

TAXONOMIC STUDIES IN STACHYS: II A new infrageneric classification of *Stachys* L.

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ABSTRACT. A new infrageneric classification is proposed for the genus *Stachys* as it occurs in Europe, N Africa and SW Asia, including the Tien Shan in C Asia. A total of 154 species are represented in the area, distributed among 2 subgenera and 21 sections. Twelve new sections, 16 new subsections and 14 informal series are described. Two changes of status are proposed, including the elevation of sect. *Betonica* to subgeneric rank. Keys to all supraspecific groups are provided and the distribution of sections, subsections and species in the area studied is indicated by means of isoflor maps.

FOREWORD BY P. H. DAVIS

The present account has been extracted, with slight modifications, from Dr Bhattacharjee's Ph.D. thesis, *Taxonomic studies in the genus Stachys with particular reference to the Middle East* (University of Edinburgh, 1973). Except for new species, subspecies and varieties already published in *Notes R.B.G. Edinb.* 33:275-292 (1974), her thesis has remained unpublished. The work contains much valuable morphological and anatomical data. However, the main purpose of the present paper is to present and validate her formal infrageneric classification and her key to the sections and subsections, so that her synoptic classification, which covers Europe, N Africa and SW Asia, can be used in her revision of *Stachys* for *Flora of Turkey* vol. 7. Her classification contains two subgenera (*Stachys* and *Betonica*) divided into 19 and 2 sections respectively; the series are treated as informal groups.

INTRODUCTION

NOTES ON THE DISTRIBUTION OF STACHYS

Stachys, one of the largest genera of the Labiatae, contains about 275 species. It is a subcosmopolitan genus centred in the warm temperate regions of the Mediterranean and SW Asia, with secondary centres in N and S America and southern Africa; it is absent from Australia and New Zealand.

In the Old World area covered by this paper (Europe, N Africa and SW Asia including the Tien Shan) there are two main centres of diversity as assessed by the number of species. One is confined to S and E Anatolia (with a minor disjunction in the central part of the Taurus range), Caucasia, NW Iran and N Iraq; the other to the Balkan peninsula. The Asiatic centre mainly embraces two phytogeographical regions, namely Mediterranean and Irano-Turanian. The European centre is Mediterranean and Euro-Siberian, the Irano-Turanian region being absent from Europe. The genus scarcely penetrates into the Saharo-Sindian region.

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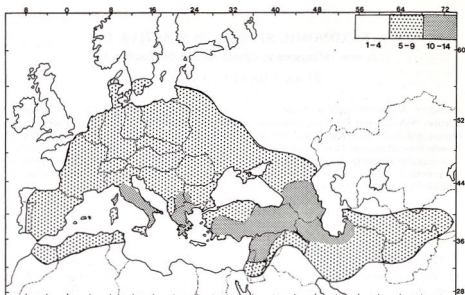


FIG. 1. Isoflor map of the sections and subsections of *Stachys* (based on 4° grid).

If we assess diversity by the number of sections and subsections in the same area, the SW Asian centre has 14 sections, the Balkan centre 9 sections (see Fig. 1 for distribution of sections and subsections). The maximum concentration of species is in SW Asia, where c. 95 out of 154 species occur.

An isoflor map (Fig. 2), based on a grid of 2° of latitude and longitude, shows where the maximum concentration of species occurs in the Balkans and SW Asia. The contours have been smoothed out to take into account the known distribution and topography. Of the 72 species growing in Turkey, 28 are endemic.

The majority of species grow in rocky places, mainly on limestone and other basic rocks. Saxatile habit conditions have evidently had an influence on the evolution of general habit and life form. Related species usually grow in similar but allopatric habitats.

HISTORY OF INFRAGENERIC CLASSIFICATION

Infrageneric classification of *Stachys* began in 1827, when Dumortier (*Florula Belgica*) subdivided the genus into three sections, viz. *Olisia* Dum., *Stachydotypus* Dum. and *Eriostomum* (Hoffmanns. & Link) Dum. His divisions were preceded by '§' which is the normal sign for sections and acceptable as such unless there are indications to the contrary. Dumortier's sections were mainly based upon the number of flowers per verticillaster and on the length of the bracteoles.

Reichenbach (*Fl. Germ. Exc.* 1:318-320, 1830) proposed three infrageneric groups, namely: a) *Campanistrum*, b) *Chamaesideritis*, c) *Eriostachys*, mainly on annual versus perennial habit, calyx shape and corolla colour, but did not give any indication of their intended rank. *Campanistrum* has been accepted in the present classification as it is the earliest name for the section including *S. arvensis*.

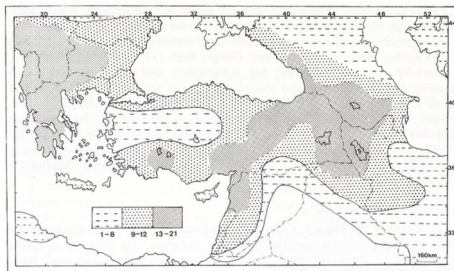


FIG. 2. Isoflor map of *Stachys* species in the Balkans and SW Asia (species numbers based on 2° grid).

Bentham (*Lab. Gen. Sp.*, 1834) adopted much of Dumortier's and Reichenbach's classification, recognising nine sections including two sections of *Betonica*. He recognised sect. *Olisia* Dum. and Reichenbach's groups *Eriostachys* and *Chamaesideritis*, with circumscriptions altered to include more species. He also accepted sect. *Stachyotypus* (correcting Dumortier's original spelling 'Stachydotypus'), including some species of *Campanistrum* and *Eriostachys* of Reichenbach in it. In doing so he emphasised the rose-purple corolla, smaller bracteoles and few-flowered verticillasters, and subdivided *Stachyotypus* into three groups: *Genuinae*, *Ruderales* and *Oligantheae*. Later Bentham (in DC., *Prodr.* 12, 1848) excluded *Betonica* from *Stachys* and renamed the subdivisions of sect. *Stachyotypus* as *Elatae* and *Agrestes*.

Boissier (*Fl. Or.* 4, 1879), following Bentham (1848), accepted three main sections, *Eriostachys*, *Stachyotypus* and *Olisia*, based mainly on perennial versus annual habit, many- or few-flowered verticillasters, conspicuous or inconspicuous bracteoles, and herbaceous or suffruticose stems. He subdivided sect. *Eriostachys* into two subgroups (*Germanicae* and *Micranthae*) on corolla size, and sect. *Stachyotypus* into six (*Sylvaticae*, *Fragiles*, *Rectae*, *Ambleiae*, *Fruticulosae*, *Infrasculares*) mainly on herbaceous versus suffruticose habit, presence or absence of basal rosettes etc. His subgroups were indicated by '§' signs and were not given a formal rank.

Briquet (in Engler, *Nat. Pflanzenfam.* 4(3a):260-267, 1896) accepted Boissier's classification for the most part but followed Bentham's earlier treatment (1834) by including *Betonica* in *Stachys*. The main changes were the substitution of the sectional names *Eriostomum* Hoffmanns. & Link for *Eriostachys*, and *Eustachys* Briq. for *Stachyotypus* Dum. (in which he included several of Reichenbach's, Dumortier's and Bentham's sections,

e.g. *Olisia* Dum., *Chamaesideritis* Reichb.). His subgroups were again preceded by '§' signs and not given formal indication of rank.

More recent treatments included those of Knorring (*Fl. URSS* 21, 1954) and Kapeller (*Monogr. Ser. A. Sist. Geogr. Rast. (Tiflis)* 4, 1961). Knorring essentially followed Boissier; his subsections and series lacked Latin descriptions or diagnoses and consequently were not validly published, but some have recently been validated by Omel'chuk-M'yakushko (*Ukr. Bot. Zhurn.* 31(5):637-638, 1974). In her account of the genus in the Caucasus, Kapeller (*op. cit.*, 1961) accepted five sections including the new section *Thamnostachys* Kapeller. The remaining four (sect. *Ambleia*, sect. *Zietenia*, sect. *Eriostachys*, and sect. *Stachys*) agree with Bentham's circumscription.

THE STATUS OF *BETONICA*

Throughout the history of the classification of *Stachys* different opinions have been expressed about the status of *Betonica*. To arrive at a stable conclusion, I have surveyed *Betonica* throughout its range and have compared its members with the nearest groups of *Stachys* on the basis of morphological and some anatomical features. The sections of *Stachys* most closely related to *Betonica* are *Eriostomum* and (to a lesser extent) *Fragicaulis*, *Infrasolaris* and *Olisia*. Sects. *Ambleia* and *Zietenia* have also been compared as they resemble *Betonica* in a few characters.

The *Betonica* group is characterised by prominent sterile rosettes, and usually unbranched flowering shoots arising from an axillary bud of the rootstock (except for the annual *S. serbica*). The leaf margins are deeply crenate to serrate. Deeply crenate-serrate leaves also occur in *S. alpina* (sect. *Eriostomum*) as do unbranched flowering stems (in *S. germanica* s.l. and *S. alpina*), thus breaking down the distinction. The floral leaves of *Betonica* usually become abruptly smaller upwards, but decrease gradually in size in *S. (Betonica) betoniciflora*. Bract-like upper floral leaves, a $\pm$ constant feature of the *Betonica* group, also occur in *S. aleurites* and *S. bombycina* (sect. *Olisia* subsect. *Distantes*). The floral morphology of both *Stachys* and *Betonica* is similar except for the nature of the calyx and bracteoles: calyx sessile and bracteoles with a broad hardened base in *Betonica*, but calyx pedicellate with the bracteoles (if present) having a narrow soft base in *Stachys*. The character of the presence of an exannulate corolla, more or less constant in the *Betonica* group (except *S. alopecuros*) versus its absence elsewhere, breaks down as some species outwith the *Betonica* group (e.g. *S. longiflora* and *S. pinardii*) also have exannulate corollas. Parallel anther loculi, found in *Betonica*, also occur in some species of sect. *Ambleia* (e.g. *S. inflata* and *S. nivea*). The only constant diagnostic morphological feature of *Betonica* is the previously mentioned presence of sessile flowers and bracteoles with hardened base. Among anatomical features, the presence of adaxial phloem in the petiole and nutlets without pitted thickening in the sclerenchyma are characters constant in *Betonica* (of which all species were examined) which have not been observed in *Stachys* (in which one to three species of each of the 19 sections were examined). However, much more extensive sampling of *Stachys* is required to confirm these differences.

In view of the character states discussed above, the *Betonica* group is best treated as *Stachys* subgenus *Betonica* and the rest as subgenus *Stachys*.

