

RUBUS SPECIES PRESENT IN ALEXANDRU BELDIE HERBARIUM

SPECIILE DIN GENUL *RUBUS* PREZENTE ÎN HERBARUL *ALEXANDRU BELDIE*

DINĂ L.^{1*}, *VASILE Diana*¹, *DINĂ Maria*¹, *BLAGA Tatiana*²

*Corresponding author e-mail: dinka.lucian@gmail.com

Abstract. *Rubus* Genus, which encompasses 750 species spread out on almost all continents, has a significant importance, both from a botanical perspective, as well as an economical and medicinal one. The purpose of the present paper is to describe some of the most important species belonging to the *Rubus* Genus present in the Al. Beldie Herbarium from INCDS „Marin Drăcea”, Bucharest. As such, the paper analyzes the species harvesting year and place, the botanists that have collected them as well as the plates conservation state. As a total, 114 plates that belong to the *Rubus* Genus were analyzed, namely 65 species. The species with most samples present in the herbarium is *Rubus caesius* L., followed by *R. idaeus* L. and *R. tomentosus* Borkh. The *Rubus* species were collected from France, Poland, Germany, Austria and Romania (Bucegi Mountains, Brașov, Arad, Timișoara, Caransebeș, Vâlcea, Buzău, Ilfov, Maramureș). The *Rubus* samples present in the herbarium were collected between 1853 and 1999, the majority of them being gathered between 1887 and 1942 by renowned local or foreign botanists. The conservation state of the plates is generally good.

Key words: herbarium, *Rubus*, blackberry, raspberry, plants

Rezumat. Genul *Rubus*, care cuprinde 750 de specii răspândite pe aproape toate continentele, are o importanță deosebită, atât din punct de vedere botanic, cât și economic sau medicinal. Scopul acestui articol este de a descrie câteva specii mai importante din genul *Rubus* prezente în colecția Herbarului Al. Beldie, de a analiza anul recoltării acestor specii, locul de unde s-au prelevat, botaniștii care au realizat acest lucru și starea de conservare a planșelor. Au fost analizate 114 planșe care aparțin genului *Rubus*, aparținând la 65 de specii ale acestui gen. Specia cu cele mai multe exemplare în herbar este *Rubus caesius* L., urmată de *R. idaeus* L. Speciile de *Rubus* au fost colectate din Franța, Polonia, Germania, Austria, România. Exemplarele de *Rubus* din herbar au fost colectate între anii 1853 și 1999, de către botaniști renumiți din țară sau străinătate. Starea de conservare a planșelor este în general bună.

Cuvinte cheie: herbar, *Rubus*, zmeur, mur, plante

INTRODUCTION

Rosaceae Family is formed of approximately 90 genres and 2520 species and can be found predominantly in the temperate regions of the north hemisphere

¹ “Marin Drăcea” National Institute for Research and Development in Forestry, Brașov, Romania

² “Marin Drăcea” National Institute for Research and Development in Forestry, Bacău, Romania

(Seeram, 2008; Khatamsaz, 1992). *Rubus* Genus (*Rosaceae*, *Rosoideae* subfamily) includes perennial herbaceous shrubs or plants.

The general assumption is that the species originates in South-West China (Gu *et al.*, 1993), as this area is archaic from a geological point of view and was not covered by glaciers during the Quaternal period.

At least 299 botanic taxons are described as originating from China, being distributed in 27 provinces (Gu *et al.*, 1993). Vavilov (1940) considers that China occupies “the first place in the entire world” in regard with “the composition of wild and cultivated fruits.”

Rubus Genus encompasses 750 species (Robertson, 1974; Lu, 1983; Gu *et al.*, 1993; Thompson, 1995) and can be found on all continents with the exception of Antarctica (Focke, 1910, 1911, 1914; Gustafsson 1942, 1943; Spies and Du Plessis, 1985; Hummer, 1996).

Most *Rubus* species are perennial shrubs with biannual stems. The plant's position varies from erect to crawling. Some plants are runner (*R. cissoides* Cunn. From New Zealand), while others are small alpine forms that spread through subterranean stool (*R. chamaemorus* L.).

