



CEPHALANTHERA RUBRA (L.) RICH. (ORCHIDACEAE) IN MID-WEST POLAND
(WIELKOPOLSKA) – DISTRIBUTION, ENDANGERMENT AND CONSERVATION STATUS

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ABSTRACT. A significant decline of the population of *Cephalanthera rubra* has been observed in the NW territory of Poland. This endangered species is legally protected in Poland: it has been included in the Polish red book of plants (category EN) and in the national and local Red lists (Red list of vascular flora of Wielkopolska – category EN). In June 2007, two sites of this rare species has been found in the Notecka Forest (Karwin Forest District – north west Wielkopolska). This paper presents the results of verification of the new sites of *C. rubra* and shows present state of knowledge of conservation, distribution and threat degree of the mentioned species in the area of the Wielkopolska and Ziemia Lubuska regions.

KEY WORDS: *Cephalanthera rubra*, Orchidaceae, distribution, threatened species, ATPOL, conservation status, Wielkopolska, Poland

INTRODUCTION

Red helleborine, *Cephalanthera rubra* (L.) Rich. (Orchidaceae), is a plant occurring mainly in deciduous forests. It is usually indicated as a characteristic species of the alliance *Fagion sylvaticae* Luquet 1926 em. Lohm. et R.Tx. in R.Tx. 1954. Red helleborine attains its optimal distribution in Poland in fertile beech woods – *Mercuriali-Fagetum* Celiński 1962 and in local types of orchid beech woods: coastal (*Cephalanthero rubrae-Fagetum* Piotr. et Olacz. ex W. Mat. 2001), Kashubian (*Fagus sylvatica-Cypripedium calceolus* community) and Sudeten (*Fagus sylvatica-Hypericum maculatum* community) as well as in those characteristic for the Pieniny Mts. (*Carici albae-Fagetum*) and the Małopolska region (*Fagus sylvatica-Crucjata glabra* community) (BRZEG and WOJTERSKA 2001, MATUSZKIEWICZ J.M. 2001, DANIELEWICZ and PAWLACZYK 2004, HERBICH and PAWLACZYK 2004, KWIATKOWSKI 2004, PERZANOWSKA 2004, MATUSZKIEWICZ W. 2006). A synthetic study by HEREŹNIAK and BERNACKI (2001) reveals that red helleborine was found also in thermophilous oak woods, oak-hornbeam forests, lime-maple forests and mixed coniferous forests. It prefers relatively sunny habitats and is found in those fragments of forest communities which are characterised by lower tree cover as well as at the edges of various types of forests and along forest roads and tracks (HEREŹNIAK and BERNACKI 2001 and literature there cited, BRZOSKO and WRÓBLEWSKA

2003, NOBIS and NOBIS 2006). This species was only rarely recorded in anthropogenic habitats (e.g. NOWAK and NOWAK 2004).

According to HEREŹNIAK and BERNACKI (2001), in Poland, *C. rubra* is characterised by its wide and, at the same time, scattered distribution. The species is mainly known from the country's lowlands, while it is rarely found in the mountain areas (BARTOSZEK et AL. 2008). It attains the highest density of localities, as the maps of its distribution in Poland show (SZLACHETKO and SKAKUJ 1996, HEREŹNIAK and BERNACKI 2001, ATLAS... 2001), in the Sandomierska Basin, Great Mazurian Lakes region and Białowieża Forests. The number of this orchid localities, confirmed after 1980, is estimated at ca. 150, from about 300 known from Poland (HEREŹNIAK and BERNACKI 2001).

Red helleborine is rated in Poland an endangered species (the EN category) and listed in the "Polish red book of plants" (POLSKA CZERWONA KSIĘGA... 2001), as well as in the "Red list of the vascular plants in Poland", in the EN category (ZARZYCKI and SZELĄG 2006). It is under legal protection both in Poland and neighbouring countries (POLSKA CZERWONA KSIĘGA... 2001). In the Wielkopolska and Lubuska regions, *C. rubra* is a critically endangered species (JACKOWIAK et AL. 2007), after 1980, found or confirmed in only five localities (BRZEG 1988, CHMIEL 1993, STEFANEK-PAŃCZUK and ANTKOWIAK 1997, JERMACEK 1997, and the POZ herbarium).

The aim of this work is to present information on the distribution and conditions of occurrence of *C. rubra* in the newly found localities in the Notecka Forest. Moreover, all available data on the occurrence of red helleborine in the Wielkopolska and Lubuska regions (Wielkopolska-Kujawy Region). The article particularly draws attention to the problem of this species protection in Poland.

