

A SHORT DESCRIPTION OF *ANDROSACE* GENRE PLANTS PRESENT IN *ALEXANDRU BELDIE* HERBARIUM FROM I.N.C.D.S. BUCHAREST

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Abstract

„*Marin Drăcea*” National Institute for Research and Development in Forestry from Bucharest has in its possession a Herbarium with a rich collection of plants (approximately 60.000 plates) and which is registered in Index Herbarium. The Alexandru Beldie Herbarium consists of private donated collections as well as collections obtained through exchanges of plates. For the present article, 66 plates from the Herbarium were studied, namely the ones belonging to the *Androsace* genre. The plates were then systemized on species (19 to be specific), harvest year, place of origin and after the specialist that has gathered them. The *Androsace* species were harvested from Romania, as well as other countries and are in a very good conservation state, even though some species were harvested starting with the year 1840. Most species were gathered in the interval 1940-1949. The Al Beldie Herbarium offers significant historical data which is a valuable research resource, together with rich data concerning the species, their origin place and developing conditions.

Keywords: *Androsace*, botanists, herbarium, species.

1. INTRODUCTION

Plants with flowers are considered a priority in research endeavors due to the fact that they are relatively well known (Joppa et al., 2010). Furthermore, plants are considered pivot organisms in monitoring and measuring global biodiversity as they contain a rich component in species of almost all habitats from Earth (Mutke and Barthlott, 2005).

Generally speaking, during collecting them, only a small number of plant species is recognized, while new species are described by comparing them with plants from Herbarium, by referral to other species connected with them and that are present in herbarium collections (Bebber et al., 2010).

As such, herbariums can be a diversity source for describing the relatively intense collected flora (Shevock and Taylor, 1987; Ertter, 2000). When plant collections will be gathered from the most inaccessible parts of the world, the herbarium plates will represent another final frontier for discovering a large number of new plant species with flowers. This fact emphasizes the essential role of the taxonomic research activity based on herbarium in documenting worldwide flora and the necessity of a general access to global collections by digitizing them (Bebber et al., 2010).

A very valuable herbarium, registered in Index Herbarium, with a rich collection of plants (approximately 60.000 plant plates), in process of digitization, is the one from „*Marin Drăcea*” National Institute for Research and Development in Forestry, Bucharest (Vasile et al., 2017). This

herbarium which carries the name of the national academician Alexandru Beldie, who has studied preponderantly the flora of Bucegi Mountains (Beldie, 1967; Beldie, 1972), is composed of private donated collections among which the 112 species from the *Hieracium* genre collected by Al. Beldie (Dincă et al., 2017), the species collected by S. Paşcovschi from Bazoş Dendrological Park, Timişoara (Chisăliţă et al., 2017), as well as collections obtained through plate exchange.

2. MATERIALS AND METHODS

The study material was represented by the 66 plates from the above mentioned herbarium, belonging to the *Androsace* genre. These plates were systemized based on the species (the herbarium holds 19 species of the genre: *Androsace alpina*, *Androsace arachnoidea*, *Androsace argentea*, *Androsace bryoides*, *Androsace carnea*, *Androsace chaixii*, *Androsace chamaejasme*, *Androsace charpentieri*, *Androsace ciliata*, *Androsace elongata*, *Androsace glacialis*, *Androsace helvetica*, *Androsace lactea*, *Androsace maxima*, *Androsace obtusifolia*, *Androsace pubescens*, *Androsace pyrenaica*, *Androsace sarmentosa*, *Androsace villosa*), harvest year, origin place and the specialist that has gathered them. An extract from the *Androsace* genre inventory is rendered in Table 1. Some species are omitted from the table due to the fact that their location, year or harvest date are not recorded.

