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Chorological additions to the flora of eastern Yugoslavia

Abstract

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On the basis of floristic investigations, review of herbarium material (BEO, BEOU) and data from the literature, new or revised distribution maps for Montenegro, Serbia and Macedonia are presented for the following, mostly endemic or subendemic taxa: *Asplenium lepidum*, *Parietaria serbica*, *Aconitum toxicum*, *Ranunculus flabellifolius*, *Malcolmia orsiniana* subsp. *serbica*, *Potentilla visianii*, *Kitabelia vitifolia*, *Athamanta hungarica*, *Melampyrum bihariense*, *Ramonda serbica*, *Cirsium waldsteinii*, *Tragopogon pterodes*, *Hieracium humile* subsp. *brachycaule*, *Sternbergia colchiciflora*, *Carex transsilvanica*, *Cypripedium calceolus*, and *Pseudorchis friwaldii*.

Introduction

Eastern Yugoslavia (Serbia, Montenegro and Macedonia) is floristically one of the most interesting and richest parts of the Balkan Peninsula. Turill's (1929) statistical and floristic analysis, as well as a large quantity of other floristic and phytogeographical works confirm this statement. About 5500 vascular plant species are to be found in this part of Yugoslavia, with a prominent share of endemic and relict taxa. The reasons for this pronounced floristic richness lie in the extraordinary geomorphological, petrographical and climatological diversity of the area, in its geographical position and in its role of important floristic refugium within the Balkan Peninsula.

Despite the fact that the flora of eastern Yugoslavia is well known, as a result of research that started in the middle of last century and still intensely continues up to this very day, precise information on the distribution of some species as well as on their taxonomic status and ecology is still lacking.

Our floristic investigations aimed at completing the chorological and ecological information on a certain number of species, especially at the borders of their areas.

Material

Wide areas in Serbia, N Montenegro and Macedonia, were explored by us between 1985 and 1989. We collected abundant plant material which is treated in this paper only for a selection of 17, mostly endemic or subendemic taxa.

For drawing maps of the full Balkan range of these taxa and on their detailed

distribution in eastern Yugoslavia, abundant herbarium material from the Natural History Museum in Belgrade (BEO) and from the Institute of Botany, University of Belgrade (BEOU), as well as many published data were used. The material was critically revised in order to eliminate long-standing errors found in the literature, both with regard to taxonomic identification and geographical location. On the area maps, our new localities as cited in the text were indicated by numbered arrows. Abbreviations of geographical territories on area maps are those used in Flora Europaea (Tutin & al. 1964-1980) and by Hayek (1924-1933).

A review of species

Asplenium lepidum C. Presl

NE Serbia: (1.) Canyon of the Lazareva reka, N exposed limestone rocks, 7.1985, *Stevanović & Niketić* (BEO). E Serbia: (2.) Knjaževac, gorge of Beli Potok near the village Niševac, N exposed limestone rocks, 6.1986, *Stevanović & Niketić* (BEO); (3.) Soko Banja, gorge of the river Moravica, N exposed limestone semi-cave near the river, c. 340 m, 7.1986, *Niketić* (BEO). W Serbia: (4.) Ivanjica, gorge of the river Veliki Rzav at the foothill of Mt. Mućanj, limestone rocks, 7.1989, *Lakušić* (BEOU); (5.) T. Užice, Potpeć, Drežnička Gradina, *Černjavski* (BEO, det. Gajić). CW Serbia: (6.) Čačak, gorge of Ovčar-Kablar, at the mouth of the limestone semi-cave near the monastery of St. Sava, 8.1939, *Izmajlov* (BEO, det. Soška). SW Serbia: (7.) Tutin, Mt. Mokra planina, Veprinja, *Rudski* (BEO). SC Macedonia: (8.) Mariovo, Mt. Mesnik, 1938, *Oehm* (BEO, det. Soška).

This fern inhabits crevices of moist limestone rocks at the mouth of caves and semi-caves. Because of its specific ecological needs it is easily overlooked and, moreover, it can be readily confused with *A. ruta-muraria* L. New localities of this interesting fern in the gorges of eastern Yugoslavia fit into its general distributional pattern. Generally speaking, it is not as common as one might suppose when viewing the dot map of its Yugoslav distribution (Fig. 1).

Parietaria serbica Pancic

SE Serbia: (1.) Niš, Sićevačka klisura, Oblik, N exposed limestone rocks at the mouth of a semi-cave, c. 600 m, 5.1985, *Niketić* (BEO); (2.) Niš, Sićevačka klisura, Kusača, N exposed limestone rocks at the mouth of a semi-cave, c. 730 m, 7.1985, *Niketić* (BEO); (3.) between the cities Bela Palanka and Pirot, gorge of the river Nisava, near the village Ciflik, N exposed limestone rocks, c. 300 m, 5.1987, *Stevanović & Niketić* (BEO); (4.) Pirot, gorge of the river Jerma, near the village Odorovci, N exposed limestone rocks at the mouth of a semi-cave, c. 650 m, 5.1986, *Stevanović & Niketić* (BEO).

Our new localities in eastern Serbia, in the basin of the river Nisava, fit into the known range of this species in the southwestern part of its area. The map (Fig. 2b) has been completed on the basis of verified information given by Pančić (1874), Petrović (1882) and more recently Mayer (1973). In all our localities in the gorges of E Serbia the plants tend to avoid exposure to heavy rainfall (ombrophobes) and inhabit the mouth of caves or

semi-caves and overhanging rocks.

P. serbica is closely related to the submediterranean *P. lusitanica* L. which has also been recorded from the eastern part of the Balkan Peninsula, namely in Bulgaria (Stojanov & Stefanov 1948, Jordanov 1963-1982). In our opinion the chorological and ecological differentiation of these two species involves an interesting problem whose answer may be the specific ecology of *P. serbica* observed by us.

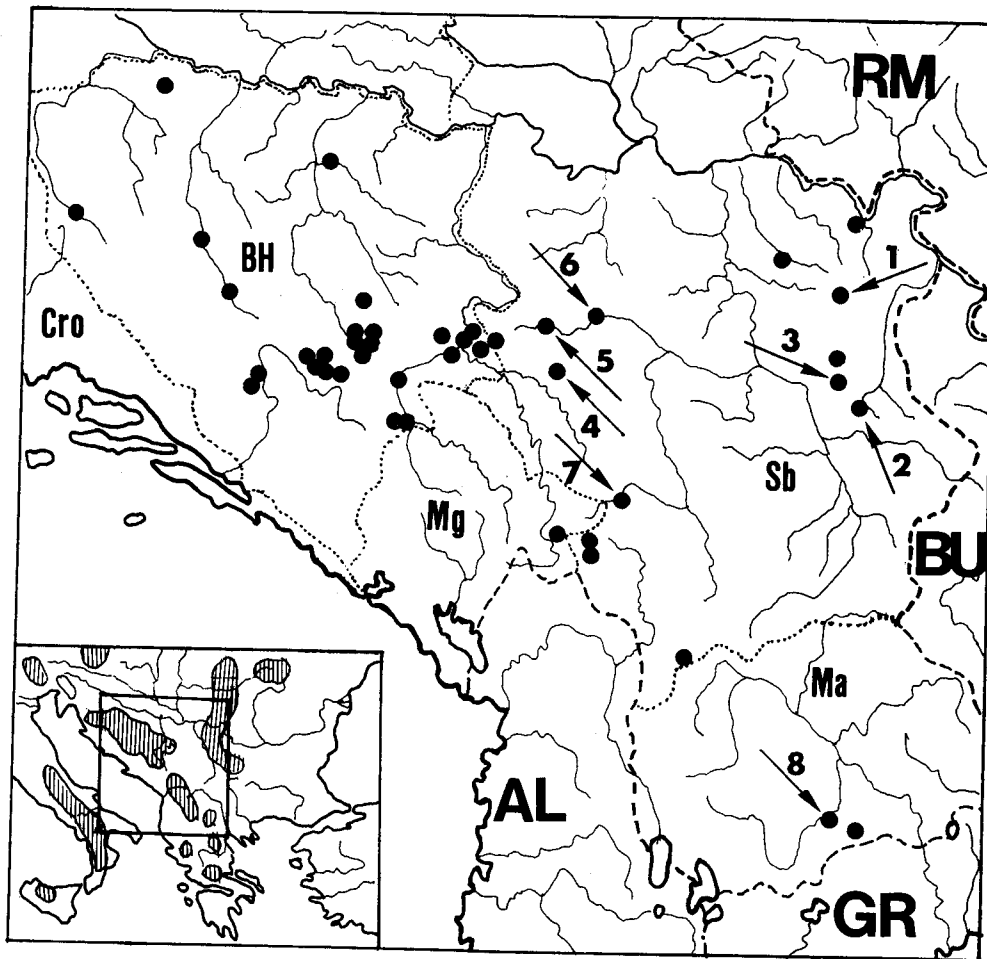


Fig. 1. Distribution of *Asplenium lepidum* C. Presl in C and E Yugoslavia.

Aconitum toxicum Reichenb. var. *bosniacum* (G. Beck) G. Beck

C Serbia: (1.) Mt. Kopaonik, Metodije, slopes of the Brzecka reka river gorge, spruce forest, limestone, c. 1600 m, 8.1986, *Lakušić & Niketić* (BEOU); (2.) Mt. Kopaonik, Gobelja, Ostri vrh, spruce forest, limestone, c. 1720 m, 7.1988, *Lakušić & Damjanović* (BEOU).

