09.	Bucegi, Zănoaga	Al. Beldie	1
47	14	ICEF Forestry Research and Experimentation Institute	<i>Asperula cynanchica</i> L.	1936.08.15.	Nereju	Haral	1
47	35	Bucharest's Polytechnics School Herbarium, Botanic Laboratory	<i>Asperula glauca</i> L.	1931.07.13.	Dobrogea	C. C. Georgescu	1
47	50	Dr. C. Baenitz, Herbarium Europaeum	<i>Asperula hexaphylla</i> All.	1986.07.03.	Alpes- Maritimes, Nanan	E. Reverchon	1
47	57	Dr. C. Baenitz, Herbarium Europaeum	<i>Asperula neilreichii</i> Beck	1992.08.09.	1500 m alt Nieder- Osterreich	Louis Keller	1
47	76	Flora Sicula	<i>Asperula rupestris</i> Tin.	1990.06.16.	Palermo	D. Lansa	3
47	78	Flora Graeca Exsiccata	<i>Asperula stricta</i> Boiss.	1830.05.27.	Athanas	G. Orphanides	2
47	103	Herbarium from the Forest Research Institute	<i>Asperula taurina</i> L.	1943.05.04.	Comana	C.C. Georgescu	2
47	108	Bucharest's Polytechnics School Herbarium, Botanic Laboratory	<i>Asperula taurina</i> L. var. <i>leucanthera</i>	1932.05.18.	distr. Dâmbovita,	P. Cretzoiu	1
47	127	Museum Botanicum Universitatis, Cluj / Flora Romaniae exsiccata	<i>Asperula graveolens</i> subsp. <i>graveolens</i>	1939.08.03.	Basarabia, distr. Cetatea Alba	G. Bujorean	1
47	132	Museum Botanicum Universitatis, Cluj / Flora Romaniae exsiccata	<i>Asperula tenella</i> Heuff.	1958.06.04.	Oltenia, distr. Râmnicul Vâlcea	M. Ciurchea, E.L. Nyarady	1

Materials and methods

The analyzed material was composed of 101 herbarium vouchers. All data (scientific name, collection name, harvesting date, harvesting place, the name of the person who has collected or identified the plant, conservation degree) were incorporated into an electronic dataset. In order to assess the conservation degree of each voucher the scale suggested by Vasile *et al.* (2017) was used: 1 - well conserved plant, entire and correctly attached to the voucher, 2 - plant detached from the voucher with striped but present parts, 3 - detached plant with missing parts and 4 - detached and fragmented plant with over 50% of its parts missing. All the plant names were unified according to 'The Plant List' database. An excerpt of the inventory is rendered in Table 1.

Subsequently, a short morphologic, ecologic and chorologic characterization of the most relevant representatives was made.

Results and discussions

The *Asperula* genus stored in 'Al. Beldie' Herbarium comprises the following members: *Asperula aristata* Lf., *A. aristata* subsp. *oreophila* (Briq.) Hayek, *A. capitata* Kit. ex Schult., *A. cynanchica* L., *A. cynanchica* subsp. *occidentalis* (Rouy) Stace, *A. cynanchica* subsp. *pyrenaica* (L.) Nyman, *A. cynanchica* var. *altissima*, *A. galioides* M.Bieb., *A. glauca* L., *A. glauca* L. var. *hirsuta* Wall., *A. glomerata* (M.Bieb.) Griseb., *A. gussonei* Boiss., *A. graveolens* subsp. *graveolens*, *A. hexaphylla* All., *A. hirsuta* Desf., *A. hirta* Ramond, *A. neilreichii* Beck, *A. pubescens* (Willd.) Ehrend. & Schönb.-Tem., *A. rumelica* Boiss., *A. rupestris* Tin., *A. stricta* Boiss., *A. taurina* L., *A. taurina* L. var. *leucanthera*, *A. tenella* Heuff. ex Degen and *A. tinctoria* subsp. *hungarorum* (Borbás ex Jáv.) Soó.