Table 1. The inventory of Androsace genre from Alexandru Beldie Herbarium, INCDS Bucharest (extract)

Drawer number	Plate number	Herbarium/ Botanic collection/ Institution	Species name	Harvest date	Harvest place	Collected by/ Determined by	Conservation Degree (1..4)*
2	155	Herbarul Politehnicii Bucuresti	<i>Androsace alpina</i> L.	1952.08.12	Bucegi Vl. Horoabei	Al. Beldie	1 1
2	173	Scoala Politehnică Bucuresti Dr.C.Baenitz,	<i>Androsace arachnoidea</i> Schott	1931.07.21	Ceahlau	P. Cretzoiu, C.C. Georgescu	1
2	122	Herbarium Europeum Fl.Gallica	<i>Androsace chaixii</i> G.G.	1885.05.03	Basses Alpes Bois d'Allons	E.Revechon	1
2	136	Herbarium Al.Beldie	<i>Androsace chamaejasme</i> Host.	1947.05.19	Bucegi Piciorul Babelor	Al.Beldie	1
2	123	Flor. Helvet Tessin Polytechnic Bucharest Herbarium,	<i>Androsace charpentieri</i> Heer.	1888.07.14	Monte Garzinola	R.Beryer	1
2	141	Silviculture Faculty Botanic Laboratory	<i>Androsace elongata</i> L.	1946.05.06	Ilfov com.Dridu Pad Taiata	I.Morariu	1
2	103	Flora Helvetica	<i>Androsace glacialis</i> Hoppe	1892.08	Flims Rhactia 2700m	Bernoulli Basil	1
2	148	Museum	<i>Androsace lactea</i>	1930.07.01	distr. Brasov	E.I.Nyarady	1

		Botanicum Universites Cluj Museum	L.		Cristianul Mare		
2	160	Botanicum Universites Cluj	<i>Androsace maxima</i> L.	1939.04.23	Dobrogea distr.Caliacra Capul Caliacra	Al Borza	1
2	107	Dr.C.Baenitz, Herbarium Europeum Herbier	<i>Androsace obtusifolia</i> All.	1887.07.19	Plozakmuhle Posen	G.Ritschl	1
2	104	G.Vidal Plantes des Basses-Alpes	<i>Androsace pubescens</i> DC.	1890.08.12	Baralonnitte a Berard	Bernoulli Basil	1
2	175	F.Schultz et Winter,Herbar ium normale	<i>Androsace villosa</i> L.	1856.07	Muntii Velebit (Croatia)	Farcas- Vucotinovici	1

* 1=very well preserved plant, entirely and correctly attached to the plate; 2=plant detached from the plate, with existing parts; 3=plant detached from the plate, with missing parts; 4=plant detached from the plate and fragmented, with over 50% of its parts missing.

3. RESULTS AND DISCUSSIONS

The *Androsace* genus belongs to the *Ericales* Order, *Primulaceae* Family. It can be found primarily on mountain areas ranging from the Alps and up to the Pyrenees or Caucasus (Figure 1). The plant originated in the Himalayas, where it can still be found today (Schneeweiss et al., 2004)



Figure 1. The worldwide spread *Androsace* genre (<https://en.wikipedia.org/wiki/Androsace>)

Sometimes known as *rock jasmines* or *fairy candelabras*, these plants are widely cultivated for their dense cushions covered in white or pink flowers. It is estimated that there are about 110 species. Only in the north hemisphere approximately 48 species of the genus were described. Furthermore, recent molecular studies show that the genera *Douglasia* (found in north-western North America and easternmost Siberia), *Pomatosace* (an Himalayan endemic) and *Vitaliana* (a European endemic) are nested within *Androsace* (Trift et al., 2002). Phylogenetic studies have also demonstrated that the ancestor of *Androsace* first appeared about 35 million years ago and was most probably an annual species. Evolution towards the denser morphology of cushions took place twice, independently in Asia and in Europe (Boucher et al., 2012).

The plant can be recognized by its leaves rosettes that resemble a sack. The calicium has 5 division, the corolla has an oval-shaped tube longer than the leaves length, while the corolla's 5 lobes are whole. The fruit is globular or slightly ovoid and contains 35 seeds. The solitary flowers are white or pink (<http://christian000.free.fr/pages/000-accueil.htm>).

The representative species of this genre that can be found in the collection are the following:

1. *Androsace alpina* (L.) Lam.

