THE DISTRIBUTION OF *ARUM MACULATUM* L. (ARACEAE) IN POLAND

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ABSTRACT

Until recently *Arum maculatum* was considered the only representative of genus *Arum* in our country. The record of *Arum alpinum* Schott and Kotschy in localities in south-east Poland, from which *Arum maculatum* L. had been reported previously, encouraged us to undertake the study on the distribution of both species in the west of Poland. We found that *Arum alpinum* occurs also in Silesia, whereas the range of *Arum maculatum* is restricted to northwestern part of Poland.

So far a total of 17 localities of *Arum maculatum* were recorded in Poland (within the present borders). Only 7 of them exist at present, 4 in natural and 3 in synanthropic sites. In view of such a small number of existing localities, the species should be regarded as endangered in Poland. In this paper we present the diagnostic features of both species and their distribution on ATPOL base-maps.

KEY WORDS: *Arum maculatum*, *Arum alpinum*, distribution in Poland, endangered plants.

INTRODUCTION

The knowledge on the number of European *Arum* species and their geographical ranges is still unsatisfactory. According to Flora Europaea (1964-1980) there are 7 species within the genus on the European continent. Studies of Bedalov and Fischer (1995) or Boyce (1993) also suggest a substantial taxonomical variety within this group. Although *Arum* species have been the subject of numerous taxonomical research, chorological problems of this group still remain unresolved, especially in middle Europe, e.g. in the latest study of flora of eastern Germany only *Arum maculatum* was reported (Benkert, Fukarek and Korsch 1998). However, some localities in the south of this country belong to *Arum alpinum*; this species was found by the authors of this paper in Landeskronen near Görlitz – a locality previously described to hold the *A. maculatum* population (Schube 1903).

Until recently all Polish populations were identified by various authors as *Arum maculatum* L., the species with the subatlantic distribution range. The revision of herbarium specimens collected in south-east Poland (Mirek et al. 1995) revealed that all specimens were *Arum alpinum* Schott and Kotschy – a sub-mediterranean species. Our controls of known localities of *Arum* in Lower Silesia confirmed that *Arum alpinum* occurred also in this part of Poland. As *Arum maculatum* was not found in the south of Poland in the course of this check-out we decided to undertake the study in north-west Poland, where localities of

this species had been earlier described by German and Polish florists (Homann 1828-1835; Müller 1898, 1911; Czubiński 1950; Celiński 1962, 1964; Ćwikliński 1996). In this region 16 localities are known from literature, herbarium collections and unpublished data.

METHODS

Controls of localities in Lower Silesia, Opole Silesia, a part of Upper Silesia, and Western Pomerania were conducted in 1998-2000. In phytocoenoses where *Arum* species were recognised, phytosociological records were made and soil samples from the rhizosphere zone were taken; these data will be published later.

The distribution of localities of both species was presented on cartograms from Distribution Atlas of Vascular Plants of Poland (Zajac A. and Zajac M. 2001) in 10-km grid squares system (Zajac 1978). The status of particular localities was determined following the categories applied in ATPOL. Moreover, all present localities of *Arum maculatum* are shown in Table 2. Both on cartograms and in the mentioned Table we used the following categories of localities:

- – presently existing locality;
- + – extinct locality;
- × – locality not confirmed at present;
- – synanthropic locality.

TABLE 1. A comparison of the most important discriminating features of *Arum maculatum* and *A. alpinum*. The data were taken from: Bedalov (1978, 1985), Bedalov and Fisher (1995) and Boyce (1993).