Among them stand out through the high number of vouchers held *A. taurina* (18 vouchers), *A. cynanchica* (17 vouchers), *A.*

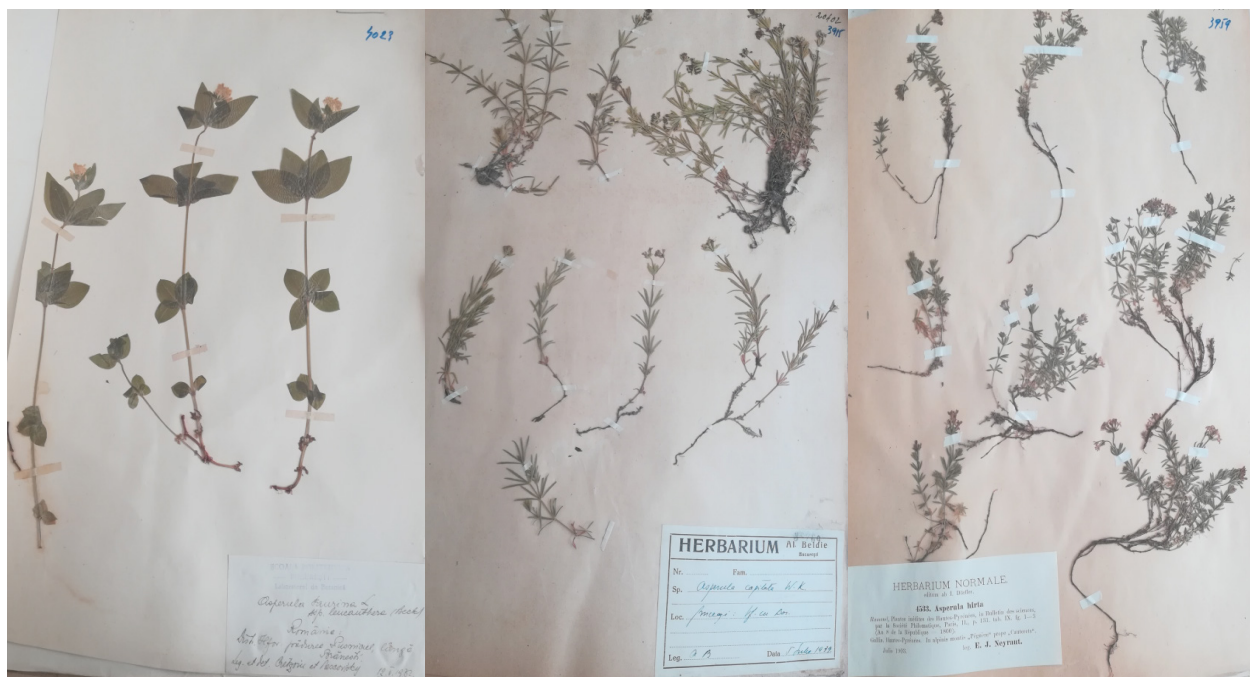


Figure 1. *Asperula taurina*

Figure 2. *Asperula capitata*

Figure 3. *Asperula hirta*

capitata (12 vouchers) and *A. taurina* var. *leucanthera* (10 vouchers). At the same time, *A. graveolens* subsp. *graveolens* (6 vouchers) and *A. rumelica* Boiss. (2 vouchers) are listed as rare in the 'Red List of Superior Plants from Romania' (Oltean *et al.* 1994).

Asperula taurina (Fig. 1) can be found from the Mediterranean region up to the central parts of Europe from where it extends to south-western Asia. The stems are erect and ascending, branched into 4 edges, more or less hairy, with long internodes. The leaves are ovate-lanceolate, acute, very shortly petiolate, in whorls of four. The inflorescence is surrounded by long ciliate and uneven bracts. The corollas are white or pale yellowish with violet or white (in the case of var. *leucanthera*) anthers. Both taxa grow on eubasic and intensely humiferous soils.

A. cynanchica commonly known as squinancywort is widespread through Southern and Central Europe, where it occupies mainly dry and calcareous grasslands (Codd and Rich, 2007). It is characterized by numerous, branched, procumbent or ascending and glabrous stems. The leaves are arranged in whorls of 4 throughout, linear, glabrous, acute with flat to weakly revolute margins. The corollas are broadly infundibuliform and the tube exceeds the lacinium by at least 1.5 times. Usually, the flowers are pale purplish to

whitish pale and often rough. It prefers mesobasic-eubasic and low humiferous soils. Furthermore, this species is widely polymorphic having reported several subspecies and intraspecific units (Codd and Rich, 2007).

A. capitata (Fig. 2) has a narrow distribution, being restricted to Romania and Bulgaria. The stems are up to 30 cm high, glabrous and slightly branched. The leaves are linear, glabrous, in whorls of 6 (4 on the infertile branches) with smooth margins. The inflorescence is capituliform, with 20-25 flowers placed on the top of the stems, at the base surrounded by an involucre composed of linear-lanceolate bracts. The corollas are pale purplish to whitish and the tube is two times longer than the lacinia. It vegetates on limestone cliffs in subalpine and alpine regions.

A. graveolens subsp. *graveolens* can be found across south-eastern Europe where it grows on marine and continental sands. The stems are elongated, obliquely ascending, branched into 4 edges with leaves arranged in whorls of four, linear, shorter than internodes. The inflorescence are lax, with short pedicelate and pale purplish flowers. Also the corolla is hairy on the outside and on the ribs. In Romania is found along the Black Sea coast and some rivers.