On Mt. Kopaonik *Aconitum* populations have been found which completely agree in

morphology with *A. bosniacum* from eastern Bosnia (Beck 1891). On the basis of herbarium specimens, Beck (1891) mentions the presence of this species also in Serbia ("Serbia: prope Kruševac, leg. Pančić (sub *A. variegato*), in Herb. Pal. Vindob."). In the same paper Beck points out that the newly described taxon is vicarious to the Transylvanian *A. toxicum* Reichenb. and *A. schurii* G. Beck. Later, Beck (1906) considers all three taxa as belonging to the flora of Bosnia, and he downgrades *A. bosniacum* and *A. schurii* to varieties of *A. toxicum*.

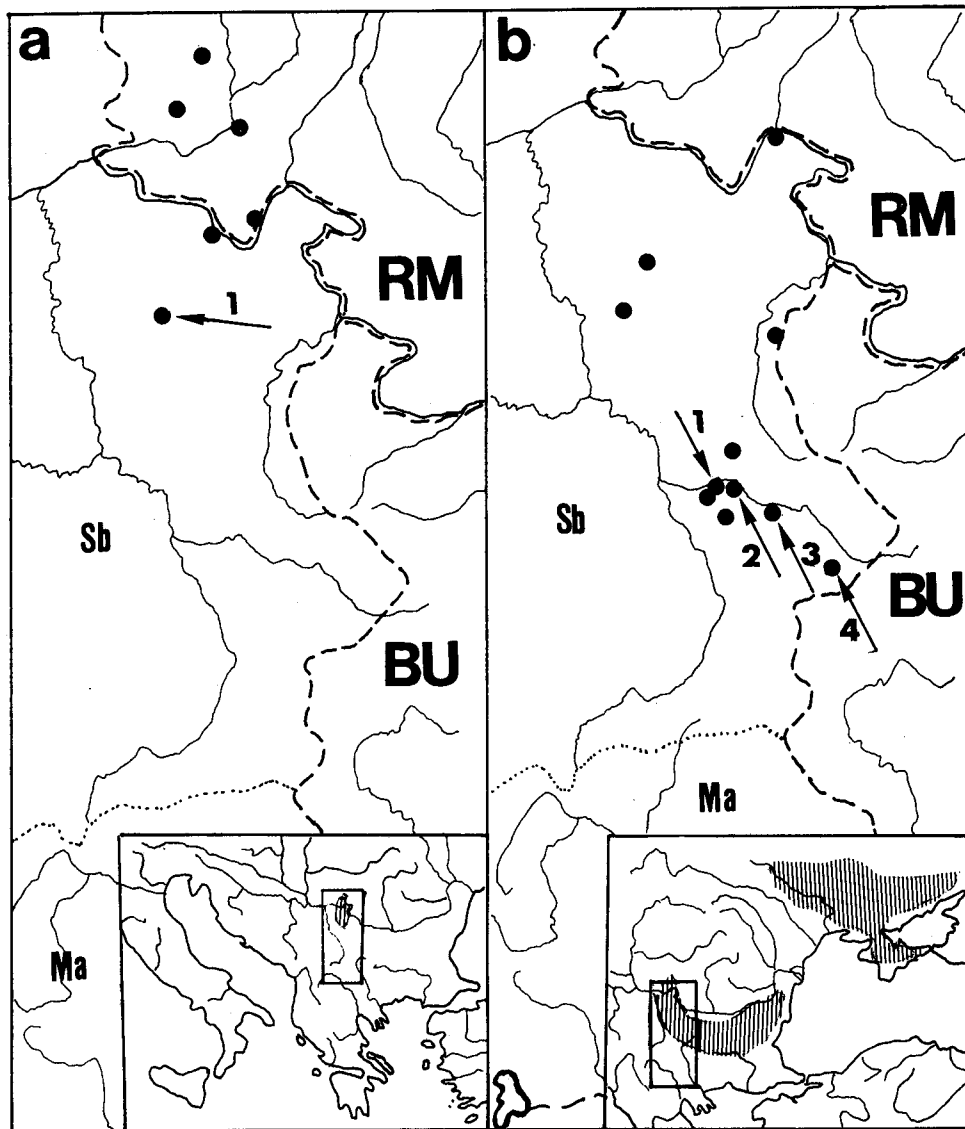


Fig. 2. a: Total distribution of *Ranunculus flabellifolius* Heuffel; b: Distribution of *Parietaria serbica* Pančić in E Yugoslavia (Serbia).

A. toxicum is an Illyrian-Carpathian element and is one of the sibling species of the *A. variegatum* complex. Bearing in mind Pančić's (1874) indication of *A. variegatum* from Mt. Kopaonik (Samokovska reka), it is reasonable to assume that the Serbian specimen of Panic quoted by Beck was in fact collected in the Kopaonik area and indeed belongs to *A. toxicum* var. *bosniacum*. Our new findings reported above supported that assumption. Our localities of *A. toxicum* var. *bosniacum* are the easternmost occurrences of *A. toxicum* in the Balkan part of its area (Fig. 3a).

Ranunculus flabellifolius Heuffel ex Reichenb.

NE Serbia: (1.) Žagubica, Gornjačka klisura gorge, beech forest, 4.1986, *Stevanović & Matić* (BEOU).

R. flabellifolius belongs to the *R. auricomus* aggregate which, in a taxonomic sense, is not yet properly understood. For a long time this species had only been known from the mountains of the Banat in SW Romania (Săvulescu 1952-1973). The first discovery of this species on the territory of Yugoslavia, in the locality Pesaca, between the village Bosman and Boljetin in the Derdap gorge in SE Serbia, was reported by Diklić (1974).

Our finding the species in the Gornjačka klisura, the southern and western limits of the area of *R. flabellifolius* (Fig. 2a) have shifted substantially. Its total range now extends from the southwestern parts of the Carpathians in the Banat region of Romania to the mountains of SE Serbia. It is therefore more correct to consider *R. flabellifolius* an eastern Pannonian to western Mesian floristic element rather than a mere Pannonian element, as Gajić (1980) would have it.

Malcolmia orsiniana (Ten.) Ten. subsp. *serbica* (Pančić) Greuter & Burdet

NE Serbia: (1.) Canyon of the Lazareva reka, near the village Zlot, N exposed limestone rocks, 7.1986, *Lakušić & Niketić* (BEOU). SE Serbia: (2.) gorge of the river Visocica, near the village Paklestica, N exposed mouth of a limestone semi-cave, c. 850 m, 5.1987, *Stevanović & Niketić* (BEO). SW Serbia (Kosovo): (3.) Mt. Ošljak, above the city of Prizren S exposed limestone screes, c. 1400 m, 8.1987, *Niketić* (BEO); (4.) Sar planina, near the village Brod, limestone screes under the nest of the golden eagle, c. 1500 m, 6.1985, *Stevanović* (BEOU).

M. serbica Pančić (1874) was first described from Mt. Tupižnica in SE Serbia. The taxonomic status of this taxon has been differently interpreted in the literature (Adamović, 1908; Hayek, 1924-1933; Ball in Tutin & al. 1964-1980). Only recently has it been established that it belongs to the Apennine-Balkan chasmophytic species *M. orsiniana* (Ten.) Ten. with the status of a subspecies, subsp. *serbica* (Pančić) Greuter & Burdet, presenting transitional features between the typical Apennine-Balkan subsp. *orsiniana* and the Greek subsp. *angulifolia* (Boiss. & Orph.) A. Stork (Stork 1972, Greuter & al. 1986). *M. orsiniana* subsp. *serbica* has a western Mesian-Scardo-Pindian distribution.

The newly discovered locality in the canyon of the Lazareva reka near Zlot in SE Serbia represents the northernmost and the most continental point of the area of this taxon (Fig. 4b). Our field observations have shown that it inhabits nitrophylous limestone habitats such as the mouths of caves or semi-caves and the foot of cliffs where organic matter accumulates, either through the water trickling down along the rocks or due to a strong

zoogenic influence by, e.g. sheep seeking shelter under the rocks.

***Potentilla visianii* Pančić**

NW Macedonia: (1.) Gorge of the river Vardar, near the village Raduša, c. 15 km NW of Skopje, rocky serpentine slopes, c. 500 m, 7.1988, *Stevanović & Niketić* (BEO).
C Serbia: (2.) Mt. Kopaonik, E exposed rocky serpentine slopes near the village Vljakovci in the valley of the Brzecka reka, 6.1985, *Stevanović & Niketić* (BEOU).

P. visianii is one of the typical serpentinophytes of the central Balkan flora. Its area is characterized by a series of microdisjunctions conditioned by the presence of serpentine massifs, even though in at least one part of its area (Mt. Pastrik, on the Albanian-Yugoslav border) it inhabits limestone habitats as well. The largest number of occurrences is in the serpentine areas of W and SW Serbia, with just some outports in W Bosnia and NE Albania.

By our new findings in NW Macedonia, we have expanded southwardly and also eastwardly, the known distributional range of *P. visianii*; the findings on the eastern slopes of Mt. Kopaonik are on the eastern border of the central part of the area of this species (Fig. 4a).

***Kitaibelia vitifolia* Willd.**

NE Montenegro: (1.) Ivangrad, gorge of the Kaludarska reka, above Ostri Krs, at the margin of a mixed oak forest, c. 750 m, 8.1987, *D. Lakušić & R. Lakušić* (BEOU).