Feature	<i>Arum alpinum</i>	<i>Arum maculatum</i>
Chromosome number	2n = 28 diploid	2n = 56 tetraploid
Tuber	vertical, discoid or depressed-globose, with the shoot appearing from near the centre of the upper surface	horizontal, irregularly cylindrical, with the axis of the cylinder horizontal and the shoot appearing at one end of the axis
Leaves	usually not or only slightly sagittate and uniformly green	oblong-hastate to -sagittate, either uniformly green or marked with dark purple spots
Peduncle (scape)	as long as the petiole	little longer than half of the petiole
Spathe	the limb (blade) of the spathe is not more than 2.5 to 3 times as long as the tube, ovate-lanceolate to elliptic lanceolate, pale greenish on the inner side or purple on the inner border	the spathe's limb is more than 3 times as long as the tube, elliptical or broadly ovate-elliptical, pale greenish, sometimes marked inside with purple (blackish) spots, rarely totally suffused with purple
Spadix	half length of the spathe, appendix more or less purple uniformly cylindrical or enlarged at the top into a club, stipe (stalk) usually not very distinct	the appendix of the spadix is purple or yellow, "club" is at its base slightly tapering into a stipe, which is as long as the upper part or slightly longer
Spines on the surface of the pollen grains	numerous, their bases are not enlarged	densely distributed, more or less uniform in shape and size, their bases are enlarged and spines are shorter than in <i>A. alpinum</i>

TAXONOMICAL REMARKS

The two *Arum* species occurring in Poland vary considerably. One of the most important features is the tuber morphology: *Arum alpinum* has a vertical, depressed-globose or discoid tuber, whereas the tuber of *A. maculatum* is horizontal, irregularly cylindrical with a horizontal axis of the cylinder.

Leaves of *A. alpinum* are uniformly green and usually not (or only slightly) sagittate, while these of *A. maculatum* are oblong-hastate to sagittate, either uniformly green or with dark purple spots. The last feature is used to discriminate between the two forms: *A. maculatum* var. *maculatum* – with spots, and *A. maculatum* var. *immaculatum* – without spots.

The genus *Arum* is rather homological considering palinology. Nevertheless, some differences in the morphology of the surface of pollen grains were detected between the studied species. In both species pollen grains are covered with small spines separated by psilate areas. In *A. maculatum* spines are more numerous, although somewhat shorter than in *A. alpinum*. In the former species the bases of spines are enlarged (Bedalov 1985; Bedalov and Hesse 1989).

There are also differences in the number of chromosomes between the studied species. *Arum alpinum*, as other species with a vertical discoid tuber, is diploid (2n=28), whereas *A. maculatum*, like other *Arum* species with a horizontal tuber – a poliploid, more precisely – tetraploid (2n=56) (Wcisło 1970; Boyce 1993; Bedalov 1978).

Other, important discriminating features are listed in Table 1.

RESULTS

Controls of *Arum* localities in Silesia and Pomerania and a thorough verification of the species identification have confirmed that indeed there are two *Arum* species in Poland. *Arum alpinum* occurs in the south of Poland (Fig. 1), while *A. maculatum* in the northwestern part of the country (Fig. 2). The ranges of both species are separated by a wide gap.

Arum maculatum is a rare component of our flora – so far (apart from revisioned stands in southern Poland which turned out to belong to *Arum alpinum*) only 14 natural localities of the species have been recorded, all in north-west Poland (Table 2). In the course of our study we visited 9 stands of this species. Only in 3 of them did we find individuals of *Arum maculatum* – these stands were classified as existing. Other 6 localities, where we did not manage to find any individuals of the species, were classified as extinct. Apart from that, a locality in Niepołtoko (Załoski 1998, not published) was classified as presently existing. The rest of the sites were not controlled and classified as not confirmed at present.

In Sitno *Arum maculatum* grows in a manorial park, whose vegetation resembles that of riverside elm carrs *Ficario-Ulmetum campestris* (Balcerkiewicz 1976). This population consist of approximately a few hundred flowering and fruiting individuals of the spotted form – *A. maculatum* var. *maculatum*.

In Wielogószcz near Recz, the *Arum* locality is situated within a reserve "Grądowe Zbocze" (Ćwikliński 1975). In this locality a form without spots *A. maculatum* var. *immaculatum* was recorded. The number of flowering individuals is considerably lower than in Sitno. *Arum* is here a component of a transitional phytocoenosis, in between low dry-ground forest and riverside carr, in the valley of a small watercourse.

In the vicinity of Równo *Arum maculatum* grows in the reserve "Skalisty Jar Libberta". It is one of the most interesting reserves of Western Pomerania considering geological structure (Baciczko and Agapow 1992). The population size is estimated at 300-400 flowering and fruiting individuals of both forms, spotted and without spots.

