

WHITE PURPLE BROOM (*CHAMAECYTISUS PURPUREUS* SCOP.)

RDEČI RELIČNIK (*CHAMAECYTISUS PURPUREUS* SCOP.)

Jože BAVCON¹

ABSTRACT

White Purple broom (*Chamaecytisus purpureus* Scop.)

White-flowered representatives are just an aspect of the diversity of the Slovenian flora. Their frequency varies, differing also with respect to single parts of Slovenia. Purple broom (*Chamaecytisus purpureus* Scop.) is a plant of dry grasslands in Scots pine forests, from lowlands to the montane zone. It was discovered by Wulfen in the vicinity of Solkan and described by Scopoli. On the dry meadow near Ljubljana on the year 2013 appeared with usual coloration for that species also an islet of totally white plants. It seems this occurrence could be a consequence of stress, i.e. drought, which triggered the expression of recessive genes which are white homozygous varieties of purple broom.

Key words: dry meadow, purple broom (*Chamaecytisus purpureus*), drought, white colour

IZVLEČEK

Rdeči reličnik (*Chamaecytisus purpureus* Scop.)

Belo cvetoči predstavniki so le en vidik raznolikosti slovenske flore. Njihova pogostost se spreminja in se razlikuje glede na posamezne dele Slovenije. Rdeči reličnik (*Chamaecytisus purpureus* Scop.) je rastlina suhih travnikov in gozdov rdečega bora, od nižine do montanskega pasu. Odkril ga je Wulfen v bližini Solkana, opisal pa Scopoli. Na suhem travniku v bližini Ljubljane se je v letu 2013 pojavilo poleg rastlin z normalno obarvanostjo še nekaj skupin popolnoma belo cvetočih rastlin. Zdi se, da je ta pojav lahko posledica stresa, to je suše, ki je sprožila izražanje recesivnih genov, kot so bele homozigotne različice rdečega reličnika.

Ključne besede: suhi travnik, rdeča relika (*Chamaecytisus purpureus*), suša, belo cvetoča različica

¹ University Botanic Gardens Ljubljana, Department of Biology, Biotechnical Faculty, Izanska cesta 15, SI-1000 Ljubljana, e-mail: joze.bavcon@botanicni-vrt.si

1 INTRODUCTION

Plant determination keys often indicate various flower colours typical of a single species. With some species the predominant flower colour characteristic of a species is reported together with the possibility of its being white. In *Mala flora Slovenije* (MARTINČIČ et al. 2007) a number of statements are made to this effect in connection with different genera, but the situation in nature does not seem to support them. In certain areas white-flowered varieties occur rarely, elsewhere they are truly rare, while in some species on which different keys provide varying information naturally growing white-flowered varieties are hardly ever, or never, encountered in nature.

Slovenia is very diverse in terms of its climate, relief, geological and petrographic structures, and flora. It is divided into four phytogeographic regions, Alpine, Dinaric, subpannonian and submediterranean, along with a prealpine and a predinaric transitions (M. WRABER 1969). All of this is reflected in the outstanding diversity of its flora.

White-flowered representatives are just an aspect of the diversity of the Slovenian flora. Their frequency varies, differing also with respect to single parts of Slovenia. STEARN (1997) draws a very precise distinction between single occurrences of the colour white. He uses *albiflorus*, white-flowered, to refer to the flower as a whole, and other epithets to describe parts of the flower, for instance, *albidus* - whitish etc. The term 'albinos', which is often used colloquial language, is not entirely correct as albinos are defined as organisms lacking normal pigmentation. The expression white-flowered refers to those representatives of the Slovenian flora whose flowers are basically other than white – their flowers exhibit colours differing from those characteristic of single species. In nature, however, specimens can be found whose flowers are white or whitish, meaning that we have to do with exceptions. As explained already by WHELDALE (1916), in such instances the impaired ability to produce anthocyanins results in albinism. Similarly, the current studies find that white-flowered varieties result from the lack or absence of various plant pigments (GOODWIN 1988).

