V. Stevanović, K. Tan & A. Petrova

Mapping the endemic flora of the Balkans - a progress report

Abstract

Stevanović, V., Tan, K., Petrova, A.: Mapping the endemic flora of the Balkans - a progress report. — Bocconea 21: 131-137. 2007. — ISSN 1120-4060.

The distribution of Balkan endemics is mapped using similar 50×50 km UTM squares as adopted in the Atlas Florae Europaeae project. Approximately 1660 taxa at species and subspecies rank out of an estimated 2670 taxa or c. 60% of the total endemic Balkans flora, has already been mapped. The following families contribute most in terms of species number: *Caryophyllaceae* (293), *Cruciferae* (161), *Scrophulariaceae* (136), *Liliaceae* (119), *Campanulaceae* (111), *Boraginaceae* (81), *Ranunculaceae* (62), *Violaceae* (59), *Rosaceae* (49), *Dipsacaceae* (45) and *Iridaceae* (36). In addition, c. 30 smaller families as well as certain large genera that may be mentioned as the most prominent, are included: *Verbascum* (67), *Asperula* (44), *Scutellaria* and *Micromeria* (13 each), *Satureja*, *Nepeta* and *Saxifraga* (12 each) and *Pedicularis* (11).

Introduction

The project: Mapping the endemic flora of the Balkans, was initiated only two years ago. It is based on distribution data collected and mapped using similar 50×50 km UTM squares as adopted in the Atlas Florae Europaeae project coordinated at Helsinki. For the grid system applied and grid cell names see Kurtto & al. (2005). A large database has been built up and presently caters for more than 2670 taxa at species and subspecies rank. Part of this work was completed (maps and distribution data for 1100 taxa) and presented at the Third International Balkan Botanical Congress (Stevanović & al. 2003). That output includes the following families which in terms of numbers (in parentheses) contribute most to the endemic flora of the Balkans: *Caryophyllaceae* (293), *Cruciferae* (161), *Campanulaceae* (111), *Boraginaceae* (81), *Ranunculaceae* (62), *Violaceae* (59), *Rosaceae* (49), *Iridaceae* (36), c. 30 smaller families as well as certain genera of which *Verbascum* (67), *Asperula* (44), *Astragalus* (30), *Chamaecytisus* (13), *Scutellaria* and *Micromeria* (13 each), *Satureja*, *Nepeta* and *Saxifraga* (12 each) and *Pedicularis* (11), may be mentioned. Further work covers an additional 560 taxa from the following families: *Liliaceae* (119), *Plumbaginaceae* (45), *Hypericaceae* (22), *Linaceae* (24), *Euphorbiaceae* (18), *Fumariceae* (16), *Primulaceae* (13) as well as numerous small families that contribute less to the endemic flora of the Balkans. Thus both, from previous and present flora-mapping,

1660 taxa will be catered for, representing c. 60% of the endemic flora of the Balkans which is currently estimated as between 2600 and 2700 taxa. The real number would be known only after all Balkan floras are completed, because 20 years is a modest timescale for this to be achieved. Some on the completed or on-going floras and related works are: Hayek (1924-1933), Turrill (1929), Flora Europaea (1964-1980, 1993), Webb (1966), Flora na Narodna Republika Bălgarija (Jordanov 1963-1976; Jordanov & Kuzmanov 1979; Velčev & Kožuharov 1982; Velčev & Kuzmanov 1989; Kožuharov & Kuzmanov 1995), Mountain Flora of Greece (Strid 1986; Strid & Tan 1991), Flora Hellenica (Strid & Tan 1997, 2002), Flora SR Srbije (Josifović 1970-1976, 1977; Sarić & Diklić 1986), Flora Srbije (Sarić 1992), Flora Bosne i Hercegovine (Beck 1903-1921, 1927, Beck & Maly 1950, Bjelčić 1967-1983), Conspectus Florae Montenegrinae (Rohlena 1942), Flora na Republika Makedonija (Micevski 1983-2001), etc.

