

A SURVEY OF THE MEDITERRANEAN SPECIES OF LAMIACEAE FAMILY IN THE FLORA OF SERBIA

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Abstract

The review of the species belonging to the group of plants characterized by a broad or narrow Mediterranean orientation in distribution represented in flora of Serbia is given. A comparatively large number of these plants from *Lamiaceae* (*Labiatae*) family stems from specific history of flora, characteristics of relief and climatic condition, as well as a strong influence from the Mediterranean.

Introduction

In the flora of Serbia, the *Lamiaceae* (*Labiatae*) family is represented with a total of 32 genera and a total of 160 species (DIKLIĆ & JANKOVIĆ, 1974). Of these, the group of plants totaling 42 species, for which the Mediterranean region had been a cradle, or during the last glacial period a refugium, holds an important position. A comparatively large number of these species may come as a surprise, considering that Serbia is entirely a continental country, with no direct spatial contact with the sea.

In Serbia, however, as well as in the Balkans, things do not confirm easily to the global, and probably standard models. Thus, according to the ISO Standard two-letter codes, the Level four (HOLLIS & BRUMMITT, 1992), Yugoslavia belongs to the southeastern Europe. However, according to the geographical division in *Flora Europaea*, only the Balkan part of Yugoslavia, *i.e.* southward of the Sava and the Danube, belongs to southeastern Europe, while the Pannonian part, northward of the Sava and the Danube, is allocated to Central Europe. On the territory of Serbia, this geographical division coincides entirely with the phytogeographical regions.

Flora Europaea applies the term "Mediterranean region" to the 100 kilometers wide belt encircling the Mediterranean Sea. Serbia is hundreds of kilometers away from this region, yet its flora comprises the plants from the *Lamiaceae* family whose distribution has a Mediterranean orientation. The explanation for this is to be found in the series of specific circumstances and changes, both in this age and in the remote geological past of the Earth, which have affected the modern flora of the Balkans and Serbia.

The Balkan peninsula represents a door to the understanding of history of European flora, and the flora of Serbia provides a key that may unlock it.

I would like to point out here that, in this paper, in the listing of data on plant distribution, the appellation "Yugoslavia" will be applicable to the territory of the administrative entity of former Yugoslavia. The only intention in doing so is to avoid any ambiguity, as previously, in literature, the data with the appellation "Yugoslavia" were applicable to that territory. Today, however, when speaking of plants whose ranges still partly or completely extend over the territory of the former Yugoslavia it seems best to employ the term "Yugoslav countries."

Geographic, ecological and geohistorical background

The territory of Serbia is rather nonhomogeneous in respect of relief; in the north there lies a vast plain, Vojvodina, gradually developing into mountainous tracts towards the south.

Vojvodina, the southern skirt of the Pannonian Plain, was during the late Neogene the bed of the ancient Pannonian Sea, remains of the yet older Parathetis.

The largest part of Serbia, however, is an area of alternating mountains and valleys. It has a varied relief and the altitudes ranging from 28 to 2650 meters. The massifs are intersected by large rivers along whose sides deep, spacious valleys stretch; also by canyons and ravines, cut through by smaller rivers. In addition, there are various karst formations such as doline, depressions and karst fields.

To the southwest is the Kosovo Plain; it is large, but smaller than Vojvodina.

River courses, which abound in Serbia, belong to the basins of the Black, the Adriatic and the Aegean Sea. Although weakened, the marine climatic influences are nevertheless conveyed into Serbia from the East, the West, and the South.

Generally speaking, Serbia has a moderately continental climate (RADINOVIĆ, 1981). The varieties of relief, however, occasion a series of varieties, subtypes, and climates local in character, distinguishable by the duration of particular seasons, the mean and absolute temperatures, the rainfall types, and the humidity levels. For example, the climate in Vojvodina is distinctly continental, on the high mountains it is montane, while the southern parts, exposed to the influence of the Mediterranean, have the characteristic traits of the sub-Mediterranean climate. Climate has also been abated in the ravines and canyons which were protected by steep crags and where large or small quantities of water served as heat accumulators and temperature regulators.