K. vitifolia is one of the two species of the E Mediterranean relict genus *Kitaibelia*, which is limited to the Balkan Peninsula and to Asia Minor where it is represented by *K. balansae* Boiss. (Cullen, in Davis 1967). *K. vitifolia* is endemic to Yugoslavia (Fig. 5). A large number of published data on the distribution of *K. vitifolia* exists (Beck 1906, Hirc 1903, Čerevcki 1959, Micevski & Drenkovski 1968, Stjepanović-Veselić in Josifović 1970-1976, Obradović & Pal 1987, Šilić 1984).

The main occurrences of *K. vitifolia* are in valleys and gorges which are known to be major refugia of Tertiary plant species in the Balkan Peninsula. Its habitats, however, are mostly man-made, such as roadsides, dikes, orchards, vineyards, low scrub and the margins of degraded forests, which indicates that curiously the occurrence of *K. vitifolia* is anthropogenic to a large extent. *K. vitifolia* can therefore be considered as an element of the Tertiary flora which has adapted itself to anthropogenic habitats and which today is actively spreading along the river valleys in which it occurs.

The finding of *K. vitifolia* near Ivangrad, its first proven occurrence on the territory of Montenegro, is probably a recent stepping-stone on the way of this general spread.

K. vitifolia has been considered as a southeastern-eastern Illyrian endemic floristic element (Gajić 1980). However, considering its wide distribution on the Balkan Peninsula, in our opinion, it should better be placed in the central Balkan endemic element.

***Athamanta hungarica* Borbas**

NE Serbia: (1.) Žagubica, Gornjačka klisura, limestone rocks, 5.1989, *Mišić*

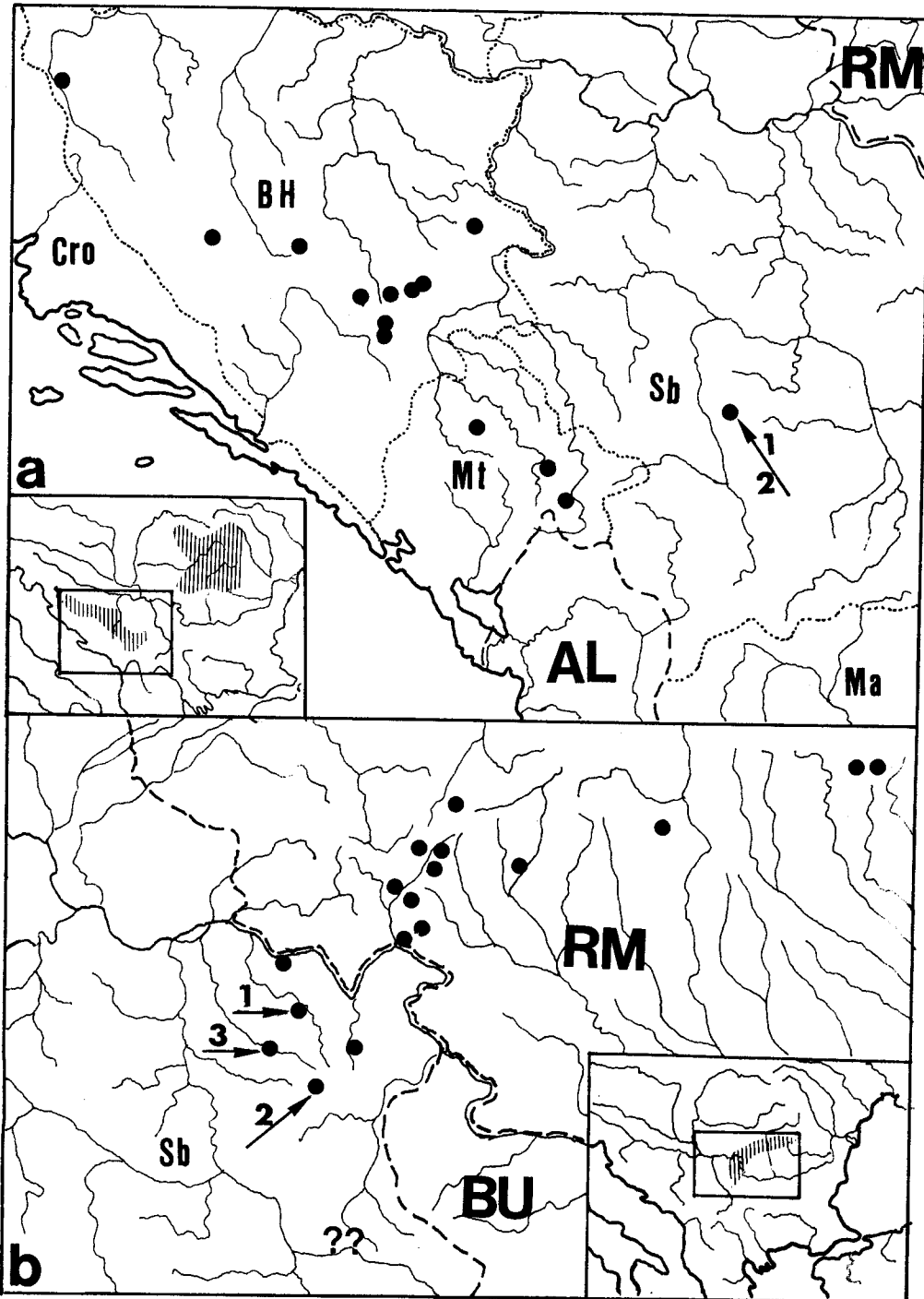


Fig. 3. a: Distribution of *Aconitum toxicum* Reichenb. on the Balkan Peninsula; b: Total distribution of *Athamanta hungarica* Borbas.

(BEOU); (2.) Zlot, 1932, *Weber* (BEOU); Zlot, canyon of the Lazareva reka, N exposed limestone rocks, 7.1985, *Stevanović & Niketić* (BEOU); (3.) Petrovac na Mlavi, Ladna Voda, limestone rocks, 5.1951, *Lindner* (BEO, det. Nikolić).

Until recently, *A. hungarica* was only known from the Carpathians in Romania. First information on the occurrence of this species in Serbia were provided by Obradović (1981) who mentioned it from the northern branches of the Kučajska mountains in NE Serbia and from the cliffs above the city of Golubac in the Djerdap gorge. Our revision of herbarium material has brought to light that this species had been found much earlier in NE Serbia, by *Weber* (BEOU) and *Lindner* (BEO), but had been misidentified. In the older literature "*A. mathioli*" is furthermore indicated for two localities in SE Serbia, Ples near Nis and Uljkamen near Knjazevac (Pančić, 1874). Since we do not possess the material collected by Pančić in these localities, we can only suggest that it most probably also belongs to *A. hungarica**. Gajić (1985) reported "*A. haynaldii*" from limestone rocks of Majdanpečka Domena in NE Serbia; this record most likely refers to *A. hungarica* as well.

Due to all these findings the known area of *A. hungarica* now covers, besides the Carpathians, the mountains of E Serbia as well. We can therefore assign it to the south Carpathian-west Mesian floristic element. The occurrences of *A. hungarica* at Ladna Voda and near Zlot represent, respectively, the westernmost and southernmost definitely known locality of the species (Fig. 3b).

Melampyrum bihariense A. Kerner

NE Serbia: (1.) Zlot, canyon of the Lazareva reka, 7.1986, *Lakušić & Niketić* (BEOU); (2.) Majdanpek, Debeli lug, Spinj, Jabucji potok, in an oak forest, 7.1946, *Cernjavski* (BEO).

This Carpathian species plus *M. hoermannianum* K. Maly (Illyrian) and *M. doerfleri* Ronn. (Scardo-Pindian) form a complex of three sibling species. *M. bihariense* was known in Serbia, up to now, only in the region of Derdap, while indications for W Serbia (Pozega) refer to *M. hoermannianum*. Our new localities represent the southernmost points of the known area of the species (Fig. 6).

M. bihariense, in these localities, is mostly found in forests, siblijak and low scrub. It is represented by the autumnal ecotype, *f. romeri* Ronn., which is characterized by a much-branched habit. In the canyon of the Lazareva reka, however, the presence of typical forms has also been noted in open rocky communities (*Seslerietum filifoliae* Zolyomi).

Ramonda serbica Pancic

SE Serbia: (1.) between Bela Palanka and Pirot, near the village Čiflik, left bank of the river Nišava, N exposed limestone rocks in *Carpinus orientalis* forest, 5.1987, *Stevanović & Niketić* (BEO). NW Macedonia: (2.) Gostivar (SW slopes of Sar planina), gorge of the river Belica, near the village Orcusa, N exposed limestone rocks

* On our map (Fig. 3b) these localities are indicated by question marks.

in *Ostrya carpinifolia* forest, 5.1989, V. Stevanović, Niketić & B. Stevanović (BEO).
 SE Montenegro: (3.) Biocce, canyon of the Mala Mijeka below the village Klopoti
 (Bratonožići), N exposed limestone rocks, c. 180 m, 5.1989, Stevanović & Bulić
 (BEOU).

