

THE HERBARIUM – A DATA SOURCE FOR *ALLIUM* GENUS SPECIES

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Abstract . *Allium* is an extremely diversified genus that encompasses more than 750 species almost exclusively distributed in the North hemisphere (Mediterranean Europe, Asia, North America, South America and sub-Saharan Africa). The *Allium* genus includes some species that are economically valuable and cultivated worldwide, such as the common onion, garlic, scallion or chive. Other species have important medicinal properties or are used in horticulture. The purpose of this paper is to inventory the *Allium* genus species present in the Al. Beldie Herbarium from INCDS "Marin Drăcea" Bucharest and describe some of them. The Herbarium host 111 plates that contain 56 *Allium* genus species. Most plates belong to *Allium schoenoprasum* L., *Allium oleraceum* L. and *Allium ursinum* L. and the most *Allium* genus species were gathered in 1932 and 1942. A large number of plates are signed by Al. Beldie, while others belong to S. Paşcovski, Al. Borza, C. C.Georgescu and were gathered from Italy (Naples, Sicily), Bulgaria, Alps or Pyrenees and from Romania from Bucegi Mountains (most of them), Băile Herculane, Iaşi, Tulcea. The herbarium offers a unique perspective for the *Allium* genus species in regard with their location-temporal dynamic. The information can be used as a starting point for comparing distribution changes from the past and the future.

Keywords: gathered, genus, herbarium, properties, species.

INTRODUCTION

The *Alliaceae* family is a much known family of perennial herbaceous plants belonging to *Asparagales* Order.

The taxonomy position of *Allium* genus and its connected genus was for a long period a controversial subject. For example, in the early angiosperm classifications (MELCHIOR, 1964), they were situated in the *Liliaceae* Family (STEARN 1992). Later, due to their inflorescence structure, they were included in *Amaryllidaceae* Family.

Recently, based on some molecular analysis, a division in a larger number of small monophyletic families was realized. Furthermore, in the most recent and competent monocotiledonate taxonomy treaty, *Allium* genus and its close relatives were acknowledged as a distinct family (*Alliaceae*), very close to *Amaryllidaceae* Family (FRITSCH AND FRIESEN 2002).

The Angiosperm Phylogeny Group II System from 2003 also acknowledges the family and places it in the *Asparagales* Order, monocotiledonate phylum (LYANTAGAYE, 2011).

Allium is an extremely diversified genus that encompasses more than 750 species almost exclusively distributed in the North hemisphere (Mediterranean Europe, Asia, North America, South America and sub-Saharan Africa) (STEARN 1992, LANZOTTI 2006). This number is based on the *Allium* species as live plants from savage environments as well as the cultivated ones or the dry and pressed species from herbariums.

The *Allium* genus is characterized by the fact that their bulbs are enveloped in membranous or fiber tunics. The plants can vary in height between 5 cm and 150 cm, the flowers are forming an umbrella over a stem with no leaves, while the petals are free or almost free (FRIESEN ET AL. 2006).

Most species produce remarkable quantities of cysteine sulfoxides, which provide their specific smell and taste. Furthermore, the genus includes some species that are economically valuable and cultivated worldwide, such as the common onion, garlic, scallion or chive. Other species have important medicinal properties or are used in horticulture (FRITSCH AND FRIESEN 2002).

The purpose of this paper is to inventory the *Allium* genus species present in the Al. Beldie Herbarium from INCDS "Marin Drăcea" Bucharest and describe some of them, as the majority of traditional taxonomy plant studies were based on dry specimens sheltered in herbariums.

MATERIAL AND METHODS

The "Al. Beldie" Herbarium from INCDS "Marin Drăcea" Bucharest, is realized in the memory of Dr.Doc. Forest Engineer Alexandru Beldie and contains samples with over 60.000 plates that host herbaceous and ligneous species, moss, reindeer moss and fern, plants from the Red List and many others (VASILE ET AL. 2016a).

The collection contains 10.000 sheets with plants collected by Al. Beldie himself, while the rest of 50.000 plates originate from private collections donated by certain researchers or from foreign herbariums obtained through exchanges.

