

THE CHARACTERISTICS OF PLANT SPECIES FROM *ARABIS* TYPE PRESENT IN *AL. BELDIE* HERBARIUM FROM I.N.C.D.S. BUCHAREST

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ABSTRACT

Well represented within Al. Beldie Herbarium from I.N.C.D.S. Bucharest, the Arabis species comprises herbaceous, annual or perennial plants. The 32 species inventoried in the present paper are in a good conservation state, being gathered by Romanian and foreign specialists between 1858 and 1954. After a brief presentation of the above mentioned herbarium, the present paper intends to analyze the situation of Arabis plant collections, trying to present beside the morphological presentation of plants other data regarding them, such as: date and place of harvest, the name of the specialist that gathered the plants and the conservation state, graded on a scale of 1 to 4. The Arabis species present in Al. Beldie herbarium have been harvested from different parts of Europe, starting with mountain areas (Pyrenees Mountains, Alps, Dinaric mountains and Romanian Carpathians) and continuing up to hill or plain areas from Romania, Bulgaria, Ukraine or Hungary.

KEY WORDS: *Arabis, herbarium, genus, species, botanists.*

INTRODUCTION

Marin Drăcea National Forest Research and Development Institute (INCDS) from Bucharest holds a Herbarium that contains numerous plates dedicated to certain plants (approximately 60.000). They are still preserved in their original maps and are arranged in 30 modules, each with 20 drawers (Vasile *et al.*, 2017). The collection is registered in INDEX HERBARIUM and is composed of particular donated collections and pieces from foreign collections purchased through exchanges. The botanists that have collected and created it are well known personalities from the domain of systematic botanic. Amongst the Romanian botanists we mention Al. Beldie, which had a special interest in this herbarium, S. Pașcovschi, C.C. Georgescu, Paul Cretzoiu, I. Morariu, Al. Borza, Bujorean, E.I. Nyarady, N. Iacobescu, I. Prodan, M. Haret, I.Pop, M. Petcuț etc. Amongst the foreign botanists we mention: Jagger, G. Treffer, E. Krummel, F.A. Tschering, O. Gelert, Dr. Lerch, S. Stefanoff, T. Georgieff, Grabmayr, K. Rechinger, H. Siegfried, W. Bernoulli Basil, Carl Stormer, W. Migula etc.

MATERIALS AND METHODS

The study material was composed of the 78 existing plates from the herbarium mentioned above that belong to the *Arabis* type. These were then systemized after species,

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harvest date, the place where they were taken and the specialist that did the harvest. An excerpt of the *Arabis* inventory is rendered in Table number 1.

TABLE 1. *Arabis* inventory from Al. Beldie INCDS Bucharest Herbarium (excerpt)

Drawer number	Plate number	Herbarium/ Botanic collection/ Institution	Species name	Harvest date	Place of harvest	Collected/ Determined by:	Conservation Degree (1..4)
3	1		<i>Arabis caerulea</i> Hanke		Indescifabil	Rehsteiner	1
3	3	Flora Bulgareca Exicata	<i>Arabis caucasica</i> Willd.	1932.07.26	Macedonia Muntii Pirin Kutelo	B.Stefanoff/ T.Georgief	1
3	7	Dr.C. Baenitz herbarium europaeum	<i>Arabis campestris</i>	1887.06.06		Dr.Lerch (Conv. Schweiz)	1
3	8	Museo Botanico Universitates Clusienis	<i>Arabis auriculata</i> Lam.	1923.04.28	Transilvania Distr Cluj,Cluj	G.Bujorean	1
3	16	Herbarium Al.Beldie	<i>Arabis alpina</i> L. var.nana	1942.04	Bucegi Izvorul Dorului	Al.Beldie	1
3	33	Societe Pyreneenne	<i>Arabis cevenensis</i>	1890.07.26	Averyrow Aubrac	H.Costa	1
3	41	Societe Helvetique	<i>Arabis verna</i> R.B.r.	1886.04.15	Montpellier France	M.Auboudy	1
3	47	Herbier A. Pallet	<i>Arabis serpyllifolia</i>	1891.07.18	Lillard de Lans	A.Pellet	1
3	58	Flora Hungarica	<i>Arabis procurrens</i> Waldst. & Kit.	1887.05.02	Herkulesfurdo	L.Richter	1
3	69	Herbar G.Stroh	<i>Arabis pendula</i> L.	1889	Savepta/Volga in Russland	A.Becker	1
3	75	Flora Norvegia Herb. Carl Stormer	<i>Arabis hirsuta</i> L.	1887	Slearpno Chria	Carl Stormer	1
3	78		<i>Arabis ciliata</i> Koch.	1875.07.15	Alpi Elvetia	Ros. Masson	1

RESULTS AND DISCUSSIONS

***Arabis* Type** is part of *Brassicales* Order, *Brassicaceae* family, *Brassicoideae* subfamily. Being an annual or perennial herbaceous plant, that can grow from 10 cm up to 80 cm, its main usage is as an ornamental plant, and sometimes considered just a weed. The plant can be recognized by its hairy aspect, large leaves (between 1 and 9 cm), long capsule fruits and small, white and four petal flowers. (<https://en.wikipedia.org/wiki/Arabis>).