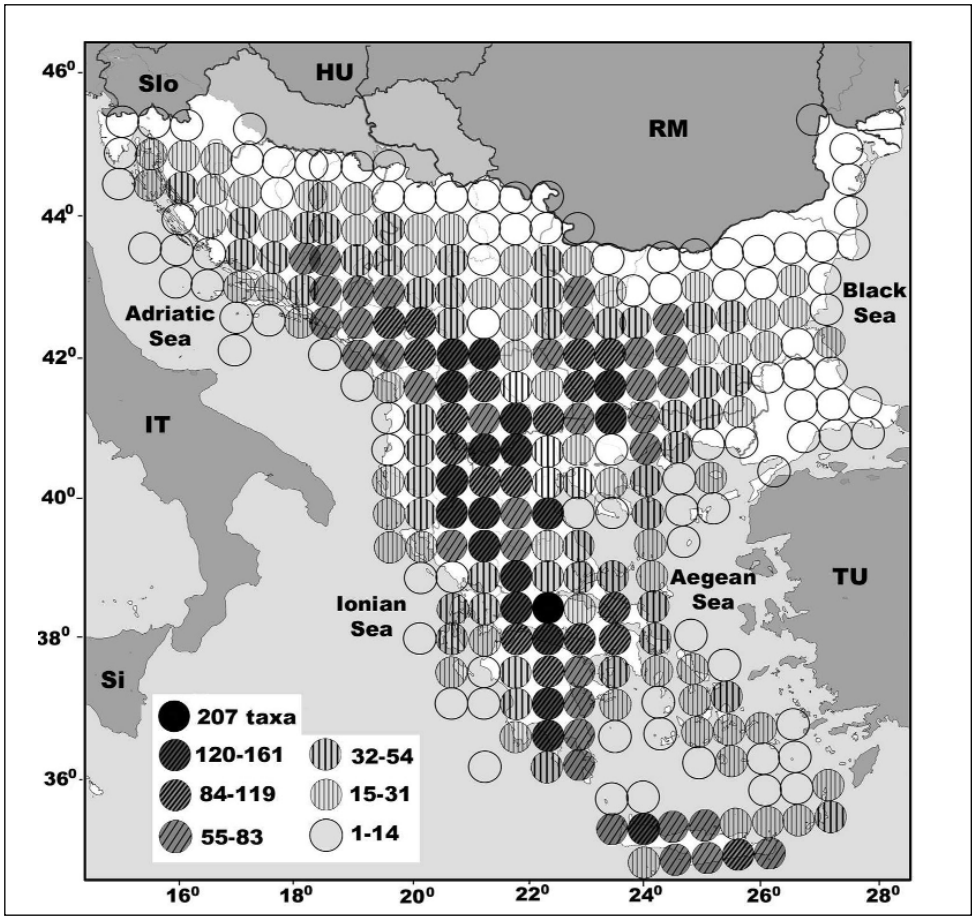

Fig. 1. Distribution of taxa per UTM square (map based on 1660 endemic taxa excl. *Compositae*, *Gramineae*, *Umbelliferae*, *Leguminosae* p.p. and *Labiatae* p.p.).

Can we determine centres of distribution or hot-spots of endemic flora in the Balkans based on a sample of 1660 endemic taxa?

Although mapping of the endemic flora is not yet complete, the data based on 1660 taxa already indicates the most important centres of endemic flora in the peninsula. From a broad global viewpoint the whole Balkan peninsula, except the very far north close to the Panonnian plain, may seem like "one great hot-spot of endemism in Europe". However, a detailed analysis of distribution of endemic taxa shows several regions distinctive by their extremely high endemism values (Fig. 1).