All the plant species, including the *Allium* ones, are kept in their original maps and are deposited in drawers belonging to 30 wood modules from within the Institute.

A database was created for all plants belonging to *Allium* Genus, as well as for *Hieracium* (DINCĂ L. ET AL. 2017a), *Androsace* (DINCĂ M. ET AL.2017), *Melica* and *Eragrostis* (CĂNTAR ILIE AND DINCĂ MARIA, 2017), *Arabis* (DINCĂ L. ET AL.2017b), *Ornithogalum* (ENESCU AND DINCĂ L., 2017), *Potentilla* (CRIȘAN ET AL., 2017) and *Veronica* (DINCĂ L. ET AL. 2017c). This database contains the drawer number, species present in the drawer maps, the afferent collection, harvest date, harvest place, the person who determined or collected the plant, as well as its conservation degree. As such, the conservation degree has assigned a numerical code that ranges from 1 to 4, where 1 represents a well conserved plant, complete and correctly attached to the plate, 2 – a plant detached from the plate, with existent but detached parts, 3 – a plant detached from the plate, lacking some parts and 4 – detached and fragmented plant, with over 50% of its parts missing.

RESULTS AND DISCUSSIONS

Allium genus species present in the herbarium

The Herbarium host 111 plates that contain 56 *Allium* genus species, namely: *Allium sphaerocephalum* L., *Allium ammophilum* Heuff., *Allium ampeloprasum* L., *Allium angulosum* L., *Allium atropurpureum* W. Et K., *Allium atroviolaceum* Boiss., *Allium besserianum*, *Allium bulbiferum*, *Allium carneum*, *Allium chamaemoly* L., *Allium cirrhosum* Vand., *Allium coppoleri*, *Allium cupani* Raf., *Allium descendens* L., *Allium ericetorum*, *Allium flavum* L., *Allium foliosum*, *Allium fuscum* Janka., *Allium guttatum* Stev., *Allium insubrieum* Boiss. Rent., *Allium lineare* L., *Allium longispathum*, *Allium marginatum* Jka., *Allium melanantherum*, *Allium moly* L., *Allium montanum* F W Schmidt, *Allium moschatum* L., *Allium narcissiflorum*, *Allium nigrum* L., *Allium obliquum* L., *Allium ochroleucum* W. K. ssp pseudo-ochroleucum, *Allium oleraceum* L., *Allium paniculatum* L., *Allium pendulum*, *Allium regelianum* Bosker., *Allium reticulatum strictum* Sohr., *Allium regelianum* Bosker., *Allium roseum* L., *Allium rotundum* L., *Allium saxatile* M. Bierb., *Allium schoenoprasum* L., *Allium segetum*, *Allium senescens* L., *Allium setaceum* W. et K., *Allium siculum* ucria ssp. dioscoridis K. Richt., *Allium suaveolens* Jacq., *Allium subhirsutum* L., *Allium tauricum* Bess., *Allium tenuiflorum* Ten.,

Allium triquetrum L., *Allium tulipaefolium* Led., *Allium ursinum* L., *Allium victorialis* L., *Allium vineale* L., *Allium bulgaricum*.

Most plates belong to *Allium schoenoprasum* L., *Allium oleraceum* L. and *Allium ursinum* L (Fig.1).

