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Conceptual draft of a three-stage system for protection of localities of rare and threatened plants on the example of the orchid family (Orchidaceae) in Poland

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Abstract: The present state of safeguarding of localities of plants from the orchid family in Poland within the framework of official forms of nature protection is highly random and thus unsatisfactory. This statement is true both with regard to the percentage of localities which are placed under protection and to the distribution pattern of protection sites which is inadequately correlated with the pattern of occurrence of individual species (or subspecies) in the respective regions of the country. In the face of this situation, an attempt was made to prepare the concept of a universal system which would enable a simple, transparent and objective selection procedure for the most valuable localities of rare or threatened species. The presented project relies on two simple and basic assumptions. The first one is a three-stage design of the system. Natural assets and scientific value serve as criteria for selection and classification of the most valuable localities at one of three levels: the highest national level (red points), the medium-value macroregional level (yellow points) and local level (green points). The second assumption states that for each species (subspecies), a maximum number of 10 localities (points) can be selected in each territorial unit for its respective level. Final result of analysis, as individual maps and plans of protection for each species (subspecies), should serve the realisation of the paramount goal which is the rational management of biological resources. The presented system should also make it easier to select localities which require legal protection as well as serve as a reliable and objective tool for choosing sites for monitoring.

Key words: Orchids, Orchidaceae, rare and threatened plants, project of locality protection, system of locality protection

1. Introduction

The orchid family (Orchidaceae) is represented in the flora of Poland by ca. 50 species, making it an average, medium-sized family in the Polish flora of vascular plants. However, if we regard the orchid family as legally protected plants, we can easily notice that this is the most numerous coherent systematic group of plants placed as a whole under strict legal protection in our country and that its representatives constitute over 20% of all protected species of flowering plants in Poland. Taking into consideration the above-mentioned facts and the declarations of numerous botanists about the high level of endangerment of Polish orchids (e.g.: Michalik 1975; Żukowski 1976; Zarzycki 1992), 25 years ago the author embarked on an endeavour to gather information on their distribution, habitats and resources. The accumulation of a significant quantity of data has made it possible to launch the national scientific programme ORPOL (Orchidaceae Poloniae) – "Orchids of Poland" – with the paramount aim of working out the most rational means of biological resource management for these plants (Bernacki 2000a). The assumptions of this programme expect it to provide objective scientific premises for undertaking practical actions in the domain of legal protection of species from the orchid family in Poland (Bernacki 2000b, 2001).

The results of the author's studies, summarising the present state of research, are currently compiled in the "Atlas of distribution, endangerment and protection of orchid family (Orchidaceae) biological resources in Poland" which is under preparation and encompasses 50 taxa (48 species, including two represented by 2 subspecies each). The atlas presents 6 thematic issues, including: (1) distribution (in the horizontal and vertical aspect); (2) biological resources (taking into account populations number and occupied area as well as the share of generative shoots); (3) phytogeography (with

special attention to present and historical range limits); (4) microhabitat ecology (with determination of ecological amplitude and the habitat optimum); (5) threat (with a reference to neighbouring countries) and (6) protection of localities. These issues are dealt with in a cartographic manner on cartograms and maps as well as in a numerical manner in diagrams and tables, while their sequence has been designed so as to describe the present state and at the same time to estimate in an objective way the target capabilities and requirements of protection for individual species and subspecies in the most comprehensive manner possible. The problem of protection of localities of plants from the orchid family has been illustrated for the 48 taxa currently recorded from Poland on the last plate in the presented atlas. This plate presents not only the current state and forms of protection in national parks, nature reserves and ecological management areas as well as the role of national parks in the protection of orchid localities, but also the project of the three-stage system of protection of localities.

2. A review and analysis of the present state of protection of orchid localities in Poland

The preservation of localities of plants from the orchid family in the territory of Poland within various forms of land-based protection of nature, such as e.g. national parks, nature reserves or ecological management areas, has hitherto not been the subject of detailed analysis with the single exception of *Cypripedium calceolus* (Świeboda 1976). Meanwhile, even a superficial review of currently existing localities of these plants makes it possible to ascertain that the state of their protection is highly random and in many cases utterly insufficient. This statement refers both to the percentage share of localities of individual species which have been placed under protection and to the pattern of distribution of objects preserving these localities which is very poorly correlated with the frequency of occurrence of each given species (or subspecies) in respective region of the country.

