



CONTENTS

Editorial	1
The Lavender Bag	1
Lamiaceae research in Hungary	1
Alien <i>Salvia</i> in Ethiopia	3
Pollination ecology of Labiatae in Mediterranean	4
Studies on the genus <i>Thymus</i>	6
Relationships of Subfamily Pogostemoideae	8
Controversies over the <i>Satureja</i> complex	10
Obituary - Silvia Botta de Miconi	11
Bibliography of recent taxonomic publications	12

EDITORIAL

R.M. Harley & A. Paton

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Welcome to the fourth Lamiales Newsletter. As usual, we still require articles for inclusion in the next edition. If you would like to receive this or future Newsletters and are not already on our mailing list, or wish to contribute an article, please do not hesitate to contact us. The editors' e-mail addresses are: **A.Paton@rbgkew.org.uk** or **R.Harley@rbgkew.org.uk**.

As reported in the last Newsletter the Instituto de Quimica (UNAM, Mexico City) have agreed to sponsor the next Lamiales conference. Due to the current economic conditions in Mexico and to allow potential participants to plan ahead, it has been decided to delay the conference until November 1998. It is hoped that the conference will be held in Oaxtepec, near Mexico City. The organisers will be: Baldomero Esquivel, Instituto de Quimica, Circuito Exterior, Cd.

Universitaria, Coyoacan 04510, Mexico D.F. Mexico. Tel: +5256224448. Fax: +525616 22 17. e-mail: baldo@servidor.unam.mx and T.P. Ramamoorthy, 412 Heartwood Dr., Austin, TX 78745, USA. They are anxious to hear from anyone willing to help organise the conference or who have ideas for symposium content.

This edition of the Newsletter and the third edition (October 1994) will shortly be available on the world wide web (<http://www.rbgkew.org.uk/science/lamiales>).

This also gives a summary of what the Lamiales are and some of their uses, details of Lamiales research at Kew and a list of currently recognised genera. Information concerning the conference will also be carried here as planning proceeds. □

THE LAVENDER BAG

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The *Lavender Bag* newsletter first appeared in May 1994 and has been welcomed by Lavender enthusiasts all over the world. Its aims are to facilitate information exchange, aid identification and accurate labelling and provide a forum for amateur and professional plantsmen and plantswomen who have more than a passing interest

in the genus. *The Lavender Bag* will appear in May and November and if you would like to receive future issues, please send £2.50 (£4.00 overseas via air mail) to the Editor, Mrs Joan Head, 6 Church Gate, Clipston-the-Wolds, Keyworth, Nottingham, NG12 5PA, United Kingdom.

THE ACTIVITY OF A LAMIACEAE RESEARCH TEAM IN HUNGARY

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A significant part of Hungarian *Lamiaceae* research is conducted by a joint research team of approximately 15 researchers at the Research Institute of Ecology and

Botany of the Hungarian Academy of Sciences (Vácrátót) and at the Institute of Pharmacognosy of the A. Szent-Györgyi Medical University (Szeged). This team is headed by the author of this paper. In addition to the work of this team some additional research is carried out in co-operation with other Institutes like the Institute of Pharmacognosy of the Semmelweis Medical University (Budapest), the Medicinal Plant Research Institute (Budakalász) and with the Department of Chemical Engineering of the Technical University (Budapest). The research is sponsored partly by National Grants (OTKA) and partly by companies. The School of Pharmacy and Biomedical Sciences, University of Portsmouth, and University Institutes in Transylvania (Romania) are among the collaborating foreign research institutes.

The theoretical basis of the investigations dates back to a general project, "Chemotaxonomic and Production Biological Evaluation of Plants, Native or Suitable for Introduction into Hungary". This research was launched by the late Prof. I. Máthé Sen. more than three decades ago. The goal of this project is to evaluate plant taxa for cultivation in Hungary. Within it, the study of the *Lamiaceae* was started by three researchers in 1986.

The object of this research is the comparative evaluation of various species and accessions of the same species from different origins growing under similar conditions. This includes chemical, biological production, and taxonomic research. The study of variation within the same taxa helps find the best conditions for optimal yield or, as we call it, the optimum production of the most significant secondary metabolites. To achieve this end *Lamiaceae* populations were created in an experimental field partly from seeds of various species, obtained via

botanical garden seed exchanges, partly by gathering and/or cultivating the native species (92 species are in Hungary). Nowadays the collection has 500 accessions of some 150 species in 30 genera.

These populations give us the opportunity for multidisciplinary work. The continuous revision (reevaluation) of the taxa from a morphological viewpoint is of outstanding importance. As a result of this systematic work new taxa in Hungary have been found.

Since the beginning of our work, comparative studies have been carried out, among them, the determination of the presence, or absence of some chemical characteristics of the *Lamiaceae*. The excellent work of Cantino & Sanders (1986) provided the basis for subfamilial comparison. In addition to essential oils, rosmarinic acid, iridoids, etc. we found that the freely occurring triterpene carbonic acids (oleanolic and ursolic) may merit more detailed study (Máthé *et al* 1993). Though it has been known for a long time that these compounds are present in the family, they seem to occur in much larger amounts, like the essential oil content, in the species of *Nepetoideae* rather than those of the *Lamioideae*. This phenomenon seemed to be interesting enough to start intensive work on the study of the variation of these compounds from various aspects.