Most species have falling leaves, but there are also some species that are always green. The leaves differ in length from 1 cm up to 20 cm. Also, the leaves can be whole, lobate, trifoliolate, pent foliated or pennate composed. The stem's diameter varies from 2 to 7 cm. Furthermore, *Rubus* species can have large spines on the stem that can reach 1.5 cm in length, trichomes or neither spines nor trichomes (Smolarz and Zmarlicki, 1993).

Ripe fruits have colors that vary from white to yellow, orange, red, purple or black. The fruit is apocarpic, multiple and pulpy (poly drupe). The weight varies on the species, from 0.4 g (Gu *et al.*, 1993) to 20.5 g (Hall, 1990).

Rubus species are extremely important, both from an economical point of view (for the fruits), as well as from a medicinal one (leaves and fruits).

The purpose of the present paper is to describe some of the most important *Rubus* species present in the Al. Beldie Herbarium from INCDS „Marin Drăcea” Bucharest.

MATERIAL AND METHOD

The plant collections from Al. Beldie Herbarium were used as a main material in order to describe the *Rubus* species. The Herbarium was created in 2002 within INCDS Bucharest (Vasile *et al.*, 2016), being besides the library and laboratories an essential part of the research institute.

The collection holds over 40.000 plates with wood and herbaceous forest species, moss, lichen, fern and plants from the Red list (Cântar *et al.*, 2017; Crișan *et al.*, 2017; Dincă *et al.* 2017; Dincă *et al.*, 2018; Dincă *et al.*, 2017; Enescu *et al.*, 2018; Scărlătescu *et al.* 2017). As such, the herbarium contains plants from all continents originating from private donated collections or foreign collections obtained from exchanges. 10.000 plates have belonged to academician Al. Beldie, who has gathered them himself.

RESULTS AND DISCUSSIONS

The enterprised investigations have identified the presence of 114 plates in the Herbarium that belong to the *Rubus* Genus. Within these plates, 65 species belonging to this Genus were identified.

The species with most samples present in the herbarium is *Rubus caesius* L., representing 22% of the total 65 species, followed by *R. idaeus* L. and *R. tomentosus* Borckh.- 9%, *R. parviflorus* Nutt. and *R. saxatilis* L. – 6%, *R. bifrons* Vest., *R. candicans* Weiche ex Rcb, *R. arcticus* L., *R. dumetorum* Schldl., *R. hirtus* L., *R. maximus* Marsson and *R. odoratus* L. – 5%. The other species are present in the herbarium only with one sample.

The *Rubus* species were gathered from France, Poland, Germany, Austria and Romania (namely Bucegi Mountains, Brașov, Arad, Timișoara, Caransebeș, Vâlcea, Buzău, Ilfov, Maramureș) (fig.1).

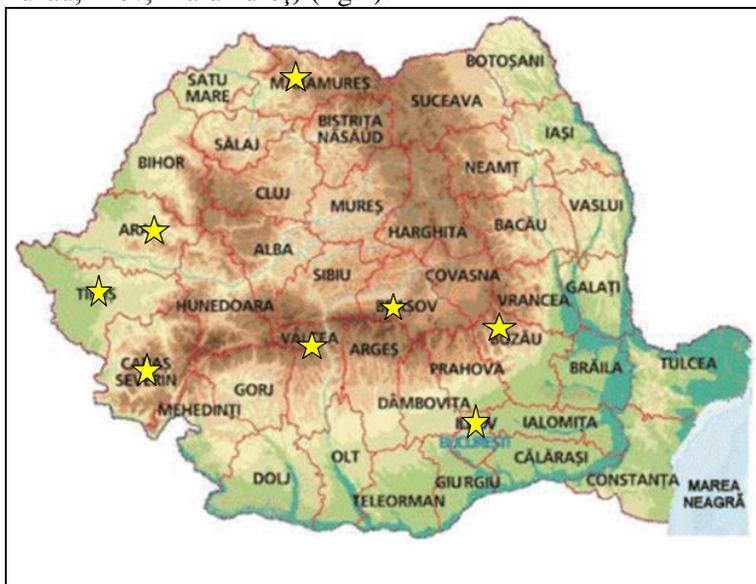


Fig. 1 *Rubus* samples present in the Herbarium and collected from Romania

***Rubus caesius* L. – Plain blackberry.** Native species spread out in all Europe, Caucasus, Central Asia and West Siberia. The plant appears both in the forest fund as well as outside it, especially in plains (Stănescu *et al.*, 1997).