Our new findings of *R. serbica* are situated close to the border of its Yugoslav area. The
 locality between Bela Palanka and Pirot is the easternmost in Yugoslavia, lying about 30

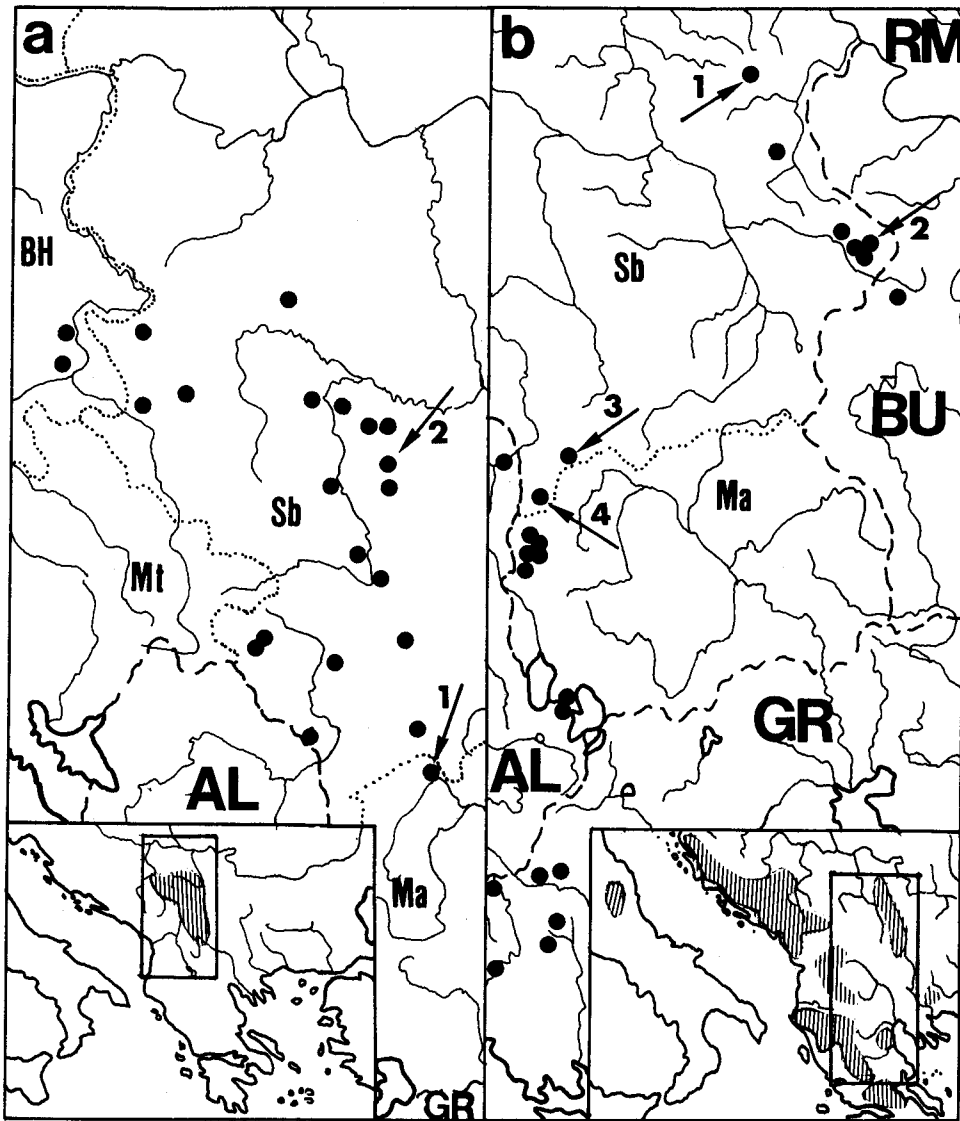


Fig. 4. a: Total distribution of *Malcolmia orsiniana* (Ten.) Ten. subsp. *serbica* (Pančić) Greuter & Burdet in E Yugoslavia (Serbia, Macedonia).

km away from the closest known occurrence in the Sićevačka klisura.

The locality in the gorge of the river Belica, on the SW slopes of the Sar planina, is the last of a series of newly discovered ones in the basin of the river Vardar (Aegean river system) and, at the same time, it is the northernmost finding in Macedonia. The distribution of *R. serbica* in the Aegean river system in Macedonia has been discussed in a particular paper (Stevanović & al. 1986). The assumption that *R. serbica* occurs in the canyons of the river Morača and of its tributaries in Montenegro have been confirmed by its finding in the canyon of the Mala rijeka, a tributary of the Morača (Fig. 7).

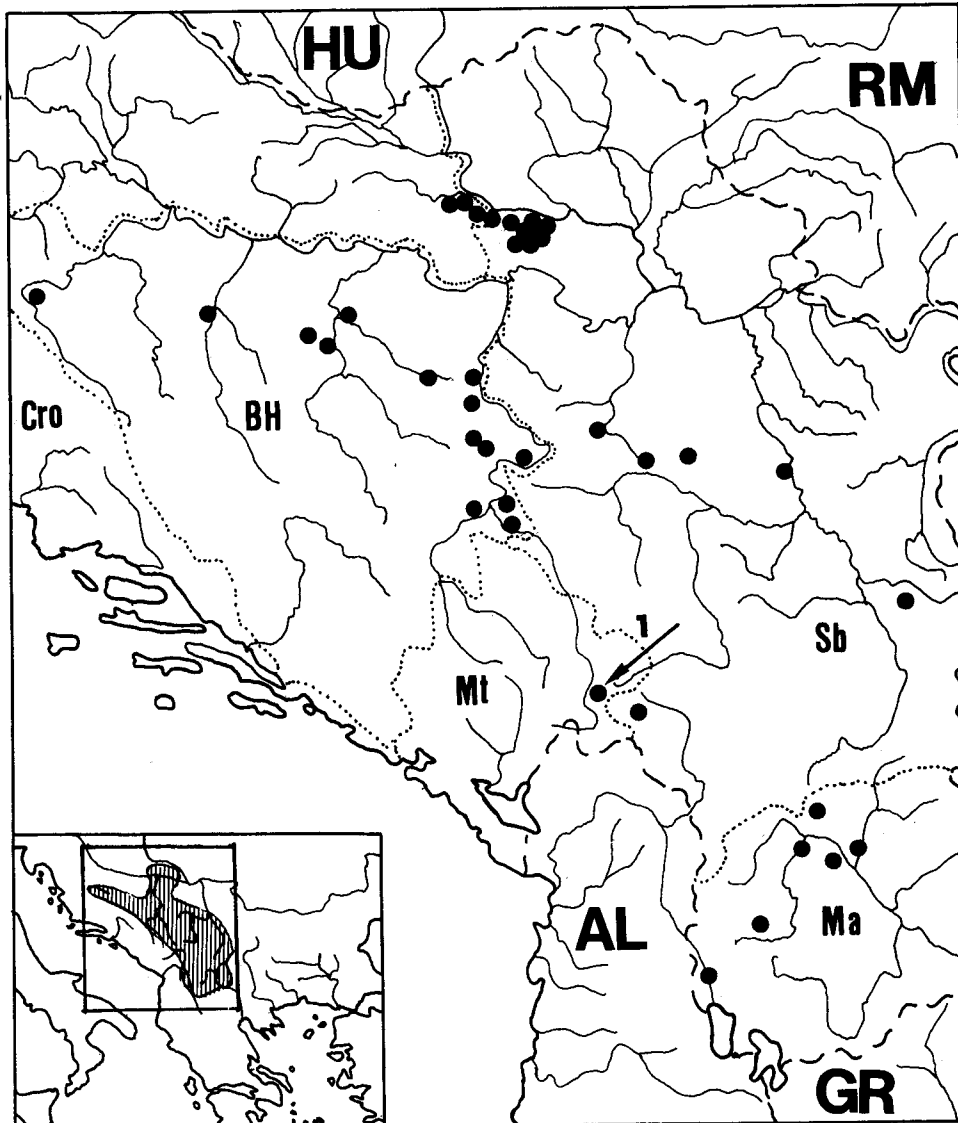


Fig. 5. Total distribution of *Kitaibelia vitifolia* Willd.

Cirsium waldsteinii Rouy

C Serbia: (1.) Mt. Kopaonik, gorge of the Brzecka reka, spruce forest on limestone, c. 750 m, 8.1986, *Niketić & Lakusić* (BEOU).

C. waldsteinii belongs to the central-south European montane element. Most often it is found in moist habitats in the montane and subalpine broadleaved-and-conifer or pure conifer forests.

