

## CYTOTAXONOMICAL AND PHYTOGEOGRAPHICAL INVESTIGATION OF THE SPECIES *ARUM ITALICUM* MILL. IN JUGOSLAVIA

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*Arum italicum* is morphologically a rather variable species, and many types differently treated by authors have been described. Different chromosome numbers have been published for this taxon ( $2n = 28, 64, 83, 84, 85$ ) (Table 1). Since the chromosome numbers of the investigated plants are not always accompanied by morphological characteristics it is not clear whether the different chromosome numbers are correlated with the variability of the plants.

### Material and Methods

Investigations were carried out on living plants collected in various localities in Jugoslavia (Table 2, Fig. 1) and cultivated in the Botanical Garden of the Faculty of Science, University of Zagreb. Herbarium specimens from collections of Ljubljana, Zagreb, Sarajevo and Belgrade were also studied.

Mitotic chromosomes from the root tip cells were examined by "squash" method. After treatment in saturated solution of paradichlorobenzene for about three hours, the roots were fixed in acetoalcohol (1:3) with addition of a few drops of carmine acetic and ferro acetic. Finally the material was stained in acetocarmine and placed in euparal.

### Results

#### *Morphological Investigations*

*A. italicum* is perhaps one of most variable species of the genus *Arum*. Variability is particularly obvious in the colour of leaves, but certain constant characteristics of taxonomical importance for this species are also noticeable.

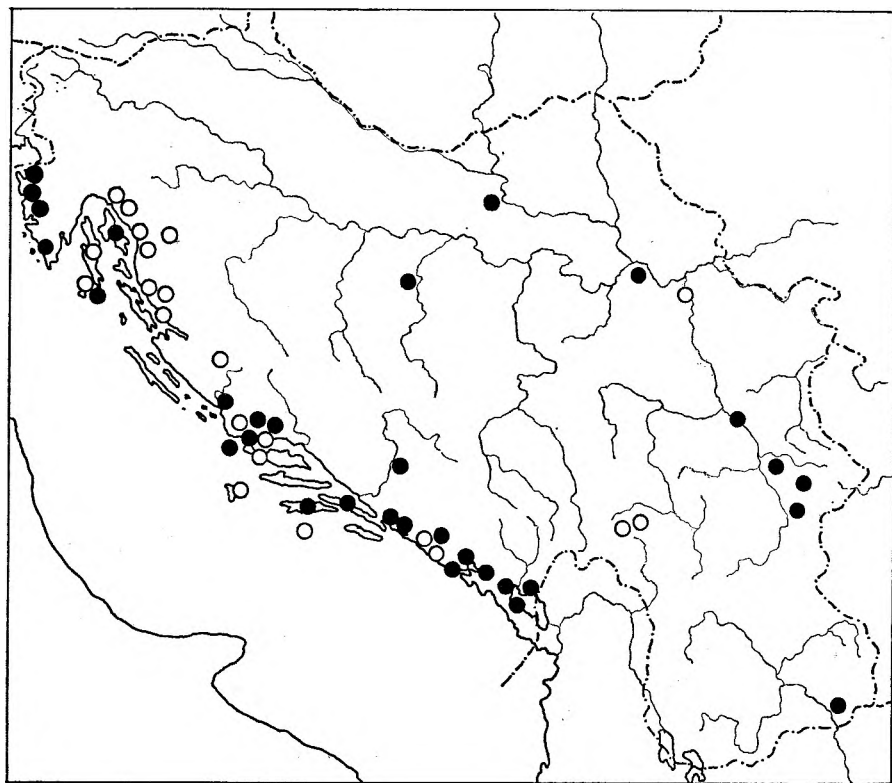


Fig. 1. *Arum italicum*, ● localities of specimens investigated  
○ data from herbarium

Sl. 1. *Arum italicum*, ● lokaliteti istraženog materijala  
○ podaci iz herbara

Table 1. *Arum italicum*, survey of chromosome numbers determined so far

Tabela 1. *Arum italicum*, pregled dosada utvrđenih kromosomskih brojeva

year godina	author autor	2n
1937	Dangeard	64
1940	Maude	84
1945	Malvesin-Fabre	64
1954	Lovis	84
1954	Prime	83, 84
1955	Prime et al.	84
1957	Jones	84
1960	Prime et al.	84
1971	Beuret	84
1971	Dahlgren et al.	28
1971	Nilsson et al.	28
1971	Marchi	83, 84, 85
1972	Beuret	84
1973a	Bedalov	84
1973b	Bedalov	84

The peduncle in the plants of this species is never longer than one half of the leaf petiole (Fig. 2).