The plant has a small stature, subarbutive, ranging from 0.2 up to 1m, that can be found at a very low altitude. The stems are pale green, slender, rounded (not polygonal) and with glandular trichomes. The species blooms from June until September, while the fruits appear from July until September. The sepals are large, almost erect on the fruits, while the petals are white. The fruits are poly drupes, black-blue-brown in color (Hummer, 1996; Joshua *et al.*, 2013).

The plant can grow on very alkaline soils in semi-shadow or without shadow, preferring however humid soils (Wyremblewska *et al.*, 2010).

***Rubus hirtus* W et K – crawling blackberry** (fig. 2). Native shrub with crawling stems that are short and spiky, forming dense carpets that restrain the regeneration of forests; the stem presents spikes and red or dark blue unequal, pedicellate glands (Hummer, 1996).

The leaves alternate and have 3 variable folioles, unequally serrated and hairy on the back; the terminal foliola is larger. The leaves are green also during winter and become red due to the cold (hibernated leaves). The plant blooms from June until September. The fruits are black poly drupes, sweet and eatable (Joshua *et al.*, 2013).

Forest blackberry is common all-around Europe and present in Romania from hills (holm stands, common beech stands), up to the mountain floor. It is a relatively hygrophyte species, pretentious towards atmospheric humidity. Although it is resistant in shadow, it does not produce fruits in this condition. The plant is important from an economic point of view, having numerous benefits (Lee *et al.*, 2012).

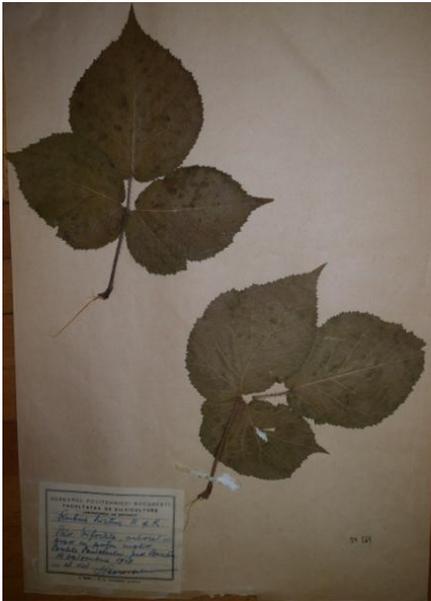


Fig.2 *R. hirtus* collected in 1949



Fig.3 *R. idaeus* collected by Wolff in Cluj

***Rubus idaeus* L. – Raspberry** (fig. 3). It is a native species that grows in areas with temperate and cold climate from Europe and Asia. Furthermore, the plant is frequently found in our country starting from hill regions un to high altitudes. It appears especially in exploited areas (felling areas) as well as in open woods and forest clearings (Stănescu *et al.*, 1997).

The plant forms shrubs with numerous stems erect, that can reach 1-2.5 m in height. The sprouts are geniculated, green-gray in color and with spikes

situated especially towards the base of stems. The leaves are imparipinnate composed, with 5-7 folioles, glabrous and green on the superior side, while white-tomentose on the inferior one. The flowers are white, small and appear in May-June (Williams, 1959). The fruit is a globular poly drupe, red when it reaches maturity, succulent, sweet and easily detachable from the receptacle. The fructification is abundant in full light (Dale, 2008).

***Rubus parviflorus* Nutt. – thimble raspberry** (fig. 4). A native species from North America that grows from the sea level in North up to altitudes of 3000 m in South. It usually develops alongside roads and railroads and appears as an ecological succession in forests with thinning or with forest fires (Griffith and Ganders, 1993).