Alpine Rock-Jasmine or *Androsace alpina* is an alpine plant that grows on siliceous fields (especially granite) and at high altitudes (above 4000 meters). It can also be found in rock gardens, as it is popular as ornamental plant. The plant can be recognized by its white or pink flowers, that are so numerous during the flowering season, that they can cover entirely the foliage (https://en.wikipedia.org/wiki/Androsace_alpina). This small plant (1-5 cm) grows in the superior rocky alpine areas, up to altitudes extremely high. Its pale pink flowers (occasionally white) bloom between July and September. The leaves, not persistent on the stem, are forming towards the branches top small ash-green rosettes. The plant is cultivated as ornamental plant on rocks and is multiplied by dividing the stems. It prefers the siliceous fields (schist's, granite or gneiss) from France, Switzerland, Italy or Central Europe (<http://christian000.free.fr/pages/000-accueil.htm>).

2. *Androsace carnea* L.

The plant can be recognized through its white or pink flowers that bloom from May up to August and that are disposed in a simple umbel, with peduncles that are usually shorter than the involucre bracts during blooming. The calyx has oval divisions, while the corolla has whole lobes. The leaves are grouped in rosettes gathered around the base of the flower's stem. Cultivated as ornamental plant, it is spread at altitudes gathered between 1400 and 3000 meters in France, Spain, Switzerland, Italy, the Carpathians and Central Europe (<http://christian000.free.fr/pages/000-accueil.htm>).

3. *Androsace chaixii* G.G.

Mainly found in the French Alps, where it grows on rocky places and in open woodlands, *Androsace chaixii* is an annual or biennial plant. The plant is recognizable through its toothed leaves and yellow or pink flowers (https://www.plant-world-seeds.com/store/view_seed_item/2849). The corolla has twice the length of the calyx during blooming. The flowery stems are elongated laterally and are covered by small shin leaflets (<http://christian000.free.fr/pages/000-accueil.htm>).

4. *Androsace chamaejasme* Host.

The plant is recognized by its leaves bordered by long cilium, green and without shin leaflets on its sides, grouped in rosettes that are more or less flattened (Figure 2). The involucre bracts are shorter than the peduncles after blooming (<http://christian000.free.fr/pages/000-accueil.htm>).

5. *Androsace charpentieri* Heer.

A short plant (that can reach 2-4 cm in height) whose flowers bloom between July and August. The stem has small leaves that persist a very long time. The peduncle that holds the flowers has third the length of the leaves from the basis. The calyx has 5 sharp divisions. It usually grows at the highest altitudes of alpine zones from Switzerland and Central Europe (<http://christian000.free.fr/pages/000-accueil.htm>).

6. *Androsace ciliata* DC.

A plant with peduncles of 5-15 mm that bypass the leaves situate at their basis. The leaves are green, without shin leaflets, but with cilium on the margins, disposed in rosettes on top of the branches, which do not persist for too long. The flowers are pink or purple, while the fruit is shorter than the calyx (<http://christian000.free.fr/pages/000-accueil.htm>).



Figure 2. *Androsace chamaejasme*



Figure 3. *Androsace lactea*

6. *Androsace ciliata* DC.

A plant with peduncles of 5-15 mm that bypass the leaves situate at their basis. The leaves are green, without shin leaf, but with cilium on the margins, disposed in rosettes on top of the branches, which do not persist for too long. The flowers are pink or purple, while the fruit is shorter than the calyx (<http://christian000.free.fr/pages/000-accueil.htm>).

7. *Androsace elongata* L.

A plant that can reach 2-7 cm and that does not appear at high altitudes, but which is spread out throughout Central and East Europe, Sicily, Caucuz, Siberia and North America. The flowers are really small, with a white or pink corolla and appear during April-May, when they are grouped in 3-8 simple umbels. The leaves are oval elongate, denticulate and almost without shin leaf. The flower's peduncles are 4-10 times the length of bract. The calyx has a conic shape, while the corolla is smaller than the calyx and has 5 entire lobes. It is an annual plant, with a thin and elongated root (<http://christian000.free.fr/pages/000-accueil.htm>).