The first of the above-mentioned observations is easy to confirm by examining Table 1, comparing the two exemplifying parameters of threat to orchids in Poland, the number of extant localities and percentage loss of localities, with numerical characteristics of localities currently placed under legal protection. The cited table shows on specific examples that for the two most strongly endangered species in Poland, i.e. *Herminium monorchis* and *Orchis coriophora*, despite their having currently only a single confirmed locality each and additionally belonging to the group with highest values of locality loss percentage, no localities are placed under legal protection. A similar situation is recorded for *Spiranthes spiralis*, although in this case the number of extant localities is higher (six). Subsequent species, including: *Dactylorhiza baltica*, *Orchis pallens*, *O. palustris*, *Epipactis albensis* and *Neottianthe cucullata*, with the number of extant localities between 6 and 30, are provided with protection of localities in a highly divergent manner, with the percentage ranging from 8% to nearly 30%. A relatively well-protected species is *Epipactis microphylla*, for which as many as 50% of localities are placed under protection in nature reserves and in the Pieniny National Park, especially when we take into consideration that two of the non-protected localities have been discovered as late as several months ago, in 2005. For the three last species, their localities are very well protected. An exemplary case is *Orchis*

Table 1. Comparison of parameters quantifying present endangerment with numerical indicators of the legal protection of localities for the selected orchid species in Poland (state: 1. 09. 2005)

Name of species	Endangerment parameters		Protected localities	
	Number of extant localities	Loss of localities [%]	Number	Percentage [%]
Herminium monorchis	1	94.4	0	0.0
Orchis coriophora	1	99.0	0	0.0
Spiranthes spiralis	6	95.1	0	0.0
Dactylorhiza baltica	24	51.0	2	8.3
Orchis pallens	24	27.3	2	8.3
Orchis palustris	6	80.6	1	16.7
Epipactis albensis	30	6.3	6	20.0
Neottianthe cucullata	7	78.1	2	28.6
Epipactis microphylla	6	14.3	3	50.0
Orchis purpurea	11	8.3	9	81.8
Coeloglossum viride	135	65.0	120	88.9
Chamorchis alpina	20	28.6	20	100.0

purpurea for which over 80% of localities is protected in nature reserves and ecological management areas. A very high coefficient of protection of localities is recorded for *Coeloglossum viride*, however in the case of this species one must remember that 90% of localities is located in the Tatry National Park, nearly 9% within the remaining number in other regions of Polish Carpathians in various national parks, while only 3 lowland localities are all in the Biebrza National Park. For *Chamorchis alpina*, all localities are under protection, because its entire range in Poland is located within the Tatry National Park.

The second observation refers predominantly to the species which show non-uniform geographical distribution. A good illustration of the problem is provided by the species which are frequent in the mountains, where they are often protected in national parks and nature reserves, while they are rare and sparsely distributed in the lowlands where they are thus much more strongly endangered – with, additionally, only a minor share of localities under legal protection (e.g. *Coeloglossum viride* described in the previous paragraph as well as *Gymnadenia conopsea* and *Orchis mascula*) or, on the contrary, species that are frequent in the lowlands and rare in the south of the country (e.g. *Dactylorhiza incarnata*).

3. Project of a three-stage system for protection of localities of rare and threatened species

In the face of the fact of insufficient preservation of localities of plants from the orchid family within the existing system of individual forms of nature protection, an attempt was made to prepare draft assumptions of a universal system which would put in place a simple, transparent and objective procedure for the selection of most valuable localities of rare and threatened species which are particularly worthy of protection. Another equally important premise for the creation of the presented project was also the fact that the progress of urban development causes many agricultural and woodland areas, including sites that are valuable from the naturalist point of view, to be encroached on by industrial and transport construction projects and by residential housing.

3.1. Basic principles

The presented draft project rests on two simple and basic principles. The first one refers to a three-stage system of valuation. Natural values and scientific assets make it possible to select and classify the most valuable localities within three levels of relative worth: highest national level (red points), medium macroregional level (yellow points) and local level (green points). The second principle states that for each species (subspecies) in an individual territorial unit of a specific level, a maximal number of 10 localities (points) could be selected that are most valuable, best preserved and most representative from the scientific point of view, depending on the general level of endangerment of a species and scientifically justified requirements for its protection.