The study of the pattern of inorganic element accumulation (27 elements) also showed an interesting picture. It turned out that a certain correlation could be observed in the accumulation (Máthé *et al* 1992). The cluster analysis of the data revealed only slender connections among genera at the subfamilial level.

Another level of our approach is the study of the variation of populations of the same species. This has been done by studying the production

biology of the species. The biomass and certain secondary metabolites of the species were measured during the growing season (time-dependent variation). In a similar way the populations of various origin (space-dependent variation) were compared with each other. Such studies have been performed on *Melissa officinalis* L., *Lavandula angustifolia* Mill., *Ocimum basilicum* L., *Salvia officinalis* L., *S. pratensis* L., *S. nemorosa* L., *S. nutans* L., *Marrubium* species, *Hyssopus officinalis* L., etc. The purpose of this work was to select the best strains for further breeding. At the same time information could be gained about the expected diversity of the species concerned.

The occurrence and quantitative changes of the N-methylated amines characteristic of the family are also investigated. Some compounds like trigonelline, choline betain, stachydrin, etc. may be of important role in stress. The study of their variation may be of chemotaxonomic significance as well as physiological one.

Some investigations were carried out in connection with the presence of beta ecdysone in the *Lamiaceae*. Ecdysteroids are present in *Ajuga*. We have tested other genera and could not find them in detectable quantities in some fifty species tried (including *Salvia*). This work is going on and many interesting chemotaxonomic data result.

A relatively new aspect of our approach is the isolation of secondary metabolites from selected species. Detailed isolation processes are performed in connection with *Salvia* and *Marrubium* for diterpenoids, *Hyssopus*, *Melissa* and *Lavandula* for phenolic compounds like flavonoids and coumarines, *Physostegia virginiana* (L.) Benth. for iridoids, etc. besides the essential oil content obtained by steam distillation.

The first results of these investigations will be published soon.

The diversity of compounds present in many plants, forced us to deal with methodological problems. We had to justify the reproducibility of our results and methods, and we wanted to elaborate quick and sensitive methods for routine investigations so that the comparative work could be more reliable. TLC Densitometry proved to be a good tool beside UV-VIS photometry, HPLC, OPLC, GC, GC-MS measurements.

Special processes were also tried for a more detailed evaluation of the chemistry of some common *Lamiaceae*. A series of investigations were carried out on *Salvia officinalis*, *Lavandula angustifolia*, *Melissa officinalis* for the comparison of their extracts gained by supercritical fluid CO₂ extraction, and traditional water steam distillation respectively.

The number of papers, short communications, abstracts of presentations has surpassed one hundred since the beginning of this research.

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A CENTRAL AMERICAN WEEDY SALVIA IN ETHIOPIA

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In connection with a collaborative research between the University of Addis Abeba, Ethiopia and the University of Illinois in Champaign Urbana, USA, I made fieldtrips in 1994-95 to the project sites in Welo Region in north central Ethiopia. In both trips, I came across and collected a very unusual herbaceous labiate, which I had not encountered before. After collecting the specimen for the first time in 1994, I tried to match it with specimens at the National Herbarium, Addis Abeba University (ETH), but without success. In a subsequent visit to the project area in 1995, I collected the plant in other localities as well asking the local people if they had any information on the plant: local names, local uses, etc. I was told by nearly all informants that the plant was known in the area only for only four to six years and was spreading rapidly. I then thought that the plant may have been introduced. In a research visit in July 1995, to the Herbarium, Royal Botanic Gardens, Kew (K), my suspicion was confirmed and the plant was identified (with the help of Drs. Ray Harley and Alan Paton, Kew) as *Salvia tiliifolia* Vahl, a native of central America.

S. tiliifolia was described by Vahl (1794: 7) as *S. tiliaefolia* from Mexico. The species has been subsequently discussed in various publications: Correll and Johnston (1970: 1370); Standley and Williams (1973: 298) and Codd (1985: 100).

Annual herb 40-70 cm tall. Stems sparingly pilose, simple or branched.

Leaves petiolate; Leaf-blade broadly ovate, 4-6 x 3.5-5 cm, sparingly pubescent, acuminate at the apex, truncate at the base, finely and regularly crenate. Inflorescence simple or paniculate; verticils 6-14 flowered. Calyx hispid, ribbed, 4-6 mm long, 2-lipped, upper lip + entire. Corolla blue, 5-7 mm long. Seeds black.

The plant is a native of Central America. It has been introduced to the United States and ?Canada. According to available information, the plant is only so far known in the African Continent from Pretoria, South Africa, having been introduced in 1943 (Codd, 1985).