A. rumelica is native to south-eastern and eastern Europe to north-western Turkey (Caputo

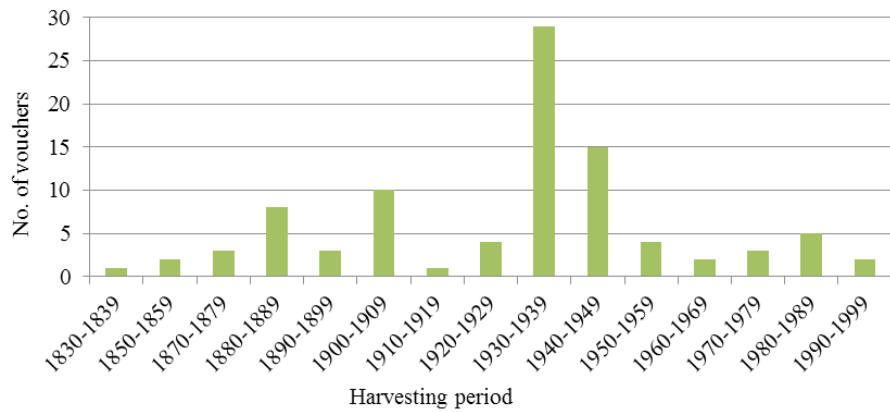


Figure 4. Harvesting periods of *Asperula* plants from 'Alexandru Beldie' Herbarium

et al., 2013) where is found on stony slopes. It has numerous, slightly branched and glabrous stems, with leaves in whorls of four, narrowly linear and acuminate. The corolla lobes are two-thirds as long as the tube. The flowers are whitish pale on 2 mm long pedicels. Leaves in whorls of 4-6, linear or lanceolate.

A. hirta (Fig. 3) is a non-native plant that grows in the western parts of the Pyrenees Mountains where it vegetates on subalpine and alpine limestones (Chouard, 1948). The stems are erect or ascending, glabrous or more rarely hirsute, carrying 1-2 inflorescence. The corolla is pinkish or white-pinkish, glabrous with the tube is shorter than the lobes.

A. glauca is distributed on western, central and southern Europe (Ančev and Krendl, 2011) on dry, mostly calcareous and loamy soils. The plant stems are erect, branched into four edges, glabrous, sometimes with a few hairs at the base. Leaves are in whorls of 8-10 throughout, the simple leaf blades are linear, with a rounded upper end on which a short spiky tip sits. The inflorescence is broadly infundibuliform with white and cup-shaped flowers.

A. aristata is reported to south-eastern Europe, Alpes and nord-western Balkans (Caputo *et al.*, 2013) where it prefers mesobasic and eubasic soils. The stems are erect and ascending, lignified at the base with linear, smooth and glabrous leaves. The corollas have short, lanceolate and arrested bracts. The flowers are reddish with short, erect pedicels.

The plants were collected within a period of 162 years, the most prolific period for the herbarium enrichment being between the years

1930-1939 (Fig. 4). The oldest voucher from the herbarium dates back to 1830 and belongs to an *A. stricta* sample originating from Flora Graeca Exsiccata, while the newest belongs to an *A. neilreichii* sample originating from the Dr. C. Baenitz, Herbarium Europaeum.

A significant part of the herbarium material was collected from our country, especially from forests situated on soils with mesobasic and eubasic properties like eutricambosols or cernozioms (Fig. 5).

The herbarium samples were collected mainly by important Romanian botanists: S. Pascovschi, P. Cretzoiu, St. Golescu, C.C. Georgescu, Al. Beldie, Al. Borza, T. Bunea, V. Leandru, I. Morar, M. Haret, St. Purceanu, I. Lupe, A. Rădulescu, M. Păun, G. Bujorean.

A number of 20 vouchers were donated or bought through exchanges from over 10 similar foreign institutions such as Flora Croatica, Flora Sicula, Flora Helvetica, Flora Hispanica Exsiccata, F. Poggi et C. Rossetti Plantae Italicae, Museum Botanicum R. Hori Taumnensis, Herbarium Normale ed. Ab. I. Dörfler, Herbarium dr. Z. Karpati, Herbarium agri Ticinensis, Herbarium L. Giraudias, M. Gandoger - Flora Hispanica exsiccata, Flora Alp. Maritim et Liguriaie.