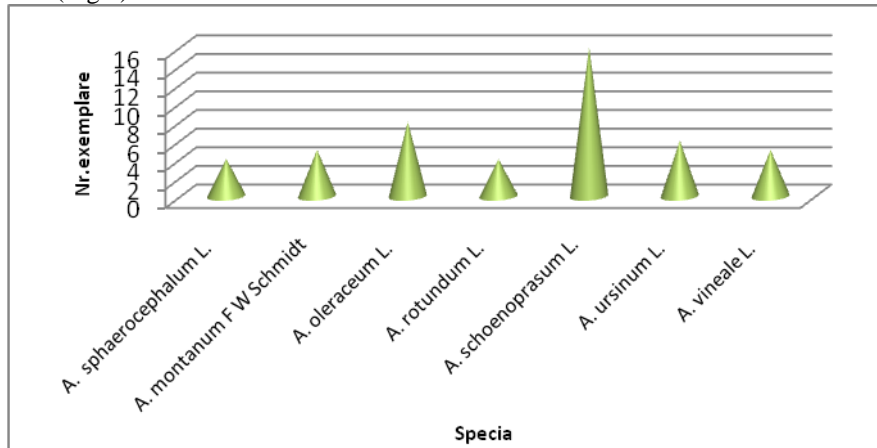


Fig. 1. *Allium* genus species present in the herbarium

Allium schoenoprasum L. – known as **chive**, is a monocotyledonate perennial species, similar to onion. It is the smallest onion species and the most widespread. Its name originates from the Greek language (skhoínos = bulrush or cane and prason= scallion). The English name (chives), derives from the Latin word cepa (DE WILDE-DUYFJES 1976).

The chive does not produce large bulbs (Fig. 2), but forms new auxiliary sprouts after forming two or three leaves with sprouts attached to short rhizomes. The plant forms dense agglomerations with narrow, linear and empty leaves that usually reach 15-30 cm in height. Flowers appear under the shape of dense umbrellas and not as bulbils (bulbils= small sprouts with leaves as scales that appear on the stem) as is the case for many other *Allium* species that have fewer space between flowers.

Both leaves and flowers are eatable. The leaves are massively used in Europe cuisine, while the flowers are mainly used in salads. The taste is similar with onions but is more lightly (DE WILDE-DUYFJES 1976).



Fig.2. *A. schoenoprasum* L. exemplary from Pyrenees Mountains, 1857

The chive produces sulphur compounds (including methyl sulphur and disulphur) very similar with garlic, but in lower quantities. Even though they have medicinal properties (antifungal, antimicrobial, improves the circulation etc.), it has a limited usage in medicine. The high quantity of sulphur compounds can help in eradicating harmful insects, so that it can

be used as chaperon plant besides other garden plants (POULSEN, 1990; VAN DER MEER, 1997; HANELT, 2001; MAXTED & RHODES 2016).

The species is extremely polymorph and is cultivated both as vegetable as well as ornamental. The chive was cultivated in Japan and Italy from where it was distributed in Central and West Europe in the early Medieval Age (HELM, 1956; HANELT, 2001).

Allium oleraceum L. (**field garlic**) (Fig.3) - is a species of wild garlic from Eurasia. As such, it is a bulbous perennial plant that grows wild in dry areas and can reach 80 centimeters in height. It reproduces through seeds and bulbs (LINNAEUS 1753).

This plant prefers a partial or complete exposure to sun and tends to grow on slightly humid and loamy soils, even though it can also grow on other types of soils. Field garlic disseminates quickly, as a herb and it can be very difficult to get read of it (GLEASON & CRONQUIST 1991).



Fig.3. *A. oleracem* L. exemplary from Hanul Conachii (Al. Beldie) and Ciolpani (indecipherable)

Allium ursinum L. (**bear's garlic**) – its name ("ursinum") originates from Latin, namely from "ursus" (bear) and is connected to the legend that bears, after their winter sleep, eat this plant in order to eliminate the toxins from their organism and to regain their power (REJEWSKI, 1996). Another etymological hypothesis is connected to "Ursa major", a constellation in the north hemisphere, because *A. ursinum* was for ancient Greeks one of the most Nordic *Allium* species (BÖHLING 2008). The name of "wild garlic" can also be found but causes confusions with other *Allium* species (*A. vineale* or *A. canadense*), as well as with *Tulbaghia* species (DEFELICE 2003; LYANTAGAYE 2011).

It is a bulbous plant with a narrow and elongated bulb of approximately 1,5-6 cm in height that has few fir at the basis. It can reproduce itself vegetative as the bulb sometimes forms "daughter bulbs". The contractile roots start to form after three years (MACKŮ AND KREJČA 1989; ČINČURA ET AL. 1990). If the soil is sufficiently mellow, the roots can penetrate deep in the soil and reach up to the depth of 27cm (ELLENBERG 1988).