The species was probably introduced to Welo Region in north central Ethiopia in the 1980's. The Region was frequently affected by drought and famine followed by massive humanitarian assistance, one element of which was the distribution of grains and cereals for food and for cultivation. Since then the plant has gradually established itself and at present it seems to be spreading vigorously, replacing native herbs in some sites. The plant does not seem to be eaten by grazers at all. Apart from its uncontrolled expansion its adverse effects, if there are any, remain to be seen.

Specimens Examined:

Welo: 5-6 km from Kombolcha town towards Yegof State Forest along the edges of the main road, 2070-2150 m, 10 Dec. 1994, *Sebebe Demissew* 4332(ETH); 4 km from Hayq towards Gobeya, edge

of cultivated farm, 1930 m, 8 June 1995, *Sebsebe Demissew* 4510 (ETH); Hayq Estifanos Church, 5 km from Hayq town under a big *Ficus* tree, 1940 m, 11 June 1995, *Sebsebe Demissew* 4630 (ETH, K).

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LABIATAE: A KEY FAMILY FOR WILD BEES AND THE POLLINATION ECOLOGY IN MEDITERRANEAN PHRYGANIC COMMUNITIES

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The major physiognomic characteristic of the garrigue and the phrygana (i.e. the counterpart of garrigue in the East Mediterranean Basin), is the dominance of the Labiatae family. *Thymus* spp. are the most prominent example, not only because they give their characteristic fragrance, but also because the genus is identified with the ecosystem itself, locally known as thymarónas (Greece) or tomillares (Spain), from the words thymari or tomillo meaning thyme. In W. Greece phrygana may also be dominated by another labiatae species, i.e. *Phlomis fruticosa*, therefore locally called asphakónas, from aspháka, its common name.

The species of Labiatae are predominantly bee-pollinated (van der Pijl, 1972; Stebbins, 1974; Faegri and van der Pijl, 1979). In the Mediterranean region, in particular, Labi-

atae are pollinated by solitary bees (Herrera, 1987; Shmida & Dukas, 1990; Dafni, 1991). This paper summarises the results of a 12-year study (1983–1994) at community level on the pollination ecology of Labiatae in a phryganic ecosystem near Athens, Greece (Petanidou, 1991; Petanidou & Vokou, 1993; Petanidou & Ellis, 1995; Petanidou & Smets, 1995; Petanidou *et al.*, 1995).

Flowering – Ten Labiatae species occurred in the study area. In the order of flowering (i.e. median date of flowering) these were: *Lamium amplexicaule* L. ssp. *amplexicaule*, *Salvia verbenaca* L., *S. triloba* L. fil., *Phlomis fruticosa* L., *Prasium majus* L., *Satureja thymbra* L., *Stachys cretica* L. ssp. *cretica*, *Teucrium polium* ssp. *capitatum* (L.) Arcangeli, *Ballota acetabulosa* (L.) Bentham, and *Thymus capitatus* (L.)

Hoffmanns. & Link. The total range of the family's flowering time was 142 days, from calendar date 43 to 285. Flower life span was in average 1.8 days (range 1.2–3.1). The duration of flowering of a species was negatively correlated with the time of flowering starting from January 1st.

Nectar – Labiatae were by far the most nectar rewarding species in the phrygana, both in volume and sugar content: half of the top ten nectar-producers of the phrygana were Labiatae. The differences became even higher if, instead of the per flower nectar production of a species, the per population nectar production was taken into consideration. These findings suggested the characterisation of the members of Labiatae as the consistent nectar producers of the Mediterranean ecosystems (cf. also Herrera, 1985). At community level this is very important because Labiatae consist of a unique group that bees rely on for energy, and most importantly, for water supply in an area characterized by water shortage.

Pollinators – All phryganic Labiatae species were found to be insect-pollinated, visited by a total of 201 insect species, primarily Hymenoptera and secondarily Diptera. The total number of pollination events amounted to 324. Forty-three insect species, about half of them bees, were exclusively supported by Labiatae. *Thymus capitatus* in particular, supported an exceptionally high number of flower visitors (123 species) and 50% of the monotropous visitors (i.e. those that are exclusive to one plant species) of the family.

Among the Hymenoptera visiting Labiatae, solitary bees were the most important group being active throughout their flowering season, while wasps formed a particular guild visiting the late flowering *Thymus capitatus* and *Teucrium*

polium. The group of solitary bees comprised 95 species, making 47.3% of all insect species visiting Labiatae, out of which 15 were one plant specialists. The importance of Labiatae for specialist bees was due to the fact that Labiatae were the main host plants at the end of the flowering season, i.e. during the hot and rainless summer.

As to the types of bees visiting them, Labiatae formed a particular group. Compared to non-labiates, Labiatae were visited by the large-sized, and the long-tongued bees (viz. Anthophoridae, Apidae, and Megachilidae), in particular by Megachilidae, while they were avoided by Andrenidae and Halictidae. The association of Labiatae with Megachilidae, the most Mediterranean of all 7 bee families occurring in phrygana, implies that these two groups have interdependently co-evolved in the Mediterranean region. This is also demonstrated by the fact that all late flowering Labiatae except *T. polium* constituted the stronger supporters of Megachilidae in the phrygana (i.e. the plants with the highest bridge value in facilitating Megachilidae to survive over time; cf. Petanidou & Ellis, 1995).