While this phenomenon is quite usual with some genera and species, it is extremely rare with others, although determination keys may claim differently, namely, that it is of relatively frequent occurrence. Let me give two examples. Some white specimens of snake's head fritillary (*Fritillaria meleagris* L.) are normally found every year. Contrary to this, *Mala flora Slovenije* (T. WRABER 2007) describes it as »rarely white«. They do not appear with equal frequency in all

habitats. In some of them they are found more often, in others never. The same information, i.e. that white specimens are rare, is given also for other species, for instance, meadow clary (*Salvia pratensis* L.) (JOGAN 2007). Unlike aforementioned snake's head fritillary a white-flowered meadow clary can hardly ever be found at all. In the course of my long research of our meadows and mountain meadows in different parts of Slovenia which I regularly visit during their blooming season I have so far found the white specimens of meadow clary only in a single area of Lower Carniola. Every naturally growing species can develop a white-flowered variety but what remains to be seen is the frequency with which it occurs (KUMMERT 1986, 2011a, b, VASILEVSKA et al. 2009, PIERCE 2011, BERNINI et al. 2013). The chances of finding a white specimen decrease in terms of rarity or extreme rarity.

The situation in horticulture is basically different from nature where white representatives both appear and disappear spontaneously. The representatives observed in nature often provide the ground for further selection resulting in the improvement of the existing properties. Irrespective of all the aforesaid facts, it is safe to say that with some species the occurrence of white varieties is definitely a real rarity. In modern horticulture white representatives often seem to become part of fashion trends but it is also true that they have been described throughout the history of botanic activity.

In the floras relating to the territory of present-day Slovenia the descriptions of single species include the form *alba* or else the white colour of the flower is stated as an exception (SCOPOLI 1772, HOST 1827, HLADNIK 1826, WULFEN 1858, PACHER 1881, 1884, 1887, SCHIFNER 1890, POSPICHAL 1897, 1898, HAYEK 1908-1956). As a point of interest, most deviations from the usual colours and most varieties are, similarly as in more recent horticultural works, stated in Host's *Flora Austriaca* (1827).

Our contemporary botanic works include but a modest number of references to special features and flower colours differing from the usual ones. Different colour varieties and special features were reported mostly by RAVNIK (1972 a, b, c, 1975, 1986), STRGAR (1980), and ACCETO (1996), KLENOVŠEK et al. (2003), BAVCON (2014). The question to be answered is always the same, namely, how to define such special features. From the present point of view, describing a form as special seems questionable, for only when we embark upon a close study of a certain species and plant it in large numbers in one spot of the garden we become ac-

quainted with at least a part of its Gaussian curve. Though we may never know all of it, we shall get a better approximation. At this point every species proves to possess a substantially greater potential – higher diversity levels within the species (BAVCON 2008, 2009, 2010 a,b, 2011, 2012) than can be imagined. This is why, taxo-

nomic speaking, single deviations are most probably not justified. The question is more likely about different types or potential new varieties that may prove interesting to horticulturalists, but from a taxonomic point of view this is still just one species with a very wide colour range if examined against a colour chart.

2 MATERIAL AND METHODOLOGY

I have been collecting and observing the material over the last 15 years. The plants differing from the usual description of single species and those, respectively, standing out from single species in local populations were collected in different parts of Slovenia and brought to the Botanic Garden where they are grown in culture.

Due to a short blooming season of single species it often takes quite a number of years to gain insight into their diversity. Only then can one start gathering specimens diverging from the usual ones. However, the year in which a plant is transferred to the garden conditions usually coincides with the peak of its blooming season, meaning that such a year is already lost in terms of observing the plant and comparing it with others. Its outward appearance in garden conditions will be seen again only the following year. In some very rare cases observation and comparison are possible already in the collection year, actually only when I collect still barely flowering specimens. From the point of view of special feature selection this may sometimes prove ineffectual since only a fully developed flower reveals all of its characteristics. Further problems to be solved concern different years and growing of all these specialities in culture where each requires proper conditions for optimal growth. The growth of these plants in flower beds or surrogate garden habitats is mostly unproblematic. However, close monitoring of plants involves the introduction of the flower pot experiment where each pot is provided with a number so that in the subsequent years the outward appearance of the plant is duly followed up. This requires a much greater amount of work because each individual pot needs to be tended to, which is all but easy considering the fact that the Botanic Garden is seriously understaffed. As a result, single plants took several years to develop their growth habit, since a plant allows comparison only in its optimal phase. A larger number of representatives of single species have over recent years been added to the Botanic Garden.