MATERIAL AND METHODS

The area under study – the Notecka Forest (130 thousand ha) – is situated in the vast area of the Warta and Noteć rivers interfluvium, in the Gorzów Valley (KONDRACKI 2002). It is a compact forest complex, dominated by scots pine forests, mostly of the *Leucobryo-Pinetum* type (LIBBERT 1933) W. Mat. 1962 em. W. et J. Mat. 1973. A scots pine forest landscape complement numerous, scattered spots of raised peat bogs, natural or anthropogenic watercourses and water bodies, as well as small complexes of deciduous forests – mainly acidophilous oak and beech woods.

New localities of *C. rubra* were found in the area of the Karwin Forest District, in the course of the studies carried out as a part of the general inventory of forest and non-forest habitats in the State Forests (2006-2007).

In the present work, the names of vascular plant species follow MIREK et AL. (2002) while phytosociological classification and nomenclature of plant communities is based mainly on the work by BRZEG and WOJTERSKA (2001).

RESULTS

New localities of *Cephalanthera rubra* in the Notecka Forest

In the years 2006 and 2007, two new localities of *C. rubra*, not reported earlier, were found in the western part of the Notecka Forest. They are situated south of the town of Drezdenko (Strzelce-Drezdenko County, Lubusz Province) in the forest complexes under the Karwin Forest District Management.

The first of the localities lies within two neighbouring forest divisions – no. 169 and 198 – of the Solecko forest subdistrict (Karwin Forest District), about 3.5 km to the south of the village of Gościm. In the ATPOL grid square system (ATLAS... 2001) it is localized in the square BC60. In June 2007, 12 individuals were found in the division no. 169, while in 2008, 55 flowering individuals were recorded within the division 169 and 198 during the subsequent monitoring visit. All populations occurred at the edges of acidophilous beech forest, right next to a periodically drying watercourse (on its both sides) connecting lakes Łąkie and Gostomie. The estimated area of the locality with *C. rubra* is about 300 m².

Phytosociological relevés illustrate species composition and quantitative relations within the studied population of red helleborine.

Relevé no. 1. Sunny edge of the acidophilous beech wood. Date: 2007.06.08. The area: 10 m². Tree cover 'a' – 30%: *Pinus sylvestris* 2.2, *Fagus sylvatica* 2.2; shrub cover 'b' – 10%: *Fagus sylvatica* 2.2; herbaceous plants cover 'c' – 20%: *Cephalanthera rubra* 1.2, *Vaccinium vitis-idaea* +.1, *Vaccinium myrtillus* 1.2, *Rumex acetosella* +.1, *Calluna vulgaris* +.1, *Deschampsia flexuosa* +.1, *Fagus sylvatica* +, *Quercus robur* +; layer 'd' cover – 30%.