Why flowering in guilds? – Based on seven flowering traits, viz. corolla depth, corolla size, height of the flower from the ground, flower cover of the population, nectar amount per flower, essential oil production, and flower colour, the 10 Labiatae of phrygana were distinguished in two equally represented groups: the Early flowering group, characterized by late winter-early spring flowering, encompassing the first five species mentioned above; and the Late flowering group, comprising the remainder, characterized by late spring-summer flowering. An epitome of the flowering features of the two groups revealed that the Early flowering species were characterized by dissimilar

highly nectar rewarding flowers and extended duration of flowering (55 vs. 36 days of the Late flowering group). In summary, they were characterized by an increased floral attractiveness compared to the Late flowering species and by a differentiation in flower prototypes within the group. By contrast, in Late flowering species, flower character differences were minimal, and the per flower nectar production low.

Differences in floral morphology, and floral rewards between the two time guilds were accompanied by differences in the composition of insect visitors. The most interesting fact is that out of 201 pollinator species of Labiatae (98 bees), only 19 species (13 bees) were shared by both Early and Late flowering groups. However, contrary to what one might have expected, the species most differentiated among them and more nectar rewarding (i.e. Early flowering) were not visited by more visitors. The Early flowering group was visited by a total of 48 insect species, whereas the Late flowering one by 172 species. Moreover, the number of insect species per plant species was significantly higher in the Late flowering group even if *T. capitatus*, supporting an extremely high number of insect species, was excluded from the analysis. This means that the species offering copious floral rewards (i.e. Early flowering) were not those abundantly serviced by pollinators (i.e. Late flowering).

All the above findings imply that the two groups of Labiatae are fundamentally different as to their ecology and, consequently, as to their pollination characteristics: the first group, by flowering early in the year faces milder environmental stresses (e.g. water shortage) but meets difficulties with pollinator availability; therefore, it maximises its attractiveness to optimise its competitive ability at a time when pollinators are

comparatively few. On the other hand, the harsh environment the Late flowering species have to overcome is compensated by an abundance of pollinator species. Yet, these differences are accompanied by morphological adaptations of the plants to overcome water stress: all Late flowering species are either extremely hairy or particularly fragrant, whereas amongst those of the Early group only two have these characteristics (viz. *S. triloba*, and *P. fruticosa*). These differentiations in pollination profiles suggest that the real Mediterranean group of Labiatae is the Late flowering one: this is also supported by the fact that the latter group is particularly visited by Megachilidae, the most Mediterranean of all bee families in this community.

Managing phryganic Labiatae for bees

– Most Labiatae are perennials, especially those identified within the Mediterranean group, therefore they come into bloom several years after a fire – a very regular element of the Mediterranean ecosystems. Because Labiatae species are by far the consistent nectar producers of phrygana, and because they support a particularly diverse wild bee fauna, they plan an essential key role in the conservation of the ecosystem as a whole. This implies that the vital role that Labiatae play cannot be substituted by other species, such as annuals which come dominantly into bloom during the first post-fire years. In other words, the too-frequent fires will certainly diminish the biological value of the phrygana, not only as to its floral element, but as to the bee fauna as well. Again, in order to attain the maximal diversity in these continuously changing Mediterranean communities a mosaic of different-age-succession stages should be maintained by incorporating traditional methods of management, such as light grazing, controlled

fires, and controlled bee-keeping especially during the first post-fire years. In view of achieving this goal, creating phrygana nature reserves is not only necessary but more urgent than ever.

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□

The west Mediterranean Region seems to be the centre of origin of this genus. Jalas (1971) divided it into 8 sections: *Mastichina*, *Micantes*, *Piperella*, *Pseudothymbra*, *Thymus*, *Teucrioides*, *Hyphodromi* and *Serpyllum*.

The first 5 are only found on the Iberian Peninsula, in the northwest of Africa and the Macaronesian Region (Western Region). These 5 sections are more or less well-known (Morales, 1986, 1994).

Section *Mastichina* comprises two species found only on the Iberian Peninsula: *T. mastichina* or wild marjoram and *T. albicans*.

Section *Micantes* comprises the herbaceous looking Ibero-macaronesian *T. caespititius*, that occurs in the northwest Atlantic Region of the Iberian Peninsula and also in Madeira and Azores, and the woody species from Morocco *T. saturejoides* and *T. riatarum*.

Section *Piperella* is made up of one endemic species *T. piperella* from Valencia, Murcia and Albacete provinces in eastern Spain.

Section *Pseudothymbra* is characterized by the presence of bracts and long flowers. In some cases the corolla can be up to 2 cm. Of the 9 species, 7 occur in the south of the Iberian Peninsula (*T. lotocephalus*, *T. villosus*, *T. longiflorus*, *T. membranaceus*, *T. moroderi*, *T. funkii*, *T. antoninae*) and 2 are found in the northwest of Africa (*T. bleicherianus*, *T. munbyanus*).