A. ursinum forms a stem of up to 50 cm in height, at the end of which inflorescence appear from April to the first part of May. The inflorescences have a semispherical shape, umbrella type, which holds up to 30 white flowers (Fig.4).

The plant usually has 2-3 leaves that are neat, flat, elliptically-lanceolate, with a distinct limb, well developed, sharp at the peak, narrowing progressively in the petiole. The leaf's breadth is of 20-64 mm (SZAFFER ET AL., 1988) (Fig.5).



Fig. 4. *A. ursinum* L. during the flowering period **Fig. 5.** *A. ursinum* from Banat, 1944 (Al.Borza and Al. Buia)

A. ursinum mainly regenerates through seeds, while the vegetative regeneration is less important. The seeds are black and sub globular with a length of 2-3 mm and concentrated in tricotomic capsules (HERMY ET AL., 1999, SENDL 1995). These mature in June and July and fall directly on the field, being too heavy to be transported by the wind. As such, their transport on longer distances is done via water or wild animals (EGGERT 1992).

All the plant's parts are eatable. The leaves are collected in April and May for medicinal purposes, while the bulbs are harvested in September and October. The harvest is done in raw state, directly from the forest. In Romania, *A. ursinum* is gathered in significant amounts (VASILE ET AL., 2016b).

In previous eras, the plant was cultivated as vegetable, medicinal plant and spice in Central and North Europe. During the last years, the plant started to be cultivated as garden plant, near houses in Germany and mountain regions from Caucis (HANELT, 2001).

Years, places and persons that gathered the herbarium species

The most *Allium* genus species were gathered in 1932 and 1942, while the least number of species date to 1975-1992 (Fig.6).

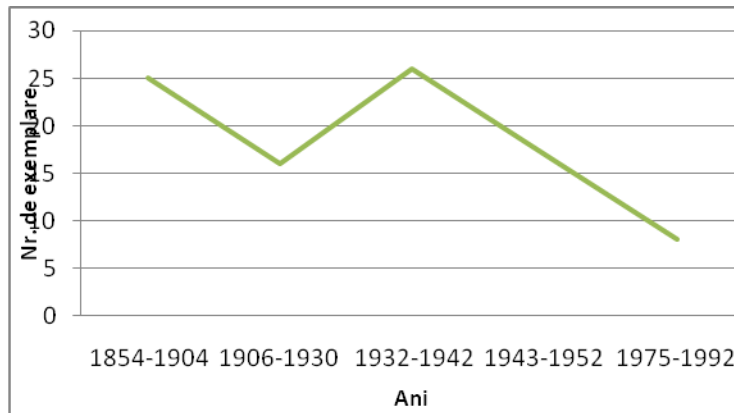


Fig. 6. The period in which the herbarium plant were collected

The *Allium* species were mainly gathered from Europe, namely Italy (Naples, Sicily), Bulgaria, Alps or Pyrenees. From Romania, the plants were collected from Bucegi Mountains (most of them), Băile Herculane, Iași, Tulcea, Mangalia, Cluj, Hunedoara, Retezat Mountains etc. "Al Beldie" Herbarium contains *Allium* species collected or acknowledged by renowned local and foreign botanists. A large number of plates are signed by Al. Beldie, while others belong to S. Pașcovski, Al. Borza, C. C.Georgescu, Bujoreanu, Grințescu. I.D. Tătăranu, M. Haret, E.L. Nyárády.

A large number of plates belong to foreign botanists such as A. Becker, A. Arval, E. Reverdron, etc.

The plates' conservation state

The plates are very well conserved and maintained, so that the plants are entire and well fixed (grd.1) or entire and with some parts detached from the plate (grd.2). Only a small number of plants are detached from the plate and have missing parts (grd.3) (Fig.7). This aspect is caused by the fact that each plate is protected by Parched paper that is folded over the plate in order to protect the attached plant against colliding with the neighboring plate ("protection shirt").