In addition to the specific features of the relief (ravines, canyons, karst formations) and the beneficent effects of sub-Mediterranean character of climate, especially in the southern parts, the ecological factors of the habitats were also conducive to the survival of Mediterranean species. These were geological (limestone) and pedological (terra rosa) composition, and orographic position (southerly exposition).

The ancient Balkan flora traces its remote origins to the Mediterranean mountains and islands of the Tertiary (STEVANOVIĆ & al., 1995). At that period, the distribution of land and sea was different from what it is today. These may be the reasons for the existence of a number of authentic sub-Mediterranean oases in Serbia, deep in the continent, such as the Djerdap complex, and many other small-scale ravines.

During the Great Ice Age of the Quaternary, the glaciation process in the Balkan peninsula was, owing to its southern position, specific relief, and beneficial influence of the Mediterranean smaller in scale than that in the middle and northern Europe. Glaciers were formed only in alpine regions, at the altitudes of more than 1500 meters above sea level (CVIJIĆ, 1921, 1924, 1926). Although the climate in general was colder than in the Tertiary, it was warm enough for a number of cold-sensitive species, devastated elsewhere in Europe, to find refugium on the territory of the Balkans, where many of them have remained to the present day. As isolated islands, these refugia were also remarkably appropriate places for the speciation of Tertiary Mediterranean species (MIŠIĆ, 1981; JANKOVIĆ & al., 1984).

The process of migration has also been the means of enriching the flora of Serbia with Mediterranean, and especially sub-Mediterranean elements (TURRIL, 1929). During the period of rise in temperature, subsequent to the Ice Age, species had migrated or expanded their native ranges continuously from the area of the Mediterranean towards the north. A number of this species have remained in hospitable habitats, notably in the southern parts of Serbia.

The conspicuous presence of the Mediterranean species of the *Lamiaceae* family may therefore be readily explained by the complexities and singularities of geological and biological changes and processes which have left their mark on the flora of this area.

Eury-mediterranean species

The flora of Serbia comprises species from the group of Mediterranean plants belonging to the *Lamiaceae* family, whose ranges, apart from the Mediterranean, encompass different parts of Europe, variously distant one from another, or spread over Asia (HEYWOOD & RICHARDSON, 1972). Although these species, as being more tolerant to diverse ecological conditions, have spread considerably further from the Mediterranean, they still grow most frequently in dry, warm, and sunny habitats, mostly on meadows, on bedrock, in scrubs, and in the forests glades. Phytogeographically, they belong to different elements of flora, depending on the direction in which their respective ranges had spread. Whether their spreading was the result of the natural potential of a species, or the anthropogenic influences, is also of consequence.

A number of the species which have spread furthest to the north of Europe by anthropogenic influence, such as *Stachys annua* L. and *Salvia verticillata* L. (HEYWOOD & RICHARDSON, 1972), occur on the territory of Serbia (DIKLIĆ & JANKOVIĆ, 1974) within the boundaries of their natural ranges.

Some of the species from this group, likewise occurring within their natural ranges, are represented on the territory of Serbia by their infraspecific taxa.

Prunella laciniata f. *subintegra* Hamilt. grows in the southwest of Serbia (Kosovo), in the habitats sub-Mediterranean in character (DIKLIĆ & JANKOVIĆ, 1974; DIKLIĆ, 1986).

The widely distributed species *Teucrium chamaedrys* L. exists in Serbia in its typical variety *chamaedrys*, and the variety *glanduliferum* Haussk. Within its typical variety, apart from the typical form, another four forms are clearly distinguished. Among them, the range of the form *albiflora* Sigunov is, so far, limited to the Deliblato Sands (Vojvodina) (DIKLIĆ & JANKOVIĆ, 1974; DIKLIĆ, 1986).