Section *Thymus* comprises 11 species; 3 of these, *T. hyemalis*, *T. zygis* and *T. willdenowii* are all in North Africa and the Iberian Peninsula, 3 occur in the southwest of the Iberian Peninsula (*T. capitellatus*, *T. camphoratus*, *T. carnosus*) and 3 in the southeast (*T. orospedanus*, *T. baeticus*, *T. serpylloides*). *T. loscosii* is an endemic species from the Ebro River valley, and *T. vulgaris* lives in the eastern half of the Iberian Peninsula, the Mediterranean Region of

France and the north of Italy. This species has been cultivated since Roman times and is well-known throughout the world as a pot-herb.

Section *Teucrioides* was studied by Hartvig (1987), and comprises the previously *T. teucrioides* and the newly described *T. rechingeri* and *T. leucospermus*, found in the mountainous regions of Greece.

At the moment I am working on the section *Hyphodromi*. I, like Jalas, recognize 3 subsections: *Subbracteati*, *Serpyllastrum* and *Thymbropsis*. There are more than 60 species within this section, that occur in the Mediterranean Region and the arid regions of Asia.

Subsection *Subbracteati* includes the north African *T. algeriensis*, the central Spanish *T. mastigophorus*, the south Italian *T. spinulosus* and the east Mediterranean *T. boissieri*, *T. dolopicus*, *T. cherlerioides* and *T. striatus*.

Subsection *Serpyllastrum* includes *T. bracteatus*, *T. leptophyllus*, *T. lacaitae* of the middle of Spain, *T. granatensis* of the Southeast of Spain, and *T. fontqueri*, that occurs south of and near the Pyrenees; or the east Mediterranean *T. bracteatus*, *T. comptus* and *T. zygioides*.

Subsection *Thymbropsis* includes the north African *T. broussonetii*, *T. maroccanus*, *T. lanceolatus*, *T. numidicus*, *T. pallescens*, the east Mediterranean *T. laconicus*, *T. holosericeus* and the Asian *T. bovei*, *T. cariensis*, *T. cilicicus*, *T. decussatus*, *T. eigii*, *T. leucostomus*, *T. neurophyllus*, *T. sipyleus* and *T. syriacus*.

Section *Serpyllum* appears to be the oldest in the genus. More than 70 species belong to this section. They occur throughout the area of the genus, except in Madeira and the Azores. It is in this section that we find the biggest chromosomal variation. There are also woody species that grow in the mountains in arid areas e.g. *T. origanoides* in Lan-

zarote (Canary Islands), *T. serrulatus* and *T. schimperii* in Ethiopia, *T. laevigatus* in the southwest of the Arabian Peninsula. Another group of species are more or less herbaceous and occur in the Mediterranean mountains and the rest of Eurasia as far as Japan and also along the coasts of Greenland. The species of the last group seem to be younger in evolutionary terms and have probably been an actively evolving since the last glaciation, when this group colonized the new lands free of ice. This group is also taxonomically very difficult and corresponds to the 3 last subsections. Jalas (1971) divided this section into 7 subsections.

Subsection *Insulares* comprises *T. willkommii*, an endemic species that occurs on the mountains of the provinces of Castellón and Tarragona (East of Spain), *T. richardii* from the Balearic Islands, Marettino island near Sicily and Yugoslavia, the north African *T. dreatensis* and *T. guyonii*, the Canary Island *T. origanoides* and the endemic species of northwest Turkey *T. bornmuellerii*.

Subsection *Pseudopiperellae* comprises *T. herba-barona* of Mallorca ($2n=28$), Corse ($2n=56$) and Sardinia ($2n=84$) (Mayol & al., 1990) and *T. nitens* from the South of France.

Subsection *Isolepides*, with the European *T. sibthorpii*, *T. glabrescens*, *T. longedentatus* and *T. pannonicus*.

Subsection *Kotschyani* includes the Ethiopian *T. serrulatus* and *T. schimperii*, the Arabian *T. laevigatus* and a lot of Asian species.

Subsection *Pseudomarginati* includes the European species *T. longicaulis*, *T. nervosus*, *T. ocheus*, *T. praecox*, *T. pulcherrimus*, *T. thracicus*, *T. stojanovii* and the Himalayan *T. linearis* (Jalas, 1973).

Subsection *Alternantes* includes the European *T. alpestris*, *T. alternans*, *T. bioriensis*, *T. comosus*, *T.* ➤

STUDIES ON THE GENUS *THYMUS* L.

Ramón Morales

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The genus *Thymus* comprises about 150 species (Jalas & Kaleva, 1970) distributed throughout the arid, temperate and cold regions of the Old World north of the Equator and on the coasts of Greenland (Morales, 1989).