When choosing the suggested code names of points, selection of the colour scheme of nomenclature was guided by the fact that the designation "red point" associates itself with the phrase "biodiversity hot spot" (Kornaś & Medwecka-Kornaś 2002; Pullin 2004), while the designation "green point" has an attractive connotation at a local level, e.g. a green point in a commune, in an administrative district or in a physicogeographical or geobotanical mesoregion. A "yellow point" associates itself with an intermediate state. At the same time, a concentration of red and yellow points will indicate most important biodiversity foci (hot spots) at the national level.

3.2. Additional principles

It has been assumed that respective red and yellow points corresponding to localities are selected only in those cases when a species (subspecies) is endangered or at least is vulnerable to threat in a given area. Green points can be specified without regard to the local degree of threat to the species (subspecies). The selection of a maximal number of 10 sites (points) should be also dictated by the occurrence of individual species as important or diagnostic ones in regulations specified by international conventions and in nature protection programmes (e.g. Natura 2000), as well as by the level of responsibility that Poland helds for their maintenance and preservation at the level of European Union and global flora. These localities which have not been granted national status because of the limitation to 10 most valuable points should be first in line to be selected at the lower (macroregional) level. A possible excess of valuable localities at the macroregional level should be treated in a similar manner – by transfer to the local level as locally most important sites.

When selecting most valuable localities and attributing them respective ranks at one of three territorial levels, natural and scientific values were taken into account. The natural value includes the following most important characteristics of a locality: population size; presence of generative individuals which ensure a natural reproductive cycle; state of habitat preservation as well as lack of external threat factors. On the other hand, the most important scientific (predominantly biogeographical) values are: the need to preserve the species in regions where it is exceedingly rare or where the process of its extinction is most strongly pronounced; potential possibility of creation of a refuge ensuring preservation of the species; location of a site at the range limit of

a species, where special protection can slow down the process of range retraction; location of a site in an ecological corridor for a given species, linking larger or more compact areas of its occurrence.

4. Case studies for selected species

The enclosed maps explain in detail the proposed three-stage system for protection of localities of rare and threatened plants, on the example of 4 selected species from the orchid family.

Figure 1 illustrates species which are currently very rare with the total number of extant localities in Poland lower that ten. The first one is *Epipactis microphylla* recorded from a total of 7 localities, of which 6 exist now. All these localities have been classified at the national level with the highest rank due to the rare occurrence of this species, geographical limit character of localities which determine the northern boundary of its European range and a very good or at least good state of habitat preservation. This is consistent with the "Endangered" category given to this species in the Polish Red Data Book of Plants (Baryła 2001). Apart from these red points, the map includes one extinct locality in the vicinity of Sanok in the far south-eastern region of Poland. The second species depicted in Figure 1 is *Spiranthes spiralis*. In contrast to the previously described species, this one had been much more frequent in Poland, having been recorded from 123 localities, but during several recent years its occurrence has been confirmed only in 7 of them. It has been listed in the Polish Red Data Book of Plants (Bernacki *et al*. 2001) as "Critically Endangered". The map shows the historical range of the species and extant localities illustrated as red points. Due to the rare occurrence of the species, very strong decrease in the number of localities and conspicuous retraction of the range, all localities have been given the highest rank at the national level. The number "2" placed as a symbol next to one red point sign on the map indicates that there are two localities of this rank in this geographical location.

Figure 2 depicts species which are much more frequent, with a higher number of recently confirmed localities. *Orchis pallens* has been observed on 33 localities in Poland and 24 out of this number have been confirmed as extant. Thus, this number requires a hierarchical classification of localities according to their natural and scientific value. *Orchis pallens* occurs in Poland as a species with small range limited to the Western Carpathians and the Miechów Upland, but no significant regression of this species is observed with neither an excessive loss of localities nor diminishing of the range. Thus, the level of threat to this species is