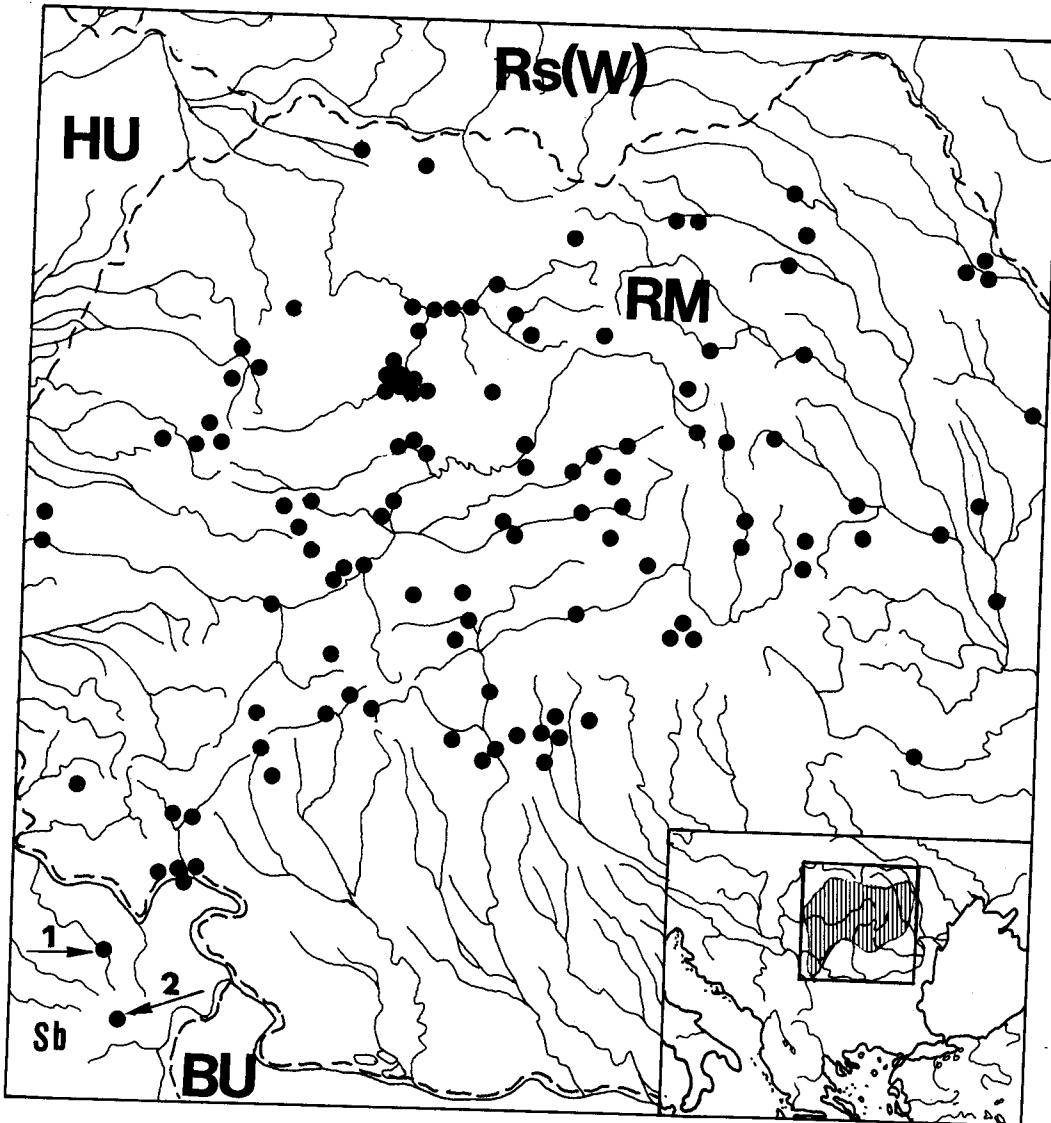


Fig. 6. Total distribution of *Melampyrum bighariense* A. Kerner.

The area of the species comprises the eastern Alps, the central and southern Carpathians, and the Dinaric Alps, where its southern limit extends to the source of the river Tara in Montenegro and where its easternmost known locality was on Mt. Golija in W Serbia.

Our new find of *C. waldsteinii* on Mt. Kopaonik extends eastwardly the Yugoslav part of its range (Fig. 8b).

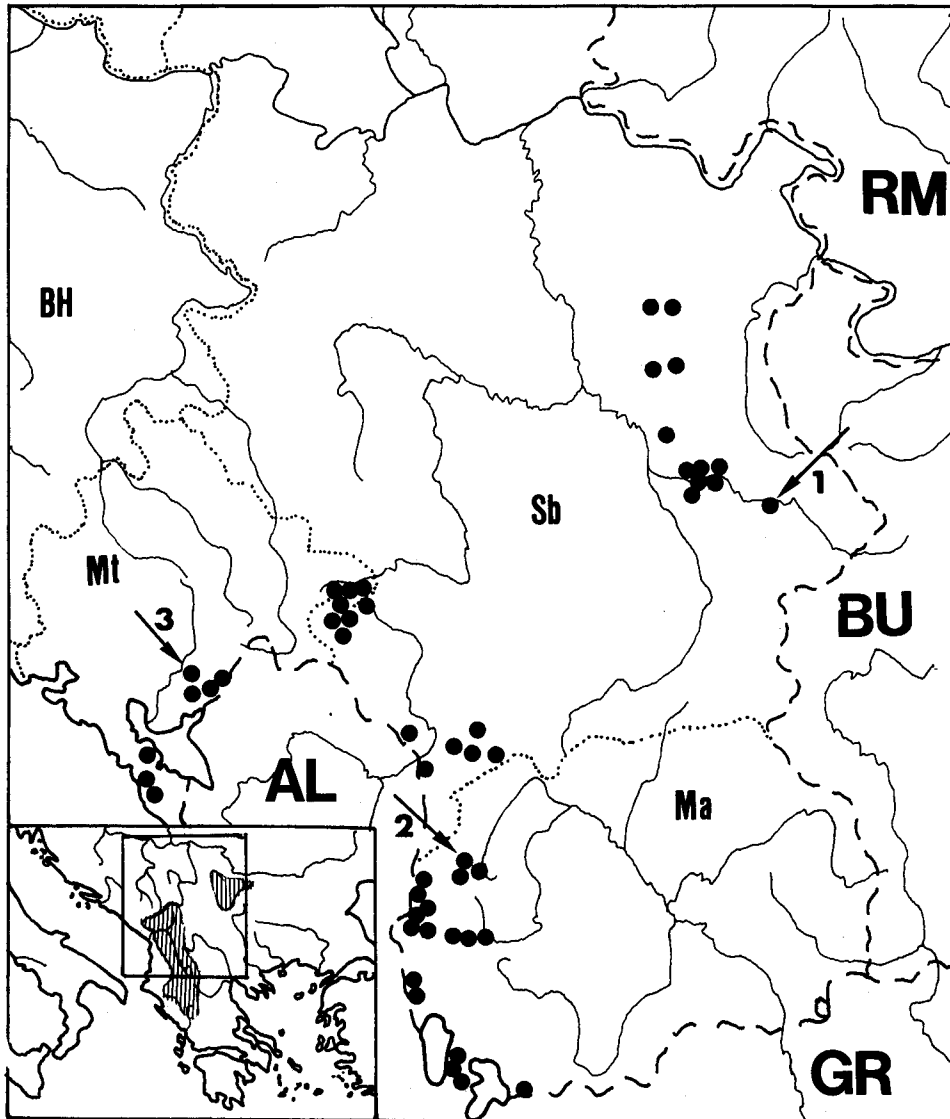


Fig. 7. Distribution of *Ramonda serbica* Pančić in Yugoslavia (Serbia, Macedonia, Montenegro).

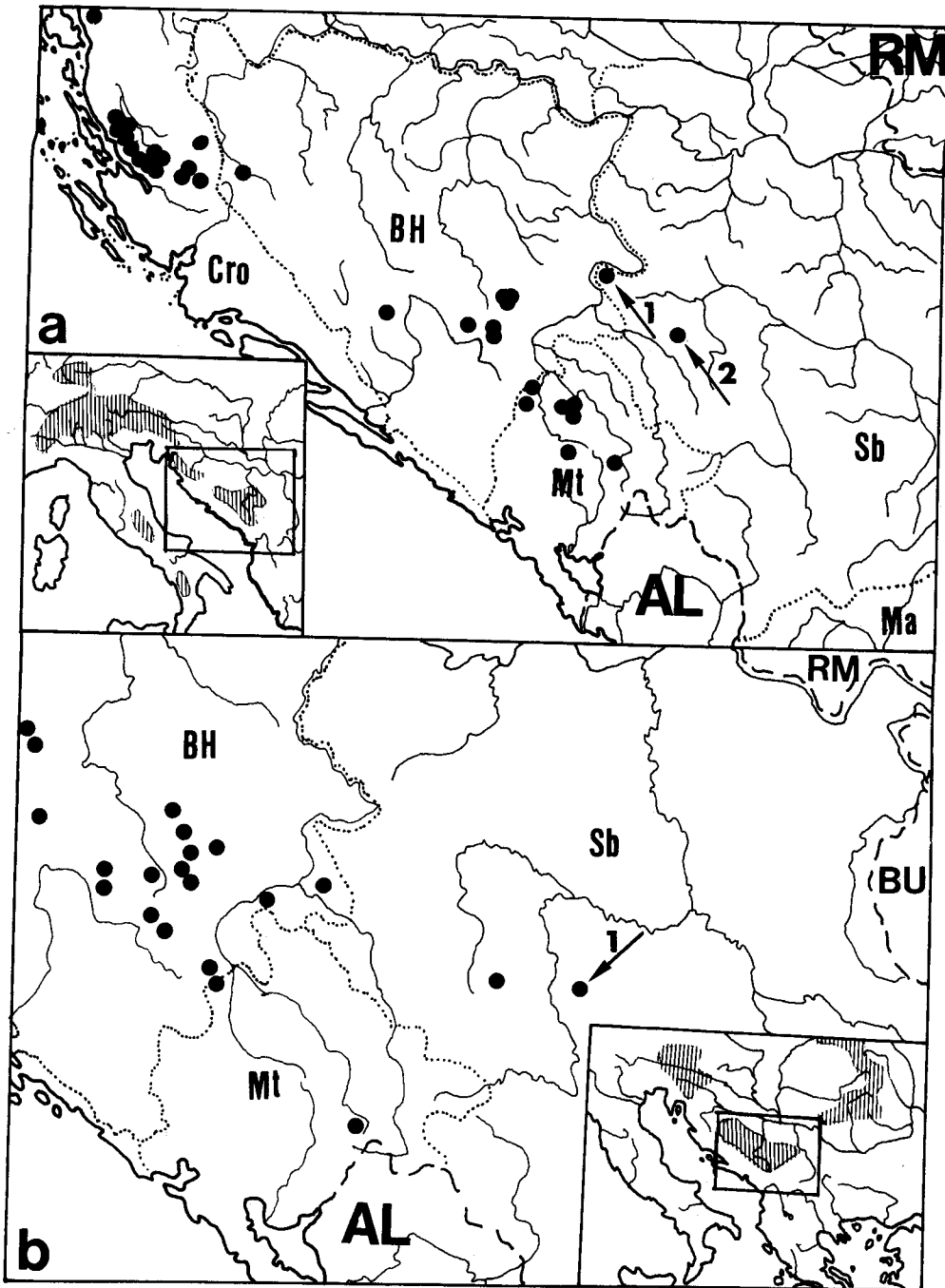


Fig. 8. a: Distribution of *Hieracium humile* Jacq. on the Balkan Peninsula; b: Distribution of *Cirsium waldsteinii* Rouy on the Balkan Peninsula.