The known chromosome numbers are $2n=24$, 26, 28, 30, 32, 42, 48, 50, 52, 54, 56, 58, 60, 84 and 90, which correspond to the diploid, tetraploid and hexaploid levels. Probably, from a basic number $x=7$, the secondary basic numbers $x=14$ and $x=15$ originate. The most frequent numbers are $2n=28$, 30, 56 and 60. Aneuploidy occupies an

important place in the evolution of this genus and is responsible for the other numbers.

The pollen of this genus is very homogeneous, usually hexacolpate and with supracolpate ornamentation; the size varies between 21-46 μm and P/E between 0.9 and 1.3 (Morales, 1986).

All chemical studies show the great homogeneity of this genus (Morales, 1986). Hybridization is very common where two or more species live together. Usually there does not seem to be genetic incompatibility

between species. All this makes taxonomic studies in this genus a lot more difficult.

As regards human use, thyme species are very important and usually well-known as medicinal and aromatic plants, used in pottery and also in cosmetics and perfumery in almost all the places where they grow. Their essential oils are industrially obtained by distillation. They are also used as ornamental plants and a lot of cultivars have been obtained as a result of cultivation. Thyme species have many popular names in a lot of different languages.

froelichianus, *T. oehmianus* and *T. pulegioides*.

Subsection *Serpyllum* with the European *T. serpyllum* and *T. talijevii*, and *T. quinquecostatus* of Japan.

I calculate that the *Thymus* includes more than 200 taxa.

As far as the chemistry of essential oils is concerned, a lot of studies have been done and now we are currently studying the composition of the essential oils of 284 samples of seven species around Madrid (Spain). It was possible to analyze so many samples because it was not necessary to distil. With the new ATD (automatic thermal desorption) method, moreover only a small quantity (1-40 mg) of plant was needed (Esteban & al., 1993). Previous results showed that *T. mastichina*, *T. vulgaris*, *T. lacaitae* and *T. praecox* do not have chemotypes and the composition of their essential oils was less variable. *T. bracteatus* did not have chemotypes, but its essential oils were very variable. *T. pulegioides* has 2 chemotypes and *T. zygis* 4 chemotypes.

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RELATIONSHIPS OF SUBFAMILY POGOSTEMONOIDEAE REVEALED BY STAMEN CHARACTERS

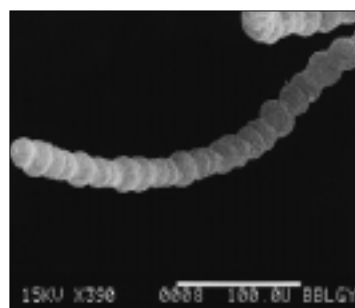
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A PhD. thesis on *Pogostemon* Desf. has recently been completed. *Pogostemon* with 80-90 species has sometimes been divided into two genera, *Pogostemon sensu stricto* and *Dysophylla* Blume. A number of other genera, all small and of uncertain affinity, have been placed near *Pogostemon* either in the same tribe, Pogostemoneae (Benth. ex Endl.) Briq., or most recently in the same subfamily, Pogostemonoideae (Endl.) P.D. Cantino, Harley and Wagstaff. They are *Rostrinucula* Kudo, *Comanthosphace* Moore, *Leucoseptrum* Smith, *Eurysolen* Prain

Fig. 1. Moniliform staminal hair of *Pogostemon quadrifolius*.



and *Colebrookea* Smith. In contrast to *Pogostemon*, these are all small genera with 1-6 species each. Ryding (1993) recently suggested that *Comanthosphace*, *Leucoseptrum* and *Rostrinucula* be removed from the Pogostemonoideae on the basis of nutlet anatomy. It has also been suggested (Cantino et al. 1992, Abu-Asab, M.S. & Cantino, P.D. 1994) that *Anisomeles* R.Br. has a close relationship with *Pogostemon*.

These taxa all have exerted stamens and in most taxa the anthers are unilocular and the filaments are

Fig. 2. Stamens of *P. quadrifolius* showing unilateral distribution of hairs on filaments and unilocular anthers.

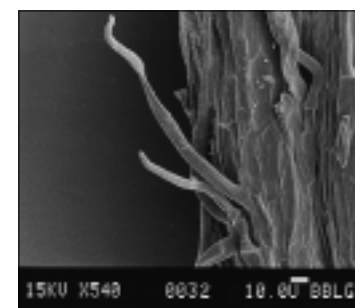


hairy. *Pogostemon* was named for its bearded stamens: *pogon* is Greek for beard and *pogonostemon* means "with bearded stamen" (Stearn 1992). However close examination of the taxa (Bhatti 1995) reveals important differences and calls into question the naturalness of Pogostemonoideae.

All four stamens are exerted from the corolla in all the taxa in question. However, in *Anisomeles* although they are exerted from the corolla tube they do not exceed the central lobe of the upper lip of the corolla. Stamens emerge from the upper part of the corolla tube, and are exerted between the sinus of upper and lower lobe of the corolla. In *Eurysolen gracilis* Prain and *Leucoseptrum canum* Smith all filaments are inserted under the upper lip of the corolla. In male flowers of *Colebrookea oppositifolia* Smith stamens filaments are exerted, but in female flowers they are included in the corolla.