Rubus parviflorus is a dense shrub that can reach up to 2.5 meters in height and with stems without spikes that can reach a diameter of 1.5 centimeters.

The leaves are palmate, up to 20 centimeters (much larger than all *Rubus* species), with five lobes and a soft, hairy texture. The flowers are among the largest of any *Rubus* species, being in contrast with the plant's Latin name *parviflorus* ("small flower"). The plant produces red eatable fruits of approximately one centimeter in diameter, that appear from June until the end of August. The harvested fruit resembles a thimble and gives the plant its thimble raspberry name (USDA 2015).

***Rubus saxatilis* L. – cliff raspberry** (fig. 5). It is a species largely spread out in Europe and Asia, from Iceland and East Spain to China. The stems are green and reach a height of 20-60 cm, being covered by short spikes as a needle. The leaves are usually composed of three folioles. The inflorescence is a corymb, with a few flowers.



Fig. 4 *R. parviflorus* collected by Ș. Pașcovschi



Fig. 5 *R. saxatilis* collected by Al. Beldie in 1942 in Caraiman

The fruit is an aggregate of many red, pulpy drupes, spherical and red, with a diameter of 1-1.5 cm and it contains large kernels (Hummer 1996; Richards *et al.*, 1996).

Cliff raspberry appears on rocky fields, in humid forests and in exploitation feeling areas after the trees have been cut (Wyremblewska *et al.*, 2010).

***Rubus tomentosus* Borkh.** *Rubus tomentosus* Borkhausen var. *canescens* (de Candolle) Wirtgen, is a European species similar with *R. bifrons* and *R. vestitus*, but more pubescent than each of them.

It usually grows in South and Central Europe and South-West Asia, from Portugal up to Iran, North Germany, Poland and Ukraine (Kosiński and Bednorz, 2003).

The leaves are small, with 3 or 5 folioles, elliptically elongated, white-tomentose on the inferior side, green on the superior side and dented on the margins. The flowers are small, yellow and in panicle (Oklejewicz, 2006).

***Rubus candicans* Weiche ex Rcb.** A tall shrub with long stems, covered by numerous spikes. The leaf is pinnate composed and formed of 5 folioles. The stems are vertical at the beginning and as they grow they start to bend and lose their spikes. The fruits are round, being formed of more small and pulpy drupes (Domac, 1984).

***Rubus arcticus* L.** It is spread out in Alaska, North Scandinavia, Russia, Mongolia, Belarus, Poland, North-East China, North Korea, Estonia, Lithuania, Canada and North America.

The plant develops well on acid soils rich in organic matter. It is a spike shrub that can grow up to 30 cm in height, woody at the base, but very slender above the soil. The fruits are sharp red or dark purple and have an unusual resistance towards frosts and cold meteorological conditions. The fruits are extremely tasteful, being considered a delicacy and called “the prince raspberry” in Russia (Karp *et al.*, 1997).

***Rubus dumetorum* Schldl (*R. schiedeanus*).** Is a shrub that grows in South Mexico and Central America, being a perennial, pubescent and spiky plant. The leaves are composed of 3-5 thick folioles, while the flowers have white petals and the fruits are black drupes (García-Mendoza and Meave, 2011).

***Rubus maximus* Marsson.** It is a shrub spread out in South and West Baltic coast, including Usedom, Rügen and Hiddensee islands (Henker and Kiesewetter, 2009).

The stems are erect or sub-erect, 1-1.5 m in height, glabrous, green and sometimes purple in the part exposed toward the sun. The plant presents dark purple spikes, straight or slightly sloping, reaching 2-4 mm in length. The leaves have 4-5 large folioles that can reach 35,5cm in length (Henker and Kiesewetter, 2009). Fruits appear during July-August, are black-red drupes and many are not fully developed (Kosinski and Zielinski, 2013).