The species from this type that are found in the collection are as follow:

***Arabis allionii* DC.:** the stem is simple, straight and tall (4-5 cm). The leaves are also straight, irregular gnawed and lanceolate. The flowers are white, concentrated as a truss that elongates after flowering. The silique are thin, soft, straight, 2 cm long and strongly situated to the ax. It mainly grows on weakly humid pastures.

***Arabis alpestris* Schleich. ex Rchb.:** appears in the specialty literature as situated at altitudes of over 1700 m in the year 1902 (Vaccari, 1903). Other variations (*Arabis alpestris*, var. *hirsuta* and var. *glabra*) have been identified in the Swiss Alps (Melly, 1914). In France,

the species was identified on top of Grand Colombiers peak from the French Alps. In Germany, *Arabis alpestris* was identified in the Bavarian Mountains in the year 1905, more exactly on Wetterstein massif (Flahault, 1905).

Arabis alpina L. (including the *nana* variety): is a plant that grows on gravels, screeds and sometimes limestone from mountain areas. It can be found in Europe, North America, Asia (Central and Eastern parts) and Africa (North and East parts). The above mentioned *A. alpina*, is considered to have been originated in Asia Minor and then migrated towards East Africa where it can still be found. The plant found its way also in Europe, although its presence is more felt in Asia Minor even today. Furthermore, its genetic attributes are considered to be uniform in most parts of Europe (especially in central and North Europe) (Koch *et al.*, 2006). Regarding its anatomy, the plant has a tall stem (that can reach 40 cm) and white four-petal led flowers. Also, the leaves are pretty long but irregular in the basal rosette (https://en.wikipedia.org/wiki/Arabis_alpina). Its importance is generated by its genetic influence, the plant being considered an ideal organism for molecular biology and genetics studies. As such, a first genetic map was already drafted (QTL map) together with the first phenotypes.

Arabis auriculata Lam.: with a thin white root and a tall, straight stem (10-20cm), the plant is simple, usually red with its stem and leaves covered by shinleaf. Its leaves are oval and elongated, while the flowers are white, small and situated in a terminal truss. It mainly grows on walls and cliffs from mountain areas (De Lamarck & DeCandolle, 1805) (figure 1).

Arabis bellidifolia Linn. (including the *intermedia* variety): has one or more straight stems, usually red, simple and long, reaching 10-50 cm. The leaves from the base of the stem are oval, while the ones from the stem are elliptical or elongated. The flowers are white, situated in a terminal truss, usually straight, sometimes slightly inclined. The silica are straight, linear and compressed. The plant usually grows in the Alps, amongst stones and near torrents and glaciers (De Lamarck & DeCandolle, 1805).

Arabis brassicaeformis Wallr.: a perennial plant, having a tall, rigid and simple stem that can reach 50 cm and even 1 m. The leaves are shiny, soft, oval, long, lanceolate, straight and shortly auriculated. The flowers are white or pale pink, while the sepals are equal at the basis. The inflorescence is elongated, large, with a straight raceme and long peduncles. It usually flowers between May-June and can be found in Central Europe and up to Spain, along the Arden, Vosges, Jura, Alps, Cevennes, Corbières and Pyrenees Mountains (<http://www.tela-botanica.org/bdtfx-nn-5932-nomenclature>).

Arabis caerulea Hanke: has a long, wooden and cylindrical root. The leaves from the base are oval, full or gnawed, while the ones from the stem are sessile, oval elongated and are in a number of 2-3. The flowers are blue, with a tail and concentrated in a terminal truss that is sometimes inclined. The silica are thin and long, reaching 12-15 mm. It grows on cliffs around areas covered with snow the entire year and it can reach 5-10 cm in height (De Lamarck & DeCandolle, 1805).

Arabis caucasica Willd.: is a native European and Mediterranean plant. It is a solid plant that can reach 0.2 and up to 1 meter. Being a perennial and evergreen plant, it flowers during spring and is pollinated by bees (https://en.wikipedia.org/wiki/Arabis_caucasica).