Each filament is terminated by a unilocular anther in all the taxa except *Anisomeles*. Bilocular anthers have been observed in the upper pair of filaments in *A. indica* (L.) Kuntze and *A. malabarica* (L.) R.Br. ex Sims, whereas, the lower pair of filaments are terminated by unilocular anthers. All four filaments have a bilocular anther in *A. salviifolia* R. Br.

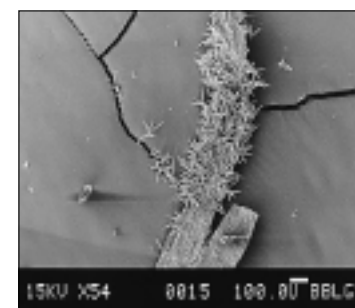
Fig. 3. Staminal hairs of *Eurysolen gracilis*.



All species of *Pogostemon*, except *P. atropurpureus* Benth., *P. speciosus* Benth., *P. travancoricus* Beddome and *P. reflexus* Benth. which are glabrous, have the middle of the filaments hairy. Press (1982), like earlier workers, described the staminal hairs in the *Pogostemon* as long and thread like in structure. However, close study of herbarium specimens and some living material in India and at Kew shows that in all species examined with hairy filaments, 75 species in total, the hairs are moniliform (Figure 1). The possession of glabrous filaments is probably a derived feature in this genus. The filaments of *P. brachystachyus* Benth. and *P. menthoides* Blume have been described as glabrous or nearly so (subnudis) in their type descriptions. Various Floras have reported the same. However, *P. brachystachyus* has densely hairy filaments, and a few moniliform hairs have been seen on the filaments of *P. menthoides*. The hairs at the base of the filaments in *Pogostemon*, where present, are not moniliform but are simple, unicellular or multicellular and villous, tomentose, strigose and setose. The presence or absence of these basal hairs has proved useful in erecting a sub-generic classification of *Pogostemon*, which will be described elsewhere.

In the small number of species, *P. benghalensis* (Burm. f.) Kuntze, *P.*

Fig. 4. Staminal hairs of *Leucoseptrum canum*.



auricularius (Blume) Hassk., *P. hayneanus* Benth., *P. paniculatus* (Willd.) Benth. and *P. quadrifolius* (Benth. in Wallich) Kuntze, in which living flowering material was examined, either in India or at Kew, it is clear that the filament hairs are situated unilaterally (Figure 2). The density and structure of hairs on the filaments make it difficult to observe the exact distribution of filament hairs on most dried specimens.

The possession of moniliform filament hairs in *Pogostemon* contrasts with the condition of other taxa in the Pogostemonoideae and the rest of the Labiatae. Simple, uniseriate and multicellular hairs have been recorded on the filaments in *Eurysolen gracilis* and also in all three species of *Anisomeles* examined (Figure 3). Stellate filament hairs have been observed in *Leucoseptrum canum* (Figure 4). Species of *Comanthosphace* and *Rostrinucula* have glabrous filaments.

Endress (1994) has reported that several different angiosperm families have moniliform hairs in their flowers. For example they are widespread in the Commelinaceae where they are found on the stamens of *Rhoeo* and *Tradescantia*. Perhaps most interestingly moniliform hairs are recorded for some members of the Verbenaceae. Endress (1994) included an illustration of *Verbena peruviana* which shows moniliform hairs exactly like those of *Pogostemon* except they are not borne on the filaments but at the sinus of the petals. Subfamily Pogostemonoideae might be better restricted to *Pogostemon*. This will be discussed in a paper recently submitted for publication.

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are good grounds for recognizing a number of genera, which fall into two distinct groups: Satureioid genera and Micromerioid genera.

Unfortunately Doroszenko's studies did not extend to those genera with only two fertile stamens, such as *Ziziphora* in the Old World and a number of genera allied to *Hedeoma* in the Americas. In all respects apart from stamen number these appear to be remarkably similar to *Satureja* and its allies, and a detailed study and cladistic analysis of the whole group is urgently needed.

Doroszenko then goes on to recognize a total of 17 genera worldwide, two of which are new. *Satureja* sensu stricto is largely restricted to the Mediterranean region. 7 genera, including *Gardoquia* and *Xenopoma*, are restricted to the Americas, and *Micromeria*, *Calamintha*, *Clinopodium*, *Acinos* as well as the Irano-Turanian genus *Cyclotrichium* are among the Old World genera recognized. Two new genera are recognized from Africa.

The European genera have recently been re-assessed by Stace (1991), who recognizes *Satureja* in the strict sense, but combines *Calamintha*, *Acinos* and *Clinopodium* under the latter, earlier name.

Although Doroszenko's treatment requires careful reassessment, he was almost certainly correct in recognizing Old and New World groups as generically distinct. Among these, *Gardoquia*, which includes many large, shrubby species, primarily in the Andes, with long, brightly coloured flowers adapted to bird-pollination, certainly merits recognition.