On the territory of Serbia, *Stachys germanica* L. demonstrates a high degree of variability (DIKLIĆ & JANKOVIĆ, 1974; DIKLIĆ, 1986). In addition to its typical subspecies, within which the variety *penicellata* (Heldr. & Sart.) Boiss. is distinguished, there exists the subspecies *velezensis* (Sag.) Hayek, a Yugoslav endemite, also noted by HAYEK (1929) in Bosnia and Herzegovina, and Macedonia.

The species *Stachys officinalis* (L.) Trevis, whose range stretches to the north as far as the line Central Scotland - South Sweden - Southwest Russia (HEYWOOD &

RICHARDSON, 1972), exists in Serbia infraspecifically in the rank of the form *stricta* (Ait.) Boža & Vasić (DIKLIĆ, 1986).

In addition to the typical subspecies and form, whose distribution almost coincides with that of the species, *Sideritis montana* L. is also represented in Serbia by form *xanthocoma* Azn. so far noted only in Yugoslavia (DIKLIĆ & JANKOVIĆ, 1974).

The ranges of a number of species, while spreading northward, reach in Serbia their easternmost points.

The range of the species *Teucrium botrys* L. spreads in large measure over southwestern and Central Europe (HEYWOOD & RICHARDSON, 1972). Towards the east, in the vicinity of Yugoslavia, its presence has been definitely confirmed in Romania and recently in northern parts of Bulgaria as well (GUSULEAC, 1961; MARKOVA, 1989). The sites in Serbia are probably the easternmost findings of this species.

The north-eastern boundary of the range of the species *Calamintha nepeta* (L.) Savi, lies in the south of Serbia.

The plants of the Pontic - Mediterranean distribution comprise a special group. They bear witness to the link between the flora of these two specific regions, the link rooted into the remote past measured by millions of years. In that part of the world the distribution and the relation of the sea and land were somewhat different from those of today, man is witness to.

Of the Pontic - Mediterranean plants from the *Lamiaceae* family, the following four species are present in the flora of Serbia.

Scutellaria altissima L. and *Marrubium peregrinum* L. are widely distributed throughout the territory of Serbia (DIKLIĆ & JANKOVIĆ, 1974).

The data in Flora of SR Serbia convey the impression that the presence of the species *Salvia aethiopsis* L. in Serbia is uncertain. Without any actual evidence, this species is rather vaguely stated to be distributed sporadically in Serbia (DIKLIĆ & JANKOVIĆ, 1974). However, the specimens found on several sites in the south of Serbia (Kosovo) in recent years, bear witness to its presence.

In regard of their respective ranges in Europe (HEYWOOD & RICHARDSON, 1972), all three aforementioned species are found in Serbia on their northern boundaries, or in the northernmost parts of their ranges.

Stachys recta L., widely distributed and much variable species is not monotypic in Serbia neither. To the contrary, it has a rather complex infraspecific structure (DIKLIĆ & JANKOVIĆ, 1974). It is present in its typical subspecies, the most frequent one, characteristic of northern Europe. In addition to the typical variety, the varieties *angusta* (Borb.) Diklić, *rechingeri* K. Maly, *midzorica* (Adam.) Diklić and *jugoslavica* K. Maly, with the form *glandulosa* K. Maly, are also present. The subspecies *subcrenata* (Vis.) Briqu. characteristic of the countries surrounding the Adriatic Sea is, in central and eastern Serbia, represented by the varieties *fragilis* (Vis.) Diklić, *ramosissima* Roch. and *karstiana* (Botb.) Hay. The subspecies *baldacci* (K. Maly) Hayek, the Balkan Peninsula endemite, grows in the southwest of Serbia. It also occurs in Dalmatia, Montenegro, and Albania (HAYEK, 1929). In addition to its typical variety, the varieties *malyi* Hayek and *chrysophae* (Pančić) Hayek, with the form *glanduliferus* (K. Maly) Hayek, are clearly distinguished.