Placing of *Betonica* at co-ordinate sectional rank with other sections of *Stachys* is unsatisfactory since the morphological gap between *Betonica* and *Stachys s. str.* is of a different order to those distinguishing the sections of the latter.

SECTIONAL CLASSIFICATION OF SUBGENUS STACHYS

Subgenus *Stachys* shows a wide range of variability which is difficult to define. In their previous sectional classifications Bentham and Boissier apparently weighted a few selected characters, e.g. annual versus perennial habit and number of flowers and bracteoles per verticillaster. As a result the few sections recognised were mostly large partially heterogeneous assemblages of unrelated or distantly allied species.

I have used the principle of maximum attribute classification to construct groups which are more likely to be 'natural', i.e. to reflect a common ancestry instead of being the product of convergence. With these considerations in mind, the larger heterogeneous groups of previous taxonomists (cf. sect. *Zietenia* Bentham, § *Fruticulosae* Boiss.) have been split up into smaller, sometimes even monotypic sections and subsections. Boissier's '*Fruticulosae*' has been divided into one monotypic section (*Mucronata*), four other fairly small sections (*Candida*, *Swainsoniana*, *Thamnostachys* and *Aucheriana*) and sect. *Olisia* subsect. *Spinosae* (monotypic). Four other monotypic sections, *Roseostachys*, *Corsica*, *Neurocalyx* and *Zietenia*, have been recognised by segregating them from heterogeneous groups of previous classifications. When these monotypic sections are compared with other larger but relatively homogeneous sections (e.g. sect. *Eriostomum*, sect. *Olisia*, sect. *Amblesia*) it is clear that both the larger and the smaller groups are very distinct in their own right.

In the present treatment, therefore, the genus is divided into two subgenera, *Stachys* and *Betonica*, the former being divided into 19 sections and the latter into two. Some of the main sectional names of Dumortier (*op. cit.*, 1827) and Bentham (*op. cit.*, 1834) are accepted on grounds of priority. The rank of Boissier's subgroups of sections could not be accepted because he published them with '§' signs without a clear indication of the formal rank intended. Some of them have been assigned sectional rank under new authorship; others are given new names. The new 'subsections' and 'series' of Knorring (*Fl. URSS* 21, 1954) were invalidly published; some have later been validated by Omel'chuk-M'yakushko (1974) but most remain invalid. In my account, all the species are classified to formal subsectional level; below this, some informal series have been recognised; these are unnamed but denoted by letters of the alphabet. In the Synopsis species are listed in alphabetical order within sections and subsections but in the main account their order attempts to reflect natural relationships.

SYNOPSIS OF SECTIONS, SUBSECTIONS AND SPECIES

Subgen. *Stachys*

1. Sect. *Eriostomum*

Subsect. *Germanicae*

acutifolia

alpina

balansae

ehrenbergii

floccosa

germanica

heraclea

hissarica

huber-morathii

libanotica

obliqua

persica

pinetorum

rizeensis

sericantha

sericophylla

sibirica

tournefortii

tschatkalensis

- Subsect. **Creticae**
byzantina
cretica
macrotricha
thirkei
tmolea
 Subsect. **Spectabiles**
bayburtensis
huetii
longispicata
spectabilis
viticina
2. Sect. **Mucronata**
mucronata
3. Sect. **Infrarosularis**
amanica
cataonica
citrina
petrokosmos
pumila
rupestris
4. Sect. **Roseostachys**
rosea
5. Sect. **Setifolia**
iraqensis
menthoides
setifera
6. Sect. **Stachys**
 Subsect. **Sylvaticae**
hydrophila
palustris
sylvatica
 Subsect. **Circinatae**
circinata
durandiana
guyoniana
mialthesii
7. Sect. **Candida**
candida
chrysantha
iva
maweana
saxicola
spreitzenhoferi
8. Sect. **Swainsoniana**
 Subsect. **Swainsonianeae**
euboica
ionica
spruneri
swainsonii
 Subsect. **Decumbentes**
anisochila
canescens
decumbens
menthifolia
panagaea
plumosa
9. Sect. **Fragilicaulis**
 Subsect. **Multibracteolatae**
asterocalyx
ballotiformis
benthamiana
brantii
fragillima
graveolens
kurdica
laetivirens
lanigera
mardinensis
megalodonta
subnuda
viscosa
 Subsect. **Fragiles**
buttlerei
euadenia
longiflora
pinardii
pseudopinardii
10. Sect. **Olisia**
 Subsect. **Rectae**
albanica
angustifolia
arenaria
atherocalyx
beckeana
fontqueri
iberica
leucoglossa
recta
sparsipilosa
tetragona
virgata
 Subsect. **Distantes**
aleurites
bombycina
distans
 Subsect. **Annuae**
annua
maritima
moureltii
parolinii
talyschensis
 Subsect. **Rosulatae**
diversifolia
inanis
munzurdagensis
 Subsect. **Spinosae**
spinosa
11. Sect. **Campanistrum**
 Subsect. **Ocymastrum**
brachyclada
duriacii
ocymastrum
 Subsect. **Arvenses**
arabica
arvensis
marrubiiifolia
milanii
spinulosa
12. Sect. **Corsica**
corsica
13. Sect. **Sideritopsis**
obscura
pseudosideritis
zoharyana
14. Sect. **Neurocalyx**
neurocalycina
15. Sect. **Satureoides**
burgsdorffiioides
melampyroides
ramosissima
satureoides
16. Sect. **Thamnostachys**
 Subsect. **Fruticulosae**
araxina
fruticulosa
grossheimii
sosnowskyi
 Subsect. **Paulinae**
paulii
17. Sect. **Aucheriana**
acerosa
aucheri
glutinosa
ixodes
multicaulis
pilifera
18. Sect. **Zietenia**
lavandulifolia
19. Sect. **Amblesia**
aegyptiaca
aemawendica
inflata
kotschyi
laxa
nivea
obtusicrena
palaestina
tomentosa
trinervis
turcomanica
 Subgen. **Betonica**
20. Sect. **Betonica**
alopecuroides
macrantha
monieri
officinalis
serbica
21. Sect. **Macrostachya**
betonicifolia
discolor
macrostachya
scardica

SYSTEMATIC ACCOUNT

Stachys L., Gen. Pl. ed. 5:523 (1754); Sp. Pl. 580 (1753).

Incl. *Betonica* L., Gen. Pl. ed. 5:250 (1754).

Annual and perennial herbs, sometimes suffruticose or rarely dwarf shrubs. *Leaves* simple, broadly ovate-cordate to lanceolate, petiolate or sessile. *Verticillasters* 2–20-flowered, dense or remote, with or without bracts (floral leaves) and bracteoles. *Pedicels* present or absent. *Calyx* tubular to campanulate, 5–10-veined, usually smooth, rarely ridged but never deeply sulcate, sub-bilabiate to $\pm$ regular, rarely bilabiate; teeth 5, usually subequal, sometimes posterior 3 distinct from 2 anterior, not dilated at base. *Corolla tube* sub-exserted or exserted, rarely included in calyx tube and usually not dilated towards mouth, annulate or rarely exannulate; limb bilabiate, upper lip erect to subpatent, concave, entire or emarginate, rarely deeply bifid, lower lip trilobed, middle lobe largest, entire to emarginate. *Stamens* 4, ascending, exserted from corolla tube, posterior pair usually shorter than anterior, rarely $\pm$ at the same level and arising at a higher level than anterior pair inside corolla tube; filaments usually with a few swollen hairs near the region of attachment with corolla tube, or naked; anthers bilocular, usually divaricate, rarely subparallel to parallel. *Style* gynobasic, apex subequally bifid into subulate stigmas; nectaries 4-lobed, alternating with ovary lobes, anterior one largest. *Nutlets* dry, obovoid to oblong, sometimes flattened-trigonus, apex rounded, attachment scar small and basal, ventral ridge smooth or distinct.

Distribution of genus: subcosmopolitan (excl. Australia), but mainly centred in the Mediterranean region and SW Asia.

KEY TO SUBGENERA AND SECTIONS

1. Flowers pedicellate; flowers and bracteoles with narrow unhardened base; lower cauline leaves usually obscurely crenate to $\pm$ entire, rarely distinctly crenate; nutlets usually obovoid without flattened lateral and apical winged margins, apex irregularly lobed (I. Subgen. *Stachys*) 2
- + Flowers sessile; flowers and bracteoles with broad hardened base; lower cauline leaves deeply crenate-dentate; nutlets compressed-trigonus with flattened lateral and apical winged margins, apical wing usually irregularly lobed (II. Subgen. *Betonica*) 25
2. Upper corolla lip densely sericeous-tomentose on outer surface, hairs usually exceeding lip 3
- + Upper lip naked to sparsely hairy, hairs not exceeding lip 4
3. Verticillasters 4-many-flowered; calyx teeth not rigidly spinescent; flowering axis elongate, usually simple with few branches 1. Sect. *Eriostomum*
- + Verticillasters 2-flowered; calyx teeth rigid and stiffly spiny; flowering axis dwarf, divaricately branched and bushy 2. Sect. *Mucronata*
4. Plants with creeping rhizomes, growing in damp places 5
- + Plants without creeping rhizomes, growing mainly in rocky habitats 6

5. Floral leaves spinescent; verticillasters with oblong acuminate bracteoles as long as or slightly shorter than calyx tube; stamens little exerted from corolla tube 5. Sect. *Setifolia*
- + Floral leaves not spinescent; verticillasters with very few inconspicuous short, setaceous bracteoles as long as pedicels; stamens exerted, as long as upper corolla lip 6. Sect. *Stachys*
6. Plants usually with conspicuous basal rosettes of sterile shoots; flowering axis usually unbranched; stems with not more than 3 pairs of cauline leaves 7
- + Plants usually without basal rosettes of sterile shoots; flowering axis (when present) conspicuously branched; stems with at least 5 pairs of cauline leaves 8
7. Basal leaves ovate-elliptic to ovate-oblong, cordate to subcordate, rarely cuneate at base; calyx teeth c. $0.5 \times$ as long as tube; indumentum without stellate hairs 3. Sect. *Infrasolaris*
- + Basal leaves oblong-lanceolate to oblanceolate, attenuate at base; calyx teeth $1.5-4 \times$ as long as tube; indumentum with stellate hairs 18. Sect. *Zietenia*
8. Annual, or if perennial then with basal rosettes (usually sterile at flowering time) or stems rooting at nodes 9
- + Suffrutescent perennials without basal rosettes 14
9. Stem shortly adpressed-pubescent or puberulent, sometimes with patent glandular hairs; calyx teeth triangular to lanceolate-subulate 10
- + Stem patent-pilose or patent-hispid (hairs c. 2 mm) with glandular and eglandular hairs, rarely glabrescent; calyx teeth oblong to oblong-lanceolate 11
10. Lower cauline leaves oblanceolate, attenuate at base; calyx urceolate in fruit, mouth densely hairy; habit always annual 15. Sect. *Satureioides*
- + Lower cauline leaves ovate-lanceolate to ovate-elliptic, cordate to cuneate at base; calyx not urceolate in fruit, mouth sparsely hairy; annual, or if perennial then with basal rosettes of leaves 10. Sect. *Olisia* p.p.
11. Calyx bilabiate, prominently veined in fruit; lower cauline leaves obovate, attenuate to cordate at base; always annual 12
- + Calyx sub-bilabiate, not prominently veined in fruit; lower cauline leaves ovate to ovate-elliptic, cordate to subcordate at base; annual or perennial 13
12. Plant hispid to pilose; verticillasters bracteolate; corolla lips included in calyx 13. Sect. *Sideritopsis*
- + Plant glabrescent; verticillasters ebracteolate; corolla lips exerted from calyx 14. Sect. *Neurocalyx*
13. Plant annual, not rooting at nodes; verticillasters c. 6-flowered 11. Sect. *Campanistrum*
- + Plant $\pm$ perennial, rooting at nodes; verticillasters 2-flowered 12. Sect. *Corsica*