While one may not wish to accept all of Doroszenko's conclusions, there is little doubt that his painstaking study went far towards providing a more natural arrangement of the *Satureja* group, and a rationale for accepting a number of genera. In a recently published cpDNA restric-

tion site analysis of the Nepetoideae, Wagstaff et al. (1995) produce evidence that Briquet's treatment of the group, submerging most genera within *Satureja*, does not produce a monophyletic group and several genera need to be recognized. According to their strict consensus tree, the merging of *Satureja* and *Micromeria* would also require the inclusion of such genera as *Thymus*, *Thymbra* and even *Mentha*, if a monophyletic group were to be maintained.

As a result of this, it seems very hasty to make any further purely nomenclatural adjustments on the grounds of convenience, until new evidence gives us surer support for a firm basis for classification. With the renewed interest in the family, and with the evidence from molecular studies, this may now be close at hand.

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CONTROVERSIES OVER THE SATUREJA COMPLEX

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The outburst from Pedro Pérez de Paz in Taxon (1994), over R.H. Willemse's paper in which he sinks all Macaronesian *Micromeria* into the genus *Satureja*, highlights one of the main problems in taxonomy, where careful research and hesitancy to publish due to insufficient data, can be hijacked by hasty assessment based on limited knowledge.

In the recently published checklist of genera of Labiatae (Cantino et al., 1992), the authors decided to retain *Micromeria* as a distinct genus, until the results of a broader-based survey of the group, on a worldwide basis, could be made known.

Bentham was responsible for the first detailed classification of the Labiatae, modifying his system several times. In his final classification (1876), he recognized a number of genera that have, by some authors, been considered as wholly or in part congeneric with *Satureja*. These included *Micromeria* (in which he placed the American *Xenopoma* Willd. as a section), *Gardoquia* Ruiz & Pavon, and

Calamintha Mill. (including sections *Clinopodium*, *Calomelissa* and *Acinos*.)

Briquet (1896), however, placed all these into *Satureja*, recognizing 14 sections within it. This treatment has largely been followed by Epling for the Americas (Epling & Játiva, 1964, 1966), and also in Africa (Brenan, 1954; Seybold, 1988) but not in Europe, where, until recently, *Micromeria*, *Clinopodium*, *Calamintha* and *Acinos* were usually treated as separate genera.

Greuter, from a Mediterranean viewpoint, considered that the division into *Satureja* and *Micromeria* was an unnatural one, but also placed the other genera near *Clinopodium* into synonymy of the former, more on the grounds of nomenclatural stability (Greuter & Raus, 1984).

A largely overlooked study by Doroszenko (1987), entitled "Taxonomic studies on the *Satureja* complex", and only available as an unpublished thesis, concludes that on the basis of a number of characters, in particular leaf anatomy, there

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Silvia obtained her degree in Biology in 1966 and became a teacher. At the same time, while teaching, she took several credits at the Faculty of Science at the Universities of Buenos Aires and La Plata. She began her research in 1971 at the Darwinian Institute in Argentina, under the supervision of Arturo Burkart, with whom she collaborated on the Flora Illustrada de Entre Rios. In 1976, guided by Dr Angel L. Cabrera, she began to specialise in the family Verbenaceae helped also by Nelida Troncoso. In 1985 she was awarded a scholarship to study in Paris with Dr Alicia Lourteig. Here she was able to concentrate on her work on the generic delimitation of *Verbena*, *Glandularia* and *Junellia*. She returned to Paris in 1991 to defend her thesis and she matriculated at the Université d'Orléans.

Much of her work was taken up with editing and preparing many floras especially Jujuy, Patagonia and San Juan. She was the co-ordinator of the Verbenaceae and the Floras of Paraguay and Argentina.

She undertook several study visits and collecting trips in South America including Chile, Brazil and Uruguay. In 1989 she was awarded a scholarship to visit the Field Museum of Natural History in Chicago, and from there she visited Austin, New York, Missouri and the Smithsonian.

With the help of the Royal Society, London she continued her revision of the tribe *Verbeneae* at Kew. She collaborated here with Dr Peter Brandham in the Jodrell Laboratories.

In 1985 she married Carlos Miconi, a sculptor. This was a very happy period of her life, and Carlos accompanied her on many of her trips away from home.

We first met Silvia in 1991 and were immediately impressed with her enthusiasm for her work and her zest for life. She easily made friends wherever she travelled, and her warm and generous spirit will be sadly missed.

**BIBLIOGRAPHY OF RECENT TAXONOMIC
PUBLICATIONS ON THE LAMIALES**

The following list of publications has been abstracted from the Kew Index of Taxonomic Literature (June 1993 to September 1995), and we are extremely grateful to the editors and compilers for their assistance in preparing this bibliography. Where possible, articles are listed under genus or tribe, which are arranged alphabetically. Publications which cover many genera are listed at the beginning under general subject headings. All diacritical marks have been removed to facilitate editing.

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