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Orobanche purpurea (Orobanchaceae) in Poland: current distribution, taxonomy, plant communities, and preferred hosts

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Abstract: The paper presents the current distribution of *Orobanche purpurea* s. str. (excl. *O. bohemica*) in Poland, based on a critical revision of herbarium and literature data as well as results of my field research. Most of the records date back to the 19th or early 20th century and are now historical. Most of them lack also herbarium documentation. Since the 1950s the species has been found in 10 new localities, only partly documented by herbarium specimens. Currently it is present in only 4 localities, in valleys of the Lower Vistula and the Lower Oder (Odra) rivers and in the Silesian-Kraków Upland (Wyżyna Śląsko-Krakowska). These are some of the northernmost sites known for the species, and the new data extend its continuous distribution range. A map of its distribution in Poland is included. The taxonomy, biology, and ecology of *O. purpurea* are also discussed.

Key words: *Orobanche purpurea*, Orobanchaceae, taxonomy, distribution, phytocoenoses, Poland

1. Introduction

Orobanche purpurea Jacq. (Orobanchaceae) has a European-West-Asiatic distribution (Pusch & Günther 2009). Its geographic range extends from Portugal through Spain, south Italy, Greece, in the north (as isolated localities) to the United Kingdom, Netherlands, Denmark, Sweden, Poland, Baltic states and central Russia, in the east to Asia Minor, Caucasus, and India. It has also been reported from Canary Islands, Morocco, and North America (Beck 1890; Kreutz 1995). Its Polish localities lie at the northern limit of its continuous distribution. Thus the species is widely distributed, but still rare.

Most of its European records are historical now. It is classified as vulnerable in Slovakia (Feráková *et al*. 2001), critically endangered in the Czech Republic (Procházka 2001), and endangered in Germany (Korneck *et al*. 1996). It is a declining species, extinct in many of its British sites (Rumsey & Jury 1991). In Poland, *Orobanche purpurea* is one of the most threatened and rarest species. A vast majority of its records date back to the 19th and early 20th century (e.g. Weiss 1825; Wimmer & Grabowski 1829; Herbich 1834; Dietrich 1835; Berdau 1859; Abromeit *et al*. 1898; Ascherson & Graebner 1898; Lakowitz 1925; Schalow 1931) and are now historical. In the last 6 decades (1950-2010) it was found in 10 new localities in Poland (Szulczewski 1951; Wojterski & Wojterska 1953; Michalak 1970; Chmiel 1987; Grzegorzek 1995, 1996; Dubiel & Gawroński 1998; Nowak *et al*. 1998; Wróblewska 2000; Babczyńska-Sendek 2005; Prajs 2010; Nowakowski *et al*. 2011), but currently it is confirmed in only 4 of them. In the national red list (Zarzycki & Szeląg 2006) it was classified as R (rare, potentially endangered), which does not seem sufficient now. This was probably due to the poor knowledge of the distribution of the genus at that time. Mostly for the same reason, on regional red lists it is classified as I (Indeterminate) in the Kuyavian-Pomeranian region (Rutkowski 1997), as DD (Data Deficient) in the Opole Province, Lower Silesia, and Małopolska Upland (Nowak *et al*. 2003; Kącki *et al*. 2003; Bróż & Przemyski 2009), as endangered in Western Pomerania, Upper Silesia, Kraków Province, and Chrzanów Commune (Żukowski & Jackowiak 1995, Parusel *et al*. 1996, Zając & Zając 1998, Dubiel

et al. 2000), as critically endangered in Wielkopolska and the Sudetes (Jackowiak *et al*. 2007, Fabiszewski & Kwiatkowski 2002), and as extinct in Silesia Province and Pomerania (Pomorze Gdańskie) (Urbisz & Parusel 2012; Markowski & Buliński 2004). This species will also be included in the new edition of the Polish Red Data Book of Plants in the category CR (Piwowarczyk & Prajs 2012).

In Central Europe, *Orobanche purpurea* prefers arid and semi-arid grassland, sandy places, dry slopes, edges of vineyards, rocky steppes, open shrubland, fallow fields, grassy field borders, and ruderal habitats, on neutral or slightly alkaline soils developed on limestone or dolomite bedrock, most often in communities of the class *Festuco-Brometea* (suballiance *Agropyro intermediate-Festucenion valesiacae*), order *Quercetalia pubescenti-petraeae*, alliances *Geranion sanguinei, Arrhenatherion*, and *Convolvulo-Agropyrion* (Zázvorka 1997, 2000; Pusch & Günther 2009). It occurs at altitudes of up to 785 m in the Czech Republic, 980 m in Slovakia, 430-750 m in Germany (Jura Mts.), 1290-2100 m in the Caucasus (Uhlich *et al*. 1995; Zázvorka 1997, 2000), and 1900 m in Switzerland (Valais, also known as Wallis) (Pusch & Günther 2009).