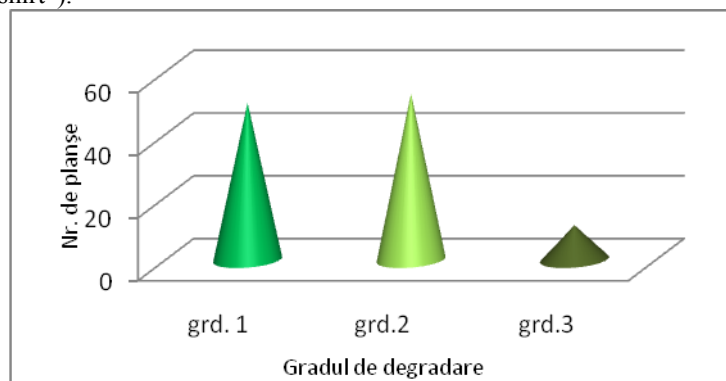


Fig.7. The conservation state of herbarium plates

CONCLUSIONS

From the 750 *Allium* genus species outspread in the North hemisphere, 56 species in a very good conservation state and kept in 111 plates were identified in the "Al. Beldie" Herbarium.

The herbarium offers a unique perspective for the *Allium* genus species in regard with their location-temporal dynamic. Even though the herbarium data can be heterogeneous in regard with the description of the location and habitats, their limitations being caused by different sampling criteria and efforts, the herbarium proves to be very useful when the plants' distribution models are explored on a large scale.

By studying the *Allium* exemplars from the herbarium, it can be observed that they offer data concerning their harvest, geographic locations, so that characteristics regarding their apparition can be estimated, together with establishing their habitats. Furthermore, this information can be used as a starting point for comparing distribution changes from the past and the future.

BIBLIOGRAPHY

- BÖHLING N. 2008. Eine Hypothese zur Ableitung des Namens „Bär“lauch. Ber Inst Landschafts-Pflanzenökologie Univ Hohenheim Heft 17:199–204.
- CĂNTAR I.C., DINCĂ M., 2017. Two genus of plants from *Poaceae* family (*Melica* and *Eragrostis*) existing in "Alexandru Beldie" herbarium of I.N.C.D.S. Bucharest. JOURNAL of Horticulture, Forestry and Biotechnology, Volume 21(3), 2017, pag. 68-76.
- ČINČURA F, FERÁKOVÁ V, MÁJOVSKÝ J ET AL. 1990. Pospolite rošliny šrodkowej Europy. PWRiL, Warszawa.
- CRİŞAN V., DINCĂ L., ONEŢ C., ONEŢ A., 2017. Collection species from *Potentilla* genus. Natural Resources and Sustainable Development, pag. 27-34.
- DAHLGREN RMT, CLIFFORD HT, YEO PF. 1985 The families of the monocotyledons. Springer-Verlag, Berlin.
- DEFELICE M.S. 2003. Wild garlic, *Allium vineale* L.—little to crow about. Weed Technol 17(4):890–895 CrossRef.
- DE WILDE-DUYFJES B. E.E.1976. A revision of the genus *Allium* L. in Africa. H. Veenman & Zonen B.V. – Wageningen.
- DINCĂ L., VASILE D., VOICULESCU I., 2017a. Caracteristici ale speciilor de plante din genul *Hieracium* existente în Herbarul *Alexandru Beldie* al I.N.C.D.S. Bucureşti. Lucrări Ştiinţifice - vol. 60, seria Agronomie, U.S.A.M.V. Iaşi. In press.
- DINCĂ M., DINCĂ L., VASILE D., 2017. A short description of *Androsace* genre plants present in Alexandru Beldie Herbarium from I.N.C.D.S. Bucharest. Current Trends in Natural Sciences, Vol. 6, Issue 12, pag. 16-24.<http://www.natsci.upit.ro/current-issue/>.
- DINCĂ L., CĂNTAR I.C., DINCĂ M., 2017b. "The characteristics of plant species from *Arabis* type present in *Al. Beldie* Herbarium from I.N.C.D.S. Bucharest". Annals of West University of Timişoara, ser. Biology, vol. 20 (2), pp. 115-122.
- DINCĂ L., ENESCU R., ONEŢ A., LASLO V., ONEŢ C., 2017c. Plant species from *Al. Beldie* herbarium - *Veronica* genre - short description. Natural Resources and Sustainable Development, pag. 43-50.
- ELLENBERG H.H. 1988. Vegetation ecology of Central Europe. Cambridge University Press, Cambridge, New York.
- ENESCU R., DINCĂ L., 2017. Description of plant species of *Ornithogalum* genus present in *Al. Beldie* Herbarium from "Marin Drăcea" Bucharest N.I.R.D.F. JOURNAL of Horticulture, Forestry and Biotechnology, Volume 21(3), 2017, pag. 89-95.
- FRIESEN N., FRITSCH R.M., BLATTNER F.R. 2006. Phylogeny and new intrageneric classification of *Allium* (*Alliaceae*) based on nuclear ribosomal DNA its sequences. Aliso 22, pp. 372-395.