Tragopogon pterodes Pančić

NE Serbia: (1.) Soko Banja, Mt. Ozren, Leskovik, rocky limestone ground, 5.1985, *Niketić* (BEO); (2.) Soko Banja, near the village Vrelo, rocky limestone ground, 5.1985, *Niketić* (BEO). E Serbia: (3.) Knjaževac, Niševac, Mt. Ropalj, rocky limestone ground, 5.1986, *Niketić* (BEO); (4.) gorge of the river Svrliški Timok, 5.1986, *Niketić* (BEO). SE Serbia: (5.) Pirot, Obrenovac, Kamenica, *Jurišić*

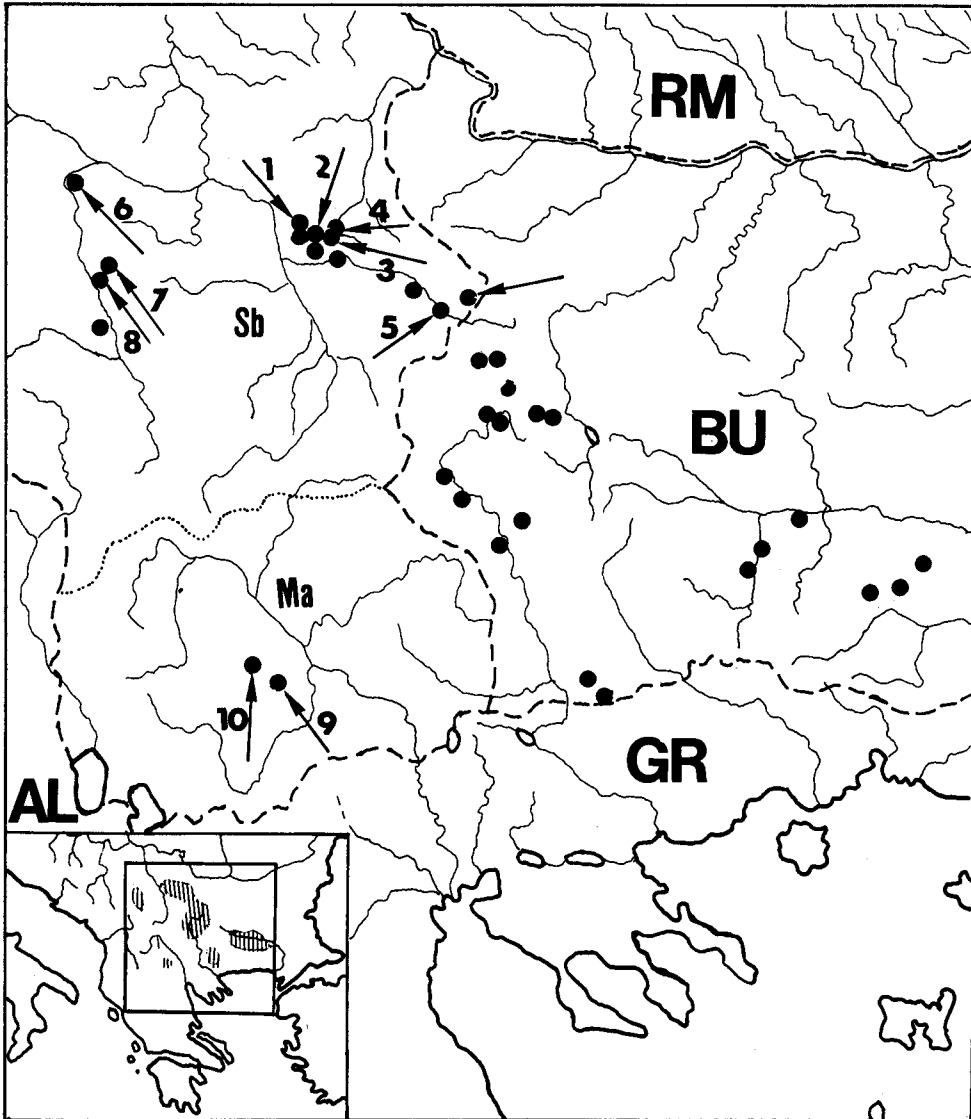


Fig. 9. Total distribution of *Tragopogon pterodes* Pančić.

(manuscr.). C Serbia: (6.) Mt. Stolovi, rocky serpentine slopes near the tower Maglič, 4.1989, *Stevanović, Lakušić & Jovanović* (BEOU); (7.) Mt. Kopaonik, Cajetinsko brdo, rocky serpentine slopes, c. 1300 m, 8.1986, *Lakušić & Niketić* (BEOU). (8.) Mt. Kopaonik, Brus, serpentine gorge of the Brzecka reka, near the village Vlajkovci, 6.1985, *Stevanović & Niketić* (BEO). C Macedonia: (9.) Prilep, Mt. Kozjak, Pletvar pass, rocky marble slopes, c. 950 m, 6.1921, *Soška* (BEOU), 8.1986, *Stevanović, Niketić & Lakušić* (BEO); (10.) Prilep, between Mt. Sivec and Mt. Babuna, 5.1922, *Simonović* (BEOU).

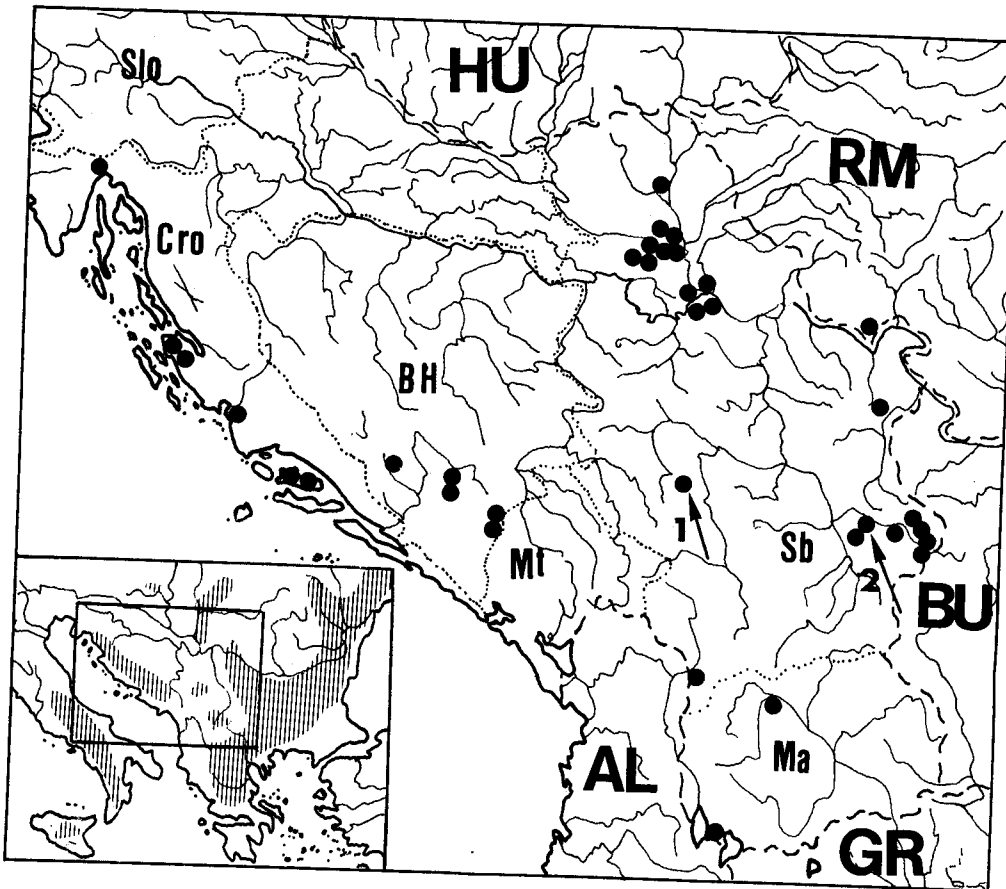


Fig. 10. Distribution of *Sternbergia colchiciflora* Waldst. & Kit. in Yugoslavia.

This very rare Mesian relict species mostly inhabits dry, rocky limestone ground in E Serbia and W Bulgaria. In this part of the Balkan Peninsula the habitats of *T. pterodes* are in phytocoenological sense basically homogenous. In the serpentine massifs of C Serbia, this species has been found by us on the eastern slopes of Mt. Kopaonik and Mt. Stolovi. The only previous information on the presence of *T. pterodes* on serpentine was that by Pavlović (1962) for the region south of Mt. Kopaonik, near Banjska. The newly discovered localities on the serpentine slopes of Mt. Kopaonik and Mt. Stolovi lie on the

western border of the area of *T. pterodes*; that on Mt. Stolovi represents its northernmost point of its occurrence (Fig. 9).