The major aim of this study was to analyse the distribution of *Orobanche purpurea* in Poland, based on my field research and verification of herbarium and literature data. Additionally, the range of its hosts, habitats, plant communities, and taxonomic problems are discussed below.

2. Materials and methods

Field research was conducted in 2006-2011. In the same period, all the herbarium materials of *Orobanche* available in Poland were revised. The examined materials of *O. purpurea* (or misidentified as this species) were deposited in Polish herbaria KRA, KRAM, KTC, OPOL, POZ. Additionally, also herbarium specimens from the Czech Republic (PR, PRC), Germany (GLM) and from a private herbarium were verified. Herbarium acronyms are those used by Mirek *et al*. (1997) and Holmgren & Holmgren (1998). The nomenclature of vascular plants follows Mirek *et al*. (2002). The nomenclature of syntaxa is based on Matuszkiewicz (2006). The localities are listed as ATPOL (Atlas of Distribution of Vascular Plants in Poland) cartogram units (10 km × 10 km, see http://www.ib.uj.edu.pl/chronpol/), in alphabetical order. Misidentifications of plants and erroneous literature data are given separately, while doubtful ones are commented upon and indicated with question marks on the map. The only reliable sites of the occurrence, confirmed in the field or on the basis of a herbarium specimen or photograph, include Dziewicza Góra near Poznań, nature reserve Grodzisko Świętne near Konin, Balin near Chrzanów, Chrzanów (district Kąty, also known as Kąty Chrzanowskie), Biebrza National Park, Biała Góra near Sztum and Zatoń Dolna near Chojna, as well as old herbarium data from Toszek, Boguszów-Gorce, and Lubiąż. The remaining data, especially old German ones, are listed but as presumable ones, as I have not found any specimens documenting those localities. All localities are described as follows: ATPOL grid unit, location with geographic coordinates and altitude wherever possible (for old records, also original German names of the localities in square brackets), and habitat description. Some additional information is given for data from the literature and revised exsiccata: the collector and collection date, exsiccatum number, and the herbarium acronym.

Additionally, phytosociological and morphometric data were collected in 2009 in the local population in Chrzanów.

3. Results

3.1. Taxonomic notes

Orobanche purpurea Jacq. Enum. Strip. Vindobon. 108, 1762. Syn.: *Orobanche laevis* auct. non. L. 1753, Sp. Pl. 2: 632; *O. caerulea* Vill. Hist. Pl. Dauph. 2: 406, 1787; *Kopsia coerulea* (Vill.) Dum., Comment. Bot. 17, 1822; *K. purpurea* (Jacq.) Beguinot in Fiori & Paoletti Fl. Analit. D'Italia 2: 473, 1902; *Phelipaea caerulea* (Vill.) C. A. Meyer Verz. Pfl. Caspic. Meer. 104, 1831; *Phelipanche purpurea* (Jacq.) Soják. Type: AUT, Vienna, "Habitat in collibus siccioribus; supra Weinhaus, & c." Jacquin, 1762 (p. 252).

Orobanche purpurea belongs to the section *Trionychon* Wallr. In contrast to the section *Orobanche* L., this section has the following characteristic features: corolla with 2 small bracteoles; calyx tubular, usually 4-dentate; corolla white, blue or violet; capsule valves free above, and basic chromosome number of 19. Recently, species of this section are classified as a separate genus, *Phelipanche* Pomel (e. g. Holub 1977, 1990; Teryokhin *et al*. 1993; Carlón *et al*. 2005). In Poland, this section is also represented by *O. ramosa*, *O. arenaria*, and *O. bohemica*. Their revised distribution and habitats (plant communities, altitude, etc.) were described in earlier works (Piwowarczyk 2012a, 2012b, 2012c; Piwowarczyk & Przemyski 2010). *O. purpurea* is highly variable, so its taxonomic status needs to be verified within its range. Molecular analysis of specimens collected in various regions revealed a very high sequence divergence between several accessions, suggesting the presence of more than one taxon within this species (Schneeweiss *et al*. 2004). Many lower taxonomic units have already been distinguished (but often not defined clearly) on the basis of flower number, inflorescence shape, flower morphology (e.g. length and