Before actually starting to collect plants, I first took a walk around, carefully examining the surfaces

where local populations were really dense. I immediately collected the most deviating specimens and made a selection of others only after surveying most of single local populations. Each specimen was first photographed in its growing site, then dug out and photographed once again to bring into view its special features with more contrast. I put all specimens from the same habitat in one bag, adding some soil and water, if necessary, and took them to the Botanic Garden. Each single plant was described and planted into a mixture of compost and leaf mold, using pots of 10x10 cm, initially clay ones. Each pot was provided with a data label. I then arranged the pots over a flower bed. At first I still sank them into the flower bed, which is better for the plants because in such a way they have a more balanced moisture supply, but unfortunately this meant too much work over the year as they were rapidly overgrown with weeds. Thus, in the subsequent years I simplified the maintenance, monitoring and photographing by introducing rectangular plastic pots of 10x10 to 14x14 cm (depending on the size of plants) which I simply placed on a foil which prevented weed growth. Thus, the only weeds that need to be removed are those on the surface of pots. I watered the plants to keep them green as long as possible. I harvested the seeds from all the seeding plants and later sowed them. The pots were watered only in the very dry periods of the year and shaded to avoid desiccation. At the end of the following winter when the plants burst into bloom once again, I examined each pot, recorded its special features and compared them with the original record. I also took yearly photos of all interesting specimens so as to ensure a less subjective comparison between single years. I checked the stability of special features at intervals of several years.

Chamaecytisus purpureus Scop. – Purple broom

Purple broom (*Chamaecytisus purpureus* Scop.) is a plant of dry grasslands in Scots pine forests, from lowlands to the montane zone. In Europe it is spread in the

South and South East Alps in north Albania, Slovenia and Croatia (TUTIN 1969). Purple broom is in Slovenia common on dry places in all phytogeographical regions (MARTINČIČ et al. 2007). It was discovered by Wulfen in the vicinity of Solkan and described by Scopoli. T. WRABER (1990) draws attention to the precision with which WULFEN (1778) describes the habitat. »While teaching mathematics in Gorizia in 1761, I set off, towards the end of April, to Solkan lying on the margins of Sveta gora Mt. where I intended to search for plants. Among numerous both beautiful and rare plants I found this broom on Gora itself and on the bank of the Soča river, and named it *purpureus*, purple, by the colour of its flowers which I first beheld on the rocks on the left bank of the river near the tobacco mill by the side of a shallow ford, and then again around mid-May, about half-an-hour above Solkan, on the same bank of the Soča by a very clear-water brooklet that people call Mrzlek (»Merzliak«). In the subsequent years of 1762 and 1763, when I worked as a philosophy lecturer in Ljubljana, Carniola, my eyes caught sight of the plant yet again: on the 7th of May at the top of Šmarna gora Mt, on the rocks right along the left side of the road, and on the 18th of May in a grove ahead of the Sava river, by the side of the road leading to Dol, and finally, on the 29th of May at Panoviče, on the estate of Baron Wolkenberg, namely in the meadows along the Sava which, if I understood correctly, are called Širjava (»Scheriau«), and here they were in great abundance as well. I then sent the plant to my great friend Scopoli, a physician in Idrija, who included it in the second edition of his *Flora Carniolica* and added a drawing of it. But as I was not entirely happy with the picture, I a while ago wrote a letter to the most excellent Hacquet, a Ljubljana professor of surgery, explained to him where and when the plant blooms, and asked him to be good enough to send me a freshly uprooted plant by courier. After this kind man obliged me, I at once took care of its drawing (...). On the 22nd of June I brought some hairy pods from Šmarna gora Mt. This phenomenon could be associated with a chillier climate at higher lying positions, because I had oth-

erwise been finding pods, also as yet unripe, that were nude and smooth.« Translation from Latin by T. Wraber 1990.