The spathe in the examined species of this taxon was white green, rarely with dark purple spots. Only in the bottle part the margins of the spathe were frequently reddish.

The spadix is not longer than one half of the spathe length (Fig. 3).

All investigated plants had a yellow, or rarely orange appendix of the spadix which was cylindrical, and rarely narrowed towards the apical part. It was as long as its stalk from which it was clearly separated (Fig. 4).

Part of the inflorescence with densely arranged female flowers was cylindrical (Fig. 5). Sterile flowers with a bulbous and verrucous base were fibrous and flexible towards the top. Upper sterile flowers were mostly arranged in four whorls (Fig. 5), rarely in two, and very rarely in more than four whorls.

Leaves of the species *A. italicum* unlike other species occurring in Jugoslavia, appear in autumn and persist through the whole winter. The triangular hastate blade varies from those with somewhat narrow and relatively long lobes to those with rounded off and relatively short lobes. The samples found on the moist, shaded and somewhat ruderal habitats have markedly large leaves and the whole plant is large while in the culture all plants become smaller. The blade is usually green (Fig. 6), with more or less conspicuous pale veins (Fig. 7), or pale spots (Fig. 8), rarely with dark purple spots (Fig. 9), or with dark purple spots accompanied with pale veins (Fig. 10), with pale veins accompanied with pale spots (Fig. 11), or more or less obvious pale spots (Fig. 12). Studying the plants in the culture one could notice that the young blade is very markedly coloured, while on the older ones colour gradually disappears until it has completely faded in some of the herbarium samples. Due to this fact, and to the great variability in the colour of leaves it was difficult to tell which of the described forms the samples belong to.

- Fig. 2. *Arum italicum*, the length of the stem does not exceed a half of the length of the petiole  
 Sl. 2. *Arum italicum*, batvo svojom dužinom ne prelazi polovinu dužine peteljke lista
- Fig. 3. *Arum italicum*, the ratio of the lengths of spadix and spathe  
 Sl. 3. *Arum italicum*, odnos dužine klipa prema dužini pricvjetnog lista
- Fig. 4. *Arum italicum*, the ratio of the lengths of the appendix and the stalk of the spadix  
 Sl. 4. *Arum italicum*, odnos dužine kijače prema dužini drška
- Fig. 5. *Arum italicum*, detail of inflorescence  
 Sl. 5. *Arum italicum*, detalj cvata
- Fig. 6. *Arum italicum*, homogeneously coloured leaves  
 Sl. 6. *Arum italicum*, jednobojni listovi
- Fig. 7. *Arum italicum*, leaves with pale veins  
 Sl. 7. *Arum italicum*, listovi s bijelim žilama
- Fig. 8. *Arum italicum*, leaves with pale spots  
 Sl. 8. *Arum italicum*, listovi sa svijetlim pjegama
- Fig. 9. *Arum italicum*, leaves with dark spots  
 Sl. 9. *Arum italicum*, listovi s tamnim pjegama
- Fig. 10. *Arum italicum*, leaves with dark spots and pale veins  
 Sl. 10. *Arum italicum*, listovi s tamnim pjegama i svijetlim žilama
- Fig. 11. *Arum italicum*, leaves with pale veins and pale spots  
 Sl. 11. *Arum italicum*, listovi sa svijetlim žilama i svijetlim pjegama
- Fig. 12. *Arum italicum*, leaves with more or less conspicuous pale spots  
 Sl. 12. *Arum italicum*, listovi s jače i slabije izraženim svijetlim pjegama
- Fig. 13. *Arum italicum*, ovally or cylindrically prolonged rhizomlike tuber  
 Sl. 13. *Arum italicum*, gomolj valjkasto ili jajasto produžen, podanku sličan
- Fig. 14. *Arum italicum*, mitotic chromosome from root tip cells ( $2n = 84$ )  
 Sl. 14. *Arum italicum*, mitotski kromosomi iz stanice korijenovog vrška ( $2n = 84$ )
- Fig. 15. *Arum italicum*, ————— distribution after Meusel (1956)  
 - - - - - present investigations  
 Sl. 15. *Arum italicum*, ————— rasprostranjenje prema Meuselu (1956)  
 - - - - - vlastita istraživanja