shape of corolla lips or calyx teeth), hairiness of individual parts, and colour (Beck 1890, 1930): var. *purpurea*: f. *purpurea*, f. *millefolii* (Reichenb.) G. Beck, f. *ciliaris* (Griseb.) G. Beck, f. *acutiloba* G. Beck from Greece, f. *achroantha* G. Beck with yellow corolla, reported from Italy and Germany, f. *longirhachis* G. Beck; var. *bohemica* (Čelak.) Beck; var. *garhwalensis* G. Beck from India and Iran; var. *hirsuta* G. Beck from Transylvania and Bulgaria; var. *iberica* G. Beck from Caucasian Iberia and South Caucasus (Transcaucasia); var. *ischnosiphon* G. Beck from Hungary; var. *pareysii* G. Beck from Crimea and Caucasus; var. *simulans* G. Beck from North Caucasus (Ciscaucasia); var. *spitzelii* G. Beck; and var. *tapetina* G. Beck. According to Novopokrovskij & Tzvelev (1958), var. *iberica*, var. *pareysii*, and var. *simulans* are closely related or belong to *O. arenaria*. In Central Europe, 2 subspecies are reported most frequently: subsp. *purpurea*, as a parasite on *Achillea*, and subsp. *bohemica* on *Artemisia campestris* (Zázvorka 2000). Currently subsp. *bohemica* is regarded as a species, *Orobanche bohemica* Čelak. [=*Phelipanche bohemica* (Čelak.) Holub & Zázvorka] (Čelakovský 1879; Holub & Zázvorka 1999; Pusch 2006; Piwowarczyk 2012b). Analyses based on nuclear internal transcribed spacer (ITS) sequences have shown some differences in DNA sequence between *O. purpurea* s. str. and *O. bohemica* (Carlón *et al.* 2005; Schneeweiss *et al.* 2004). Experiments on alternating cultivation of these 2 species on *Achillea* spp. and *Artemisia campestris* showed their stabilization in host selection (Pusch 2006). Morphological and ecological characters that distinguish these 2 species and their distribution are described by Pusch (2006) and Piwowarczyk (2012b). *Orobanche purpurea* can also be confused with *O. arenaria*, which is recorded as a parasite of *Artemisia campestris*, and is distinguished by always and densely hairy anthers, larger flowers, and a different pigmentation: yellow stems with lilac flowers.

3.2. Distribution in Poland

Most of the records of *Orobanche purpurea* date back to the early 19th century, primarily in Pomerania, along the Lower Vistula and Oder, in Lower Silesia, and the Opole region (Opolszczyzna) (Fig. 1). Herbarium specimens are lacking for many localities, so dis-