Although Wulfen's description makes no reference to the white variety, he concludes the text by pointing out the diversity exhibited by the pod hairs. It was much later that in his phytocoenological records on mountain meadows and pastures on shallow and lean grounds in Slovenia TOMAŽIČ (1941) refers to purple broom as »a pioneer species of pinewood areas trying to colonize the disrupted turf of grasses, mosses and herbs«. He cites it for the association *Pineto-Genistetum januensis*. In 1940 he reports the following: »Purple broom (*C. purpureus*) grows in greatest abundance and steadily in normally developed individua of the association. Here it thrives at its best. It is very frequent also in some other meadow phytocoenoses where pines are planted sparsely over the grounds or not present at all, for instance, in the shallow, lean and dry meadows spreading over gravel in the Posavje region in the vicinity of pine groves where purple broom makes part of the *Carex humilis-Centaurea rhenana* association. Furthermore, TOMAŽIČ (1940) states that purple broom can be either a pioneer species of a nascent forest or it indicates that these dry meadows came into existence following the degradation of pinewood associations.

TOMAŽIČ (1940, 1941) invested a great deal of work in compiling records on the dry flatlands along the Sava river. He mentions dry meadows at Roje (outskirts of Ljubljana) where the University Botanic Garden has been hiring a dry 2 ha meadow ever since 2000. The grasslands in question most probably originate from former pinewood phytocoenoses (TOMAŽIČ 1940), which seems to be evidenced by the remnants of these phytocoenoses on both banks of the Sava river and here and there also from the islands in the middle of the grasslands. TOMAŽIČ (1940) reports purple broom also for various subassociations. He states that when growing in the *Pineto-Genistetum januensis* association, it may to a moderate extent bloom throughout the vegetation season, which is made possible for it by its slightly shaded environment.

3 DISCUSSION

Purple broom was recorded as one of the species of the abovementioned meadow already in 2000 (BAVCON & MARINČEK 2004), but its occurrence there varies from one year to another. In some years it blooms profusely, in others less conspicuously, with solitary plants loosely appearing here and there over the meadow. Purple

broom dislikes regular annual mowing because it affects its bloom. Therefore it prefers more open and sufficiently light forest areas. As a result of several consecutive years of drought which weakened the growth of grasses, purple broom showed more vigorous growth. In wet years the meadows acquires a greener

appearance, especially if it was mown late in the previous year. In mid-June of such years grasses dominate over herbs and in mid-spring of such years purple broom can barely be noticed at all. In dry years, particularly in dry springs, purple broom is more conspicuous because it is not outgrown by grasses. Due to the severe droughts over the last decade the meadow was periodically left without mowing, which suited purple broom very well and encouraged the growth of its clumps. This was particularly obvious in 2013. The meadow was mown in 2011, but not also 2012 when its vegetation was critically dehydrated due to a severe and prolonged drought. In the very wet spring (ARSO 2013) the growth and bloom of purple broom were markedly vigorous. Due to the previous year's drought and a long winter (ARSO 2013) the vegetation was, in spite of dryness, in parts poorer than in the usual wet years. Dry meadows always fall behind with vegetation, especially if they were left unmown during the previous year. Purple bloom benefits from it because it is earlier than grasses. Very late mowing during the last years and swinging the scythe at an increased height allowed purple broom to develop, over the last three years, a particularly lush growth habit which became clearly noticeable in 2013. Although a whitish variety of purple broom had been found several years before (2005), in 2013 the meadow seemed to be dominated by pink varieties but no white variety was in sight. Another characteristic feature came to light, which was less conspicuous in the preceding years when purple broom's growth habit was more moderate. Single purple broom patches exhibited uniform coloration ranging from dark to light pink. Each islet represented its own special colour. No colour transitions occurred within a single islet. In the shallow areas where grasses are sparser and gravel is closer to the surface purple broom spread over relatively large islets, each of them in a different colour, as reported already by TOMAŽIČ (1941). All of this suggested vegetative spreading of single islets covering larger surfaces with every passing year. However, another, more probable explanation should be considered, namely, that the question is of single colour-related homozygous varieties that propagate by seeds. Furthermore, it is possible that single colour varieties are genetically completely stable and that they propagate by seeds. This possibility is usually less probable since the propagation of plants by seeds brings out the complete col-