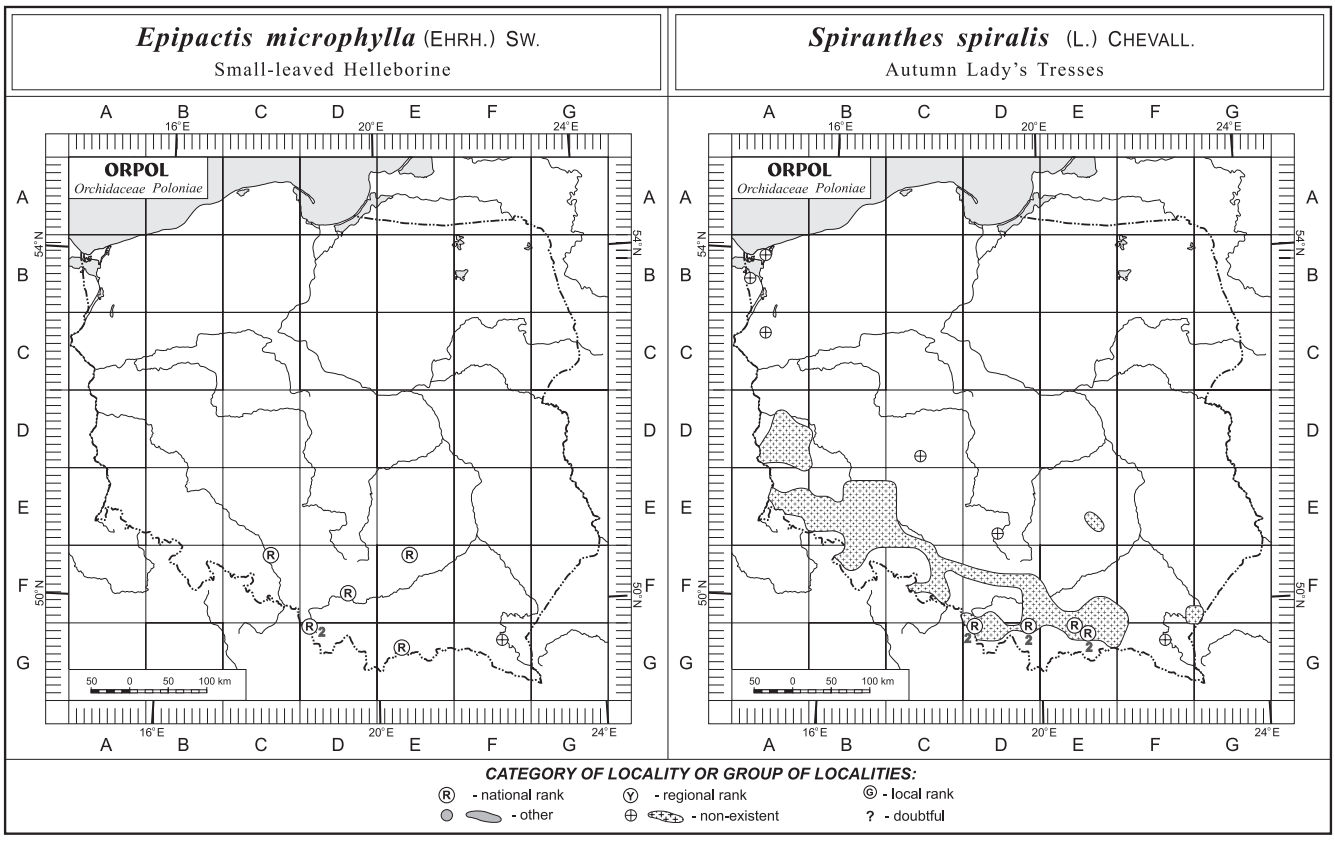

Fig. 1. Distribution of *Epipactis microphylla* and *Spiranthes spiralis* in Poland presenting the selection of most valuable localities classified according to the principles of the three-stage protection system project

intermediate and therefore it has been listed as "Vulnerable" in the Polish Red Data Book of Plants (Zając 2001). For this reason, it was considered suitable to specify only five red points. Three of them have been selected in the Cieszyn Foothills and one each in the Dunajec river valley and the Miechów Upland. In this group, only the locality in the Miechów Upland is characterised by low abundance and a relatively unstable plant community. It has, however, been granted the highest rank due to its isolated character and its northernmost location in the country. The remaining localities due to their small population size and significantly transformed habitats have been classified as yellow and green points. Some localities which have vary small populations and conspicuous changes in habitats or very unstable vegetation have not been classified to any of the protection levels. Due to the large concentration of localities in the small area of Cieszyn Foothills, detailed data on the number of selected points have been additionally listed in an inset frame on the map. The second part of Figure 2 presents the distribution map for *Coeloglossum viride*. This is also a species classified in the second edition of the Polish Red Data Book of Plants in the "Vulnerable" category (Zarzycki & Szeląg 2006). It has been recorded from nearly 400 localities, including 135 localities where its occurrence has been confirmed during the last decade. The distribution dynamics of this orchid in Poland is characterised by a significant loss of localities and very conspicuous diminishing of the geographical range. The best state of preservation of its biological resources remains in the Carpathian Mountains, with a distinct concentration in the Tatra Mountains. Therefore, the highest number of points from all three categories has been selected here. The isolated extant localities in the Sudety Mountains and in north-eastern Poland, due to their scarceness and potential possibilities of active protection, have been ascribed to – depending on the population size – the highest rank of red point (national level) or the intermediate rank of yellow point (macroregional level).