14. Flowering stems fragile at base; calyx tube and teeth herbaceous with blunt to softly spinescent tip 9. Sect. *Fragilicaulis*
- + Flowering stems not fragile at base; calyx tube and teeth non-herbaceous with mucronate or rarely blunt teeth 15
15. Indumentum with dendroid or stellate hairs; anther cells subparallel 19. Sect. *Ambleia*
- + Indumentum without dendroid or stellate hairs; anther cells divaricate 16
16. Stem floccose-tomentose to arachnoid with simple crispulate eglandular hairs 17
- + Stem adpressed-tomentose or pubescent, sometimes patently pilose with simple straight eglandular and/or glandular hairs 19
17. Verticillasters with conspicuous ovate to ovate-lanceolate or lanceolate-subulate bracteoles as long as calyx or sometimes a little shorter 10. Sect. *Olisia* p.p.
- + Verticillasters ebracteolate or with very small, few, setaceous bracteoles as long as or shorter than pedicels 18
18. Verticillasters mostly approximate in a dense spike; upper corolla lip entire or retuse 7. Sect. *Candida*
- + Verticillasters mostly remote; upper corolla lip deeply emarginate 10. Sect. *Olisia* p.p.
19. Stems adpressed-tomentose or pubescent, often eglandular 20
- + Stem patent-pilose or patent-hispid with glandular and eglandular hairs 22
20. Flowering stem ending in stiff spines; verticillasters with herbaceous, mucronate-tipped bracteoles as long as calyx tube; stems long sericeous-tomentose 10. Sect. *Olisia* p.p.
- + Flowering stems not ending in spines; verticillasters with very small, setaceous bracteoles $\pm$ as long as pedicels; stems not long sericeous-tomentose 21
21. Stems sparsely puberulent; calyx tubular and $\pm$ regular, inflated in fruit; calyx mouth glabrous 16. Sect. *Thamnostachys*
- + Stems adpressed-pubescent; calyx subcampanulate, sub-bilabiate, not inflated in fruit; calyx mouth hairy 10. Sect. *Olisia* p.p.
22. Corolla tube included; calyx with blunt teeth; leaves sessile with cordate base 4. Sect. *Roseostachys*
- + Corolla tube exerted; calyx with pointed teeth; leaves petiolate with cordate to attenuate base 23
23. Stamens slightly exerted from corolla tube; verticillasters remote; flowering stems ending in spinescent branches 17. Sect. *Aucheriana*
- + Stamens exerted, as long as upper corolla lip; verticillasters mostly approximate; flowering stems not spinescent 24

24. Lower cauline leaves broadly ovate, 4-9 × 3-6 cm, base distinctly cordate; verticillasters ebracteolate or with very few small setaceous bracteoles 6. Sect. *Stachys* p.p.
 + Lower cauline leaves usually obovate to narrowly ovate-oblong or ovate-lanceolate, 1-5 × 0.5-2.5 cm, base attenuate to truncate, rarely subcordate; verticillasters usually with conspicuous herbaceous bracteoles, as long as calyx or slightly less, rarely few and setaceous 8. Sect. *Swainsoniana*
25. Indumentum without stellate hairs; leaves usually broadly ovate-oblong or oblong 20. Sect. *Betonica*
 + Indumentum with stellate hairs at least on lower surface of leaves and inflorescence; leaves usually narrowly oblong-lanceolate 21. Sect. *Macrostachya*

I. Subgenus *Stachys*

Syn.: *Zietenia* Gled., Syst. Pl. 185 (1764).

Trixago Haller, Hist. Stirp. Indigenar. Inch. 101b (1768); Moench, Meth. 394 (1794); Hoffmanns. & Link, Fl. Port. 1:102 (1809) non Stev. (1823) nec Rafin. (1836).

Galeopsis sensu Moench, Meth. 397 (1794) non L. (1753).

Tetrahitum Hoffmanns. & Link, Fl. Port. 1:103 (1809).

Eriostomum Hoffmanns. & Link, op. cit. 105 (1809).

Trixella Fourr. in Ann. Soc. Linn. Lyon N.S. 17:135 (1869).

Flowering stems usually branched. *Leaves* usually with weakly crenate to subentire margin; floral leaves gradually passing from larger to smaller sizes. *Verticillasters* (2-)4-20-flowered. *Bracteoles* few to numerous, sometimes absent, herbaceous to setaceous with narrowed, unhardened base. *Pedicels* (0.2-)1-10 mm. *Calyx* usually sub-bilabiate, rarely ± regular or completely bilabiate; teeth ± unequal; mouth hairy or glabrous. *Corolla tube* subexserted or exserted, rarely included, annulate or rarely exannulate. *Anther cells* divaricate or rarely subparallel. *Nutlets* obovoid to bluntly trigonous, rarely oblong-elongate, apex smooth, rarely notched or apiculate in middle, marginal wing usually absent, rarely present near base.

Petiole anatomy: adaxial phloem usually absent in vascular bundles.

Nutlet anatomy: inner sclerenchymatous layer of mesocarp with scalariform to pitted unthickened areas.

Type: *S. sylvatica* L.

Distribution: throughout the range of the genus.

1. Sect. *Eriostomum* (Hoffmanns. & Link) Dum., Fl. Belg. 45 (1827).

Syn.: *Eriostomum* Hoffmanns. & Link, Fl. Port. 1:105 (1809) pro gen.

Stachys L. sect. *Eriostachys* Bentham, Lab. Gen. Sp. 526 (1834).

S. sect. *Eriostomum* (Hoffmanns. & Link) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):261 (1896).

Perennial, usually with basal sterile rosettes (not always persistent). *Flowering stems* simple or rarely branched, densely lanate to tomentose, rarely sparsely pilose or adpressed-pubescent. *Basal leaves* ovate to oblong-lanceolate, ± crenate to subentire, cordate to attenuate at base, long-petiolate. *Cauline leaves* similar but smaller, shortly petioled to subsessile,

gradually passing into $\pm$ sessile floral leaves. *Verticillasters* (4-)12-20-flowered. *Bracteoles* numerous, ovate-lanceolate to linear-lanceolate, herbaceous, usually softly (rarely stiffly) spinescent-tipped. *Pedicels* 2-10 mm. *Calyx* sub-bilabiate to $\pm$ regular, campanulate to tubular; teeth subequal, with spinescent tips; mouth hairy. *Corolla tube* subincluded, annulate; upper corolla lip densely sericeous-tomentose on outside, hairs usually exceeding the lip. *Nutlets* obovoid, slightly winged near base, apex smooth.

Type: *S. germanica* L.

1. Calyx $\pm$ regular with $\pm$ equal teeth; stem softly puberulent; glandular hairs absent from plant body . . . Subsect. *Spectabiles*
- + Calyx sub-bilabiate with unequal teeth; stem densely lanate-villous to adpressed-tomentose; glandular hairs present at least in some part of plant body 2
2. Lower cauline leaves oblong-spathulate, narrowed towards base, attenuate or rounded at petiole, rarely a few subcordate; stem adpressed-tomentose Subsect. *Creticae*
- + Lower cauline leaves ovate to ovate-lanceolate, rarely oblong-lanceolate, broader towards base, usually cordate, rarely subcordate to truncate; stem patently lanate-villous to densely pilose Subsect. *Germanicae*

Subsect. **Germanicae** Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Eriostachys* Benth. § *Germanicae* Boiss., Fl. Or. 4:715 (1879) p.p.

S. sect. *Eriostomum* (Hoffmanns. & Link) Briq. § *Germanicae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a): 261 (1896) p.p.

S. series *Lanatae* [Knorr. ex] Omel'chuk-M'yakushko in Ukr. Bot. Zhurn. 31(5):636 (1974) p.p.

Caulis patente lanato-villosus, rariore sparse pilosus. *Folia caulina* inferiora plerumque ovata vel ovato-lanceolata vel oblongo-lanceolata, ad basin latiora, cordata vel subcordata, rariore truncata, margine distincte vel rariore indistincte crenato-dentato. *Calyx* sub-bilabiatus, dentibus inaequalibus, pilis glandulosis plerumque ferens.

Type: *S. germanica* L.

1. Verticillasters 10-16(-20)-flowered; bracteoles many, not spinescent at tip Series A
- + Verticillasters 4-6-flowered; bracteoles few, spinescent at tip Series B

Series A.

Stem lanate-villous. Bracteoles not spinescent at tip. Verticillasters 10-20-flowered. Calyx weakly veined.

Species: *S. germanica* L., *S. sericophylla* Hal., *S. alpina* L., *S. balansae* Boiss., *S. ehrenbergii* Boiss., *S. rizeënsis* Bhattacharjee, *S. huber-morathii*

Bhattacharjee, *S. pinetorum* Boiss., *S. tournefortii* Poiret, *S. obliqua* Waldst. & Kit., *S. acutifolia* Link., *S. heraclea* All., *S. sibirica* Link., *S. persica* Gmel., *S. hissarica* Regel, *S. floccosa* Benth., *S. tschatkalensis* Knorr.

Series B.

Stems sparsely and patently pilose to hispid. Bracteoles stiffly spinescent at tip. Verticillasters (2-)4-6-flowered. Calyx strongly veined.

Species: *S. libanotica* Boiss., *S. sericantha* P. H. Davis.