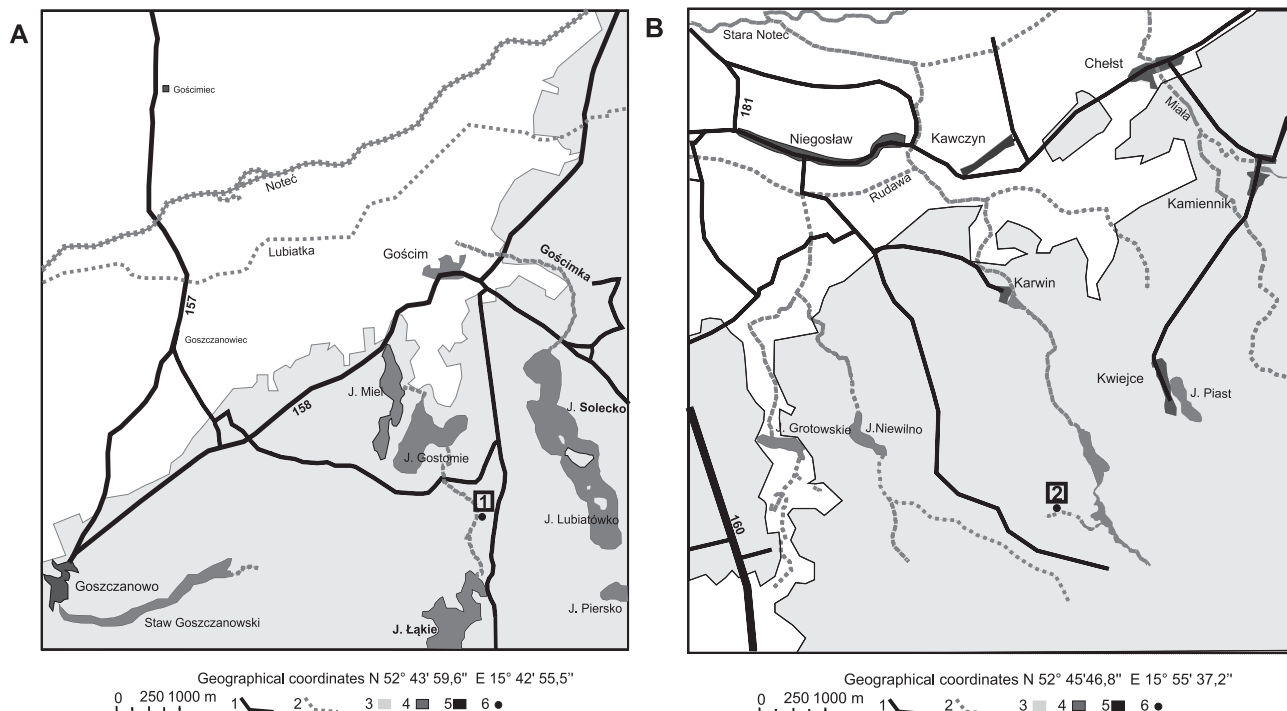


FIG. 1. Distribution of *Cephalanthera rubra* localities found in the Notecka Forest in the years 2006-2008: 1 – roads, 2 – watercourse, 3 – wooded area, 4 – lakes, 5 – towns, 6 – localities

Relevé no. 2. The area between the watercourse and acidophilous beech wood. Date: 2007.06.08. The area: 10 m². Tree cover 'a' – 20%: *Fagus sylvatica* 2.2, *Betula pendula* +; shrub cover 'b' – 5%: *Fagus sylvatica* 1.1, *Alnus glutinosa* +. herbaceous plants cover 'c' – 30%: *Cephalanthera rubra* 1.1, *Fagus sylvatica* +.1, *Carex remota* +.1, *Oxalis acetosella* +.1, *Ranunculus repens* +, *Poa nemoralis* +, *Luzula pilosa* +, *Geranium robertianum*, *Scutellaria galericulata* +.1, *Athyrium filix-femina* +, *Gallium uliginosum* +; layer 'd' cover – 10%.

The analysed locality is characterised by a low diversity of species and a large share of organic dead matter from decaying beech leaves. It should be stressed that *C. rubra* was not found in the adjacent forest communities – an acidophilous beech wood (in its part further from the watercourse), as well as in the dried up alder swamp forest.

The second locality of red helleborine was also found in June 2007, at the edge of a small watercourse in the Galewice forest complex (in the vicinity of the village of Lipówek), ca. 3.6 km to the southeast of the village of Karwin, within the Karwin forest subdistrict – forest division no. 120a. In the ATPOL grid (ATLAS... 2001), the locality is situated in the square BC62. There, the individuals of *C. rubra* have scattered distribution throughout the transition zone between an alder carr and scots pine dominated forest plantation. This fragment of a topographic low was connected with the drying spring section of the Człopia river. The watercourse merges with fishponds to the south-east of the village of Kwiejce. In the ecotone zone, mostly devoid of a compact tree stratum, there was found only a sparse undergrowth of *Betula pubescens* and *Pinus sylvestris*. In the area of 20 m², about 15 flowering individuals of red helleborine were recorded. It was accompanied by such species as: *Calamagrostis epigejos*, *Carex hirta*, *Hydrocotyle vulgaris*, *Festuca ovina*, *Agrostis vulgaris*, *Vaccinium vitis-idaea*, *Athyrium filix-femina* and *Alnus glutinosa*, while in the moss layer, *Pleurozium schreberi* grew in abundance.

Newly discovered localities deserve special attention because of the large size of populations with flowering individuals. The population in the Solecko forest

subdistrict is certainly the biggest center of this species amongst those recently found in western Poland (cf. HEREŹNIAK and BERNACKI 2001). Occurrence of red helleborine in new localities in the Notecka Forest has been documented with photographs demonstrating morphological features and environment inhabited by this species (Phot. 1-2).