our diversity characteristic of a species. In the dry meadow at Roje the complete colour diversity as characteristic of the species manifested itself always per single islets some of which even touched upon each other but were not involved in blending their colours. After examining more than a half of the meadow, some of the islets were found to include a more whitish variety which too showed uniformness of colour. In the middle of the meadow I found also an islet of a perfectly white variety such as had not been recorded in this meadow as yet. It is of course possible that the white variety should have bloomed in nuances slightly differing from the others and had previously been overlooked. Due to the very cold spring of 2013 the simultaneous bloom occurrence may have made the diversity more conspicuous. It seems even more probable that in the last dry years varieties appeared that deviate from the normal coloration. This occurrence could be a consequence of stress, i.e. drought, which triggered the expression of recessive genes which are white homozygous varieties of purple broom.

The plants appeared in a larger number and they all occupied a single islet, they were not scattered amid different islets and varyingly coloured specimens. It is of course possible that closely growing shrubs spread as a result of vegetative growth, however, as we have to do with a larger number of specimens, I believe that in this case white-variety-related homozygous specimens propagate by seeds. The meadow, closely monitored since 1998 (BAVCON & MARINČEK 2004) and hired in 2000, thus exhibited the full genetic diversity and potential of purple broom in this local population. The question is of a typical dry 2 ha meadow in which the growth of purple broom is very robust. Purple broom appears also in the nearby forest surfaces described already by TOMAŽIČ (1940). Despite the fact that purple broom often appears in dry places, its white variety is rare. Such an islet opening population is typical for the pioneer vegetation on the burnt areas (personal observation). Their be caused the same because of a year missing mowing. This goes to the states as TOMAŽIČ (1940) write that purple broom can be either a pioneer species of a nascent forest or an indicator that these dry meadows came into existence following the degradation of pinewood associations. Although various authors often submit photos of the white variety, its presence in Slovenia is rare, or better said, really just exceptional.

4 POVZETEK

Travnike v Rojah je v svojih delih opisoval že TOMAŽIČ (1940, 1941) kjer še posebej omenja pojavljanje rdeče relike (šembrovca) *Chamaecytisus purpureus*. Botanični vrt ima že od leta 2000 najet suhi travnik v Rojah, kjer varuje rastlinske vrste *in situ*. Na travniku smo že v začetnih popisih našli omenjeno vrsto (BAVCON & MARINČEK 2004), katere cvetenje pa se je iz leta v leto spreminjalo. V prvih letih opazovanj ni bila zelo pogosta vrsta. V letu 2005 smo prvič opazili belkasto različico te vrste. Vendar tedaj le en osameljen primerek. V letu 2013 pa je omenjena vrsta množično zacvetela. Po večletnih košnjah travnik v letu 2012 zaradi izredno sušnega leta nismo pokosili. Suše v prejšnjih letih so rast trav in drugih zelnatih rastlin omejile. Rdeča relika pa je prav v teh toplih letih izredno napredovala, kar se je izrazilo v letu 2013, ko je bilo opaziti množično cvetenje omenjen vrste. Vse barvne različice od temnejše do svetlo rožnate so se pojavljale v skupinah. Vsaka je bila svoje barve. Vse to kaže na to, da so se posamezne skupine razraščale vegetativno, saj običajno iz semen dobimo večjo raznolikost. Med njimi se je

pojavilo nekaj belkasto cvetočih skupin, ki so bile med običajno obarvanimi rožnatimi različicami. Poleg teh pa so se v nekaj manjših skupinah pojavile še povsem belo cvetoče različice omejene vrste. Glede na to da v prejšnjih letih ni bilo opaziti belih različic predvidevamo, da je to lahko posledica stresa - suše, ki je povzročila ekspresijo recesivnih genov, ki se je potem odrazila v belo cvetočih različicah. Te so se nato množile vegetativno, kar kaže razrast v manjše skupine. Možno je, da cvetenje v prejšnjih letih ni bilo tako izrazito, ali pa smo ga zaradi različnih vremenskih razmer spomladi zamudili. Dejstvo je, da je bilo to leto najbolj cvetoče, saj že v naslednjih letih po tem kljub stalnemu opazovanju v obdobju cvetenja te vrste ni še prišlo do tako množičnega cvetenja, kar pa je v naravi pogosto, saj posamezne vrste obilno cvetijo le na nekaj let. Pojavljanje bele različice je v Sloveniji redko. V naslednjih dveh letih smo jo našli še na nekaj mestih a to je še vedno redkost v primerjavi z nekaterimi drugimi belimi različicami posameznih drugih vrst.