Subsect. *Creticae* Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Dasystoma* C. Koch in Linnaea 21:685 (1848) p.p.

S. § *Germanicae* Boiss., Fl. Or. 4:715 (1879) p.p.

S. series *Lanatae* [Knorr. ex] Omel'chuk-M'yakushko, loc. cit. (1974) p.p.

Caulis plerumque dense (rariore sparse) adpresse tomentosus. *Folia caulina* inferiora oblongo-spathulato, ad basin angustata, attenuata vel obtusa, rariore in petiolum subcordata, margine obscure crenulato vel subintegro. *Calyx* sub-bilabiatus, dentibus inaequalibus, plerumque pilis glandulosis ferens.

Type: *S. cretica* L.

Other species: *S. tmolea* Boiss., *S. thirkei* C. Koch, *S. byzantina* C. Koch, *S. macrotricha* Rech. fil.

Subsect. *Spectabiles* Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Eriostachys* Benth. § *Germanicae* Boiss., Fl. Or. 4:715 (1879) p.p.

S. sect. *Eriostachys* Benth. § *Micrantheae* Boiss., loc. cit. (1879) p.p.

[*S.* series *Spectabiles* Knorr. in Fl. URSS 21:202 (1954) nom. inval.]

Caules breviter adpresse-pubescentes. *Folia caulina* inferiora ovato-lanceolata vel ovata, ad basin rotundata usque subcordata (rariore cuneata), margine leviter vel distincte crenato-serrato. *Calyx* ± actinomorphus, dentibus aequalibus, eglandulosus.

Type: *S. spectabilis* Choisy.

Other species: *S. viticina* Boiss., *S. longispicata* Boiss., *S. huetii* Boiss., *S. bayburtensis* Bhattacharjee & Hub.-Mor.

Distribution: Lebanon, N Syria, Turkey, Iran, Caucasia, Afghanistan.

Sect. *Eriostomum* is fairly homogeneous in its overall character resemblances and has a wide range throughout Europe, Asia and part of N Africa. Its members mostly grow in damp habitats, bearing characteristic herbaceous stems with basal sterile rosettes but sometimes xeromorphic characters have evolved in response to drier or exposed conditions (e.g. *S. cretica*). On the whole, the section apparently contains a larger assemblage of putative primitive characters than other groups of *Stachys*. From a phylogenetic viewpoint the group may stand near to, or be derived from, a more generalised ancestral stock. For convenience and also to give a natural classification, this large section is divided into three subsections. Of these, subsect. *Spectabiles* is mainly oriental and Irano-Turanian in distribution,

while subsect. *Creticae* and subsect. *Germanicae* grow widely throughout Europe and Asia.

The affinities of sect. *Eriostomum* can be traced on one hand to the monotypic sect. *Mucronata* Bhattacharjee (Crete, Karpathos: see below), and to sect. *Infrarosularis* Bhattacharjee on the other, but there are sufficient differences to maintain them as three different sections. Sect. *Eriostomum* also resembles subgen. *Betonica* sect. *Betonica* in several 'Betonica' characters which are present in some or all of its species (e.g. presence of basal sterile rosettes, unbranched flowering shoots, crenate leaf margins).

2. Sect. *Mucronata* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Zietenia* Benthām, Lab. Gen. Sp. 531 (1834) p.p. excl. typ.

S. sect. *Stachyotypus* Benthām § *Fruticulosae* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. *Eustachys* Briq. § *Fruticulosae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):264 (1896) p.p.

Perennes suffruticosae pumilae rosulis sterilibus basalibus praeditae. *Caules floriferi* divaricate ramosi, dense lanati vel tomentosi, eglandulosi. *Folia basalia* oblonga, crenulata, ad basin cuneata vel truncata, longe petiolata. *Folia caulina* pauca, ± inconspicua, sessilia, quam basalia minora sed similia. *Folia floralia* sessilia, quam verticillastos breviora. *Verticillastri* 2-flori. *Bracteolae* lanceolatae ad teretae, herbaceae, ad apicem spinescentes, calycis ± aequantes. *Pedicelli* 5–10 mm longi, in statu fructifero ad 12–14 mm elongati crassiores. *Calyx* ± regularis, campanulatus, venis prominentibus; dentes aequales, perspinosi; faux dense pilosus. *Tubus corollae* subinclusus, annulatus; labium superius extus sericeo-tomentosum, pili quam labium longiores. *Nuculae* obovoideae, ad basin paulo alatae.

Type: *S. mucronata* Sieber.—Monotypic.

Distribution: S Greece (E Crete, Karpathos).

In some distinct morphological characters such as bushy divaricate habit, strongly nerved and stiffly spiny calyx, 2-flowered verticillasters with very long, hard pedicels, this monotypic section is unique and taxonomically isolated. With respect to these characters, sect. *Mucronata* resembles some other isolated groups, e.g. sect. *Aucheriana*, sect. *Thamnostachys* and sect. *Olisia* subsect. *Spinosae*. These apparent similarities could probably be due to convergence, because the characters mentioned above are liable to be influenced by extreme environmental conditions. Strong correlation with other more stable morphological characters, e.g. presence of basal rosettes, subinclud ed corolla tube, densely sericeous-tomentose upper corolla lip, densely hairy calyx mouth, and lanate-tomentose indumentum, suggests an affinity with sect. *Eriostomum*.

3. Sect. *Infrarosularis* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Zietenia* (Gled.) Benthām in DC., Prodr. 12:486 (1848) p.p.

S. sect. Stachyotypus Benth. § *Infrarosulares* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. Eustachys Briq. § *Infrarosulares* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):165 (1896) p.p.

Herbae perennes saxatiles suffruticosae rosulis sterilibus basalibus emittentes. *Caules floriferi* ± simplices. *Indumentum* griseo-tomentosum vel patente pilosum, pili eglandulosi vel glandulosi. *Folia basalia* ovato-oblonga vel elliptica, obscure crenata, basi cordato vel cuneato, longe petiolata. *Folia caulina* pauca (2-3-nata) breviter petiolata vel subsessilia, gradatim folia floralia minora sessilia vel subsessilia transientia. *Verticillastri* 4-12(-16)-flori. *Bracteolae* paucae, lanceolatae vel lineares, herbaceae vel setaceae, tubum calycis aequantes vel breviores, non spinescentes. *Pedicelli* 1-6 mm longi. *Calyx* ± actinomorphus vel subbilabiatus, subcampanulatus usque tubulosus, dentes ± inaequales, ad apicem molliter spinescentes; os sine annulo pilorum. *Tubus corollae* subexsertus ad exsertus; labium superius extus sparse hirsutum sed pilis quam labio non longioribus. *Nuculae* obovoideae ad ± oblongae, base non alato.

Type: *S. rupestris* Montbret & Aucher.

Other species: *S. cataonica* Bhattacharjee & Hub.-Mor., *S. petrokosmos* Rech. fil., *S. amanica* P. H. Davis, *S. pumila* Banks & Sol., *S. citrina* Boiss. Distribution: S & adjacent Inner Anatolia; probably endemic.

This section forms a coherent group of closely allied chasmophytes of the eastern Mediterranean region of Anatolia. Its taxonomic position is quite isolated although some phenetic resemblances can be traced with the widely distributed sect. *Eriostomum*. The distinctness of this rosulate section of chasmophytes is in marked contrast to the close relationship of the taxa within it. This may have resulted from alternating phases of isolation and hybridization; biosystematic studies are needed.

4. Sect. *Roseostachys* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Eriostachys* Benth. § *Micrantheae* Boiss., Fl. Or. 4:715 (1879) p.p.

[*S. sect. Eriostomum* (Hoffmanns. & Link) Briq. § *Biflorae* Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):262 (1896) nom. inval.].

Herbae perennes saxatiles suffruticosae sine rosulis sterilibus basalibus. *Caules floriferi* ramosi, patente hispidi, glandulosi et eglandulosi. *Folia caulina* ovato-elliptica, crenata, apice obtusa, ad basin cordata vel subcordata, sessilia, caulina mediana et floralia similia sed minora. *Verticillastri* (2-)4(-6)-flori, remoti. *Bracteolae* lanceolatae, herbaceae, quam calycem aequales, apice obtusae. *Pedicelli* 2-6 mm longi. *Calyx* tubulosus, dentibus subaequalibus obtusis. *Tubus corollae* inclusus; labia inferius et superius crassa carnosa extus dense breviter adpresse pilosa. *Nuculae* obovoideae.

Type: *S. rosea* Desf.—Monotypic.

Distribution: Libya (Cyrenaica).

This monotypic SE Mediterranean section is quite distinct and isolated in some of its characters such as saxatile suffrutescent habit, sessile leaves, blunt thick calyx teeth, completely included corolla tube and thick, densely hairy corolla lips. There may be some affinity with sect. *Setifolia*, with which it shares bracteate few-flowered verticillasters, but otherwise remains quite distinct by the above-mentioned diagnostic characters. The infrasectional name '*Biflorae*' of Briquet (1896) is not only nomenclaturally invalid but also unacceptable since the number of flowers per verticillaster on the same inflorescence axis varies from 2 to 6, and is most frequently 4.

5. Sect. *Setifolia* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Eriostachys* Benth in DC., Prodr. 12:466 (1848) p.p.

S. sect. *Eriostachys* Benth in § *Micrantheae* Boiss., Fl. Or. 4:715 (1879) p.p.

S. sect. *Stachyotypus* Benth in § *Sylvaticae* Boiss., loc. cit., p.p.

S. sect. *Eriostomum* (Hoffmanns. & Link) Briq. § *Micrantheae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):262 (1896) p.p.

[*S.* sect. *Eriostachys* Benth series *Setiferae* Knorr. in Fl. URSS 21:211 (1954) nom. inval.].

Herbae perennes rhizomatibus longis, sine rosulis sterilibus basalibus. *Caules* floriferi elongati, simplices, rariore superne ramosi. *Indumentum* patente hispidum ad subpatens vel adpresse molliter pubescens, eglandulosum vel glandulosum. *Folia caulina* inferiora lanceolata, serrata, apice acuto, basi subcordato ad truncato, breviter petiolata. *Folia mediana floraliaque* similia sed quam inferiora minora, sessilia, apice plerumque spinescente. *Verticillastri* 4–6-flori, ± remoti. *Bracteolae* lanceolatae, herbaceae, apice spinescente, rariore paucae setaceae, quam tubus calycis aequantes vel sub-breviores. *Pedicelli* 1–2 mm longi. *Calyx* ± actinomorphus, subcampanulatus, dentes subaequales, subpatentes vel patentes, apicibus mucronatis. *Tubus corollae* subexsertus, saccatus, imperfecte annulatus. *Nuculae* obovoideae, apiculatae, costa ventralis distincta.