PHOT. 1. Flowering individual of *Cephalanthera rubra* from the locality in the Solecko forest subdistrict (Photo credit: R. Sajkiewicz)



PHOT. 2. Biotope of *Cephalanthera rubra* – the locality in the Solecko forest subdistrict (Photo credit: R. Sajkiewicz)

Distribution in the Wielkopolska and Lubuska regions

Aside from the already characterised new localities of *C. rubra*, information on the distribution of this species in the Notecka Forest is contained in the work by URBAŃSKI (1930). Hence, at present, there are the three known localities of red helleborine in the Notecka Forest. The presence of this species showed URBAŃSKI (1930) and WODZICZKO *et al.* (1938) in the Bagno Chlebowo bog complex (near the village of Bębniak, Oborniki county, Ryczywół district). However, the above-mentioned locality of red helleborine has not been found subsequently. The species occurred also in a beech wood near the village of Nienawiszcz (Oborniki county, Rogoźno district), situated in the vicinity of the Notecka Forest (URBAŃSKI 1930). Nevertheless, despite the search, this locality also failed to be confirmed in the recent years.

On the basis of a database, containing data on the distribution of vascular plants in the Wielkopolska-Kujawy Region (Database of the Department of Plant Taxonomy of Adam Mickiewicz University in Poznań and JACKOWIAK *et al.* 2008) and papers: FERTSCH 1971, JERMACZEK 1997 it was possible to state that, so far, this species was recorded in 36 localities. Majority of them is

situated in the western (11 in the Lubuska region) and north-east (nine in the Gniezno Lake District) part of the area. In the central part of the Wielkopolska-Kujawy Region, red helleborine has scattered distribution. It should be emphasized that after 1980, only five localities of *C. rubra* were found or confirmed: (1) "Wyspa Konwaliowa" nature reserve on the Lake Przemękie, in Wolsztyn county (herbarium material coll. by Hegenbart in 1989), (2) Karczma Borowa in Leszno county (BRZEG 1988), (3) Gniezno Lake District, near the village of Skorzęcin (CHMIEL 1993), (4) forests of the Kamionka Valley, in the vicinity of the village of Mnichy (STEFANEK-PAŃCZUK and ANTKOWIAK 1997) and (5) "Czarna Droga" nature reserve near Brójce, in Trzciel county (JERMACZEK 1997). Most information on the species occurrence sites (24 localities) comes from the period 1846-1940 (e.g. SZAFARKIEWICZ 1861, DECKER 1911 (1912) POZ herbarium material). In the recent period, from the Lubuskie region, red helleborine was observed only in a few localities (STEFANEK-PAŃCZUK and ANTKOWIAK 1997, JERMACZEK 1997, KUJAWA-PAWLACZYK and PAWLACZYK 2001).

The present distribution of *C. rubra* in the area of Wielkopolska-Kujawy Region was shown in the Figure 2.