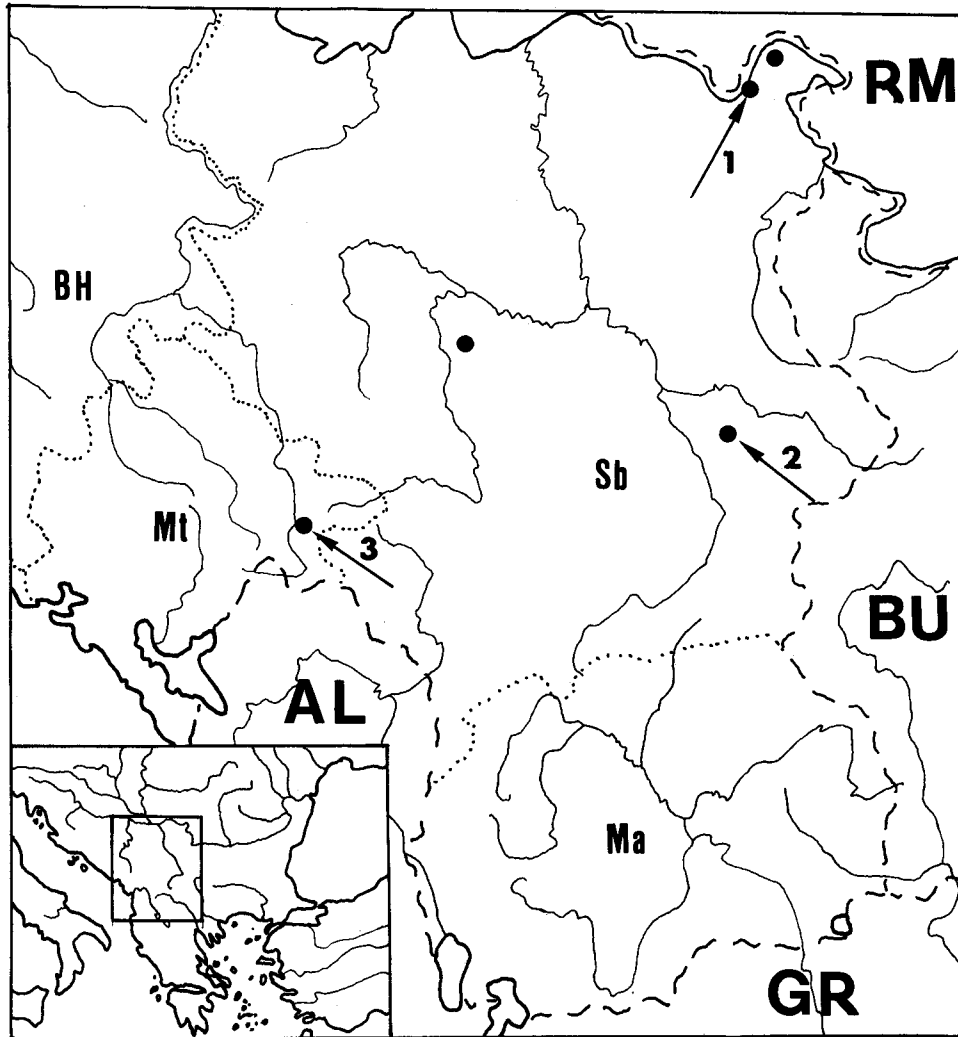


Fig. 11. Distribution of *Carex transsilvanica* Schur in Yugoslavia.

An isolated exclave of the area has been found in C Macedonia. Hayek (1924-1933) indicates *T. pterodes* for "Macedonia", but this record may just as well concern Bulgarian Macedonia, where the species also occurs (Kuzmanov et al. 1972). In the Belgrade University Herbarium (BEOU) we came across material from the surroundings of Prilep, collected by Simonović in 1922 and by Soška in 1921, and these findings were confirmed by our own. In this area *T. pterodes* grows on marble substratum together with the endemic relict species *Viola herzogii* (W. Becker) Bornm., *Stachys iva* Griseb., *Matthiola thessala* Boiss. & Orph., *Erodium absinthoides* Willd., etc.

Hieracium humile Jacq. subsp. *brachycaule* (Vukot.) Zahn

W Serbia: (1.) Mt. Tara, gorge of the river Beli Rzav, near the village Kršanje, limestone screes, c. 500 m, 5.1989, *Niketić* (BEO); (2.) Ivanjica, Mt. Mučanj, N exposed limestone rocks, c. 1500 m, 7.1989, *Stanic & Lakušić* (BEOU).

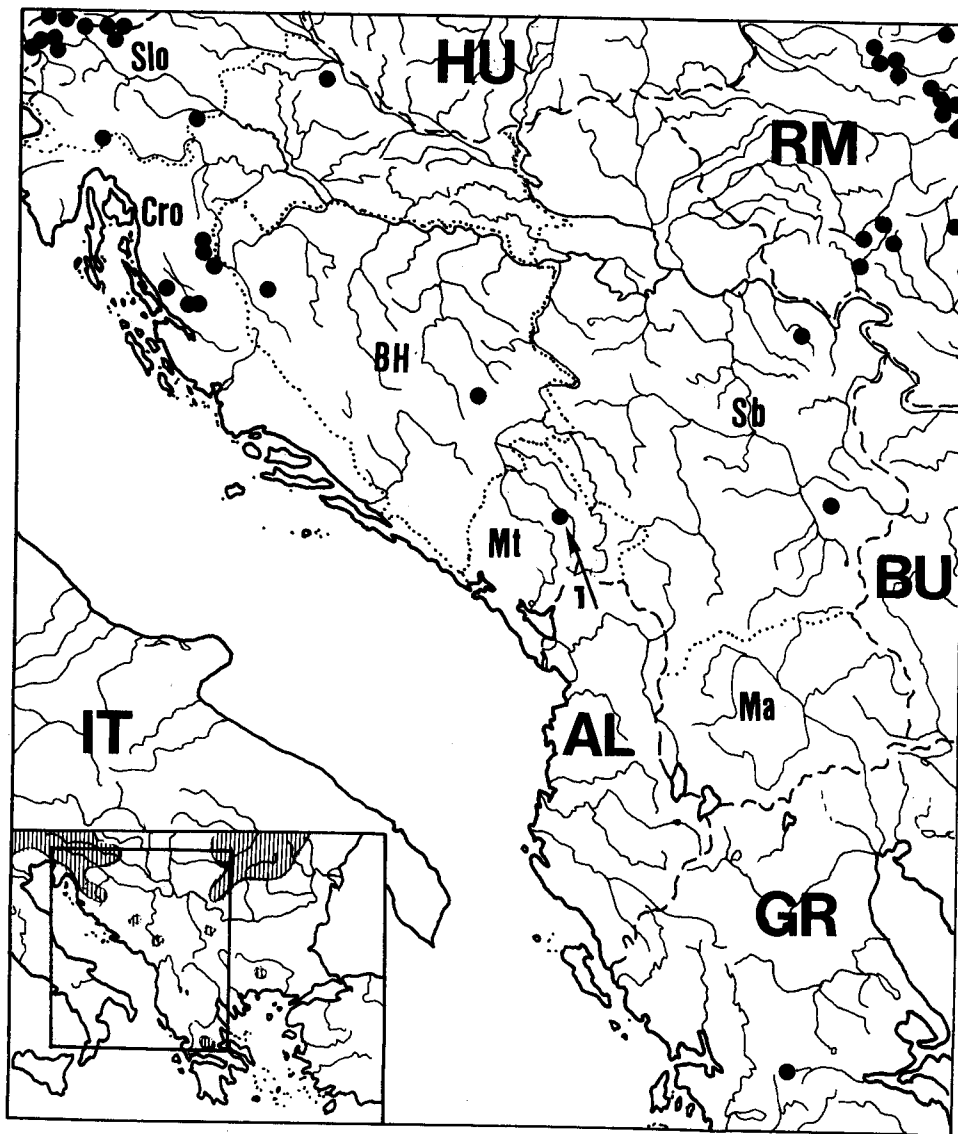


Fig. 12. Distribution of *Cyripedium calceolus* L. in Yugoslavia.

The area of this species includes the mountains of SW Europe and the Alps, from where it extends eastward all the way to the eastern Dinaric Alps. By our finding the species on

Mt. Tara and Mt. Mucanj, the first records from Serbia, this area has been extended somewhat further to the east (Fig. 8a). Our specimens fit the west-Balkan subsp. *brachycaule* (Vukopt.) Zahn.

Sternbergia colchiciflora Waldst. & Kit.

C Serbia: (1.) Mt. Cemerno, limestone slopes with steppe fragments near the St.