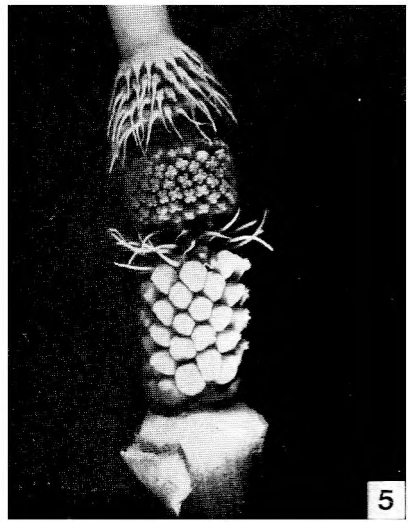
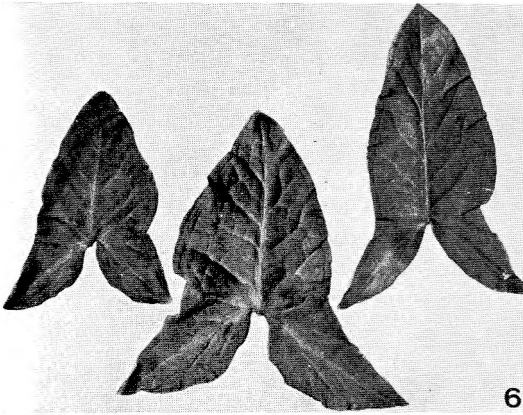
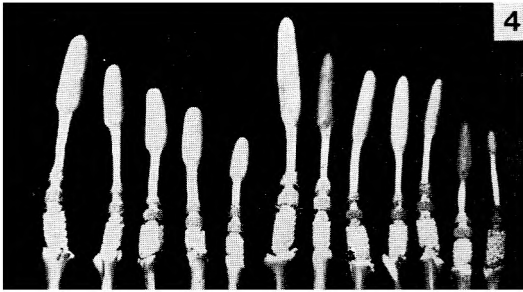
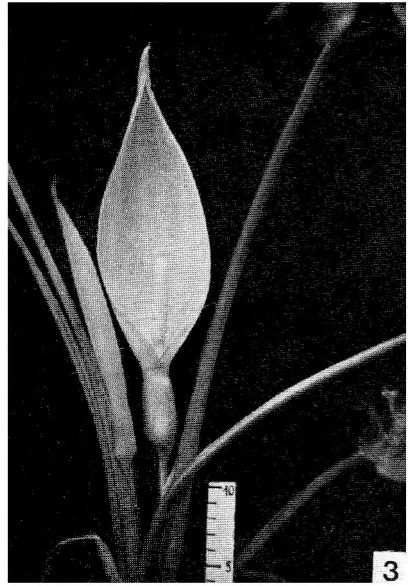
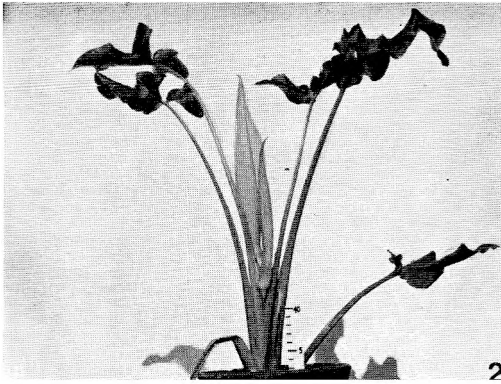


Fig. 2—6. — Sl. 2—6.