8. *Androsace helvetica* L.

A plant that can reach 2-4 cm, it forms compact shrubs formed of stems and cylindrical branches, covered with small leaves that are persistent and resistant to cold weather. The yellow flowers appear in July and August. It can be found in the superior part of alpine areas from high mountains. The leaves are really small (they don't outrun 2 mm in length), oval, obtuse, green and covered with white shin leaf. The fruit is longer than the persistent calyx that it surrounds. It prefers limestone fields from Switzerland (from where its name is taken), France, Italy or Bavaria (<http://christian000.free.fr/pages/000-accueil.htm>).

9. *Androsace lactea* L.

A plant that can reach 5-10 cm and which grows in the Alps and Carpathians, especially at altitudes of 500-3100 meters. The leaves are grouped in rosettes that can reach a diameter of 2-4 cm. Their color is dark green, while their shape is linear or slightly elliptic. The flowers bloom between May and August and are usually white and small in diameter (10-12 mm) (https://en.wikipedia.org/wiki/Androsace_lactea). The flowers, solitary, are grouped 2 or 5 in a simple umbels, while the calyx is sharp at the peak and does not present shin leaf (Figure 3). Cultivated as ornamental plant, it was previously used in Siberia against epilepsy and gallbladder diseases. It prefers limestone soils from France, Switzerland, Central Europe, Dalmatia and Bosnia (<http://christian000.free.fr/pages/000-accueil.htm>).

10. *Androsace maxima* L.

A plant that can reach 5-18 cm in height and which grows in field areas. The flowers have a white or pink corolla, are shorter than the calyx and bloom from April until July. The leaves are grouped in oval rosettes, with a few shin leaf, relatively large, while the corolla is smaller than the calyx. It is an annual plant, sometimes used as a diuretic. It prefers limestone or clay soils from the East Europe, South-East Asia and North Africa (<http://christian000.free.fr/pages/000-accueil.htm>).

11. *Androsace obtusifolia* All.

A plant that grows especially on siliceous soils. The leaf is oval elongated or have a spatula shape, reaching a height of 6-15 mm and a length of 3-5 mm (Figure 4), while the flowers are white or pink (<http://christian000.free.fr/pages/000-accueil.htm>).

12. *Androsace pubescens* DC.

Small plants (2 - 6 cm) that grow in the superior mountain areas. The flowers are white or pink and appear from June up to August. The leaves persist on the stem and usually form compact cylindrical masses. They are oval elongated, obtuse at the top, while the corolla has 5 lobes. They can grow up to 3800 m in the Alps, but also in France, Italy, Switzerland and Spain (<http://christian000.free.fr/pages/000-accueil.htm>).

13. *Androsace pyrenaica* Lam.

A plant that usually grows in the Pyrenees and reaches up to 1-5 cm in height. The cylindrical stems are forming tight columns, which protect the plant from cold. The flowers bloom from June till September, while the leaves are oval elongated, obtuse, recurved at the top, green and covered by shin leaf. The flowers are usually solitary and situated on peduncles that are 2-4 times the length of the leaf. The plant forms a turf which covers the rock's slot. It is usually cultivated as ornamental plant, not only for decorating areas with rocks, but also for garnishing borders or plateaus (<http://christian000.free.fr/pages/000-accueil.htm>).

14. *Androsace sarmentosa* Wall.

Androsace sarmentosa, also known as Rock Jasmine, is a perennial plant that can be found in Central Asia and up to Western China, at altitudes between 2700-4000 meters. It can reach up to 30 centimeters. The flower's color ranges from pale pink to purple and has a yellow central part and bloom between June and August. The rosettes are compact, formed of elliptical leaves covered with shin leaf (https://en.wikipedia.org/wiki/Androsace_sarmentosa).

15. *Androsace villosa* L.

This plant, found in Europe's and Asia's mountains presents a wide range of variations. Also used as ornamental plant in alpine gardens, it can be recognized by its small red or purple flowers (6-10 mm), gathered in umbels (Figure 5). The rosettes are composed of linear or elliptic leaves that have shin leaf towards the tip. The plant is spread out in Spain, France, Switzerland, Italy, Central

Europe, Dalmatia, Bosnia, Russia, Siberia or the southeast and east Asia, usually growing on rocky slopes at high altitudes (1500 m).