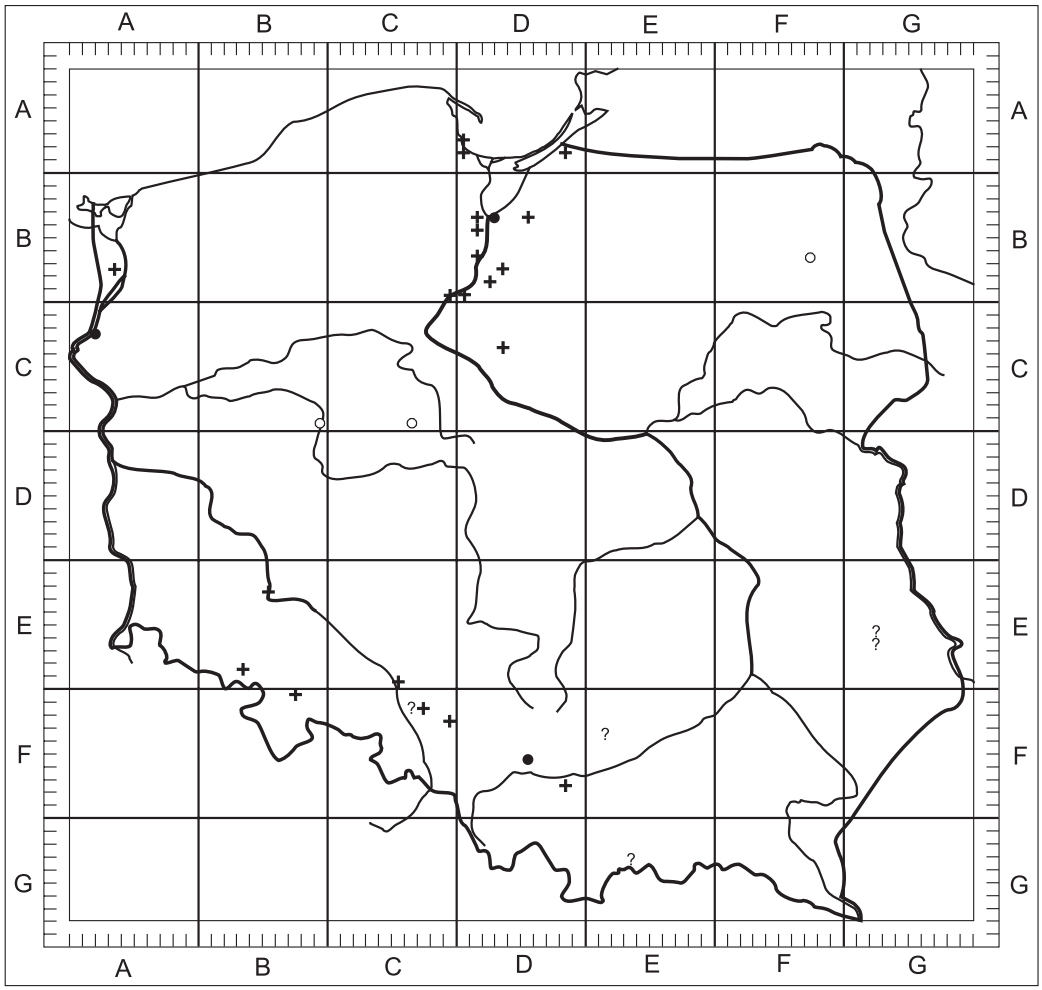

Fig. 1. Distribution of *Orobanche purpurea* in Poland
Explanations: + – probably extinct, ○ – not confirmed after 2000, ? – uncertain (probably mistakenly reported), ● – present

tribution of this species cannot be determined precisely. Already Ascherson & Graebner (1898) stated that the species was no longer present in any of the earlier reported localities. In the second half of the 20th century it was recorded by Szulczewski (1951) in the Poznań County, by Wojterski and Wojterska (1953) in Dziewicza Góra near Poznań, by Michalak (1970) in Opole-Zakrzów, by Chmiel (1987) in the Gniezno Lakeland (Pojezierze Gnieźnieńskie) in 1984, by Spałek in Kamień Śląski (Nowak *et al*. 1998), by Wróblewska (2000) in the Biebrza National Park, by Dubiel & Gawroński (1998) and Dubiel *et al*. (2000) in the vicinity of Balin near Chrzanów, and by Grzegorzek in 1990 in Chrzanów (Grzegorzek 1995, 1996), where it was next observed in 1991-1992 by Babczyńska-Sendek (2005). Currently, only the last 2 localities in the south of Poland are confirmed: the local population in Chrzanów has been observed since 1990 (Grzegorzek, herbarium specimen; Babczyńska-Sendek 2005; Piwowarczyk unpubl. data 2007, 2009; Krajewski unpubl. data 2011) and the one near Balin has also been confirmed recently (Błażej Gierczyk by letter, 2007-2008). Unexpectedly, the species was also discovered in 2007 in the valley of the lower Oder in north-western Poland (Prajs 2010), and in 2009 in the nature reserve Biała Góra in the north of Poland (Nowakowski *et al*. 2011). Thus *O. purpurea* currently exists in only 4 Polish localities, so it is critically endangered in our country (Appendix).

3.3. Biology and plant communities

In Poland, the species parasitizes primarily *Achillea* species, and this study confirmed its relationship with *A. millefolium*, *A. collina*, and *A. pannonica*. The specimens verified by me flowered in June-July.