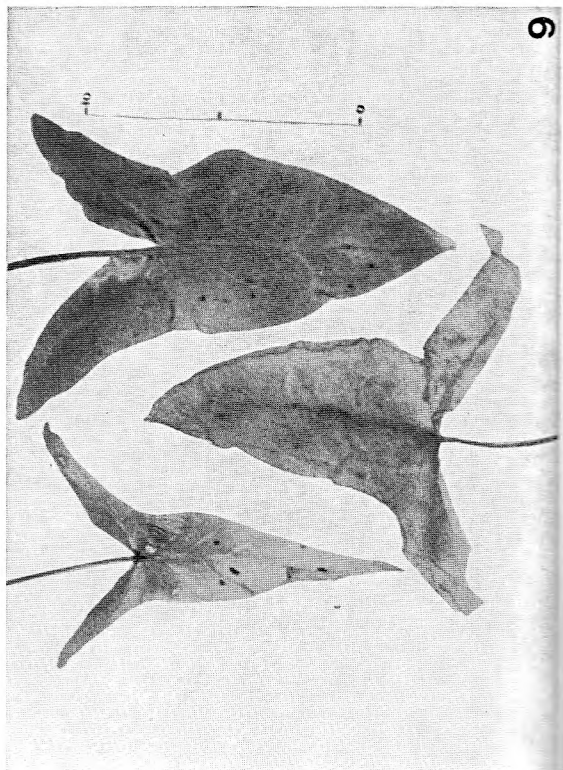
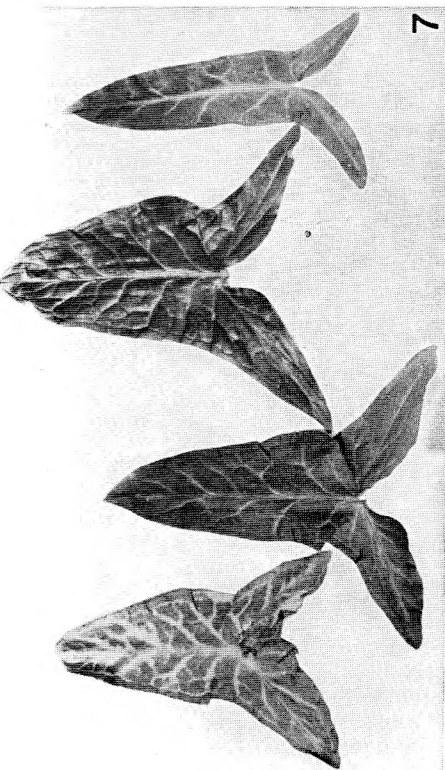
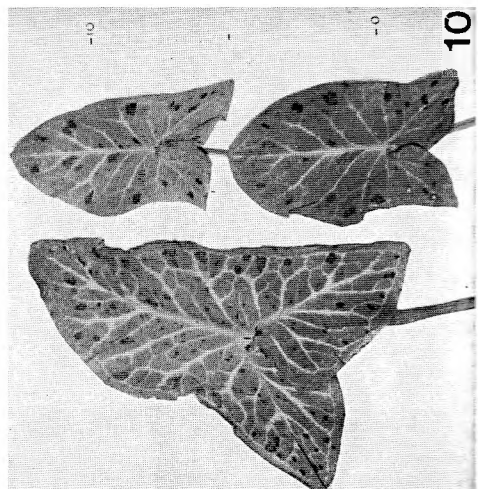
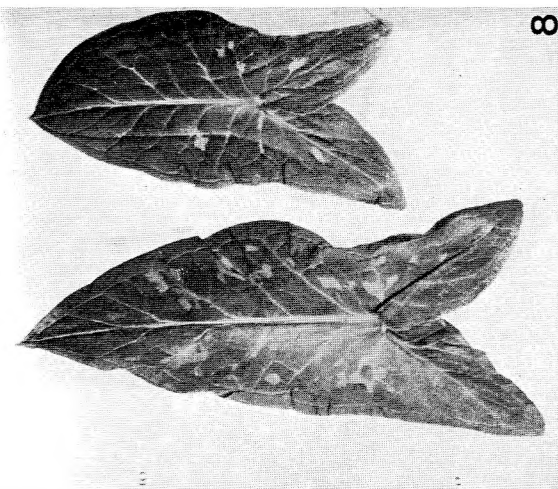
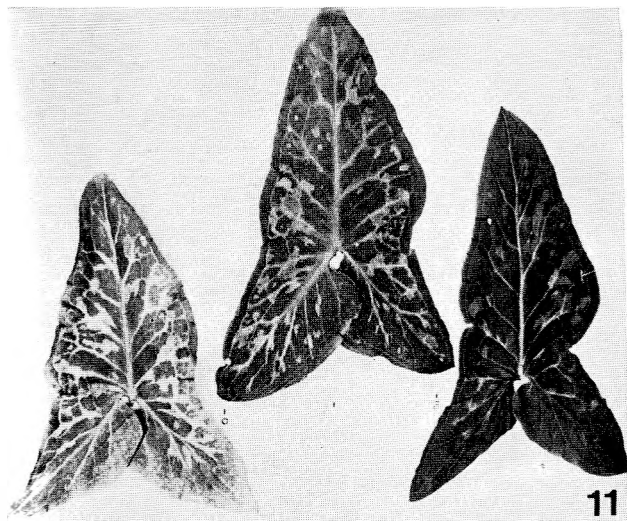
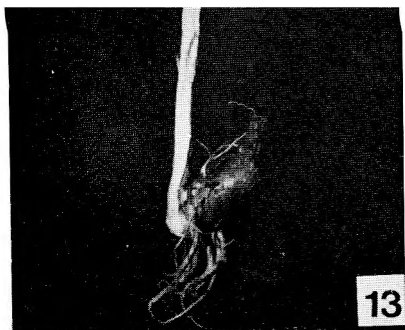