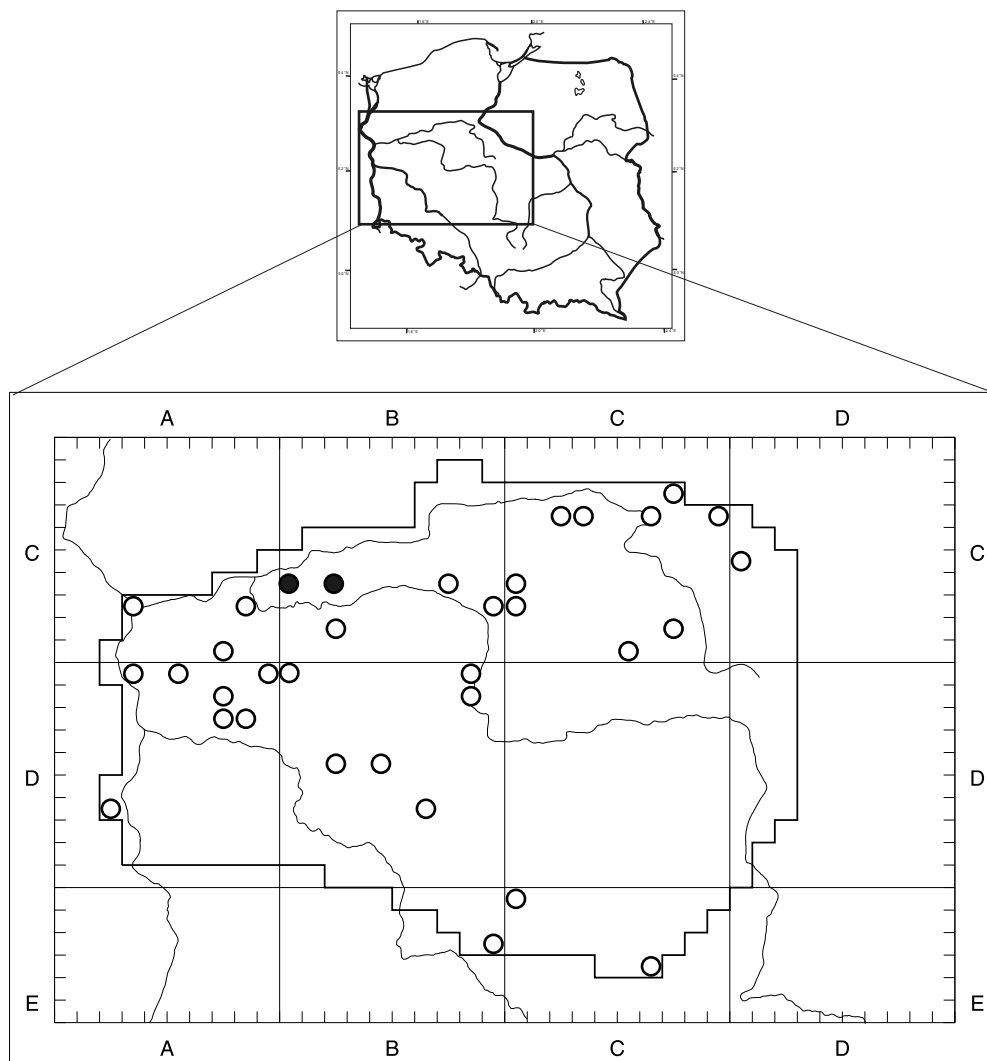


FIG. 2. Distribution of *Cephalanthera rubra* in mid-west Poland (Wielkopolska region); o – localities known from literature and herbarium material (details in the text), • – new localities

SUMMARY

Red helleborine is one of nine species of orchids reported from the Notecka Forest. Apart from it, they include: *Dactylorhiza majalis*, *D. incarnata*, *Epipactis atrorubens*, *E. helleborine*, *E. palustris*, *Liparis loeselii*, *Listera ovata* and *Neottia nidus-avis*. Populations of *C. rubra* which comprise numerous flowering individuals, like in the case of the one described from the Solecko Forest District, in Wielkopolska were documented only from the forests in the vicinity of Skorzęcin (Gniezno Lake District, CHMIEL 1993) and Lubuskie region.

As results from the two-year monitoring of populations in the Solecko Forest District, the number of observed flowering shoots may be subject to large fluctuations. Similar, detailed analyses, indicating significant fluctuations in the number of individuals, come from the studies carried out, among others, in the coastal beech wood of the Wolin island (GĘBURA 1995, PIOTROWSKA 1996), as well as from the observations of other authors (NOBIS and NOBIS 2006).

Information on the localities of *C. rubra* and conditions of its occurrence may be found in numerous works, including those recently published, e.g. CIOSEK and BZDON (2000), NOWAK and NOWAK (2002, 2004), BRZOSKO and WRÓBLEWSKA (2003), NOWAK-DAŃDA and DAŃDA (2006), NOBIS and NOBIS (2006), BECZAŁA and FIEDOR (2006). Against this background, particularly interesting are biotopes inhabited by red helleborine, as most often they involve various types of forests and localities characterised by a higher level of groundwater, as well as open sunny sites (e.g. NOWAK and NOWAK 2002, NOWAK-DAŃDA and DAŃDA 2006, NOBIS and NOBIS 2006).

It should be assumed that this species does not occur in dry and deeply shadowed places. It is also interesting that in the new localities found in the Lubuskie region, red helleborine occur in the transition zones of watercourse systems and at the edges of springs with low tree cover.

Many works emphasize the importance of high soil calcium content in ecology of *C. rubra* (e.g. HEREŻNIAK and BERNACKI 2001 and the literature there cited, PAWLACZYK 2004, NOWAK-DAŃDA and DAŃDA 2006) and the dune areas of the Notecka Forest are very poor in this element. Higher level of calcium content in the newly found species localities could be related to the ridge fragments of glacial troughs, hard-water lakes and shallow deposits of calcareous gyttia (e.g. Chara lakes and habitats; GĄBKĄ et AL. 2008), dried-up hard-water bodies and spring seepage areas.

It is hard to determine unambiguously the causes of extinction of *C. rubra* populations, both in Wielkopolska and Poland as a whole. One of particularly important reasons could be transformation of this species habitats in various parts of the country (HEREŻNIAK and BERNACKI 2001). The data to date suggest that red helleborine attains its maximum development in open forests, mainly in beech woods, quite often, already in the stage of dying, or in ecotone zones (NOWAK and NOWAK 2002, BRZOSKO and WRÓBLEWSKA 2003, NOWAK-DAŃDA and DAŃDA 2006, NOBIS and NOBIS 2006).