5 REFERENCES

- ACCETO, M., 1996: *Justinova zvončica (Campanula justiniana) v beli obleki*. Proteus (Ljubljana) 59(3): 126.
- BAVCON, J., & A. MARINČEK, 2004: *A dry meadow as a live seed bank and an object of research*. Scr. Bot. Belg. (Meise) 29:131-134.
- BAVCON, J., 2008: *Common snowdrop (Galanthus nivalis L.) and its diversity in Slovenia*. Biotehniška fakulteta, Oddelek za biologijo. Ljubljana.
- BAVCON, J., 2009: *Common cyclamen (Cyclamen purpurascens Mill.) and its diversity in Slovenia*. Botanic Garden, Department of Biology, Biotechnical Faculty. Ljubljana.
- BAVCON, J., 2010 a: *Botanični vrt Univerze v Ljubljani = University Botanic Gardens Ljubljana*. Kmečki glas. Ljubljana.
- BAVCON, J., 2010 b: *Žafrani (Crocus L.) v Sloveniji = Crocus (Crocus L.) in Slovenia*. Botanični vrt, Oddelek za biologijo, Biotehniška fakulteta. Ljubljana.
- BAVCON, J., 2011: *Can natural plants make a horticultural surprise? Spring bulbs*. In: D. OLDROYD (ed.): *Conference proceedings : back to Eden : challenges for contemporary gardens : Katowice, Ustroń, Mikołów, 21st-23rd May 2011*. Silesian botanical garden. Mikołów, pp. 137-155.
- BAVCON, J., 2012: *Crocus reticulatus and Its Hybrids in Slovenia*. In: SANTANA et al. (eds.): *Cost Action Fa 1101 Saffronomics, Book of abstracts* (Cuenca). Pp. 203- 220.
- BAVCON, J., 2014: *Belo cvetoče različice v slovenski flori. White-Flowered Varieties in Slovenian Flora*. Botanični vrt Oddelek za Biologijo BF. Ljubljana.
- BERNINI, A., F. POLANI, E. PIAGGI, F. CATTANEO & E. ANCHISI, 2013: *Fiori e paesaggi delle Alpi*. Verba & Scripta s. a. s. Pavia.
- GOODWIN, T. W., 1988: *Plant pigments*. Academic press inc. San Diego.
- HAYEK, A., 1908- 1956: *Flora von Steiermark I-II*. Akademische Druck- und Verlagsanstalt. Graz.
- HLADNIK, F., 1826: *Flora Wochinensis*. AS 882, fasc. 27.
- HOST, N., 1827-1831: *Flora Austriaca Vol 1, 2*. Sumptibus Frider. Beck Bibliop. Univers. Viennae. Wien.
<http://meteo.arso.gov.si/met/sl/climate/current/last-12-months/archive/>