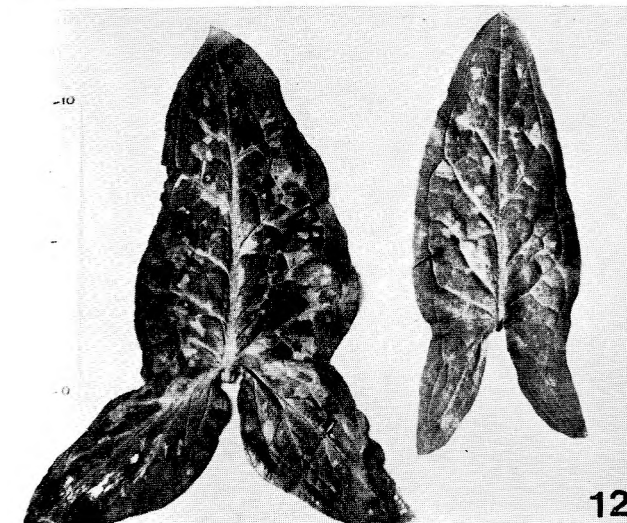
Fig. 7-10. — Sl. 7-10.



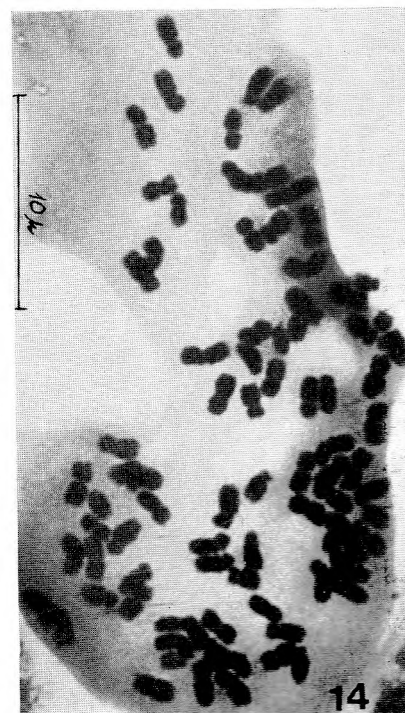
11



13



12



14

Fig. 11—14. — Sl. 11—14.