Some works emphasize that a decrease in the range of red helleborine in Western Europe is connected with the extinction of natural pollinators, mainly aculeate insects, such as *Chelostoma campanularum* (Megachilidae) (NEWMAN and SHOWLER 2007, NEWMAN et AL. 2007). It should be stressed that red helleborine reproduces only by seeds. As it was demonstrated in the studies on *C. rubra* in the Biebrza National Park (BRZOSKO and WRÓBLEWSKA 2003), the examined populations show the low level of genetic differentiation, which additionally highlights a high level of threat to such isolated populations.

Newly discovered localities of *C. rubra* occur in the region in which this orchid appears very rarely and in the last period was found only in five isolated localities. The described new sites are not directly threatened with destruction. They were excluded from forestry usage and placed under monitoring by foresters from the Karwin Forest District. A serious risk to the populations can come from the natural succession towards shrub and forest communities. Dense shrub communities may effectively eliminate a species that prefers open sunny places. Therefore, it is necessary to monitor carefully the status of populations and, in the case of a severe decrease in their size, also to implement active protection measures. Thus, the conservation of this species in the first place requires the maintenance of functional stability of its biotopes. Active protection measures should ensure the maintenance of current humidity level of habitats as well as the density of trees and understorey vegetation. It seems, that the density of shade strata should stay within the range of 60-70%. Such density ensures favourable lighting conditions of localities, at the same time, limiting the expansion of other more photophilic plants. All active protection measures should be conducted outside the vegetation season, with no topsoil disturbance in the orchid's habitat.

While considering the conservation of *C. rubra*, one should remember about the low genetic differentiation of its scattered populations (BRZOSKO and WRÓBLEWSKA 2003). A key role in the generative reproduction of this orchid play some solitary bees (Hymenoptera, Apoidea, Megachilidae): *Chelostoma campanularum* and *C. rapunculi* (SZLACHETKO and SKAKUJ 1996 and NEWMAN et AL. 2007). These bees build they nests in rotten wood, so the integral part of the protection of *C. rubra* populations must be preservation of old and dead trees in their immediate vicinity. It cannot be excluded that the observed relatively low level of the species generative reproduction (SCACCHI et AL. 1991, POLSKA CZERWONA KSIĘGA... 2001), connected also with the low efficiency in seed production (PRZYDYBA 2003, NEWMAN et AL. 2007), may result from the small number of habitats for the reproduction of bees. Moreover, it has to be taken into account that for the protection of genetic differentiation in the orchid populations, hand pollination will have to be applied (PRZYDYBA 2003, NEWMAN and SHOWLER 2007, NEWMAN et AL. 2007). The proper program of conservation of red helleborine can and should be an example of situation, when the protection of one species (umbrella species) would allow to keep the whole community of organisms.