The regions distinctive by their extremely high endemism values

Kriti, particularly the high mountain regions of Mts Ida and Psiloritis, S Peloponnisos (regions of Mts Taygetos and Parnonas), N Peloponnisos (Mts Chelmos and Killini), the mountains of Sterea Ellas (Parnassos and Giona), Mts of S and N Pindhos, Olimbos, the mountains bordering FYR Macedonia and Greece (Pelister, Kajmakčalan, Voras, Tzena), Mts Šar-Planina and Korab (in FYR Macedonia, Serbia, Albania), Slavjanka (Ali Botusch) and Pirin Mts., Mt. Rila, almost the whole Rhodopea range, Mt. Prokletije and adjacent mountains in Montenegro (Komovi, Bjelasica) and N Albania (Hekurave, Parun) and N Montenegro (Durmitor).

In these listed areas of the Balkans, and within the corresponding 50x50 km UTM squares, more than 100 endemic taxa were recorded. We presume that the total number of endemic taxa in these squares after completion of the project will exceed 200. These squares are real hot-spots of plant diversity and contribute to make the Balkans one of the most important plant areas (IPAs) in the whole Europe and also one of the World's major centres of plant diversity (Fig. 1).

Every square which contains more than 15 endemic taxa deserves special attention in plant conservation policy. Thus, most of the Balkans particularly the Aegean, Ionian and Dalmatian islands, together with coastal and mountain areas, represent significant centres of plant diversity.

Hot-spots and local endemism

A high number of endemics are restricted to only one square and may thus be termed 'local endemics'. The number of local endemics exceeds 400, representing c. 15% of the whole endemic flora. Squares with a high number of local endemics are strongly correlated to those squares which contain the greatest number of endemics (Fig. 2). The following squares have the most local endemics (numbers in parentheses): 34SFK2 – Olimbos (19); 34SGE4 – Levka Ori in Kriti (18), 34SFF1 – S & C Taygetos and NE Parnon (12); 34SFH1, 34SDK4 – Parnassos and Giona, N Pindhos – Smolikas (11 each); 34TGL1, 34SFG2, 34TEL4, 34SFF4, 35SKE4 – Slavjanka & S Pirin / N Taygetos, NW Parnon / Voras, Nidze & Kajmakčalan / SE Peloponnisos & island of Kithira / S Athos Peninisula including summit (9 each); 34TEL3, 35SLU3, 34SGH2, 34SGH1, 34TDN2 – Kozuf-Tzena / Psiloritis on Kriti / Attica / C Evvia / mt Prokletije (8 each); 34TDM3 – mts

Paštrik, Koritnik, Rudoka, Vraca, W Sara (7); 35SLE3/LE4, 34SGE2, 34TCN4, 35SKC4, 34SFJ1: island of Samothraki / W Kriti / mt Prokletije, Komovi and Bjelasica / S Evvia / Larissa (6 each).

Why the square 34SFH1 (Parnassos and Giona in S Balkans) is so extremely rich in comparison with other squares?

After mapping 1100 endemic taxa (Stevanović & al. 2003) and according to current knowledge after mapping 1660 taxa, no changes in the order of 'floristic richness' were noted. Namely, UTM square 34SFH1 (Parnassos and Giona region) with 207 recorded endemics maintains its lead. We cannot envisage significant changes would occur after