Eu-mediterranean species

In Serbia, there exists a number of species whose ranges spread almost throughout the Mediterranean; from Spain, France, and Corsica in the west, expanding like a fan towards Greece and Turkey in the southeast, and in the northeast reaching sometimes as far as the Black Sea.

The sites (DIKLIĆ & JANKOVIĆ, 1974) of the following species: *Teucrium polium* L., *Salvia sclarea* L., *Salvia virgata* Jacqu., *Calamintha grandiflora* (L.) Munch., *Scutellaria orientalis* L., *Ziziphora capitata* L., *Micromeria serpyllifolia* (M. B.) Briqu. and *Satureja montana* L. lie in Serbia on the northern boundaries of their widespread. The subspecies *kitaibelii* (Wierzb.) Briqu. of the species *Satureja montana* has a subendemic distribution in the Balkans, since it likewise occurs in Romania (GUSULEAC, 1961).

The northernmost part of the range of *Lamium garganicum* L. lies in Serbia also. The species is represented by its typical subspecies and variety, as well as the variety *molle* (Boiss. & Oroph.) Briqu. There also exists the subspecies *glabratum* (Gris.) Briqu., in addition to whose typical variety, the varieties *macedonicum* (Deg.) Hayek and *inflatum* (Heuff.) Briqu., are clearly distinguished (DIKLIĆ & JANKOVIĆ, 1974) and both characteristic of the extreme south of Serbia.

The species whose distribution is somewhat smaller in extent in the Mediterranean, such as *Thymus longicaulis* Presl. and *Calamintha suaveolens* (Sibth. & Sm.) Boiss. (DIKLIĆ & JANKOVIĆ, 1974), occur in southern Serbia in the northernmost points of their ranges. *Thymus striatus* Vahl. is found there on the north-eastern boundary of its range.

Of this group of plants, the species *Lamium bifidum* Cyrillo should be paid a special attention to. In Serbia (DIKLIĆ & JANKOVIĆ, 1974), it is represented only by the subspecies *balcanicum* Vel., which is continental in character, and endemically distributed, and is elsewhere known to exist only in Bulgaria (MARKOVA, 1989).

Furthermore, on the territory of Serbia there lie the northernmost autochthonous sites of a number of species whose native ranges are otherwise confined to the Mediterranean. Their distribution is chiefly limited to the southern parts of Serbia, which are under a more direct Mediterranean influence. The beneficial effects of a mild climate, sub-Mediterranean in character, have been enhanced by the ecological factors of their habitats, such as limestone for its geological composition, and a pedological composition of the type terra rosa and southerly exposition. Thus, these plants grow mostly on meadows and on bedrock, meaning in dry, warm, and sunny places.

The species *Salvia viridis* L., *Mentha microphylla* C. Koch, and *Scutellaria columnae* All. (DIKLIĆ & JANKOVIĆ, 1974) are found there on the northern boundaries of their native ranges; while the species *Salvia argentea* L. and *Micromeria juliana* (L.) Benth. occur on their north-eastern boundaries.

Naturalised, *Melissa officinalis* L. is grown in many countries for its agreeably aromatic leaves (HEYWOOD & RICHARDSON, 1972); and has consequently spread far to the north, outside the Mediterranean region. Its sites (DIKLIĆ & JANKOVIĆ, 1974) in Serbia, however, represent the northern boundary of its native range.

The species *Hyssopus officinalis* L. exists, as naturalized, in the Central European countries (HEYWOOD & RICHARDSON, 1972); on the territory of Serbia, however, it occurs on the north-western boundary of its native range. It is represented only by the subspecies *pilifer* (Gris.) Murb. (DIKLIĆ & JANKOVIĆ, 1974).