Type: *S. setifera* C. A. Meyer.

Other species: *S. iraqensis* Bhattacharjee, *S. menthoides* Kotschy & Boiss.

Related to sect. *Stachys* in having a similar habit, lanceolate shortly petioled to subsessile leaves and few-flowered verticillasters, but differs in having stamens slightly exserted from the corolla tube, and in the sharply spinescent floral leaves and conspicuous mucronate bracteoles. For these reasons it is kept distinct from sect. *Stachys*. Boissier (*Fl. Or.* 4:724, 727, 1879) treated *S. setifera* and *S. menthoides* under sects. *Eriostachys* and *Stachyotypus* respectively, emphasising the woody and herbaceous nature of the flowering stem; this seems a very unnatural treatment since overall resemblances show the two species to be closely allied.

6. Sect. *Stachys*

Syn.: *Stachys* L. sect. *Stachyotypus* Dum., Fl. Belg. 45 (1827).

S. sect. Eustachys Briq., in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):262 (1896).

Mesophytic or suffrutescent perennials with or without long rhizomes. *Basal sterile rosettes* absent. *Flowering stems* elongate, simple, usually unbranched, rarely branched above. *Indumentum* patently hispid (sometimes subpatent to adpressed-pubescent), glandular and eglandular. *Lower cauline leaves* ovate-lanceolate, serrate to crenate-serrate, apex acute, cordate to truncate at base, petiolate to subsessile. *Verticillasters* 4-6(-10)-flowered. *Bracteoles* small, 0.5-1.5 mm, setaceous. *Calyx* sub-bilabiate to campanulate; teeth subequal, spinescent-tipped. *Corolla tube* exerted, saccate at base or not, annulate. *Stamens* exerted as long as upper lip of corolla. *Nutlets* obovoid, apex round, ventral rib faint.

Type: *S. sylvatica* L.

1. Plant with long rhizomes, growing in damp, often shady places;
corolla tube saccate towards base Subsect. *Sylvaticae*
- + Plant without rhizomes, saxatile; corolla tube not saccate Subsect. *Circinatae*

Subsect. *Sylvaticae* (Knorr. ex Omel'chuk-M'yakushko) Bhattacharjee, stat. nov.

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Genuinae* Benth., Lab. Gen. Sp. 527 (1834) & § *Elatae* Benth. in DC., Prodr. 12:468 (1848).

S. sect. Stachyotypus Benth. § *Sylvaticae* Boiss., Fl. Or. 4:715 (1879).

S. series Sylvaticae [Knorr. ex] Omel'chuk-M'yakushko in Ukr. Bot. Zhurn. 31(5):637 (1974).

S. series Palustres [Knorr. ex] Omel'chuk-M'yakushko, op. cit. 638 (1974).

Herbs inhabiting damp places, with long creeping perennant rhizomes. *Floral leaves* not spinescent at apex. *Calyx teeth* lanceolate-subulate. *Corolla tube* saccate at base.

Type: *S. sylvatica* L.

Other species: *S. hydrophila* Boiss., *S. palustris* L.

Distribution: Temperate Eurasia, N America; S Africa (?).

Subsect. *Circinatae* Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Stachyotypus* Dum. § *Ruderales* Benth., Lab. Gen. Sp. 528 (1834) p.p.

Herbae sine rhizomatibus, in fissuris rupium crescentes. *Folia floralia* molliter spinescentia. *Dentes calycis* ovato-triangulares vel lanceolati. *Tubus corollae* non saccatus.

Type: *S. circinata* L'Hérit.

Other species: *S. guyoniana* Noë, *S. durandiana* Coss., *S. mialhesii* Noë.

Distribution: Spain & NW Africa.

Subsect. *Sylvaticae* has affinity with sect. *Setifolia* (q.v.), while subsect. *Circinatae* shows certain resemblances to sect. *Swainsoniana* (see below), particularly in suffruticose habit, long exserted stamens and patent-hispid stem indumentum.

7. Sect. **Candida** Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. & Hook. f. *Ruderales* Benth. & Hook. f. Lab. Gen. Sp. 528 (1834) p.p.

S. sect. *Stachyotypus* Benth. & Hook. f. *Ambleia* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. *Eustachys* Briq. & S. *Ambleiae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):265 (1896) p.p.

Herbae perennes saxatiles suffruticosae sine rosulis sterilibus basalibus. *Caules* floriferi pumili, ramosi, dense floccoso-tomentosi, pilis longis crispatis eglandulosis praediti. *Folia caulina* inferiora ovato-orbicularia, rariore oblanceolata, margine subintegro, cordata vel rotundata, rariore ad basin attenuata, petiolata. *Folia mediana et floralia* similia sed quam inferiora minora, breviter petiolata ad subsessilia vel sessilia. *Verticillastri* 4-8-flori, in spicum densum congesti. *Bracteolae* inconspicuae, paucae vel absentes; *Pedicelli* 2-3 mm longi. *Calyx* $\pm$ regularis, subcampanulatus, dentibus subaequalibus, obtusis vel molliter spinescentibus. *Tubus corollae* subexsertus. *Nuculae* rotundatae, obovoideae, ad basin paulo alatae.

Type: *S. candida* Bory & Chaub.

Other species: *S. chrysantha* Boiss., *S. iva* Griseb., *S. spreitzenhoferi* Heldr., *S. saxicola* Coss. & Bal., *S. maweana* Bal.

Distribution: Greece, Morocco.

This section shows an affinity with sect. *Swainsoniana* (see below) in the nature of the corolla shape, congested inflorescence, and long exserted stamens. *S. saxicola* is a characteristic NW African endemic, showing marked disjunction from the other allied endemic Greek species; it is particularly characterised by the fragility of the older portion of its flowering stems.

8. Sect. **Swainsoniana** Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Zietenia* Benth. & Hook. f. Lab. Gen. Sp. 531 (1834) p.p. excl. typ.

S. sect. *Stachyotypus* Benth. & Hook. f. *Fruticulosae* Boiss., Fl. Or. 4:715 (1879) p.p.

S. sect. *Eustachys* Briq. & S. *Fruticulosae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):264 (1896) p.p.

Herbae perennes saxatiles suffruticosae sine rosulis sterilibus basalibus. *Caules* floriferi pumili vel elongati, ramosi, patente pilosi ad hispido-glandulosi et -eglandulosi. *Folia caulina* inferiora obovata vel ovata, ad basin attenuata, rotundata vel subcordata, subsessilia vel petiolata. *Folia mediana et floralia* similia sed quam caulina inferiora minora, sessilia usque breviter petiolata. *Verticillastri* (4-)6(-10)-flori. *Bracteolae* linearilanceolatae, herbaceae, quam tubus calycis aequantes vel minores, interdum caducae. *Pedicelli* 2-5 mm longi. *Calyx* subbilabiatus ad bilabiatus, subcampanulatus ad campanulatus; dentes subaequales ad

aequales. *Corolla* subexserta, labium superius extus nudum vel sparse pilosum. *Nuculae* obovoideae, ad basin paulo alatae.

Type: *S. swainsonii* Benth.

Distribution: Balkan Peninsula (Greece, Albania, Jugoslavia, Bulgaria).

1. Leaves obovate with attenuate base, rugose; habit dwarfish, stems c. 5-16(-20) cm. Subsect. *Swainsonianae*
- + Leaves ovate-oblong to ovate-lanceolate with rounded to subcordate base, not rugose; habit elongate, stems c. (20-)30-55 cm. Subsect. *Decumbentes*

Subsect. *Swainsonianae* Battacharjee, **subsect. nov.**

Caules subpumili, c. 5-16(-20) cm alti. *Folia* rugosa, obovata, ad basin attenuata, subsessilia.

Type: *S. swainsonii* Benth.

Other species: *S. euboica* Rech. fil., *S. spruneri* [Boiss. ex] Benth., *S. ionica* Hal.

Distribution: Greece.

Subsect. *Decumbentes* Battacharjee, **subsect. nov.**

Caules elongati, c. (20-)30-55 cm alti. *Folia* non rugosa, ovato-lanceolata, ad basin rotundata vel subcordata, petiolata.

Type: *S. decumbens* Pers.

Distribution: C, E, & W part of Balkan Peninsula.

1. Calyx sub-bilabiate; teeth subequal, lanceolate-subulate with long setulose tip. Series A
- + Calyx bilabiate; teeth unequal, lanceolate, spinescent-tipped. Series B

Series A.

Calyx sub-bilabiate, densely hairy; teeth lanceolate-subulate with long setulose tip.

Species: *S. decumbens* Pers., *S. canescens* Bory & Chaub., *S. plumosa* Griseb., *S. panagaea* Phitos.

Series B.

Calyx bilabiate, $\pm$ glabrescent; teeth lanceolate with glabrescent spinescent tip.

Species: *S. anisochila* Vis., *S. menthifolia* Vis.

Subsect. *Decumbentes* has some affinity with sect. *Stachys* subsect. *Circinatae* and sect. *Olisia* subsect. *Rectae* in habit, corolla and stamen structure. On the other hand, subsect. *Swainsonianae* is more strongly related to sect. *Candida*. The whole section is characterised by its suffruticose saxatile habit, its species being in the main restricted to rock crevices.

9. Sect. *Fragilicaulis* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Chamaesideritis* Benth. in DC., Prodr. 12:483 (1848).

S. sect. *Stachyotypus* Benth. op. cit. 468 (1848) p.p.

S. sect. *Eustachys* § *Rectae* (Boiss.) Briq. & § *Fragiles* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):263 (1896).

Herbae perennes suffrutescentes saxatiles sine rosulis basalibus. *Caules* floriferi infra fragiles, erecti vel pendentes, ramosi, patente (rariore subpatente) pilosi. *Folia caulina inferiora* orbicularia vel ovata, rariore ovato-lanceolata, crenato-dentata vel crenata, ad basin cordata vel subcordata, petiolata vel subsessilia. *Folia caulina mediana* similia sed minora, breviter petiolata ad sessilia. *Verticillastri* (2-)6-10(-16)-flori. *Bracteolae* paucae vel caducae, lineari-lanceolatae vel lineares, herbaceae vel setaceae, quam tubum calycis aequales vel minores. *Pedicelli* 2-6 mm longi. *Calyx* ± regularis, infundibuliformis ad subcampanulatus, herbaceus, dentes subaequales, plerumque obtusi vel molliter spinescentes, rariore spinescentes (*S. viscosa* Montbret & Aucher). *Tubus corollae* exsertus, annulatus vel exannulatus. *Nuculae* obovoideae, trigonales, ala marginalis adest vel deest, apice apiculato ad emarginato.