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REFERENCES

- ATLAS rozmieszczenia roślin naczyniowych w Polsce. (2001). Eds A. Zając, M. Zając. Pracownia Chorologii Komputerowej Instytutu Botaniki UJ, Kraków.
- BARTOSZEK W., KOCZUR A., MIREK Z., OKLEJEWICZ K. (2008): Rośliny naczyniowe. In: Czerwona księga Karpat Polskich. Eds Z. Mirek, H. Piękoś-Mirkowa. Instytut Botaniki im. W. Szafera PAN, Kraków: 523-525.
- BECZAŁA T., FIEDOR M. (2006): Nowe stanowiska rzadkich przedstawicieli storczykowatych (Orchidaceae) na Pogórzu Cieszyńskim. *Fragm. Florist. Geobot. Polonica* 13, 2: 253-259.
- BRZEG A. (1988): Ciepłolubne zbiorowiska okrajkowe z klasy *Trifolio-Geranietae* w Wielkopolsce. *Pr. Kom. Biol. PTPN* 71.
- BRZEG A., WOJTERSKA M. (2001): Zespoły roślinne Wielkopolski, ich stan poznania i zagrożenie. In: Szata roślinna Wielkopolski i Pojezierza Południowopomorskiego. Ed. M. Wojterska. Przewodnik sesji terenowych 52. Zjazdu PTB, 24-28 września 2001, Poznań: 39-110.
- BRZOSKO E., WRÓBLEWSKA A. (2003): Genetic variation and clonal diversity in island *Cephalanthera rubra* populations from the Biebrza National Park, Poland. *Bot. J. Linn. Soc.* 143: 99-108.
- CHMIEL J. (1993): Flora roślin naczyniowych wschodniej części Pojezierza Gnieźnieńskiego i jej antropogeniczne przeobrażenia w wieku XIX i XX. Part 1. *Pr. Zakł. Takson. Rośl. UAM Pozn.* 1. Wyd. Sorus, Poznań.
- CIOSEK M.T., BZDON G. (2000): Stanowiska wybranych gatunków z rodziny storczykowatych z okolic Kielc i Pińczowa. *Chrońmy Przyr. Ojcz.* 56, 4: 76-78.
- DANIELEWICZ W., PAWLACZYK P. (2004): Nadbałtycka buczyna storczykowa. In: *Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Vol. 5.* Ed. J. Herbich. Ministerstwo Środowiska, Warszawa: 100-102.
- DECKER P. 1911 (1912): Beiträge zur Flora der südlichen Neumark und der östlichen Niederlausitz. *Verh. Bot. Vereins Prov. Brandenburg* 53: 87-269.
- FERTSCH W. (1971): Notatki florystyczne z okolic Skoków w powiecie wągrowieckim. *Bad. Fizjogr. Pol. Zach. Ser. B* 24: 257-259.
- GĄBKA M., SAJKIEWICZ R., OWSIANNY P.M. (2008): Ramienniece zbiorników wodnych w krajobrazie borowym Puszczy Noteckiej. In: Konferencja „Aktywne metody ochrony przyrody w zrównoważonym leśnictwie: woda dla lasu, las dla wody”. Rogów, 1-2 kwietnia 2008. Leśny Zakład Doświadczalny SGGW, Rogów: 17.
- GĘBURA K. (1995): Interesujące gatunki storczykowatych w lesie bukowym koło Bukwałdu pod Olsztynem. *Chrońmy Przyr. Ojcz.* 51, 4: 76-79.
- HERBICH J., PAWLACZYK P. (2004): Kaszubskie buczyny storczykowe. In: *Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny.* Ed. J. Herbich. Ministerstwo Środowiska, Warszawa 5: 96-99.
- HEREŻNIAK J., BERNACKI L. (2001): *Cephalanthera rubra* (L.) Rich. In: Polska czerwona księga roślin. Eds R. Kaźmierczakowa, K. Zarzycki. Instytut Ochrony Przyrody, Instytut Botaniki PAN, Kraków: 536-537.
- JACKOWIAK B., CELKA Z., CHMIEL J., LATOWSKI K., STACHNOWICZ W., ŻUKOWSKI W. (2008): Chorologiczno-ekologiczne aspekty współczesnych przemian flory Wielkopolski. (In print).
- JACKOWIAK B., CELKA Z., CHMIEL J., LATOWSKI K., ŻUKOWSKI W. (2007): Red list of vascular flora of Wielkopolska (Poland). *Biodiv. Res. Conserv.* 5-8: 95-127.
- JERMACEK D. (1997): Nowe stanowiska roślin chronionych na Ziemi Lubuskiej. *Przegl. Przyr.* 8, 4: 85-90.
- KONDRACKI J. (2002): Geografia regionalna Polski. PWN, Warszawa.
- KUJAWA-PAWLACZYK J., PAWLACZYK P. (2001): Rzadkie i zagrożone rośliny naczyniowe lasów Ziemi Lubuskiej i Łużyc. Wydawnictwo Lubuskiego Klubu Przyrodników, Świebodzin.
- KUSIAK W., DYMEK-KUSIAK A. (2002): Puszcza Notecka – monografia przyrodniczo-gospodarcza. Wydawnictwo Przegląd Leśniczy, Poznań.
- KWIATKOWSKI P. (2004): Sudecka buczyna storczykowa. In: *Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny. Vol. 5.* Ed. J. Herbich. Ministerstwo Środowiska, Warszawa: 91-95.
- MATUSZKIEWICZ J.M. (2001): Zespoły leśne Polski. Wyd. Nauk. PWN, Warszawa.
- MATUSZKIEWICZ W. (2006): Przewodnik do oznaczania zbiorowisk roślinnych Polski. *Vademecum Geobotanicum.* Wyd. Nauk. PWN, Warszawa.
- MIREK Z., PIĘKOŚ-MIRKOWA H., ZAJĄC A., ZAJĄC M. (2002): Flowering plants and pteridophytes of Poland. A checklist. Krytyczna lista roślin kwiatowych i paprotników Polski. *Biodiversity of Poland. Vol. 1.* W. Szafer Institute of Botany, Polish Academy of Science, Kraków.
- NEWMAN R.D., SHOWLER A.J. (2007): The use of copper rings to reduce losses of red helleborine *Cephalanthera rubra* to slug and snail herbivory in the Chiltern Hills, Buckinghamshire, England. *Conserv. Evid.* 4: 66-68.
- NEWMAN R.D., SHOWLER A.J., HARVEY M.C., SHOWLER D.A. (2007): Hand pollination to increase seed-set of red helleborine *Cephalanthera rubra* in the Chiltern Hills, Buckinghamshire, England. *Conserv. Evid.* 4: 88-93.