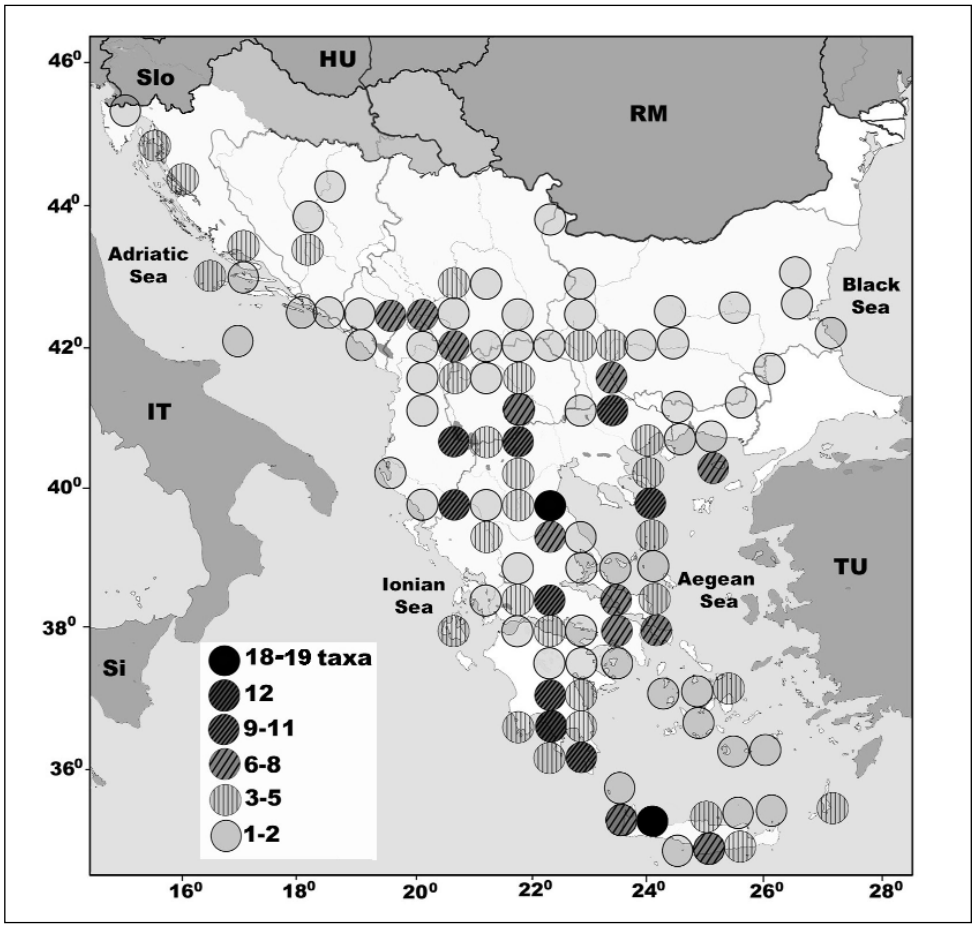

Fig. 2. Squares with the highest number of local endemics, i.e. restricted to one square only (based on sample of 1660 taxa).

mapping of 1660 taxa, even after complete mapping of an estimated 2700 taxa. The summary map based on the distribution of all taxa recorded in FH1 square perhaps provides the answer. The map (Fig. 3) shows the strong phytogeographic connection of Parnassos and Giona to two floristically rich regions in the Balkans: first to the mountain regions of N, C and S Peloponnisos reaching to Taygetos (34SEH4, 34SFH2, 34SFG1, 34SFG2, 34SFF1) and secondly, to the mountains of S and N Pindhos (34SEH3, 34SEJ1, 34SEJ4, 34SDK4).

A large number of endemic taxa from these two regions have their northern and southern distribution limits in the Parnassos and Giona region respectively. This, together with the high number of local endemics have contributed to make square 34SFH1 a ”burning” spot of endemism in the whole of Europe. By being floristically rich in itself, and by its