Type: *S. benthamiana* Boiss.

1. Bracteoles inconspicuous, very few, setaceous, as long as pedicel (c. 1-3 mm) sometimes caducous; nutlets oblong, apiculate

Subsect. *Fragiles*

- + Bracteoles conspicuous, several, herbaceous, sometimes setaceous, as long as or slightly shorter than calyx tube (c. 2-6 mm); nutlets obovoid, apex smooth or rarely notched

Subsect. *Multibracteolatae*

Subsect. *Multibracteolatae* Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Rectae* Boiss., Fl. Or. 4:716 (1879) p.p.

Bracteolae conspicuae, herbaceae, rariore setaceae, c. 2-6 mm longi. *Dentes calycis* oblongo-lanceolati ad triangulares, plerumque obtusi, rariore molliter spinescentes. *Nuculae* obovoideae, ad basin paulo alatae, rariore ala marginae provisae.

Type: *S. benthamiana* Boiss.

Distribution: E Anatolia, N Iraq, W Iran.

1. Bracteoles herbaceous, patent-pilose; stem patent-pilose to hispid Series A
- + Bracteoles setaceous, glabrescent; stem subpatent to retrorse-pubescent Series B

Series A.

Stem patent-pilose to hispid. *Bracteoles* herbaceous, pilose, as long as calyx tube or slightly less (c. 4-6 mm).

Species: *S. fragillima* Bornm., *S. lanigera* Rech. fil., *S. graveolens* Náb., *S. mardinensis* (Post) R. Mill, *S. brantii* Benth. in DC., *S. megalodonta* Bornm.

Series **B.**

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. & *Rectae* Boiss., Fl. Or. 4:716 (1879) p.p.

Stem retrorsely pubescent. *Bracteoles* setaceous, glabrescent, c. 2–4 mm. Species: *S. benthamiana* Boiss., *S. ballotiformis* Vatke, *S. kurdica* Boiss., *S. viscosa* [Montbret & Aucher ex] Benth., *S. laetivirens* [Kotschy ex] Rech. fil., *S. asterocalyx* Rech. fil., *S. subnuda* [Montbret & Aucher ex] Benth.

Subsect. **Fragiles** [Boiss. ex] Rech. fil. in Bot. Jahrb. 71:526 (1941).

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. & *Fragiles* Boiss., Fl. Or. 4:716 (1879).

Bracteoles inconspicuous, few, setaceous, c. 1–3 mm, sometimes caducous. *Calyx* teeth triangular to triangular-lanceolate, tip softly spinescent. *Nutlets* oblong-elliptic and apiculate, without marginal and apical wings.

Lectotype designated here: *S. longiflora* Boiss.

Other species: *S. euadenia* P. H. Davis, *S. pinardii* Boiss., *S. pseudopinardii* Bhattacharjee & Hub.-Mor., *S. buttleri* R. Mill (see p. 56). Distribution: SW Anatolia. Endemic.

Sect. *Fragilicaulis*, particularly subsect. *Multibracteolatae*, shows a relationship with sect. *Olisia* subsect. *Rectae*, while subsect. *Fragiles* has an affinity with some species of sect. *Swainsoniana* in habit, flower and verticillaster characters. In overall resemblances the whole section forms a coherent group. Boissier (Fl. Or. 4:716, 1879) kept the species in two separate groups, viz. § *Rectae* and § *Fragiles* under sect. *Stachyotypus*. Later, Rechinger (Bot. Jahrb. 71:526, 1941), considering multiple character correlation, put the species together in one group, his subsect. *Fragiles*, which seems to be a very reasonable treatment. The members of subsect. *Fragiles* in the sense adopted in the present account are restricted to characteristic, often shady cliff communities and show relict distribution. On the other hand, subsect. *Multibracteolatae* is more widely distributed, growing more often in xerophytic communities particularly on sloping rocks.

10. Sect. **Olisia** Dum., Fl. Belg. 44 (1827).

Syn.: *Stachys* L. (a) *Campanistrum* (Habl.) Reichb., Fl. Germ. Exc. 1:318 (1830) p.p. excl. typ.

S. sect. *Pseudosideritis* W. Koch, Syn. Fl. Germ. ed. 1:569 (1837) p.p.

Suffruticose to fruticose perennials, rarely biennials or annuals, with or without basal rosettes of leaves, xerophytic. *Flowering stems* erect to procumbent, branched, adpressed-tomentose to pubescent, rarely floccose-tomentose. *Basal leaves* ovate-elliptic to orbicular, cordate to cuneate at base, long-petioled, passing either gradually or abruptly into cauline leaves. *Lower cauline leaves* ovate-lanceolate to oblanceolate, cuneate to attenuate at base, gradually passing into smaller sessile floral leaves. *Bracteoles* usually few, setaceous, c. 1–3 mm, rarely herbaceous, lanceolate, spinescent-tipped, c. 6–8 mm long. *Calyx* sub-bilabiate, narrowly

campanulate, teeth subequal with aristate tip; calyx mouth with or without a ring of hairs. *Corolla tube* subexserted, annulate, rarely exannulate (*S. inanis*). *Nutlets* smooth, obovoid, slightly winged at base.

Type: *S. annua* L.

Distribution: Mainly Mediterranean Europe and Asia Minor, extending into Iran and Caucasia.

1. Verticillasters with conspicuous, herbaceous ovate-lanceolate to lanceolate bracteoles, c. 6–8 mm, densely hairy 2
- + Verticillasters with few, inconspicuous, linear setaceous bracteoles, c. 1–3(–4) mm, scarious to sparsely hairy 4
2. Verticillasters 6–10(–16)-flowered; stem floccose-tomentose to arachnoid, hairs curly Subsect. *Distantes*
- + Verticillasters 1–2-flowered; stem sericeous-tomentose to glabrescent, hairs straight 3
3. Flowering stems divaricately branched, ending in stiff spines; stems densely sericeous-tomentose; basal rosettes absent Subsect. *Spinosae*
- + Flowering stems not divaricately branched nor ending in spines; stems $\pm$ glabrescent with few short adpressed hairs; basal rosettes present Subsect. *Rosulatae* series A
4. Stem retrorsely adpressed-pubescent; fruiting calyx usually gibbous at base, lower teeth usually curved inwards towards mouth Subsect. *Annuae*
- + Stem antrorsely adpressed-pubescent, rarely floccose-tomentose; fruiting calyx not gibbous at base, lower teeth erect or recurved 5
5. Plant with basal rosettes of leaves; basal leaves distinct from cauline ones, ovate-elliptic to $\pm$ rotund, cordate to truncate at base Subsect. *Rosulatae* series B
- + Plant without basal rosettes of leaves; lower cauline leaves oblanceolate to ovate-lanceolate, cuneate to attenuate at base Subsect. *Rectae*

Subsect. *Rectae*

Subsect. ***Rectae*** Bhattacharjee, **subsect. nov.**

Syn.: *Stachys* L. sect. *Chamaesideritis* Bentham, Lab. Gen. Sp. 530 (1834).

S. sect. *Pseudosideritis* W. Koçh, Syn. Fl. Germ. ed. 1:569 (1837) p.p.

S. sect. *Stachyotypus* Bentham § *Rectae* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. *Stachyotypus* Bentham ser. *Rectae* [Knorr ex] Omel'chuk-M'yakushko in Ukr. Bot. Zhurn. 31(5):637 (1974).

Herbae perennes, suffrutescentes, elongatae, erectae vel procumbentes, sine rosulis basalibus sterilibus. *Indumentum* antrorse adpresse pubescens, rariore floccoso-tomentosum. *Folia caulina* inferiora oblanceolata vel ovato-lanceolata, ad basin cuneata vel attenuata. *Bracteolae* paucae, inconspicuae, lineares, setaceae, glabrae vel sparse pubescentes, c. 1–3 mm longae.

Type: *S. recta* L.

1. Stamens little exerted from corolla tube (less than half-way along upper corolla lip) Series C
- + Stamens exerted more than half-way along upper corolla lip 2
2. Stem densely floccose-tomentose; upper corolla lip deeply bifid Series A
- + Stem adpressed-pubescent; upper corolla lip entire to retuse Series B

Series A.

Stem densely floccose-tomentose. *Upper corolla lip* deeply bifid. *Stamens* exerted more than half-way along upper corolla lip.

Only species: *S. fontqueri* Pau.

Distribution: N Morocco.

Series B.

Stem sparsely adpressed-pubescent to glabrescent. *Upper corolla lip* entire to retuse. *Stamens* exerted more than half-way along upper corolla lip.

Species: *S. recta* L., *S. atherocalyx* C. Koch, *S. leucoglossa* Griseb., *S. arenaria* Vahl, *S. beckeana* Dörfler & Hayek, *S. tetragona* Boiss., *S. virgata* Bory & Chaub., *S. albanica* Markgraf.

Series C.

Syn.: *Stachys* L. sect. *Pontostachys* Koeva in Fitologiya 10:34 (1978).

Stem sparsely adpressed-pubescent to glabrescent. *Upper corolla lip* ± retuse. *Stamens* little exerted from corolla tube, less than half-way along upper corolla lip.

Species: *S. iberica* Bieb., *S. angustifolia* Bieb., *S. sparsipilosa* Bhattacharjee & Hub.-Mor.

Subsect. *Distantes* Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Ruderales* Benth. in DC., Prodr. 12:472 (1848) p.p.

S. sect. Stachyotypus Benth. § *Rectae* Boiss., Fl. Or. 4:716 (1879) p.p.

Herbae perennes suffrutescentes elongatae erectae sine rosulis basalibus sterilibus. *Indumentum* floccoso-tomentosum vel arachnoideum. *Folia* caulina inferiora ovata vel ovato-lanceolata ad basin obtusa vel cuneata. *Bracteolae* conspicuae, lanceolatae, herbaceae, ad apicem spinescentes, quam calycem aequales vel paulo minores.

Type: *S. distans* Benth.

Other species: *S. aleurites* Boiss., *S. bombycina* Boiss.

Distribution: SW Anatolia, W Syria.

Subsect. *Annuae* Bhattacharjee, subsect. nov.

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Infrasulares* Boiss., Fl. Or. 716 (1879) p.p.

[*S. series Maritimae* Knorr. in Fl. URSS 21:230 (1954) nom. inval.].

Herbae perennes, biennes vel annuae, suffrutescentes, erectae vel procumbentes; rosulae steriles basales adsunt vel desunt. *Indumentum* sparsum vel densum, retrorse adpresse pubescens. *Folia* basalia et caulina inferiora ovato-elliptica vel rhombeo-lanceolata, rariore oblanceolata, ad basin cordata vel cuneata. *Bracteolae* paucae, lineares, setaceae, c. 1-2.5 mm longae, glabrae vel setosae.