***Rubus odoratus* L.** A native shrub from East North America that prefers partially shaded areas with rich soils, slightly acid and with a moderate water content. The stems can reach 3 meters in heights. The leaves are palmate lobate, with 5 lobes (rarely 3 or 7), 25 centimeters in length. The flowers have 3-5 cm in diameter, 5 magenta or very rarely white petals that bloom in early spring up to late autumn. The fruits are eatable, red and appear towards the end of summer and the beginning of autumn (Robertson, 1974). The species was introduced in Europe (South-East UK) where it was naturalized.

The *Rubus* samples from the herbarium were collected between 1853 and 1999, while most of them were gathered between 1887 and 1942 (fig. 6).

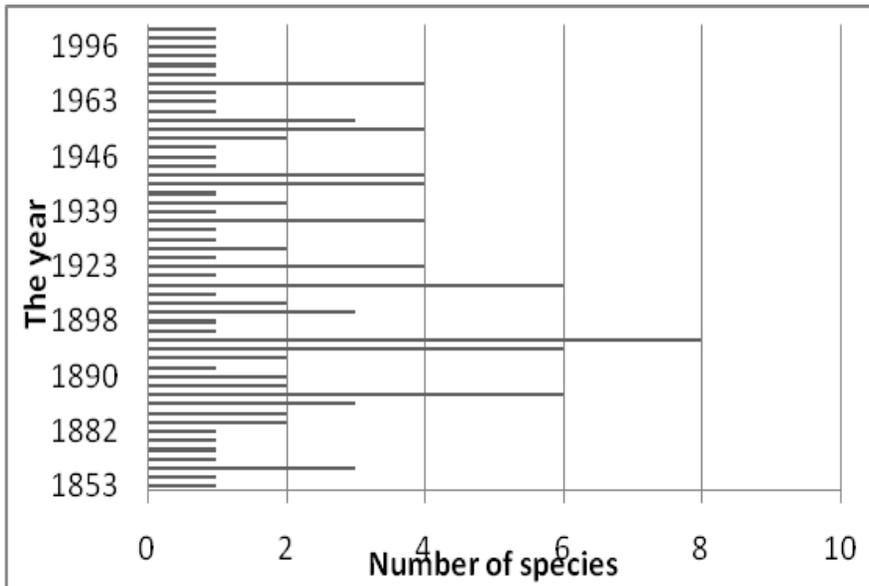


Fig. 6 The period in which the herbarium samples were collected

Collecting and classifying *Rubus* samples was realized by Romanian (Al. Beldie, I. Morariu, G.P. Grințescu, C.C. Georgescu, S. Pașcovschi, Șt. Purcelean) and foreign botanists (C. Baenitz, A. Goety, A. Goetz, K Richter, F. Schultz, C. Beckmann and E. Krummel).

The samples conservation state is generally good, most plants being only detached from the plates, with released but existent parts (second degree) or detached and lacking parts (third degree) (fig. 7). There are however numerous plates with well conserved plants, in its entirety and correctly attached to the plate (first degree) and only three plates with detached and fragmented plants, lacking more than 50% of its components (fourth degree).