Arabis hirsuta (L.) Scop.: is a tall hairy plant that can reach 15 up to 60 cm and it usually flowers between June and August. Its flowers are like a spike with white petals that are

longer than its sepals. A rosette is formed by the lower leaves, while its fruits have a tubular shape and are closely situated to the stem. The plant is indigenous to Asia, Europe and North America (Rollins, 1993), and it thrives on chalk slopes, rocks, hills and dunes (Davison, 2001). However, in recent times, its presence was mostly seen in a narrow area from Europe (Aleroyd, 1993; Karl & Koch, 2014).

Arabis hispida L. (*Arabis petraea*, *Cardamine petraea*): is also a perennial plant found on arctic and alpine rocks, especially of chalk composition from North America, Central Europe, Scandinavia, Siberia or Iceland. Its anatomy looks like this: a strong root that holds shoots, simple or branched flowers, white and purplish petals, yellow seeds and a height that ranges between 10 and 26 cm. Its apex is winged while the leaves are basal or form a rosette (Clapham *et al.*, 1987).

Arabis muralis Bertol.: encountered in central and southern Europe, its main characteristics are: obovate leaves and white flowers (pink for *A. muralis rosea*) that can reach 6-8 mm (rather small) that bloom during spring and up to summer. The stem can reach 15-30 cm in height. (<http://encyclopaedia.alpinegardensociety.net/plants/Arabis/muralis>).

Arabis pendula L.: usually present in forest gardens, around shaded areas (deep in the forest, in semi-shade areas or even in areas with no shades) and edges, the plant prefers moist soils that are well-drained, sandy or loamy and alkaline. The plant can grow up to 0.9 m and its flowers are commonly pollinated by bees (<http://www.pfaf.org/User/Plant.aspx?LatinName=Arabis+pendula>).

Arabis procurrens Waldst. & Kit.: as it names stands for „an underground spread” (Harrison, 2012), the plant is suitable for cultivation in alpine gardens where it forms a thick cover of foliage and white flowers evergreen or semi-evergreen. (Kindersley, 2008).

Arabis pumila Jacq.: growing usually between rocks and ridges from the European Alps, Dinaric and Apennine Mountains (at altitudes of 1700-3000 m), the plant can reach a height of 10-15 cm. It can be recognized by its white small flowers (6-7mm) that bloom between June and August and by its obovate leaves that sometimes have slight teeth. (<http://luirig.altervista.org/flora/taxa/index1.php?scientific-name=arabis+pumila>).

Arabis sagittata (Bertol.) DC.: Appears insularly with a more constant presence in the south part of Central Europe. It prefers dry meadows, luminous thermophile forests and their margins and sometimes even habitats with soils rich in nutrients. It usually flowers in May and June and is a perennial plant with leaves disposed in a rosette and one stem (this is usually straight, reaching a height of 45-80 cm, soft, elongated, empty and of a matte bright green). After flowering, the leaves from the base of the rosette die and have a lanceolate up to oval shape, partially or totally knurled, rounded or abruptly necked. The leaves are strictly lanceolate or ovate, whole, sharp or slightly sharp, straight, sessile at basis, shiny and thickened. The inflorescence has 5 up to 25 flowers, with the peduncle straight up to oblique, with petals of 5 up to 9.55 mm length and 1.0 - 2.5 mm width, white with straight margins (<http://botany.cz/cs/arabis-sagittata/>).

Arabis serpyllifolia Vill.: is recognized by its slim, straight stems that can reach 5-10 cm and are covered by simple or bifurcated thinleaves. All the leaves are elliptic, sessile, reunited in rosettes at the base of the plant and scattered around the stem. The flowers are white, while the petals are narrow and almost linear. The plant usually grows among cliffs and on rocky walls from mountain areas (De Lamarck & DeCandolle, 1805) (figure 2).