- NOBIS A., NOBIS M. (2006): Nowe, obfite stanowisko buławnika czerwonego *Cephalanthera rubra* L. Rich. (Orchidaceae) we wschodniej części Kotliny Sandomierskiej. *Chrońmy Przyr. Ojcz.* 63, 3: 101-104.
- NOWAK A., NOWAK S. (2002): Buławnik czerwony *Cephalanthera rubra* (L.) Rich. In: *Czerwona księga roślin województwa opolskiego*. Eds A. Nowak, K. Spałek. OTPN, Opole: 1-17.
- NOWAK A., NOWAK S. (2004): The new location of *Cephalanthera rubra* (L.) Rich. on the Opole Silesia. *Opole Sci. Soc. Nat. J.* 37: 17-22.
- NOWAK-DAŃDA A., DAŃDA P. (2006): Bogate stanowisko buławnika czerwonego *Cephalanthera rubra* (L.) Rich. na Garbie Tęczynskim (Wyżyna Krakowsko-Częstochowska). *Chrońmy Przyr. Ojcz.* 62, 2: 83-88.
- PAWLACZYK P. (2004): Ciepłolubne buczyny storczykowe (*Cephalanthero-Fagenion*). In: *Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny*. Vol. 5. Ed. J. Herbich. Ministerstwo Środowiska, Warszawa: 82.
- PERZANOWSKA J. (2004): Małopolska buczyna storczykowa. In: *Lasy i bory. Poradniki ochrony siedlisk i gatunków Natura 2000 – podręcznik metodyczny*. Vol. 5. Ed. J. Herbich. Ministerstwo Środowiska, Warszawa: 87-90.
- PIOTROWSKA H. (1996): Chronione gatunki roślin naczyniowych w Wolińskim Parku Narodowym. *Klify* 3: 7-104.
- POLSKA CZERWONA KSIĘGA ROŚLIN. Paprotniki i rośliny kwiatowe. (2001). Eds R. Kaźmierczakowa, K. Zarzycki. Instytut Botaniki im. W. Szafera PAN, Instytut Ochrony Przyrody, Kraków.
- PRZYDYBA K. (2003): Efektywność zapylania w wyspowych populacjach gatunków z rodziny *Orchidaceae* w Biebrzańskim Parku Narodowym. On-line: <http://biolchem.uwb.edu.pl/knb/download/efektzapy2.pdf>
- SCACCHI R., DE ANGELIS G., CORBO R.M. (1991): Effect of the breeding system on the genetic structure in three *Cephalanthera* spp. (*Orchidaceae*). *Plant Syst. Evol.* 176: 53–61.
- STEFANEK-PAŃCZUK W., ANTKOWIAK W. (1997): Flora i roślinność projektowanego rezerwatu „Dolina Kamionki” w zachodniej Wielkopolsce. *Bad. Fizjogr. Pol. Zach., Ser. B - Bot.* 46: 43-63.
- SZAFARKIEWICZ J. (1861): Spis roślin w Poznańskim dziko rosnących. In: *Historja naturalna dla szkół. Kurs II*, Poznań: 87-138.
- SZLACHETKO D.L., SKAKUJ M. (1996): *Storczyki Polski*. Sorus, Poznań,
- URBAŃSKI J. (1930): Rezultaty wycieczek florystycznych po Wielkopolsce wraz z projektami ochrony rzadkich roślin. *Wyd. Okr. Kom. Ochr. Przyr. Wielkop. Pomorze I*: 37-46.
- WODZICZKO A., KRAWIEC F., URBAŃSKI J. (1938): *Pomniki i zabytki przyrody Wielkopolski*. *Wyd. Okr. Kom. Ochr. Przyr. Wielkop. Pomorze 8*: 1-472.
- ZARZYCKI K., SZELĄG Z. (2006): Red list of the vascular plants in Poland. In: *Red list of plants and fungi in Poland*. Eds Z. Mirek, K. Zarzycki, W. Wojewoda, Z. Szelaąg. W. Szafer Institute of Botany, Polish Academy of Science, Kraków: 9-20.
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