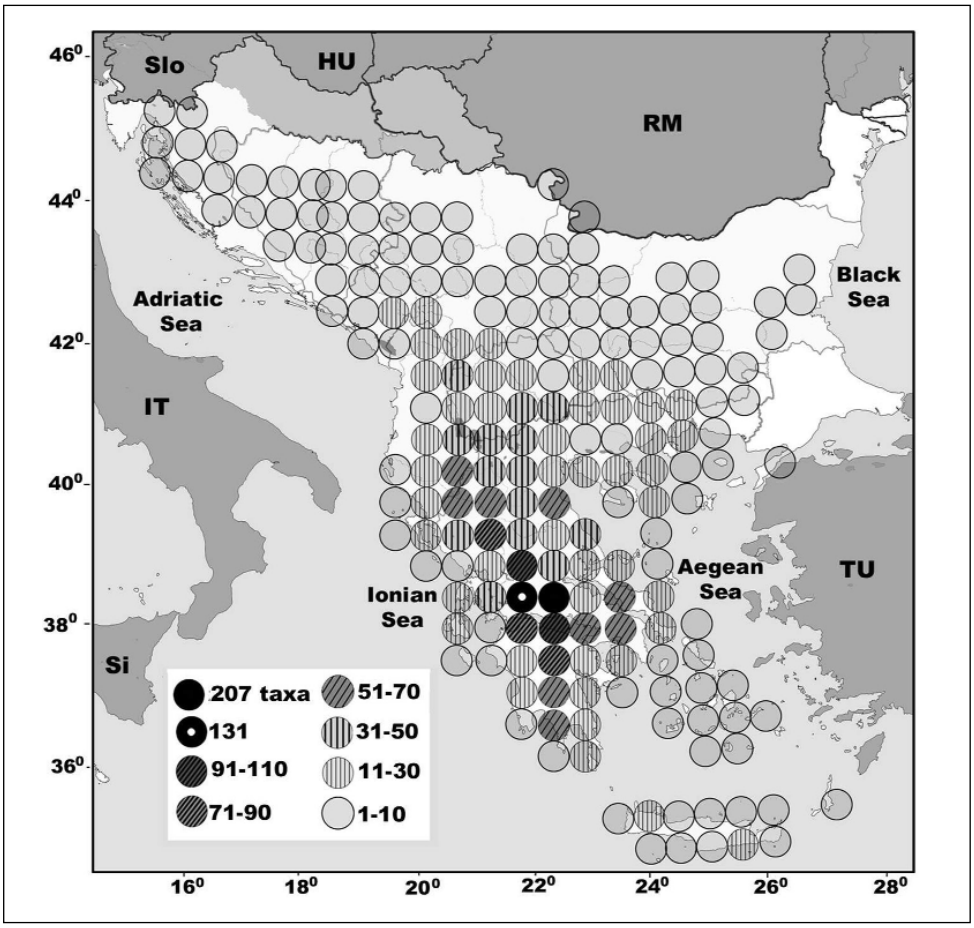

Fig. 3. Map showing strong floristic and phytogeographical connection of square FH1 (Parnassos and Giona) with other parts of the Balkans (based on sample of 1660 endemic taxa).

strategic geographical position between two extremely important centres of endemism in the Balkans (Peloponnesos and the Pindhos chain) the endemic wealth of 34SFH1 is at the same time revealed and explained.

Next step?

Despite numerous taxonomical and related chorological problems, absence of distribution data for some regions, mapping of the endemic flora of the Balkans will continue. Mapping of c. 1000 extra taxa will be our next task in the immediate future. Obviously, all this mapping of the endemic flora contributes to make taxonomical and chorological problems more apparent. Our complete database will provide floristic and phytogeographical analysis of various interesting topics, from establishing centres of diversity, the relationships including similarities and dissimilarities between floras from different squares and regions, analysis of age and area of endemics, affinities to other regions outside the Balkans, e.g., the Iberian and Ligurian peninsulas, as well as various correlations between distribution and ecology.

Acknowledgement

This work was supported by funding to V. Stevanović from the Ministry of Science and Environmental Protection, Republic of Serbia (grant No. 1505, project: Endemic flora of Serbia - distribution, ecology and conservation) and by several grants from the Carlsberg Foundation, Denmark to Kit Tan (project: Endemic plants of Greece). We thank Marjan Niketić for the electronic elaboration of our data and preparation of the maps, and Maja Tomašević and Gordana Tomović for assistance in collecting data.