Figure 4. *Androsace obtusifolia*



Figure 5. *Androsace villosa*

The plant's harvesting year. The plants were gathered in a period of time between 1848 and 1952. The oldest plants from this genre are *Androsace chamaejasme*, harvested in 1848 and *Androsace villosa*, harvested in 1856. The periods in which the most plants were gathered were 1940-1949 and 1900-1909 (Figure 6).

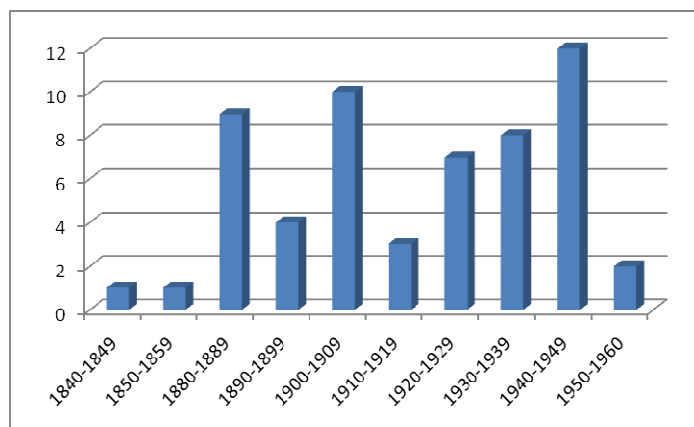


Figure 6. Harvesting periods for *Androsace* plants from "Al. Beldie" Herbarium

The harvesting place of most species (*A. chamaejasme*, *A. lactea*, *A. villosa*, *A. obtusifolia*) was generally represented by high mountain areas: especially from Bucegi mountains (Babele, Coștila, Caraiman, Omu Peak, Jepii Mici, Horoabei Valley), where they were gathered by Alexandru

Beldie, but also from Ceahlau (*A. arachnoidea*), Cristianul Mare, Piatra Mare, Sinaia, Piatra Craiului, Alps (*A. chaixii*), Berchetesgaden, Davos (*A. glacialis*), Mont Cenis (*A. carnea*), Monte Garzinola (*A. charpentieri*), Velebit Mountains (Croatia), Pic de Salletes - Hautes Pyrenees (*A. ciliata*). Different species of this genre were also gathered from Ilfov, Orhei and Cernauti (*A. maxima*), Caliacra, Turtucaia, Belgrad, Vienna, Dijon (Figure 7). Only some species are rendered on the map because some locations are overlapped or because the harvesting place for some species is unknown.



Figure 7. Harvesting place of *Androsace* plants

The persons that have gathered the plants are Romanian specialists (Al. Beldie, P. Cretzoiu, C.C. Georgescu, E. I. Nyarady, Al. Borza, Gh. Bujorean, I. Morariu, P. Cretzoiu) or foreign ones (E. Revechon, A. Erinsle, R. Beryer, Farcas-Vucotinovici, G. Ritschl, Bernoulli Basil, J. Bornmuller, J.V. Kovats).

4. CONCLUSIONS

Herbariums contain a vast deposit of valuable information about biodiversity which offers further rich data concerning plant species, their place of origin and development conditions, together with a high potential for advancing in their conservation.

The 19 species of *Androsace* genre harvested from Romania (Bucegi Mountains, Cristianul Mare, Dobrogea etc.) as well as from Austria, Italy, France, Croatia are in a very good conservations state (1st degree – with plants intact, correctly attached to the plate).

The herbarium exemplars were harvested for over 170 years, starting with the year 1840, while the most recent ones are from 50 years ago (from 1960). The most plants were gathered in the period 1940-1949.

As it can be observed, this collection offers significant historical data and is a valuable resource as research material. However, in order to maintain an equilibrium between offering a research material and preserving some irreplaceable exemplars, the time and gathering expenses, identifying and treating the herbarium collections must also be taken into account.

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