- http://meteo.arso.gov.si/uploads/probase/www/climate/text/sl/weather_events/vrocinasusa_
<http://www.arso.gov.si/vreme/zanimivosti/>
- JOGAN, N., 2007: *Lamiaceae*. In: A. MARTIČIČ (ur.): *Mala flora Slovenije. Ključ za določanje praprotnic in semenk*. Tehniška založba Slovenije. Ljubljana.
- KLENOVŠEK, D., S. BUDNA, T. BRINOVEC, M. BRINOVEC, 2003: *Rastlinski svet Bohorja*. Turistično društvo Senovo, Krško 107 pp.
- KUMMERT, F., 1986: *Alpenglöckchen*. Gartenpraxis (Frankfurt) 2: 9- 13.
- KUMMERT, F., 2011a: *Die Grosse Küchenschelle in Natur und Garten*. Gartenpraxis (Frankfurt) 4: 8-11.
- KUMMERT, F., 2011b: *Heilkräftiges Himmelblau*. Gartenpraxis (Frankfurt) 5: 16-19.
- MARTINČIČ, A., T. WRABER, N. JOGAN, A. PODOBNIK, B. TURK, B. VREŠ, V. RAVNIK, B. FRAJMAN, S. STRGULC KRAJŠEK, B. TRČAK, T. BAČIČ, M. FISHER, K. ELER & B. SURINA, 2007: *Mala flora Slovenije. Ključ za določanje praprotnic in semenk*. Tehniška založba Slovenije. Ljubljana.
- PACHER, D., 1881, 1884, 1887: *Flora von Kärnten*. Klagenfurt.
- PIERCE, S., 2011: *La conservazione delle orchidee spontanee lombarde*. Parco Delle Orobie Bergamasche.
- POSPICHAL, E., 1897-1899: *Flora des Österreichischen Küstenlandes 1-2*. Leipzig, Wien.
- RAVNIK, V., 1972a: *Nenavadni cvetovi jesenskega podleska*. Proteus (Ljubljana) 35 (3): 141.
- RAVNIK, V., 1972b: *Nenavadno njivsko grabljišče*. Proteus (Ljubljana) 35 (3): 141.
- RAVNIK, V., 1972c: *Polni cvetovi tudi v naravi*. Proteus (Ljubljana) 35 (4): 188.
- RAVNIK, V., 1975: *Nenavadna barva cvetov trolistne vetrnice (Anemone trifolia) in podlesne vetrnice (Anemone nemorosa)*. Proteus (Ljubljana) 38 (1): 12-13.
- RAVNIK, V., 1986: *Nenavadna oblika črnega bezga*. Proteus (Ljubljana) 48 (9-10): 373.
- SCHIFFNER, V., 1890: *Monographia Helleborum. Kritische Beschreibung alle bisher bekannt gewordenen Formen der Gattung Helleborus*. Nova Acta der. Ksl. Leop.- Carol. Deutschen Akademie der Naturforscher. Bd. LVI. Nr.1. Halle.
- SCOPOLI, I. A., 1772: *Flora carniolica*. Impensis Ioannis Pavli Kravss, ed. 2.
- STEARNS, T. W., 1997: *Stearns 's Dictionary of Plant Names for Gardeners*, Cassel Publishers Limited Wllington House. London.
- STRGAR, V., 1980: *Je s kranjsko lilijo kaj narobe?* Proteus (Ljubljana) 42 (2): 74.
- TOMAŽIČ, G., 1940: *Asociacije borovih gozdov v Sloveniji 1. Bazofilni borovi gozdovi*. Razpr. Mat. prir. razr. AZU (Ljubljana) 1: 77-120.
- TOMAŽIČ, G., 1941: *Senožeti in Pašniki na plitvih pustih in suhah tleh Slovenije*. Zbornik prirodoslovnega društva (Ljubljana) 2: 76-82.
- TUTIN, T. G., V. H. HEYWOOD, N. A. BURGESS, D. M. MOORE, D. H. VALENTINE, S. M. WALTERS & D. A. WEBB. (eds.): 1968: *Flora Europaea, Volume 2. Rosaceae to Umbelliferae*. University Press. Cambridge.
- VASILEVSKA, T., T. PETRAS SACKL & J. STERGARŠEK, 2009: *Rastline*. Novice Notranjskega regijskega parka. (Cerknica) 3 (2):4 – 9.
- WHELDALE, M., 1916: *The anthocyanin pigments of plants*. Cambridge University press. Cambridge.
- WRABER, M., 1969: *Pflanzengeographische stellung und Gliederung Sloweniens*. Vegetatio (The Hague) 28(III): 176-199.
- WRABER, T., 1990: *Sto znamenitih rastlin*. Prešernova družba. Ljubljana.
- WRABER, T., 2007: *Ericaceae, Iridaceae, Liliaceae, Primulaceae*. In: A. MARTIČIČ (ed.): *Mala flora Slovenije. Ključ za določanje praprotnic in semenk*. Tehniška založba Slovenije. Ljubljana.
- WULFEN (E. FENZEL, GRAF R.), 1858: *Franz Xaver Freiherrn von Wulfen 's Flora Norica Phanerogama*. Im Auftrage des zoologisch-botanischen Vereines. Wien.
- WULFEN, F. X., 1778: *Cytisus purpureus*. In: N. J. JACQUIN: *Flora Austriaca* 5. Wien.