5. Conclusions

The presented system should contribute to a better and more efficient protection of individual species and subspecies, especially for the following tasks: (1) easy hierarchical classification of localities according to their natural and scientific value on the national scale and in individual regions; (2) selection of localities which are worthy of special protection; (3) preparation of individual maps and plans of protection as final analysis products; (4) determination of requirements for creation of new objects from various forms of legal protection of nature,

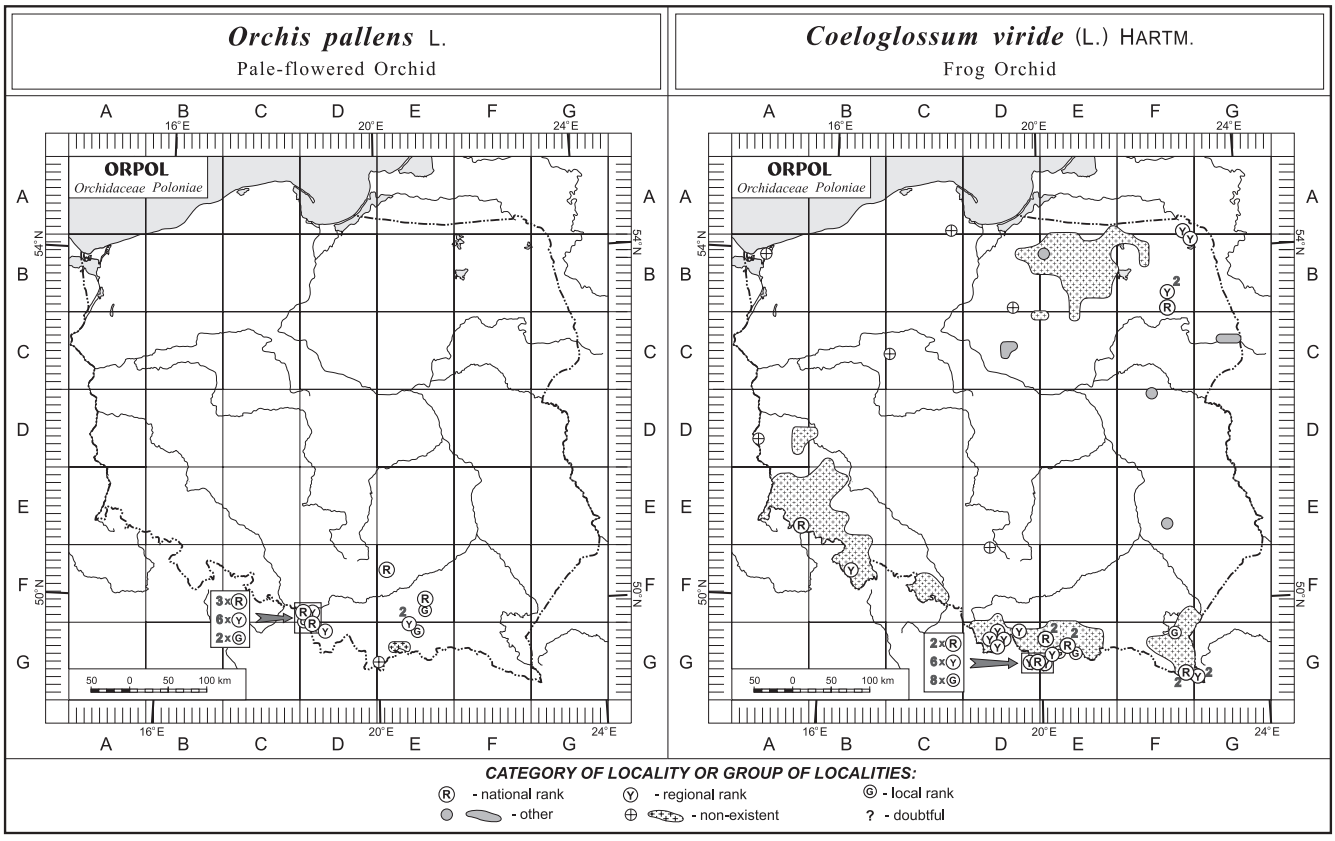

Fig. 2. Distribution of *Orchis pallens* and *Coeloglossum viride* in Poland presenting the selection of most valuable localities classified according to the principles of the three-stage protection system project