The occurrence of the typical Mediterranean species *Salvia officinalis* L. is worthy of special attention. Its native range extends from Spain to Greece, through the Mediterranean parts of Yugoslavia and Albania (DIKLIĆ & JANKOVIĆ, 1974). However, *Salvia officinalis* not only exists on the territory of Serbia, but is also an edicator of one plant community. From Pančić's "Flora of the Principality of Serbia", published in 1874, we learn that *Salvia officinalis* grew in Sićevačka Klisura - gorge in southeastern Serbia late in XIX century. Its abundance on that site, as well as the phytocoenological link with the species *Artemisia lobelii* All., likewise a Mediterranean species, was observed already at the beginning of this century (GREBENŠČIKOV, 1950). On the basis of the phytocoenological analysis, Nikolić and Diklić (1966) have described the community of these two species and named it *Artemisio - Salvietum officinalis*. This suggests that it has been in Sićevačka Klisura for quite a long time. As the site where the aforementioned community has been developed lies outside the Mediterranean region, the problem of the source of the species *Salvia officinalis* presents itself. The obvious explanation for its presence in Serbia would have been the anthropogenic factor, as is the case in a number of countries where it is grown. However, the geomorphological outlook of the site, as well as its ecological features with regard to the local climate, the geological and pedological compositions, and vegetation, sharply distinguish it from its immediate surroundings. Sićevačka Klisura is in fact one of the Mediterranean oasis in Serbia - a refugium, *i.e.* a relict habitat of Tertiary age (ADAMOVIĆ, 1908, 1909). Bearing all this in mind, we take courage to assume that the population of the species *Salvia officinalis* in Serbia is witness to its continual natural range, which was once, during the torrid Tertiary, wider by far.

Commentary

The species whose distribution has a Mediterranean orientation comprise a significant group of the representatives of the *Lamiaceae* (*Labiatae*) family in the flora of Serbia. The influence of the Mediterranean in the forming of the flora of Serbia in general becomes more obvious if we assume that around 30 local endemites as well as Balkan endemites and subendemites of the *Lamiaceae* family (which have not been discussed individually on this occasion) also belong to this group. Considering that Serbia is entirely a continental country, outside the boundaries of the Mediterranean proper, the occurrence of endemites of the family *Lamiaceae* belonging to the group of plants Mediterranean in character demands an explanation. It lies in the morphological and physiological characteristics of these plants, as well as in the ecological features of the sites where they occur. Furthermore, the majority of the Balkan endemites is evolutionarily and taxonomically linked to the species which are phytogeographically or florigenetically confined to the Mediterranean.

The principal reasons for such course of evolution lie deep in the complex geological past of this area which reaches as far back as the Tertiary and continues into the Quaternary. The specific and intricate relief of Serbia, with a multitude of gorges and canyons, has rendered possible the existence of a mosaic of small or large refugiums where the aboriginal Tertiary Mediterranean species have been preserved. Also, territorial isolation of the refugiums has enabled the processes of further speciation resulting in the forming of narrowly distributed infraspecific taxa, or even new genera and species. Although lying deep into the continent, the territory of Serbia was, owing to the southern position of the Balkans, exposed to the beneficial influence of the Mediterranean. Thus a large number of Mediterranean species were able to migrate northwards. Some of these species have spread further to the north of Europe, often due to an anthropogenic influence, but their sites in Serbia lie within their natural or potential ranges. However, the best part of the Mediterranean species whose ranges reach Serbia, occur there on a boundary-line of their distribution, usually the northern one. For the most of these species, the furthestmost points of their natural ranges occur in the southern Serbia. These parts, owing to the neighbourhood of the Mediterranean, enjoy direct beneficial effects of mild climate; and the climate is sub-Mediterranean in character. The advantages of that part of Serbia are, apart from the favourable climate, the ecological factors of habitats such as: geological (limestone) and pedological (terra rosa) composition, and orographic position (southerly exposition).

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