It is difficult to determine the range of preferred plant communities of this species in Poland because now it is reported from only several sites. In Zatoń Dolna, the species grows in an old field on loam with 0.17% calcium carbonate, on a morainic hill on a slope of the Oder valley, in a dynamic community with a high contribution of meadow species, accompanied by some xerothermic species and ruderals (Prajs 2010). In the Biebrza National Park, it is found on a so-called mineral island (Polish: *grądzik*), i.e. hills elevated above the surrounding peatlands. The plant communities with *Orobanche purpurea* are classified there as xerothermic grasslands (Wróblewska 2000). The local population in the Gniezno Lakeland is situated on medieval earthworks (ramparts), which are remnants of a medieval fortified settlement, NE of Lake Suszewskie. The plant community is also characteristic of xerothermic grassland, with infrequent woody species (Chmiel 1987). The medieval earthworks are covered by patches of *Sileno otitis-Phleetum*, forest edge communities of the class *Trifolio-Geranietea sanguinei*, and thermophilous shrub communities and woods (Brzeg *et al*. 1999). In the nature reserve Biała Góra in the Lower Vistula valley, *O. purpurea* grew in the ecotone of an oat-grass meadow (*Arrhenatheretum elatioris*) and a patch of self-sown saplings of *Quercus robur*, or near *Aristolochia clematitis* and *Vincetoxicum hirundinaria*, and at an edge of a clump with *Deschampsia flexuosa* (Nowakowski *et al*. 2011). Near Balin it was recorded in a xerothermic community on former spoil tips (Polish: *warpie*) of a calamine mine (Dubiel & Gawroński 1998). The local population of *Orobanche purpurea* in Chrzanów is found on an old field and roadsides, dominated by *Solidago gigantea*, on E and SEE slopes near shrub communities with *Prunus spinosa*. More details of the plant community are presented in the relevé below.

Relevé 1. Chrzanów (Kąty Chrzanowskie), old field on dolomite, relevé area 50 m^2, 50°09'04.5"N, 19°23' 31.8"E, altitude 307 m, species number: 35, date: 18.06.2009; C: 85%: ***Orobanche purpurea*** +, **Ch. *Molinio-Arrhenatheretea*:** *Achillea millefolium* s.l. 3, *Arrhenatherum elatius* 2, *Dactylis glomerata* +, *Galium mollugo* +, *Ranunculus acris* +, *Rumex acetosa* +, *Taraxacum officinale* agg. +, *Trifolium dubium* +, *Vicia cracca* +; **Ch. *Artemisietea vulgaris*:** *Solidago gigantea* 3, *Artemisia vulgaris* 1, *Melandrium album* +; **Ch. *Festuco-Brometea*:** *Artemisia campestris* +, *Centaurea scabiosa* +, *Dianthus carthusianorum* +, *Phleum phleoides* +; **Ch. *Stellarietea mediae*:** *Anthemis arvensis* +, *Apera spica-venti* +, *Vicia hirsuta* +, *Viola arvensis* +; **Ch. *Agropyretea intermedio-repentis*:** *Bromus inermis* +, *Convolvulus arvensis* +, *Elymus repens* +, *Equisetum arvense* +; **Others:** *Arenaria serpyllifolia* +, *Astragalus glycyphyllos* +, *Erigeron acer* +, *Euphorbia esula* +, *Hieracium pilosella* +, *Rubus caesius* +, *Senecio jacobaea* +, *Verbascum nigrum* +, *Veronica chamaedrys* +, *Vicia grandiflora* +.

In Chrzanów, 80 shoots were found in 2009, in 5 clumps of 1, 3, 11, 25, and 40 shoots. Shoot height varied from 10 to 41, on average 24 cm.

4. Discussion

Orobanche purpurea is one of the rarest species in the Polish and European flora. In Poland and Central Europe, most of its reports are historical, and new records are extremely rare. In spite of my field research in 2006-2011, no historical records were confirmed in the valley of the Lower Vistula, Lower Silesia, Opole region, on the Chełm Hump (Garb Chełmu), Lublin Upland, and in the Pieniny Mts. In fact, most of them were not confirmed already in the 19th century. The lack of herbarium specimens for most of the localities makes it impossible to verify the distribution of this species fully, especially in relation to old data.

In Poland it is now found in only 4 localities, which are recent findings: Warpie Forest near Balin, Chrzanów (Grzegorzek 1995, 1996; Dubiel & Gawroński 1998; Dubiel *et al*. 2000; Babczyńska-Sendek 2005; Piwo-

warczyk unpubl. data 2007-2009; Krajewski unpubl. data 2011), Zatoń Dolna (Prajs 2010), and the nature reserve Biała Góra near Sztum (Nowakowski *et al*. 2011). In the coming years, field research is needed to confirm the relatively recent findings in the Gniezno Lakeland, Poznań County, and the Biebrza National Park, because *Orobanche* species are characterized by a high variation in population size between years and are not observed in some years or reappear after many years.