Fig. 15. — Sl. 15.



Table 2. *Arum italicum*, localities in Yugoslavia of the material investigated\*

Tabela 2. *Arum italicum*, lokaliteti istraženog materijala u Jugoslaviji\*

Locality Nalazište	Collector Sakupio	2n
<b>Croatia</b>		
Mirna	V. Strgar	84
Limski kanal	Lj. Regula	84
Pula	J. Topić	84
Krk	A. Lovrić	84
Lošinj	D. Papeš	84
Šibenik	author	84
Veli Drvenik	author	84
Čiovo	author	84
Trogir	author	84
Kaštel Lukšić	author	84
Kaštel Kambelovac	author	84
Split	author	84
Mosor	author	84
Žrnovnica	author	84
Korčula, Blato	author	84
Pelješac	I. Trinajstić	84
Ston	author	84
Trsteno	author	84
Dubrovnik	author	84
Vinkovci	Đ. Rauš	84
<b>Slovenia</b>		
Kopar	T. Wraber	84
<b>Bosnia and Herzegovina</b>		
Mostar	Č. Šilić	84
Doboj	C. Šilić	84
<b>Montenegro</b>		
Hercegnovi	author	84
Vrbanje, Orjen	author	84
Kotor	author	84
Budva	author	84
Virpazar	author	84
Rijeka Crnojevića	author	84
Plavnica	author	84
<b>Serbia</b>		
Beograd	V. Blečić	84
Aleksinac	Č. Šilić	84
Seličevica	N. Ranđelović	84
Suva planina	V. Strgar	84
Grdelička klisura	V. Jovanović	84
<b>Macedonia</b>		
Anska reka	A. Đekov	84

\* The author is indebted to all who have sent the living material.

Some forms are usually found in clones, which is connected with their vegetative breeding. Clones with different characteristics occur mostly together on the same habitat, and even in the same population.

All investigated plants had oval, cylindrical and rhizomelike tuber (Fig. 13).

### *Cytotaxonomical investigations*

According to data from the literature (Bolkhovskikh et al. 1969, Beuret 1971, 1972, Dahlgren et al. 1971, Nilsson et al. 1971, Marchi 1971, Bedalov 1973a, 1973b) different chromosome numbers (Table 1) have been established for the species *A. italicum*.

Numerous plants from 36 different populations in Jugoslavia were cytologically investigated (Table 2, Fig. 1).

Table 2 shows that all the investigated specimens regardless of the appreciable variability and extension in Jugoslavia (Fig. 1), always have  $2n = 84$  chromosomes (Fig. 14).

### *Distribution*

Species *A. italicum* is distributed mainly over the Mediterranean area s. l. of Jugoslavia i. e. in the Adriatic and Aegeic provinces of the Mediterranean region, but sporadically it appears in the continental part too, in Vinkovci (Croatia), Doboj (Bosnia), Belgrade, Bela Crkva, Grdelička klisura (near Leskovac), Seličevica and Suva planina (near Niš) (Serbia) (Fig. 1).

Meusel (1965) (Fig. 15), and Fiori (1923—1929), Hruby (1912) and Fournier (1961), treated this species as Mediterranean-Atlantic, while Bonnier (1934) cites Southern Europe, Caucasus, Asia Minor and North Africa as the areas for this taxon. According to Horvatić (1963) the species *A. italicum* belongs to circummediterranean floristic element. Recently Dihoru (1970) has included Rumania, Hungary, Bulgaria and Ukraine as the area for this taxon. Consequently, the species *A. italicum* is relatively widely distributed, extending not only in the Mediterranean Atlantic region but also in the Sarmatic.