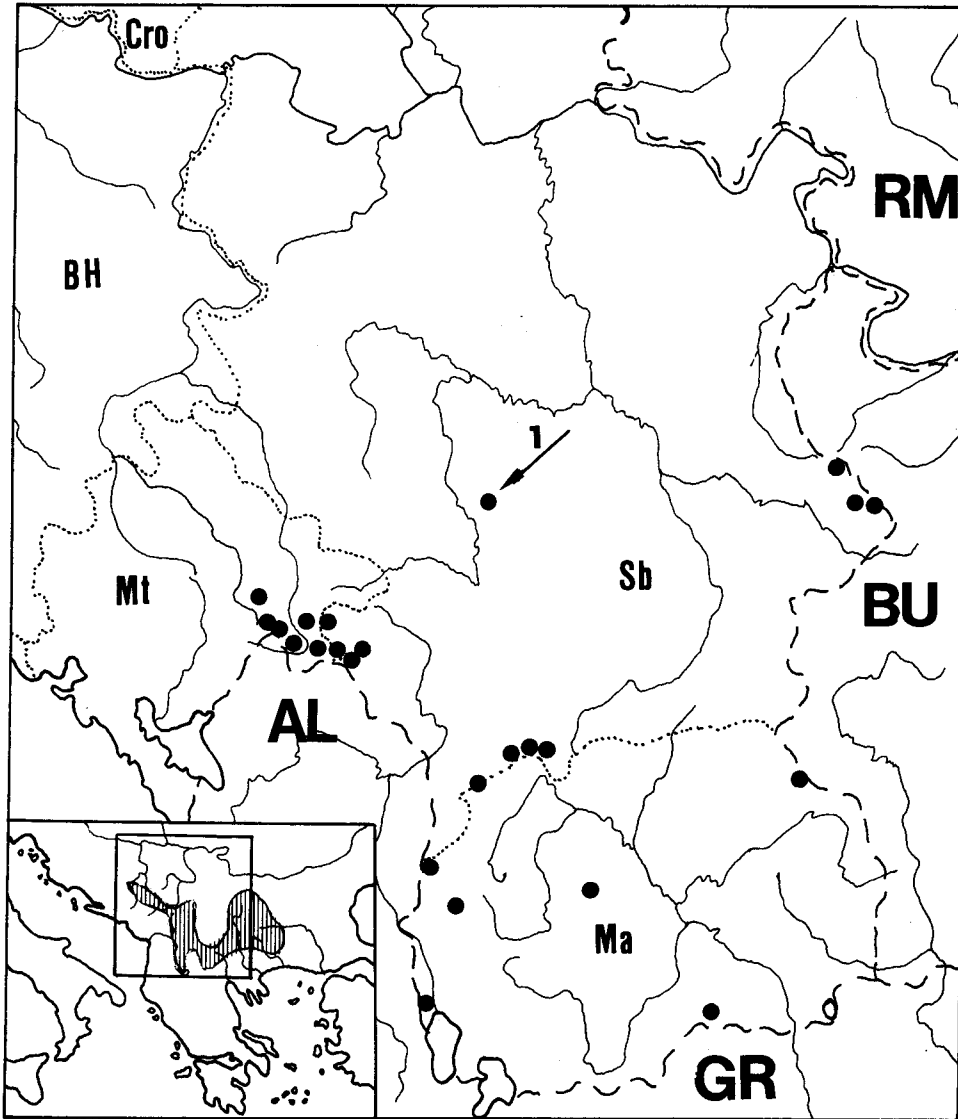


Fig. 13. Distribution of *Pseudorchis friwaldii* (Hampe) P. F. Hunt on the Balkan Peninsula.

Sava branch of the Studenica monastery, c. 800 m, 10.1988, *Stevanović* (BEOU). SE Serbia: (2.) Bela Palanka, Kurilovo hill, rocky limestone ground, steppe vegetation with dominance of *Dichanthium ischaemum*, c. 250 m, 10.1988, *Niketic* (BEO).

The distribution of this xerothermic relict extends throughout the Pontic and Mediterranean region. Several authors have discussed in detail its distribution in some parts of the Balkan Peninsula (Šilić 1966, 1972-1973, Micevski 1970, Atelari & Kamari 1989). It occurs in two disjunct areas in the Balkan Peninsula: in its sub-Mediterranean part from the Adriatic coast (var. *dalmatica* Reichenb.) to the mountains of Greece, and in the western Pontic (Pannonian) region, in the Vlaška depression, E Serbia and Macedonia (Fig. 10).

Our new finding on Mt. Čemerno in W Serbia lies half-way between the disjunct Pontic and sub-Mediterranean partial areas. Specimens from this locality, as well as those collected in E Serbia near Bela Palanka, match the typical variety from the Pontic sub-area.

Carex transsilvanica Schur.

NE Serbia: (1.) Djerdap gorge, Petska bara above the locality of Ploča, c. 500 m, 4.1967, *Dinić* (BEO). SE Serbia: (2.) Suva planina, Mosor, c. 650 m, *Stevanović & Lakusić* (BEOU). NE Montenegro: (3.) Ivograd, gorge of the Kaludaška reka, slopes of the hill Rašće close to the village Donja Ržanica, rocky limestone ground, c. 750 m, 4.1989, *Lakušić* (BEOU).

In a chorological, but also in a taxonomic and ecological sense, *C. transsilvanica* presents an unsolved problem. Published data on its distribution are contradictory. Chater (in Tutin & al. 1964-1980) gives *C. depressa* subsp. *transsilvanica* (Schur.) Egorova for SE Europe and the Carpathians only, while Jovanović-Dunjić (in Josifović & al. 1970-1976) indicates *C. transsilvanica* for NW and C Europe and for N Africa, and Gajić (1980) assigns it to the central European floristic element. According to Hayek (1924-1933) *C. transsilvanica* on the Balkan Peninsula is limited to Serbia and Thracia. A review of the literature has shown that *C. transsilvanica* was only known in Serbia from rocky serpentine ground on Mt. Stolovi in C Serbia and from a locality in the Djerdap gorge above Tekija (Pančić 1874). It had also been found in the same area by Dinić (BEO). The Djerdap gorge localities, Pančić's in C Serbia, and our own, new ones in SE Serbia in NW Montenegro (Fig. 11), are all far apart. It is possible that *C. transsilvanica* is more widely distributed in this part of the Balkan Peninsula but has been overlooked or confused with other species. Further field work as well as the revision of the extent herbarium material of, in particular, *C. humilis* and *C. halleriana* (for both of whom *C. transsilvanica* can easily be mistaken at some stage of its life cycle) are necessary to test this assumption.

Cypripedium calceolus L.

NW Montenegro: (1.) Mojkovac, canyon of the river Tara near the village Dobrilovina (Durmitor National Park — Natural Reserve Crne Pode) in black pine forest, on fixed and overgrown limestone screes, 6.1985, *Stevanović* (BEOU).

The sporadic, refugial occurrences of this subboreal Eurasian species in the mountains

of the Balkan Peninsula are among its southernmost localities. Even though Hayek (1924-1933), indicates its presence in a large number of Balkan areas, it actually occurs only in a few of them. The largest number of its localities are in W Yugoslavia, in Slovenia and Croatia. Towards the centre and east of the Balkans, the area becomes irregularly disjunct, with a widely isolated outpost in Bulgaria and a single unconfirmed record for Greece. Fukarek (1978) placed the eastern border of the Balkan area of *C. calceolus* west of the river Una in Bosnia.

A first report on the occurrence of *C. calceolus* in E Serbia, on the Suva planina near Nis, was given by Niketić (1985). It was also found on Majdanpek near Žagubica (Sigunov, oral communication). Our new find in the canyon of the river Tara is the first record of the presence of this species on the territory of Montenegro (Fig. 12). The indications of Hayek (1924-1933) of *C. calceolus* for Serbia and Montenegro are thereby confirmed, whereas its occurrence in Macedonia is still doubtful.

Pseudorchis friwaldii (Hampe ex Griseb.) P.F. Hunt

C Serbia: (1) Mt. Kopaonik, Pajino preslo, peat-bog (Carici-Sphagno-Eriophoretum R. Jov. — Dunj.), on granitic bedrock, c. 1700 m, 7.1987, *Lakušić* (BEOU).

P. friwaldii is a Tertiary orophyte of Carpathian-Balkan distribution. On the Balkan Peninsula it primarily occurs on high mountains of the north-east where it grows in peat-bogs on siliceous substratum (Stojanov & Stevanov 1948, *Lakušić* & Grgic 1971, Stevanović & Janković 1984, Jovanović et al. 1987).

It also appears in snow bed vegetation on limestone on some Dinaric mountains (*Lakušić* & Grgic 1971).

In Yugoslavia *P. friwaldii* occurs sporadically on the mountains of Montenegro, Macedonia, E and SW Serbia (Kosovo). We have nearby established its presence in C Serbia, on Mt. Kopaonik (Fig. 13).

Conclusion

During our floristic investigations in Serbia, Macedonia and Montenegro, between 1985 and 1989, we have collected a very abundant herbarium material and have gathered numerous chorological data. A small portion of these data is here presented, concentrating on new floristic records and complementary distributional data for a selection of species.

Our results can be summarized as follows:

- Species new for the flora of Montenegro:
Kitaibelia vitifolia, *Carex transsilvanica* and *Cypripedium calceolus*.
- Species new for the flora of Serbia:
Aconitum toxicum (var. *bosniacum*), *Hieracium humile*.
- Species new for the flora of Macedonia:
Potentilla visianii.
- New northernmost localities for *Pseudorchis friwaldii* (Balkan Peninsula) and for

Tragopogon pterodes and *Malcolmia orsiniana* subsp. *serbica* (total area).

- New southernmost localities for *Melampyrum bihariense*, *Ranunculus flabellifolius*, *Athamanta hungarica*, *Potentilla visianii*, and *Carex transsilvanica*.
- New westernmost localities for *Carex transsilvanica*, *Ranunculus flabellifolius*, *Athamanta hungarica* and *Tragopogon pterodes*.
- New easternmost Balkan localities for *Aconitum toxicum* var. *bosniacum*, *Cirsium waldsteinii*, *Hieracium humile* and *Potentilla visianii*.

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