Orobanche purpurea in Poland prefers old field communities of the alliance *Arrhenatherion elatioris* (with a contribution of ruderal species of the class *Artemisietea vulgaris*, field weeds of the class *Stellarietea mediae*, xerothermic species of pioneer communities of the class *Agropyretea intermedio-repentis*, accompanied by some xerothermic species of the class *Festuco-Brometea*) or xerothermic grasslands of the class *Festuco-Brometea* (with participation of thermophilous species of the class *Trifolio-Geranietea sanguinei*). It was also recorded in thermophilous oak forest (*Potentillo albae-Quercetum*) on Dziewicza Góra near Poznań (Wojterski & Wojterska 1953) or on a railway embankment in Opole (Michalak 1970). These communities are usually transitional or patchy, clearly dynamic and successional. Schwarz (1967) and Michalak (1970) reported it as an apophyte (i.e. native plant growing on disturbed land). Since it is extremely rare in Poland and no phytosociological data are available for most of its localities, it is impossible to present its phytocoenotic spectrum. The above-mentioned observations are very similar to its habitat description in the Czech Republic, Slovakia or Germany (Zázvorka 1997, 2000; Pusch & Günther 2008).

So far, research on its hosts indicates that it is probably oligophagous, as it parasitizes *Achillea* species, mostly *A. millefolium*, *A. collina*, and *A. pannonica*. In its wider geographic range, its hosts include also other *Achillea* species. According to older literature, it is additionally found on *Artemisia vulgaris* (e.g. Abromeit *et al*. 1898). In Slovakia and in the Czech Republic, it is also documented most frequently on *Achillea* species, e.g. *A. millefolium*, *A. nobilis*, *A. setacea*, *A. collina*, or *A. distans*, and rarely on *Artemisia vulgaris*. Doubts are raised also by a record of *Orobanche bohemica* on *A. vulgaris* in the village of Czarnowo (Römer 1907). Similar but rare observations were made e.g. in the Czech Republic and Slovakia, where *O. purpurea* was recorded in subruderal or ruderal habitats as a parasite on *A. vulgaris*, and was characterized by larger size and more numerous flowers (Zázvorka 1997, 2000). At present, this case should be regarded as a morphotype but it requires further research, both in the field and in the laboratory (taxonomic and molecular). This problem was mentioned also in my earlier paper (Piwowarczyk 2012b). Its records on *Dendranthema zawadzkii* (1937) and *Leucanthemella serotina* (1930-1937) from Slovakia need to be confirmed (Zázvorka 1997). It was probably erroneously recorded on *Pyrethrum*, *Anthemis, Cirsium, Phlomis, Lamium,* and *Brassica* (Beck 1930; Novopokrovskij & Tzvelev 1958; Mądalski 1967). The species flowers usually in June-July.

Polish localities of this species differ in population size, also between years: Opole-Zakrzów, 1 shoot (Michalak 1970); Gniezno Lakeland, 3 shoots (Chmiel 1987); Biebrza National Park, 12 shoots (Wróblewska 2000); Chrzanów, 80 shoots in 2009, in 5 clumps of 1, 3, 11, 25, and 40 shoots (R. Piwowarczyk, unpubl. data), and 31 shoots in 2011, in 5 clumps of 2, 4, 7, 7, and 11 shoots (Ł. Krajewski unpubl. data); Warpie Forest near Balin, 5 shoots in 2007 and 20-25 shoots in 2008, on 4 m^2 (B. Gierczyk, by letter, 2012); near Sztum, 3 shoots (Nowakowski *et al*. 2011); Zatoń Dolna, 141 shoots in 2007, in 47 clumps of up to 5 individuals (on average 3), 51 shoots in 2009, scattered in 39 clumps of 1-2, rarely 3-4 shoots and 216 shoots in 2011 (Prajs 2010, Prajs unpubl. data).

Shoots of *O. purpurea* were up to 40 cm high in the Gniezno Lakeland (Chmiel 1987), 10-20 cm in Brzeziny Kapickie (Wróblewska 2000), and 45 cm in Zatoń Dolna, where the mean height was on average 37 cm in 2007 and 32 cm in 2009 (Prajs 2010), while in Chrzanów shoot height varied from 10 to 41, on average 24 cm.