- FRITSC R.M. AND FRIESEN N. 2002. Evolution, domestication and taxonomy, pp. 5-30. In H. D. Rabinowitch and L. Currah [eds.], *Allium crop science: recent advances*. CABI Publishing, Wallingford, Oxfordshire, UK.
- GLEASON, H. A. & A.J. CRONQUIST. 1991. *Manual of the Vascular Plants of Northeastern United States and Adjacent Canada* (ed. 2).
- HANELT, P. 2001. Alliaceae. In: Hanelt, P. (ed.) *Mansfeld's Encyclopedia of Agricultural and Horticultural Crops*, Vol. 4, 3rd edn. Springer-Verlag, Vienna, pp. 2250–2269.
- HELM, J. 1956. Die zu Würz- und Speisezwecken kultivierten Arten der Gattung *Allium* L. *Kulturpflanze* 4, 130–180
- LANZOTTI V. 2006. The analysis of onion and garlic. *J. Chromatogr. A* . 1112:3–22.
- LINNAEUS, CARL VON. 1753. *Species Plantarum* 1: 299
- LYANTAGAYE S.L. 2011. Ethnopharmacological and phytochemical review of *Allium* species (sweet garlic) and *Tulbaghia* species (wild garlic) from Southern Africa. *Tanz. J. Sci.* Vol. 37, pp 59-72.
- MACKŮ J, KREJČA J. 1989. *Atlas rošlin leczniczych*. Zakład Narodowy im. Ossolińskich, Wrocław.
- MAXTED, N. & RHODES, L. 2016. *Allium schoenoprasum*. The IUCN Red List of Threatened Species 2016.
- MELCHIOR, H. 1964. 3. Reihe Liliiflorae (Liliales). In: Melchior, H. (ed.) *A. Engler's Syllabus der PFLANZENFAMILIEN*. 12. Auflage. Gebrüder Borntraeger, Berlin-Nikolassee, pp. 513–543.
- POULSEN, N. 1990. Chives, *Allium schoenoprasum* L. In: Brewster, J.L. and Rabinowitch, H.D. (eds) *Onions and Allied Crops*, Vol. III. Biochemistry, Food Science, and Minor Crops. CRC Press, Boca Raton, Florida, pp. 231–250.
- REJEWSKI M. 1996. *Pochodzenie łacińskich nazw rošlin polskich*. Przewodnik botaniczny. Książka i Wiedza, Warszawa.
- STEARNS, W.T. 1992. How many species of *Allium* are known? *Kew Mag.* 9: 180–181.
- van der Meer, Q.P. 1997. Old and new crops within edible *Allium*. *Acta Horticulturae* 433, 17–31.
- SZAFER W, KULCZYŃSKI S, PAWŁOWSKI B. 1988. *Rošliny polskie*. PWN, Warszawa.
- VASILE D., DINCĂ L., INDREICA A., VOICULESCU I. 2016a. Herbarul „Alexandru Beldie” – o colecție de plante și o importantă bază de date pentru specialiști. *Revista de Silvicultură și Cinegetică*, nr.39. P 114.
- VASILE D., DINCĂ L., VOICULESCU I., 2016b: „Recoltarea plantelor medicinale din flora spontană a fondului forestier administrat de RNP Romsilva”. *Revista de Silvicultură și Cinegetică*, nr.37, pag. 88-94.