The natural origin of the three, described above localities of *A. maculatum*: in Sitno, Wielogószcz and Równo is not certain beyond any doubt, but species composition of the herb layer and habitat conditions are very similar to natural ones.

There are known also synanthropical localities in urban and manorial parks where individuals of *Arum maculatum* were planted: the locality in Brzeg (Opole Province), in Oruński Park in Gdańsk (leg. Buliński 12. 03. 1997; the Herbarium of Institute

Fig. 1. Distribution of *Arum alpinum* in Poland. Fig. 2. Distribution of *Arum maculatum* in Poland.TABLE 2. Localities of *Arum maculatum* in Poland

No	ATPOL Square	Locality	Author	Year of last observation	Present status of the locality
1.	AB83	Szczecin	Homann G.	1830	extinct locality
2.	AB89	Kozia Góra	Ćwikliński E.	1978	extinct locality
3.	AB94	Binowo	Müller W.	1911	extinct locality
4.	AB96	Stargard	Müller W.	1911	locality not confirmed at present
5.	AC25	Sitno	Dajdok Z., Kački Z.	2000	presently existing locality
6.	AC27	Równo	Dajdok Z., Kački Z.	2000	presently existing locality
7.	AC27	Niepołcko	Zański T.	1998	presently existing locality
8.	AC37	Barlinek	Müller W.	1898	extinct locality
9.	BA76	Darłowo	Müller W.	1911	locality not confirmed at present
10.	BB09	Błotno	Ćwikliński E.	1996	extinct locality
11.	BB18	Racibórz Polanowski	Müller W.	1911	locality not confirmed at present
12.	BB23	Białogard	Müller W.	1911	extinct locality
13.	BB32	Rąbino	Ćwikliński E.	1932	locality not confirmed at present
14.	BC00	Wielgoszcz	Dajdok Z., Kački Z.	2000	presently existing locality
15.	CB99	Chełmno	Wojciechowski M.	1987	presently existing locality
16.	CE72	Brzeg	Dajdok Z., Kački Z.	1999	presently existing, synanthropic locality
17.	DA80	Gdańsk-Orunia	leg. Buliński M.	1997	presently existing, synanthropic locality

of Botany, Medical University of Gdańsk) and locality in Chełmno (leg. Wojciechowski 28. 05. 1986; the Herbarium of Department of Plant Taxonomy and Geography, N. Copernicus University in Toruń). These sites are shown in Table 2 and on the attached map (Fig. 2) as synanthropic localities.

It should be stressed that out of all localities of *Arum maculatum* in the northwestern part of the country survived only those in forest stands not subjected to forestry measures. This indicates a considerable sensitivity of the species to changes of light and moisture conditions. A total number of *Arum maculatum* localities suggests that the species should be considered as critically endangered in Poland, and deserves placing it in the Polish Plant Red Data Book.

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ROZMIESZCZENIE *ARUM MACULATUM* L. (ARACEAE) W POLSCE

STRESZCZENIE

W Polsce do niedawna przyjmowano, że *Arum maculatum* to jedyny przedstawiciel rodzaju *Arum* występujący w naszym kraju. Stwierdzenie obecności *Arum alpinum* Schott and Kotschy na stanowiskach podawanych jako *Arum maculatum* L. w południowo-wschodniej części Polski skłoniło do podjęcia badań nad rozmieszczeniem obu gatunków na zachodzie kra-
ju. W ich wyniku stwierdzono, że na Śląsku również występuje *Arum alpinum*, natomiast zasięg *Arum maculatum* jest ogra-
niczony jedynie do Pomorza Zachodniego.

Arum maculatum znany jest łącznie z 17 stanowisk, jedynie 7 z nich jest aktualnych (w tym 3 to stanowiska synantropij-
ne). Ze względu na tak niewielką liczbę aktualnych stanowisk gatunek ten należy zaliczyć do roślin zagrożonych w Polsce.
W pracy przedstawiono podstawowe cechy diagnostyczne obu gatunków oraz ich mapy zasięgowe na podkładach ATPOL.

SŁOWA KLUCZOWE: *Arum maculatum*, *Arum alpinum*, rozmieszczenie w Polsce, rośliny zagrożone.