Its presence in unstable, often disturbed sites, and very low number of localities indicate that the species is seriously endangered and its protection is extremely difficult. Active protection is vital to prevent excessive colonization by woody plants (due to plant succession) and excessive density of the herb layer. In anticipation of the urgently needed legal or active forms of protection, at the site in Chrzanów in 2011 the expansive *Solidago gigantea* was partly removed manually (Krajewski unpubl. data). We should also consider periodical shallow tillage with a cultivator (or with another farm implement) to maintain its initial stage of vegetation development, preferred by this species, and facilitating its dissemination to the vicinity of host roots.

Some forms of protection of its habitats are already available. The local population in Zatoń Dolna is situated within the borders of the Cedynia Landscape Park (Special Area of Conservation: Dolna Odra PLH 320037). The locality Brzeziny Kapickie lies in the Biebrza National Park (Wróblewska 2000). However, natural plant succession is an important threat there. In the peatland, self-sown birch and willow seedlings cause shading of the outer zone of mineral islands, while their interior is shaded by *Quercus* and *Tilia*. In the Gniezno Lakeland, the floristic reserve Grodzisko Świętne was created (Chmiel 1993; Brzeg *et al*. 1999) to protect actively that habitat and to prevent plant succession, i.e. colonization by woody vegetation. The local population near Sztum is within the nature reserve Biała Góra and

Natura 2000 site PLH220033 "Dolna Wisła" (Nowakowski *et al*. 2011).

In conclusion, considering the extremely low number of localities and small population size, also random factors may threaten the survival of *O. purpurea*, so their monitoring is necessary. The environmental monitoring should involve additionally the control of host population size.

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Appendix. List of localities of *Orobanche purpurea*