FIG. 1. *Arabis auriculata*

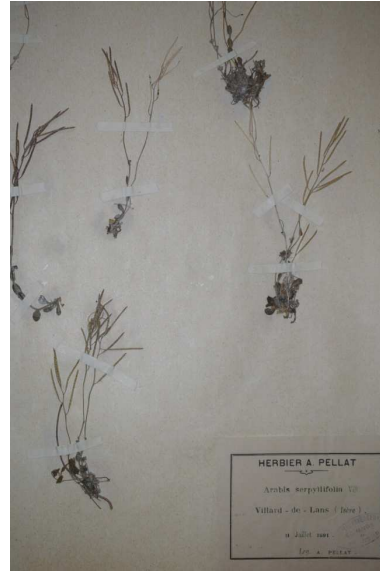


FIG. 2. *Arabis serpyllifolia*



FIG. 3. *Arabis hirsuta*

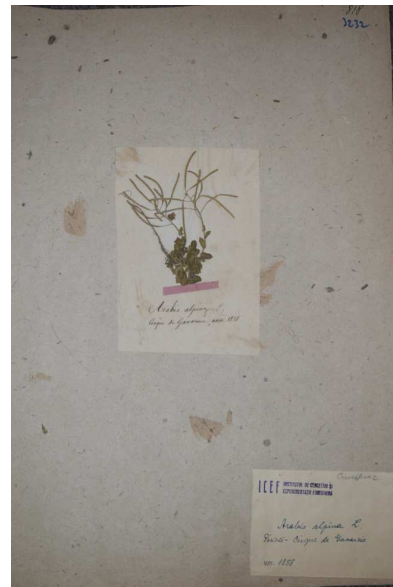


FIG. 4. *Arabis alpina*

Arabis stricta Huds.: can be recognized by the rigidity of all its parts and through its rough, simple or bifurcated shinleaves that are unevenly spread on the stem and leaves. The stems have approximately 10 cm in height, are tall, solitary or numerous, simple or ramified,

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garnished by straight, sessile leaves. The leaves from the base of the stem are concentrated in a rosette, are oval, sharp and covered in spikes. The flowers are concentrated in short trusses that become elongated after flowering. The plant usually grows amongst cliffs and gravels from limestone mountains (De Lamarck & DeCandolle, 1805).

Arabis sudetica Tausch.: is a perennial plant with an average height of 20-40 cm. The petals can reach a width of 1.3-2.5 mm, while the inflorescence is long and more or less thin, reaching a maximum height of 6-12 mm. The plant blooms in June-July and prefers humid, coarse soils, rich in nutrients (<http://flora.nhm-wien.ac.at/Seiten-Arten/Arabis-sudetica.htm>).

Arabis turrita Linn.: has a tall stem of 50 cm, slightly hairy and usually simple. The leaves from the base are long, elliptical, serrated, of a white green color and sometimes red towards the margin. The leaves from the stem are lanceolate and slightly serrated. The flowers are of a white-yellowish color and are also large. The plant usually grows in covered areas and alongside hedges (De Lamarck & DeCandolle, 1805).

Arabis verna (L.) R.Br.: an annual serrated-hairy plant, whose simple and slightly ramified stem grows up to 10-25 cm. The leaves are elongated, serrated, and coarse and concentrated as a rosette with small purple flowers. The lateral sepals are swelled at the basis and longer than the pedicel, while the petals are narrow and elongated. The plant blooms in April and May and vegetates on shadowed hills from Mediterranean Europe, Occidental Asia and North Africa (<http://www.tela-botanica.org/bdtx-nn-6003-synthese>).

Arabis vochinensis Spreng: is a perennial herbaceous plant that can reach 3-15 cm, and which has secondary roots with rhizomes. The stem is straight, starting with a basal and undivided rosette. The leaves are complete at the basis, obovate, obtuse and grouped in 2 up to 7 blocs. All the leaves have bifurcated spikes on the margins. It is an endemic alpine plant that prefers alpine meadows and can be found at altitudes of (600)1000-2200 meters. It flowers from June up to July and is a rare, calcium plant that can be found on meadows, pastures and cliffs. (<http://mitel.dimi.uniud.it/flora/scheda.php?id=1694>). It is mainly spread in South and Central Europe, in Italy, Austria, Croatia, Slovenia, Bosnia Herzegovina, Kosovo, Macedonia and Serbia (<http://luirig.altervista.org/flora/taxa/index1.php?scientific-name=arabis+vochinensis>).

Besides the *Arabis* plants presented above, the *Al. Beldie* Herbarium from *Marin Drăcea* Bucharest National Forest Research and Development Institute (INCDS), numerous other species from the *Arabis* genre are also present. Among them we mention: ***Arabis auriflora***, ***Arabis campestris***, ***Arabis cevenensis***, ***Arabis ciliata*** Koch. **var. *glabrata***, ***Arabis columbia***, ***Arabis gerardi*** Bess., ***Arabis pauciflora*** (Grimm) Garcke, ***Arabis suecica*** Fr., ***Arabis varialise***, ***Arabis dacica*** H., ***Arabis halleri*** L., ***Arabis gloriosa*** Sch., ***Arabis Ovirensis*** Wulf.