The majority of specimens are in a good conservation state, 68% of the total vouchers being scored with first conservation degree and 30% with second conservation degree (Fig. 6). Moreover, one sheet associated with *A. cynanchica* var. *altissima* and one with *A. rupestris* were found with plants slightly deteriorated (third conservation degree) and need special attention

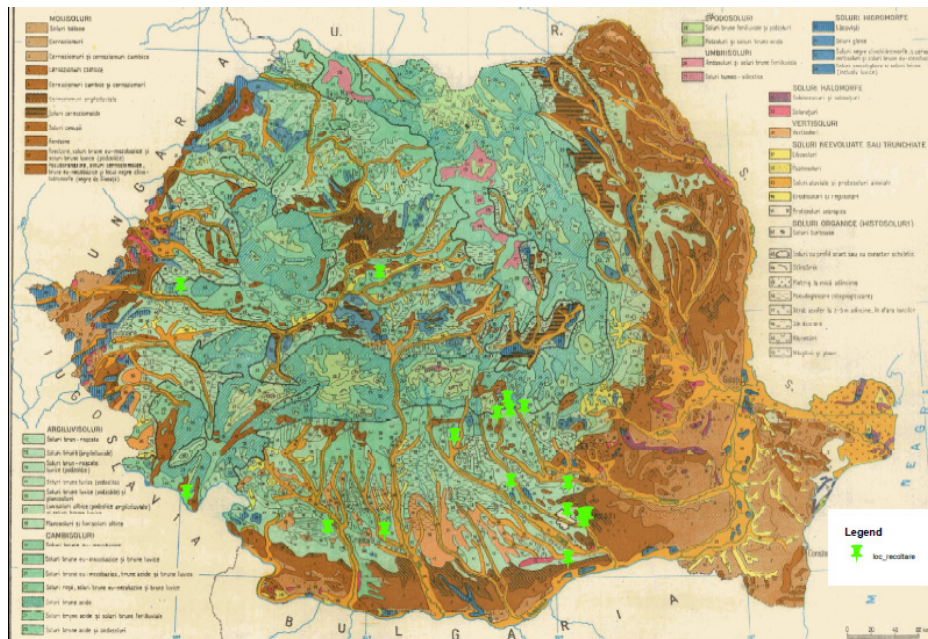


Figure 5. Main harvesting places from Romania (Soil Map of Romania – Florea *et al.*, 1971)

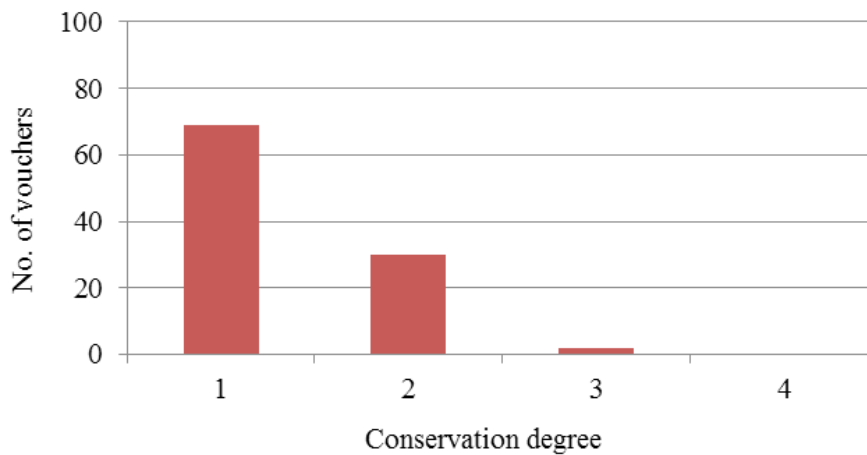


Figure 6. Conservation degree of plants from ‘Alexandru Beldie’ Herbarium

since they are the only samples of these taxa present in the collection.

Conclusion

The 101 vouchers of *Asperula* Genus stored in the ‘Al. Beldie’ Herbarium belong to 25 different taxa, from which 18 are considered independent species and 7 subspecies or varieties. Among them, *A. taurina* (18 vouchers) and *A. capitata* (17 vouchers) cumulate over one-third of the total number of vouchers. Moreover, it includes also two taxalisted as rare for the Romanian flora (*A. rumelica* Boiss and *A. graveolens* subsp. *graveolens*). The samples were collected between 1830-1992, most

of them from our country with a maximum period of development between 1930-1939. Despite the age of the collection, the specimens are properly preserved, 98% of the vouchers having a first or second degree of conservation. Also, the value of the collection has increased through numerous exchanges with various national and international institutions.

The main characteristics of *Asperula* species differentiation are stem branching, the number of leaves in whorls, as well as the color of the flowers. Furthermore, members provide information on soil trophicity, these species having mesobasic and eubasic demands.

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