References

Beck, G. v. 1903-1921: Flora Bosne, Hercegovine i Novopazarskog Sandžaka, **1-2.** – Sarajevo.
— 1927: Flora Bosne, Hercegovine i Novopazarskog Sandžaka, **3.** – Beograd.
— & Maly, K. 1950: Flora Bosne i Hercegovine, **4(1).** – Sarajevo.
Bjelčić, Ž. 1967-1983: Flora Bosne i Hercegovine, **4(2-4)**. – Sarajevo.
Hayek, A. (1924-1927): Prodromus Florae peninsulae Balcanicae, **1.** – Repert. Spec. Nov. Regni Veg. **30(1):** 1-1193.
— 1928-1931: Prodromus Florae peninsulae Balcanicae, **2.** – Repert. Spec. Nov. Regni Veg. **30(2):** 1-1152.
— 1932-1933: Prodromus Florae peninsulae Balcanicae, **3.** – Repert. Spec. Nov. Regni Veg. **30(3):** 1-472.
Jordanov, D. (ed.) 1963-1976: Flora na Narodna Republika Bălgarija, **1-6.** – Sofija.
— & Kuzmanov, B. (eds.) 1979: Flora na Narodna Republika Bălgarija, **7.** – Sofija.
Josifović, M. (ed.) 1970-1976: Flora SR Srbije, **1-8.** – Beograd.
— (ed.) 1977: Flora SR Srbije, **9.** – Beograd.
Kožuharov, S. I. & Kuzmanov, B. A. (eds.) 1995: Flora na Republika Bălgarija, **10.** – Sofija.
Kurtto, A., Lampinen, R., Junikka, L. (eds.) 2004: Atlas Florae Europaeae, **13.** – Helsinki.
Micevski, K. 1983-2001: Flora na Republika Makedonija, **1(1-5).** – Skopje.
Rohlena, J. 1941-1942: Conspectus Florae Montenegrinae. – Preslia **20-21:** 1-506.
Sarić, M. R. (ed.) 1992: Flora Srbije, **1.** – Beograd.

— & Diklić, N. (eds.) 1986: Flora SR Srbije, **10.** – Beograd.
Stevanović, V., Tan, K. & Petrova, A. 2003: Diversity and centres of endemism in the Balkan flora. – Pp. 13-14 in: Redžić, S. & Djug, S. (eds), Book of Abstracts Third International Balkan Botanical Congress "Plant resources in the creation of new values", Sarajevo 18-24 May 2003. – Sarajevo.
Strid., A. (ed.) 1986: Mountain Flora of Greece, **1.** – Cambridge, New York, Port Chester, Melbourne & Sydney.
— & Tan, K. (eds.) 1991: Mountain Flora of Greece, **2.** – Edinburgh.
— & — (eds.) 1997: Flora Hellenica, **1.** – Königstein.
— & — (eds.) 2002: Flora Hellenica, **2.** – Königstein.
Turrill, W. B. 1929: The plant-life of the Balkan Peninsula. A phytogeographical study. – Oxford.
Webb, D. A. 1966: The Flora of European Turkey. – Proc. Roy. Irish Acad. **B65(1):** 1-100.
Velčev, V. & Kožuharov, S. (eds) 1982: Flora na Narodna Republika Bălgarija, **8.** – Sofija.
— & Kuzmanov, B. (eds.) 1989: Flora na Narodna Republika Bălgarija, **9.** – Sofija.

Addresses of the authors:
Vladimir Stevanović, Botanical Institute and Garden, Faculty of Biology, University of Belgrade, Takovska 43, 11000 Beograd, Serbia. E-mail: vstev@bfbot.bg.ac.yu.
Kit Tan, Institute of Biology, University of Copenhagen, Øster Farimagsgade 2D, 1353 Copenhagen K, Denmark. E-mail: kitt@bot.ku.dk.
Ana Petrova, Botanical Institute, Bulgarian Academy of Science, Acad. G. Bonchev 23, 1113 Sofia, Bulgaria. E-mail: petrova@bio.bas.bg.