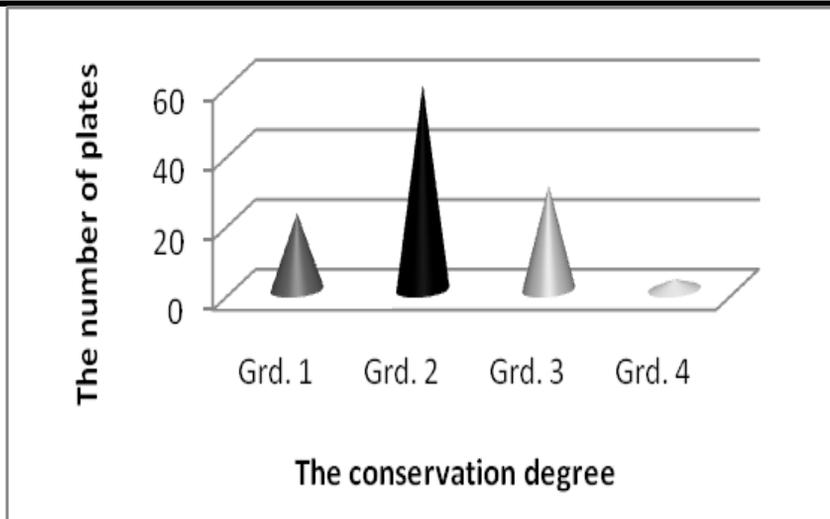


Fig. 7 The conservation degree of the herbarium samples

CONCLUSIONS

The plates with the 65 *Rubus* species present in the herbarium are remarkable through their good conservation state and their peculiar scientific value as all have kept their original labels. Even though most of them are over 160 years old, they were identified and collected by Romanian and international botanists.

Through the inventory of *Rubus* species it can be observed that Al. Beldie Herbarium contains a vast depository of valuable information about *Rubus* species from the entire Europe, as well as about biodiversity in general. Furthermore, the Herbarium is a valuable source of information concerning these species, their characteristics and their spreading areal.

REFERENCES

1. Cântar 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.
2. Crișan V., Dincă L., Oneț C., Oneț A., 2017 - Collection species from *Potentilla* genus. Natural Resources and Sustainable Development, pag. 27-34.
3. Dale A. 2008 - Raspberry production in greenhouses: physiological aspects. Acta Hort. 777, 219–223.
4. Dincă L., Vasile D., Dincă M., 2017 - Short characterisation of plant species from *Centaurea* genus present in Al. Beldie Herbarium from Marin Dracea National Institute for Research and Development in Forestry Bucharest, Annals of University of Craiova - Agriculture, Montanology, cadastre Series, Vol. 47, pp 127-135.

5. Dincă L., Dincă M., Pantea S.D., Timiș-Gânsac V., Oneț C., 2018 - *Amaranthus plant - between myth and usage*. Natural Resources and Sustainable Development, Vol. 8, No. 1, pag. 9-16.
6. 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.
7. Domac R. 1984 - *Mala flora Hrvatske i susjednih područja*. Školska knjiga, Zagreb.
8. Enescu C.M., Dincă L., Cântar I., 2018 - *First of "Alexandru Beldie" Herbarium*. Research Journal of Agricultural Science, Vol 50, No.1, p. 57-61.
9. Focke W.O. 1910 - *Species Ruborum monographiae generis Rubi prodromus*. Bibliotheca Botanica 17: 1–120.
10. Focke W.O. 1911 - *Species Ruborum monographiae generis Rubi prodromus*. Bibliotheca Botanica 17: 121–223.
11. Focke W.O. 1914 - *Species Ruborum monographiae generis Rubi prodromus*. Bibliotheca Botanica 17: 1–274.
12. García-Mendoza A.J. and Meave J.A. 2011 - *Diversidad Florística de Oaxaca: de Musgos a Angiospermas 1–351*. Universidad Nacional Autónoma de México, Ciudad Universitaria.
13. Griffiths A.J.F. and Ganders F.R., 1983 - *Wildflower Genetics-a Field Guide for British Columbia and the Pacific Northwest*. Flight Press, Vancouver.
14. Gu Y., Zhao C.M., Jin W., Li W.L., 1993 - *Evaluation of Rubus germplasm resources in China*. Acta Hort. 352:317–324.
15. Gustafsson A. 1942 - *The origin and properties of the European blackberry flora*. Hereditas 28: 249–277.
16. Gustafsson A. 1943 - *The genesis of the European blackberry flora*. Lunds Universitets Årsskrift 39: 1–200.
17. Hall H. 1990 - *Blackberry breeding*, p. 249–312. In: J. Janick (ed.). Plant breeding reviews. vol. 8. Timber Press, Portland, Ore.
18. Henker H. and Kiesewetter H., 2009 - *Rubus-Flora von Mecklenburg-Vorpommern (Brombeeren, Kratzbee-re, Himbeeren, Steinberre)*. Botanischer Rundbrief für Mecklenburg-Vorpommern 44.
19. Hummer K.E. 1996 - *Rubus diversity*. Horticulture Science 31, 182-183.
20. Joshua S., Caplan J., Yeakley A., 2013 - *Functional morphology underlies performance differences among invasive and non-invasive ruderal Rubus species*. Oecologia.
21. Karp K., Staras M., Värnik R., 1997 - *The arctic bramble (Rubus arcticus L.) – the most profitable wild berry in Estonia*. Baltic Forestry 2: 47-52
22. Khatamsaze M. 1992 - *Flora of Iran (Rosaceae)*. Research institute of forests and rangelands 6, 20-35.
23. Kosiński P. and Bednorz L., 2003 - *Trees and scrubs of the Polish part of the Eastern Sudety Mts*. Dendrobiology 49: 31–42.
24. Kosinski, P. and Zielinski J., 2013. - *Rubus maximus (Roaceae) found also in Poland*. Roczniki Akademii Rolniczej w Poznaniu CCCXI. Botanika - Steciana nr.17.
25. Lee J., Dossett M., Finn C.E., 2012 - *Rubus fruit phenolic research: The good, the bad, and the confusing*. Food chemistry 130, 785-796.
26. Lu L.T. 1983 - *A study on the genus Rubus of China*. Acta Phytotaxonomica Sinica 21: 13–25.
27. Richards, A.J., Kirschner, J., Stepanek, J., Marhold, K., 1996 - *Apomixis and taxonomy: an introduction*. Folia Geobotanica Phytotaxonomica 31: 281–282.
28. Oklejewicz K. 2006 - *Distribution patterns of Rubus species (Rosaceae) in the eastern part of the Polish Carpathians*. Polish Botanical Studies 21: 1–98. ISBN 83-89648-30-X.