especially nature reserves and ecological management plots; (5) ensuring an objective method of protection by indicating priorities in creating forms of legal protection of localities; (6) easier management of biological resources, also for the needs of territorial administration units and national parks; (7) reliable and objective selection of monitoring sites by indication of the localities which should be monitored in the first place.

The execution of all the above-mentioned tasks should contribute to the realisation of the paramount goal which is the rational management of biological resources of threatened or rare orchid species and subspecies in Poland.

Further studies and enhancement of the proposed protection system, because of the representative character of the orchid family, may provide opportunities of application of the presented project for other individual species and larger systematic groups of plants.

References

Baryła J. 2001. *Epipactis microphylla* (Ehrh.) Sw. – Kruszczyk drobnolistny. In: R. Kaźmierczakowa & K. Zarzycki (eds.). Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe, wyd. 2, pp. 533-534. PAN, Instytut Botaniki im. W. Szafera, Instytut Ochrony Przyrody, Kraków.

Bernacki L. 2000a. Program badawczy ORPOL (Orchidaceae Poloniae) – próba stworzenia zobiektywizowanych naukowych podstaw ogólnokrajowej ochrony zasobów storczykowatych w Polsce. Przegląd Przyrodniczy 11(4): 13-30.

Bernacki L. 2000b. Docelowe możliwości zastosowań wyników programu ORPOL (Orchidaceae Poloniae) – Storczykowate Polski w działalności ogrodów botanicznych. Biuletyn Ogrodów Botanicznych, Muzeów i Zbiorów 9: 43-44.

Bernacki L. 2001. Preliminary results of investigations concerning the ecological scale of microhabitats of orchidaceous species in Poland – selected examples. Acta Univ. Wrat. 2317. Prace Bot. 79: 55-71.

Bernacki L., Bartoszek W. & Fiedor M. 2001. *Spiranthes spiralis* (L.) Chevall. – Kręczynka jesienna. In: R. Kaźmierczakowa & K. Zarzycki (eds.). Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe, wyd. 2, pp. 540-542. PAN, Instytut Botaniki im. W. Szafera, Instytut Ochrony Przyrody, Kraków.

Kornaś J. & Medwecka-Kornaś A. 2002. Geografia roślin, wyd. 2, 634 pp. Wyd. Nauk. PWN, Warszawa.

Michalik S. 1975. Storczyki - ginąca grupa roślin. Wiad. Bot. 19: 231-241.

Pullin A. S. 2004. Biologiczne podstawy ochrony przyrody. xviii+393 pp. Wyd. Nauk. PWN, Warszawa.

Świeboda M. 1976. Rozmieszczenie obuwika pospolitego *Cypripedium calceolus* L. w Polsce. Ochrona Przyr. 41: 205-230.

Zając M. 2001. *Orchis pallens* L. – Storczyk blady. In: R. Kaźmierczakowa & K. Zarzycki (eds.). Polska Czerwona Księga Roślin. Paprotniki i rośliny kwiatowe, wyd. 2, pp. 566-568. PAN, Instytut Botaniki im. W. Szafera, Instytut Ochrony Przyrody, Kraków.

Zarzycki K. 1992. Zagrożenie i ochrona rodzimej flory polskiej. 49. Zjazd PTB, Kielce, 1-5.09.1992, Roślina a człowiek, Streszczenia referatów i plakatów, pp. 9-10. WSP Kielce.

Zarzycki K. & Szeląg Z. 2006. Red list of the vascular plants in Poland. In: Z. Mirek, K. Zarzycki, W. Wojewoda & Z. Szeląg (eds.). Red list of plants and fungi in Poland, pp. 9-20. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Żukowski W. 1976. Zanikanie storczyków w Polsce niżowej w świetle analizy obecnego rozmieszczenia wybranych gatunków. Phytocoenosis 5(3-4): 215-226.