### *Discussion*

The results of cytological investigations carried out in this work, and the fact that most authors investigating this species (Maude 1940, Lovis 1954, Prime 1954, Prime et al. 1955, 1960, Jones 1957, Beuret 1971, 1972, Marchi 1971, Bedalov 1973a, 1973b) have established  $2n = 84$  as somatic chromosome number, show that  $2n = 84$  is characteristic of the species *A. italicum*. Consequently the chromosome numbers which differ from  $2n = 84$ , are probably to be attributed to another species of the genus *Arum*, or to an error in the methods. I suppose that the number  $2n = 28$  established by Dahlgren et al. (1971) and Nilsson et al. (1971) for the specimens from the Balearic Islands is related to the species *A. pictum* L. known earlier from those Islands, or to the species *A. alpinum* Schott et Kotschy, as suggested by Löve et al. (1973). Concerning the number  $2n = 64$  (Dangeard 1937, Malvesin-Fabre 1945), evidently it is an error as noticed by Prime et al. (1955) and Beuret (1971), the more so because Malvesin-Fabre (1945) cites the same number also for the species *A. maculatum*.

Regardless of the great variability, some constant properties, taxonomically characteristic of this taxon and of the genus *Arum* as a whole have been established.

Thus, in addition to the chromosome number ( $2n = 84$ ) the cylindrically or ovaly elongated rhizomlike tuber is characteristic. The peduncule is never longer than one half of the leaf petiole, and the spadix a half of the spathe. The appendix of the spadix is always clearly separated from its stalk. This as well as the fact that leaves appear in the autumn and remain through the whole winter, constitute the characteristics which clearly differ the taxon *A. italicum* from other species of the genus *Arum*.

### Conclusion

The species *A. italicum* in Jugoslavia was investigated morphologically, cytologically and phytogeographically. It has been established that in spite of the great variability, there exist some constant characteristics important for the both of this species and the genus *Arum* too, as follows:

1. The tuber is cylindrically or ovaly prolonged and rhizomlike
2. The peduncle is never longer than a half of the leaf petiole
3. The spadix is never longer than a half of the spathe
4. The appendix of the spadix is cylindrical, rarely narrowed towards the apical part and clearly distinguished from its stalk
5. Leaves appear in autumn and remain through the whole winter.
6. The characteristic chromosome number for this species is  $2n = 84$ .

It has been established that in addition to the Adriatic and Aegeic zones of the Mediterranean region this species occurs also in the continental part of Jugoslavia (Vinkovci, Dobož, Belgrade, Bela Crkva, Grdelička klisura, Seličevica, Suva planina). Since Hungary, Bulgaria, Rumania and Ukraine i. e. the Sarmatic region, have been cited in recent literature as the distribution range of this species in addition to the Mediterranean Atlantic region, *A. italicum* is obviously a species with a relatively wide distribution.

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## S A D R Ź A J

### CITOTAKSONOMSKA I BILJNOGEOGRAFSKA ISTRAŽIVANJA VRSTE *ARUM ITALICUM* MILL. U JUGOSLAVIJI

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Istraživana je vrsta *Arum italicum* u Jugoslaviji. Utvrđeno je da uz veliku varijabilnost naročito izraženu u obojenosti lista, postoje i neke stalne osobine koje su značajne za taksonomiju ove polimorfne vrste, kao i roda *Arum* i to:

1. batvo svojom dužinom nikada ne prelazi polovinu dužine peteljke lista,
2. klip nikada ne prelazi polovinu dužine plojke pricvjetnog lista,
3. kijača je valjkasta, rijetko prema vrhu sužena i oštro odvojena od drška,
4. listovi se javljaju u jesen i ostaju preko cijele zime,
5. gomolj je jajasto ili valjkasto produžen, sličan podanku, i
6. broj kromosoma karakterističan za ovu vrstu je  $2n = 84$ .

Utvrđeno je također da, osim u jadranskoj i egejskoj provinciji mediteranske regije, ova vrsta dolazi i u kontinentalnom dijelu Jugoslavije (Vinkovci, Dobož, Beograd, Bela Crkva, Grdelička klisura, Seličevica, Suva planina).

Budući da se u novije vrijeme u literaturi, osim mediteransko-atlantskog područja, navodi također Mađarska, Bugarska, Rumunjska i Ukrajina, (dakle sarmatska regija), kao područje rasprostranjenja ove svojte, očito je da se i inače radi o elementu šireg rasprostranjenja.