29. **Robertson K.R. 1974** - *The genera of Rosaceae in the southeastern United States*. Journal of the Arnold Arboretum 55: 303–662.
30. **Scărlătescu V., Vasile D., Dincă L., 2017** - *Plant species from "Al. Beldie" Herbarium - Orobanchae genre - short description*. ProEnvironment Promediu, 31(10), 191 - 198.
31. **Seeram NP. 2008** - *Berry fruits: Compositional elements, biochemical activities, and the impact of their intake on human health, performance, and disease*. Journal of Agricultural and Food Chemistry 56, 627–629.
32. **Smolarz K. and Zmarlicki K., 1993** - Sixth international symposium on Rubus & Ribes. Acta Hort. 352:1–606. Skierniewice, Poland.
33. **Spies J.J. and du Plessis H., 1985** - *The genus Rubus in South Africa, I. Chromosome numbers and geographical distribution of species*. Bothalia 15: 591–596
34. **Stănescu V., Șofletea N., Popescu, O., 1997** - *Flora forestieră lemnoasă a României*. Ed. Ceres, București, pp 446.
35. **Thompson M.M. 1995** - *Chromosome numbers of Rubus species at the National Clonal Germplasm Repository*. HortScience 30: 1447– 1452.
36. **United States Department of Agriculture (USDA). 2015**. *Plants Database*. Natural Resources Conservation Service.
37. **Vasile D., Dincă L., Indreica A., Voiculescu, I., 2016** - *Herbarul Alexandru Beldie - o colecție de plante și o importantă bază de date pentru specialiști*. Revista de Silvicultură și Cinegetică, nr. 39, 114-119.
38. **Vavilov N.I. 1940** - *Uchenie o proiskhozhdenii kul'turnykh rasteniy posle Darvina*. [The theory of the origin of cultivated plants after Darwin]. Sov. Nauka [Soviet Science] 2:55–75.
39. **Williams I.H. 1959** - *Effects of environment on Rubus idaeus L. III. Growth and dormancy of young shoots*. J. Hort. Sci. 34, 210–218.
40. **Wyremblewska A.T., Zielinski Guzicka M., 2010** - *Morphology and anatomy of Blackberry pyrenes (Rubus L., Rosaceae) elementary studies of the European representatives of the genus Rubus L.* Flora 31, 370–375.