The plant's harvesting year. The plants were harvested in a time period that ranges from 1858 up to 1954. The oldest plants are *Arabis hirsuta* (Figure 3) and *Arabis alpina* (Figure 4), harvested in 1858 in Pyrenees Mountains.

The harvesting place of most species (*A. alpina*, *A. allionii*, *A. alpestris*, *A. caucasica*) is generally represented by high mountain areas: Bucegi (Caraiman, Coștila, Omul Peak, Valea Seacă, Izvorul Dorului, Valea Babei, Valea Izvorul Dorului, Valea Pripasului), Ceahlău, Domogled Mountains, Swiss Alps, Pyrin Mountains from Macedonia, Innsbruck. Different species of this genre were also harvested from Valea Cernei (*A. pauciflora*),

Herculane (*A. turrita*), Vișeu de Sus (*A. hirsuta*), Cluj (*A. auriculata*), Montpellier (*A. verna*), Savepta-Volga (*A. pendula*), Trieste (*A. verna*) etc.

The persons that have gathered the plants are Romanian specialists (Al. Beldie, C.C. Georgescu, Al. Borza, G. Bujorean, E.I. Nyarady, M. Haret, I. Todor, A. Conan) or foreign ones (P. Faure, G. Treffer, J.V. Kovats, L. Richter, A. Pellet, B. Stefanoff, A.A. Gerard, M. Auboudi, A. Becker, A. Birnbacher, Dr. Lager, Dr. Lerch).

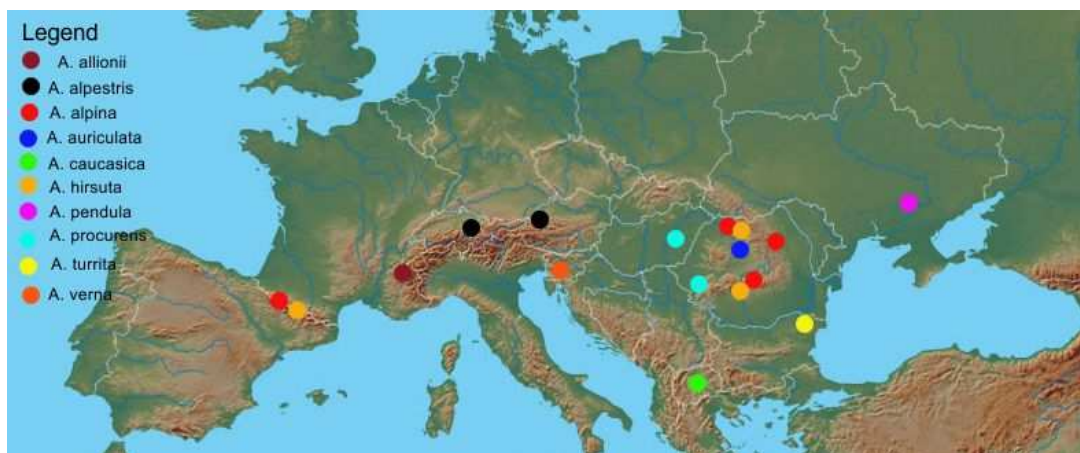


FIG. 5. Harvesting place of plants from *Arabis* genre

CONCLUSIONS

The species from *Arabis* type occupy an important place in the *Al. Beldie* Herbarium from I.N.C.D.S. *Marin Drăcea*. To be more exact, 78 plates, from 34 species, gathered in a time period that ranges from 1858 up to 1954. The oldest plants from this type are *Arabis hirsuta* and *Arabis alpina* harvested in the year 1858 in the Pyrenes Mountains.

By growing in mountain areas, the *Arabis* genre proves an altitudinal amplitude. Its species grow at an altitude that starts from (600)1000 meters (*Arabis vochinensis* Spreng), and can go up to 1700 and 3000 m in the Alps, Apennine and Dinaric Mountains (*Arabis pumila* Jacq.). The harvesting place for the species present in the herbarium are represented especially by mountain areas from Romania, together with areas from the Alps or Pyrin Mountains from Macedonia. We can conclude that the species from the *Arabis* genre present in *Al. Beldie* Herbarium were gathered from different parts of Europe, starting with the mountain area, followed by hill areas from Romania and Bulgaria or plain areas from Ukraine (Dnieper meadow) or Hungary (Tisa meadow).

The species are herbaceous, annual or perennial plants, growing to 10–80 cm tall, usually densely hairy, with simple entire to lobed leaves 1–6 cm long, and small white four-petal flowers. The species present in the herbarium flower between April-May (*Arabis verna* (L.) R.Br.) or up to June-August (*Arabis pumila* Jacq., *Arabis hirsuta* L.).

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