Type: *S. annua* L.

Other species: *S. maritima* Gouan, *S. parolinii* Vis., *S. talyschensis* Kapeller, *S. mouretii* Batt. & Pit.

Distribution: Throughout the range of the section.

Subsect. Rosulatae Bhattacharjee, **subject. nov.**

Herbae perennes, suffrutescentes, erectae; rosulae steriles basales adsunt. *Indumentum* sparse pubescens vel puberulum, interdum glabrescens. *Folia* basalia ovato-elliptica, ad basin cordata vel cuneata. *Bracteolae* paucae, inconspicuae, setaceae, ad summum 1-2 mm longae, interdum herbaceae et apicem spinescentes, calycem aequantes.

For key to series see p. 85.

Series A.

Stem $\pm$ glabrescent with few short adpressed hairs. *Flowering axis* not divaricately branched from middle but rarely with few branches towards apex, or simple. *Bracteoles* herbaceous, lanceolate; as long as calyx tube, spinescent tipped. *Calyx tube* widely campanulate.

Only species: *S. diversifolia* Boiss.

Distribution: Anatolia, Syria.

Series B.

Stem $\pm$ puberulent to glabrescent. *Flowering axis* divaricately branched throughout. *Bracteoles* setaceous, c. 1 mm. *Calyx* tubular.

Species: *S. inanis* Hausskn. & Bornm., *S. munzurdagensis* Bhattacharjee.

Subsect. Spinosa Bhattacharjee, **subject. nov.**

Syn.: *Stachys* L. sect. *Zietenia* (Gled.) Benth., Lab. Gen. Sp. 531 (1834) p.p. excl. typ.

S. sect. *Stachyotypus* Benth. § *Fruticulosae* Boiss., Fl. Or. 4:716 (1879) p.p.

Fruticulus armatus pluriramosus tholiformis, sine rosulis sterilibus basalibus. *Indumentum* adpresse sericeo-tomentosum. *Folia caulina* inferiora oblanceolata, ad basin attenuata. *Bracteolae* herbaceae, ad apicem spinescentes, quam calycem aequales vel longiores, dense hirsutae.

Type: *S. spinosa* L.—Monotypic.

Distribution: Crete.

Sect. *Olisia* is a widely variable section having its greatest diversity in Mediterranean Europe and Anatolia. The section is here divided into five subsections and a few informal series. As a whole the section shows affinities with sect. *Fragilicaulis*, particularly subsect. *Multibracteolatae* series B, and also with sect. *Swainsoniana* subsect. *Decumbentes* series B. From the former it differs in not having fragile flowering stem bases and in

its ovate-cordate median cauline leaves; from the latter it is distinguished by having adpressed-pubescent indumentum and a $\pm$ regular to sub-bilabiate calyx. The distinction of subsect. *Spinosae* and subsect. *Rectae* series A from other subsections is more or less pronounced, being based on their unique habit and indumentum, but they come closer to sect. *Olisia* than to other sections in two diagnostic characters: adpressed-tomentose indumentum and oblong-lanceolate leaves. Subsect. *Annuae* has some closely related but remarkably variable species within it (notably *S. annua*) which could be interpreted as a species complex. The closest relative of *S. annua* is *S. maritima*, which grows on sand dunes and may have evolved from a maritime ecotype of *S. annua* (or its precursor). Cytotaxonomic and biosystematic investigations are needed to confirm their taxonomic status.

11. Sect. **Campanistrum** (Habl.) Reichb., Fl. Germ. Exc. 1:318 (1830).
Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Agrestes* Benth. Lab.

Gen. Sp. 529 (1834) p.p.

S. sect. *Olisia* sensu Boiss., Fl. Or. 4:716 (1879) non Dum. (1827).

Procumbent to erect annuals, branched divaricately above soil level, stems patent-pilose to hispid, rarely glabrescent with aculeate hairs. *Lower cauline leaves* ovate to ovate-elliptic, crenate, cordate at base, long-petioled. *Median cauline leaves* and floral leaves similar to lower cauline leaves but gradually becoming oblong-lanceolate, cuneate at base, shortly petioled to sessile; floral leaves subentire to entire, softly spinescent at tip. *Verticillasters* c. 6-flowered. *Bracteoles* few, setaceous, 2–5 mm. *Pedicels* 2–4 mm. *Calyx* broadly campanulate, sub-bilabiate, teeth subequal, shortly mucronate to long-spinescent; mouth with ring of hairs. *Corolla tube* subexserted or sometimes included, annulate, upper corolla lip entire or bifid. *Nutlets* obovoid.

Type: *S. arvensis* (L.) L.

Distribution: Europe, N Africa, W Anatolia.

1. Calyx teeth lanceolate-subulate with long spinulose tip, hairy throughout; upper corolla lip deeply bifid . Subsect. *Ocymastrum*
- + Calyx teeth oblong-lanceolate or ovate-triangular with short glabrous spinescent tip; upper corolla lip entire to emarginate .

Subsect. *Arvenses*

Subsect. **Ocymastrum** Bhattacharjee, **subsect. nov.**

Syn.: *Stachys* L. sect. *Olisia* sensu Benth. Lab. Gen. Sp. 529 (1834) p.p.
non Dum. (1827).

Dentes calycis lanceolato-subulati apice longe spinuloso, tota longitudine pilosi. *Labium superius corollae* profunde bifidum.

Type: *S. ocymastrum* (L.) Briq.

Other species: *S. brachyclada* Noë, *S. duriae* Noë.

Distribution: N Africa, W Mediterranean Europe. Recorded from Crete and Lebanon.

Subsect. *Arvenses* Bhattacharjee, **subsect. nov.**

Dentes calycis oblongo-lanceolati ad ovato-triungulares apice brevi glabro mucronato. *Labium superius corollae* integrum usque retusum.

Type: *S. arvensis* (L.) L.

Other species: *S. spinulosa* Sm., *S. arabica* Hornem., *S. marrubifolia* Viv., *S. milanii* Petr.

Distribution: Throughout the range of the section.

The affinity of sect. *Campanistrum*, particularly subsect. *Arvenses*, is with sect. *Corsica* (see below) and to some extent with sect. *Stachys*, from both of which it differs in several characters. From sect. *Corsica* it can usually be distinguished by its annual, erect to procumbent habit, 4-8-flowered verticillasters and short-pedicelled flowers. From sect. *Stachys* it differs in its annual habit and shorter stamens and in not having a creeping perennating rhizome. Subsect. *Ocymastrum* on the other hand resembles sect. *Olisia* subsect. *Rectae* in its erect to ascending habit, $\pm$ oblanceolate median cauline leaves and few setaceous bracteoles, but is readily distinguished by having patent-pilose indumentum, annual habit and distinctly ovate-cordate lower leaves. Sects. *Stachys*, *Corsica*, *Olisia* and *Campanistrum* are all inter-related by various characters.

12. Sect. *Corsica* Bhattacharjee, **sect. nov.**

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. & *Oligantheae* Benth., Lab. Gen. Sp. 529 (1834) p.p.

S. sect. Stachyotypus Benth. & *Agrestes* Benth. in DC., Prodr. 12:477 (1848) p.p.

S. sect. Stachyotypus sensu Briq. & *Olisiae* Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):266 (1896) p.p.

Herbae perennes vel interdum annuae, humiles, ad nodos radicales ramulis tenuibus repentibus. *Indumentum* sparse patente pilosum. *Folia* ovata vel ovato-elliptica, parva, margine undulato vel late 2-3-crenato, ad basin cordata. *Verticillastri* biflori, remoti. *Bracteolae* absentes vel minutae, setaceae, c. 1 mm longae. *Pedicelli* 2-5 mm longi. *Calyx* $\pm$ regularis, campanulatus, dentibus $\pm$ aequantibus oblongo-acuminatis apice mucronato. *Tubus corollae* exsertus, annulatus, labium superius emarginatum vel retusum. *Nuculae* obovoideae.

Type: *S. corsica* Pers.—Monotypic.

Distribution: Corsica & Sardinia.

Sect. *Corsica* is exceptional in its slender repent perennial habit which is probably an adaptation to growth on moist rock surfaces. Briquet (*Ann. Cons. Bot. Genève* 5:74, 1901) probably misunderstood its life form, referring to it as annual, and assumed that *S. corsica* was very distinct from *S. arvensis* and *S. marrubifolia* of sect. *Campanistrum*. He compared it with some analogous species from Madagascar and S Africa, presumably *S. lyallii* Benth. and *S. serrulata* [Burch. ex] Benth. respectively. These two species are indeed very similar to the Corsican plant in their slender, repent to decumbent habit, two-flowered remote verticillasters and characteristic ovate few-crenate leaves. Benth. (*Lab. Gen. Sp.*, 1834) put all these species into sect. *Stachyotypus* & *Oligantheae*, together with some

other S African and American species (*S. aethiopica* L., *S. eriantha* Benth., etc.), as a result of weighting the habit and verticillaster characters.

This isolated endemic species of Corsica and Sardinia has been considered by Briquet as palaeogenic. It is evident that the islands have been isolated from the mainland since the Upper Tertiary (late Miocene?). The apparent similarities of *S. corsica* to the above-mentioned species may have resulted from convergent evolution, as was suggested by Briquet. This suggestion receives some support from comparison with the Mexican *S. eriantha*, which is similar in vegetative habit to *S. corsica* but differs markedly in inflorescence and floral characters. On the other hand the Mediterranean species *S. arvensis* and *S. marrubifolia* approach sect. *Corsica* in the shape of their calyx teeth and in leaf shape and margin, but look very different in general facies. As it is impossible to be sure of the true affinities of *S. corsica*, it seems best to treat it as a monotypic section.

13. Sect. *Sideritopsis* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Olisia* sensu Boiss., Fl. Or. 4:716 (1879) p.p. non Dum. (1827).

Herbae annuae. *Caules* floriferi erecti, plerumque e basi divaricate ramosi, dense patente pilosi vel hispidi. *Folia caulina inferiora* late obovata ad ovata, serrata ad crenato-serrata, ad basin cordata vel attenuata, petiolata vel subsessilia. *Folia caulina mediana et floralia* gradatim minora, ovata vel ovato-lanceolata, distante serrata vel subintegra, ad basin cuneata, apice mucronata. *Verticillastri* 4-6-flori. *Bracteolae* lineares vel lanceolatae, herbaceae, spinulescentes vel mucronatae, quam tubum calycis aequales vel paulo minores. *Pedicelli* 2.5-6 mm longi. *Calyx* sub-bilabiatus vel bilabiatus, campanulatus; dentes inaequales, oblongo-acuminati, mucronati, prominenter nervati; os calycis annulum pilorum densorum provisum. *Tubus corollae* subinclusis. *Nuculae* rotundatae ad obovoideae. Type: *S. pseudosideritis* Bhattacharjee & Hub.-Mor.