AB: 73: Szczecin-Golęcino [Stettin: Frauendorf] (Ascherson & Graebner 1898; Müller 1911), Szczecin: Drzetowo, Dziewoklicz [um Stettin auf dem Jungfernberge, bei Bredow] (Dietrich 1835); **AC: 21:** Zatoń Dolna, 53˚00'39-43"N, 14˚16'55-58"E, fallow land (leg. B. Prajs, 05.07.2009; Prajs 2010); **BC: 99:** Poznań Wschód [früher Posen-Ost] (Ascherson & Graebner 1898); Poznań County, on *Achillea millefolium* (Szulczewski 1951); Dziewicza Góra near Poznań (leg. T. Wojterski, S slope of a hill in thermophilous oak forest, section 13, 13.06.1952, POZ; Wojterski & Wojterska 1953); **BE: 25:** Winna Góra near Lubiąż [Wienberge bei Leubus] (Wimmer 1868; Winkler 1881); Lubiąż [Kr. Wohlau: Leubus] (leg. Gerhard, 18…?, GLM, 149835); **83:** Boguszów-Gorce [Gottesberg] near Wałbrzych, on *Artemisia*, (leg. Dziatzko, 27.07.1895, OPOL P/3455); **BF: 07:** Grochowa Massif [Hartheberg], Ząbkowice Śląskie County (Wimmer & Grabowski 1829; Wimmer 1868; Dietrich 1835; Winkler 1881; Fiek 1881 after Locke 1817; Schube 1903); **CB: 99:** Chełmno [Culm] (Wacker 1862; Klinggräff 1866a, after Nowicki); near Świecie [Schwetz] (Wacker 1862); **CC: 96:** remnants of a medieval fortified settlement near Lake Suszewskie, 1 km NE of Świętne village, now protected as nature reserve Grodzisko Świętne (Chmiel 1987; vid. Chmiel & Celka, 22.07.1994); **CE: 95:** Opole-Półwieś [Oppeln: Schanzvorwerk in Halbendorf] (Wimmer & Grabowski 1829; Wimmer 1868; Dietrich 1835; Winkler 1881; Fiek 1881 after Fincke 1827; Schube 1903), Opole-Zakrzów, railway embankment near a quarry, one shoot (Michalak 1970); **CF: 16:** Kamień Śląski (Nowak *et al*. 1998) – lack of herbarium specimens makes verification impossible, perhaps confused with purple-tainted *O. lutea* currently found there; **17:** Laryszka, Strzelce Opolskie County (Schalow 1931 after Schubert); **29:** Toszek [Tost], on *Achillea millefolium*, (leg. Dziatzko, 02.07.1898, OPOL, P/3454); **DA: 70:** Sopot [Zoppot] (Herweg 1915); **80:** Westerplatte, Gdańsk [Danzig] (Weiss 1825; Dietrich 1835; Schwarz 1967 after Dietrich, as an apophyte in Gdańsk harbour); **88:** Braniewo [Braunsberg u. der Kreuzkirche, Passargeufer an der Rochuskapelle] (Abromeit *et al*. 1898 after Saage 1848); **DB: 31:** Pelplin (Klinggräff 1854, 1866a, 1866b; Lakowitz 1925); **32:** nature reserve Biała Góra, Sztum Commune (Nowakowski *et al*. 2011); **35:** Stare Miasto [Alstadt] near Dzierzgoń [Christburg] (Abromeit *et al*. 1898 after Zornow 1857); **41:** Nicponie, Kwidzyn County [Liebefl.-Ufer b. d. Militär-Schwimmanstalt in Liebenthal] (Abromeit *et al*. 1898, after Scholz 1891); **61:** Kończyce [Konszic] (Abromeit *et al*. 1898); Nowe [Kr. Culm: Kr. Neuenburg] (Klinggräff 1854, 1866a, 1866b; Ascherson & Graebner 1898; Lakowitz 1925); Morgi Dolne (Abromeit *et al*. 1926); **73:** Łasin, Grudziądz County [Rain b. Lessen] (Abromeit *et al*. 1898 after Schem. 1879); **82:** Rogoźno, Grudziądz County [Schlossberg b. Schloss Roggenhausen] (Abromeit *et al*. 1898 after Rosenbohm 1879, on *Artemisia vulgaris*); **90:** Gorzuchowo, Chełmno County [Gottersfeld] (Abromeit *et al*. 1898, 1903 after Rosenbohm 1879); **DC: 33:** Zbójno, Rypin County (Mądalski 1967) – lack of herbarium specimens makes verification impossible; **DF: 55:** dry grassland on former spoil tips of a calamine mine in Warpie Forest (Lasek Warpie) near Balin near Chrzanów (Dubiel & Gawroński 1998, Dubiel *et al*. 2000; vid. B. Gierczyk 2007, 2008); wasteland in Chrzanów (district Kąty) (leg. P. Grzegorzek, near crossing of Kraków-Katowice highway with road to Balin, 28.06.1990, private herbarium of P. Grzegorzek; Grzegorzek 1995, 1996), old fields near Chrzanów (district Kąty), on S side of that highway, 50˚09'04.5"N, 19˚23'31.8"E, 307 m (Babczyńska-Sendek 2005; Dubiel *et al*. 2000; vid. Piwowarczyk, 12.07.2007, leg. R. Piwowarczyk, 18.06.2009, KTC, vid. Ł. Krajewski, 23.06.2011); **78:** between Tyniec and Skawina (Berdau 1859); **EF: 31:** nature reserve Dąbie near Klonów in Racławice Commune (Szwagrzyk 1987) – lack of herbarium specimens makes verification impossible, also field research failed to confirm its presence; **EG: 33:** Szczawnica (near Szczawny stream) (reported by Herbich (1834) as *O. caerulea*, and next as *O. coerulea* by Knapp (1872), and next by Szafer *et al*. (1924, 1953), but lack of herbarium specimens makes verification impossible. In the herbarium in Prague (PRC), one specimen of this species comes from the Slovakian part of the Pieniny Mts.: rocks near Dunajec river, 460-480 m, in a community with *Dendranthema zawadzkii* (leg. J. Suza, 22.07.1937, PRC). Only on this basis it is probable that also on the Polish side of the Pieniny the species could occur; **FB: 67:** forest section Brzeziny Kapickie, Biebrza National Park (Wróblewska 2000); **GE: 52:** Krasnystaw (Mądalski 1967) – lack of herbarium specimens makes verification impossible; **62:** xerothermic grasslands near Izbica (Fijałkowski 1994) – lack of herbarium specimens makes verification impossible, while field research detected only other species (Piwowarczyk *et al*. 2011).

Erroneous records: **AB: 34:** Wolin, Lubin, on SW slope of a sunny hill (leg. B. Chmielewski & P. Szkudlarz, 31.05.1985, POZ) – misidentified *O. caryophyllacea*; **AC: 15:** Pyrzyce, roadside, between fence of a sports field and road, opposite to S corner of fence near Vocational School, in a depression (leg. P. Szmajda, 20.08.1969, POZ; Szmajda 1974) – misidentified *O. pallidiflora*; **30:** nature reserve Bielinek (leg. Exc. Inst. Bot. U.P., 06.1952, POZ; Celiński & Filipek 1958) – misidentified *O. lutea*.