Other species: *S. obscura* Boiss., *S. zoharyana* Eig.

Distribution: Anatolia, W Syria.

This section shows affinity with sect. *Campanistrum*, but is readily distinguished by having $\pm$ bilabiate, prominently veined calyx with long pedicels, herbaceous bracteoles as long as the calyx tube and densely hispid to pilose indumentum. The type species was erroneously described as *Sideritis balansae* (see Bhattacharjee in *Notes R.B.G. Edinb.* 33:291, 1974).

14. Sect. *Neurocalyx* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Olisia* sensu Boiss., Fl. Or. 4:716 (1879) p.p. non Dum. (1827).

S. sect. *Eustachys* Briq. § *Olisiae* Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):266 (1896) p.p.

Herbae annuae, xerophilae. *Caules* floriferi erecti vel procumbentes, humiles, simplices vel divaricate ramosi, glabrescentes pilis perpaucis glandulosis et glandulis sessilibus provisi. *Folia caulina inferiora* obovata, serrata, ad basin attenuata, gradatim in folia caulina mediana et floralia similia sed minora confluentia. *Verticillastri* 4-6-flori, remoti, ebracteolati.

Pedicelli 2–3 mm longi. *Calyx* bilabiatus, campanulatus; dentes inaequales, oblongo-acuminati, mucronati et prominenter nervati; os glabrum. *Corolla* subexserta; labium superius integrum vel retusum. *Nuculae* obovoideae.

Type: *S. neurocalycina* Boiss.—Monotypic.

Distribution: W Syria.

This section has more affinity with sect. *Satureoides* (see below) than with sect. *Sideritopsis*. It differs from the former by its $\pm$ bilabiate calyx, from the latter by its ebracteolate verticillasters and sub-exserted corolla tube, and from both by its glabrescent stems and leaves.

15. Sect. *Satureoides* Bhattacharjee, sect. nov.

Syn.: *Stachys* L. sect. *Olisia* sensu Benth. in DC., Prodr. 12:481 (1848) p.p. non Dum. (1827).

S. sect. *Eustachys* Briq. § *Olisiae* Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):266 (1896) p.p.

Herbae annuae. *Caules* floriferi erecti, humiles, e basi divaricate ramosi, puberulentes usque pruinosi, glandulosi, interdum superne sparse patente pilosi. *Folia caulina* oblanceolata, crenato-dentata vel $\pm$ integra, ad basin attenuata, subsessilia, gradatim in folia caulina mediana et floralia $\pm$ sessilia minoraque transientia. *Verticillastri* 4–6-flori, ebracteolati. *Pedicelli* 0.2–0.5 mm. *Calyx* $\pm$ regularis, tubulosus; dentes $\pm$ aequales, triangularo-subulati, apice aristato; os annulum pilorum densorum ornatum. *Tubus corollae* exsertus. *Nuculae* obovoideae.

Type: *S. saturoides* Montbret & Aucher.

Other species: *S. ramosissima* Montbret & Aucher, *S. burgsdorffiioides* (Benth.) Boiss., *S. melampyroides* Hand.-Mazz.

Distribution: Anatolia, N Iraq, Syria (Mesopotamia).

This section shows affinity with the monotypic annual sect. *Neurocalyx* from which it differs in having puberulent to sparsely pilose indumentum, $\pm$ regular calyx and densely hairy ring at calyx mouth.

16. Sect. *Thamnostachys* Kapeller, Monogr. Ser. A. Sist. Geogr. Rast. (Tiflis) 4:30 (1961).

Syn.: *Stachys* L. sect. *Zietenia* Benth. in Lab. Gen. Sp. 531 (1834) p.p. excl. typ.

S. sect. *Stachyotypus* Benth. § *Fruticulosae* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. *Eustachys* Briq. § *Fruticulosae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):264 (1896) p.p.

[*S.* sect. *Stachyotypus* Benth. series *Fruticulosae* (Boiss.) Knorr. in Fl. URSS 21:225 (1954) nom. inval.].

Dwarf fruticlose shrubs without basal rosettes. *Flowering stems* branched or unbranched, not spinescent at apex. *Indumentum* sparsely adpressed-puberulent, usually eglandular. *Lower cauline leaves* oblanceolate, crenate to subentire, attenuate at base, subsessile to sessile, gradually passing upwards into similar but smaller median and floral leaves.

Verticillasters 2-flowered, remote. *Bracteoles* very small, setaceous, 2–3 mm. *Pedicels* 2–5 mm. *Calyx* ± regular, tubular, inflated in fruit; teeth erect, subequal, shortly mucronate; mouth glabrous. *Corolla tube* subexserted, upper lip usually narrowed upwards. *Nutlets* obovoid.

Type: *S. fruticulosa* Bieb.

Distribution: NE Anatolia, Transcaucasia, NW Iran (Azerbaijan).

1. Flowering stems erect, usually unbranched above; leaves oblanceolate, verticillasters remote Subsect. *Fruticulosae*
- + Flowering stems diffuse, sometimes repent, usually with axillary branches; leaves obovate; verticillasters congested in a terminal spike or head Subsect. *Paulinae*

Subsect. **Fruticulosae** Bhattacharjee, **subsect. nov.**

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Fruticulosae* Boiss., Fl. Or. 4:716 (1879) p.p.

[*S. sect. Stachyotypus* series *Fruticulosae* (Boiss.) Knorr. in Fl. URSS 21:225 (1954) nom. inval.].

Caules floriferi sine ramulis axillaribus pumilis, numquam repentes. *Folia* oblanceolata. *Verticillastri* remoti, secus totam axem floriferum exorientes.

Type: *S. fruticulosa* Bieb.

Other species: *S. grossheimii* Kapeller, *S. araxina* Kapeller, *S. sosnowskyi* Kapeller.

Distribution: Throughout the range of the section.

Subsect. **Paulinae** Bhattacharjee, **subsect. nov.**

Syn.: [*Stachys* L. sect. *Stachyotypus* Benth. series *Zappanioides* Knorr. in Fl. URSS 21:229 (1954) nom. inval.].

Caules floriferi ramulis axillaribus pumilis provisis, interdum repentes. *Folia* obovata. *Verticillastri* in spicum vel capitulum globosum terminalem congesti.

Type: *S. paulii* Grossh.—Monotypic.

Distribution: W Transcaucasia.

This section shows affinity with sect. *Aucheriana* (see below) on one hand and with sect. *Olisia* subsect. *Rectae* on the other. From the former it is distinguished by having non-spinescent flowering shoots and a ± tubular calyx which is inflated in fruit and glabrous at the mouth. From the latter it differs in its puberulent indumentum, dwarf fruticose habit, two-flowered verticillasters and tubular calyx.

17. Sect. **Aucheriana** Bhattacharjee, **sect. nov.**

Syn.: *Stachys* L. sect. *Zietenia* Benth., Lab. Gen. Sp. 531 (1834) p.p. excl. typ. & Benth. in DC., Prodr. 12:486 (1848).

S. sect. Stachyotypus Benth. § *Fruticulosae* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. Eustachys Briq. § *Fruticulosae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):264 (1896) p.p.

Suffrutices humiles sine rosulis basalibus. *Caules* floriferi ramosi, superne plerumque spinescentes, patente pilosi, rariore glabrescentes pilis densis vel sparsis. *Folia* caulina inferiora lanceolata, integra, ad basin attenuata, gradatim in folia caulina mediana floraliaque minora et spinescentia transientia. *Verticillastri* 2-4-flori, remoti. *Bracteolae* lineares vel lanceolatae, herbaceae, rariore setaceae, quam tubum calycis aequantes vel minores, apice spinescente. *Pedicelli* 5-8 mm longi. *Calyx* $\pm$ regularis, campanulatus; dentes subaequales, tubum calycis aequantes; os plerumque annulo pilorum densorum provisum, rariore glabrum. *Tubus corollae* subexsertus. *Stamina* e tubo corollae paulo exserta. *Nuculae* obovoideae. Type: *S. aucheri* Benth.

Other species: *S. pilifera* Benth., *S. ixodes* Boiss., *S. acerosa* Boiss., *S. multicaulis* Benth., *S. glutinosa* L.

Distribution: Iran, Corsica, Sardinia.

Sect. *Aucheriana* shows affinity with sect. *Thamnostachys* and with sect. *Zietenia*. It differs from the former in having $\pm$ spinescent flowering axes, patent-pilose indumentum with copious glandular hairs, and conspicuously bracteolate verticillasters. From sect. *Zietenia* it is distinguished by the absence of a stellate-haired indumentum and non-spinescent flowering stems. All the species are confined to Iran apart from *S. glutinosa* from Corsica, Sardinia and Italy which is widely disjunct from the rest of the section. The overall resemblances of the species suggest true affinity rather than one that has arisen by convergence of different stocks. I could find no W Mediterranean species which shows as close a morphological relationship to *S. glutinosa* as do the Iranian species *S. acerosa*, *S. aucheri*, *S. multicaulis*, etc. The major disjunction may have resulted from the extinction of all linking groups.

18. Sect. *Zietenia* (Gled.) Benth., Lab. Gen. Sp. 558 (1834).

Syn.: *Zietenia* Gled., Syst. Pl. 185 (1764) pro gen.

Stachys L. sect. *Stachyotypus* Benth. & *Infrasosulares* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. *Eustachys* Briq. & *Infrasosulares* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):265 (1896) p.p.

[*S.* sect. *Stachyotypus* Benth. series *Lavandulifoliae* Knorr. in Fl. URSS 21:228 (1954) nom. inval.].

Suffruticose perennials with basal sterile rosettes, xerophytic. *Flowering stems* usually unbranched with 2-3 pairs of cauline leaves. *Indumentum* sparsely to densely pilose to tomentose mixed with unequal-armed stellate hairs. *Basal leaves* lanceolate to oblanceolate, weakly serrate to entire, attenuate at base, subsessile. *Cauline leaves* similar to but smaller than basal leaves, entire, sessile. *Floral leaves* ovate-lanceolate to ovate, entire, sessile, apex acuminate, not spinescent. *Verticillasters* c. 6-flowered, remote to $\pm$ approximate. *Bracteoles* few, inconspicuous, linear, 0.5-1 mm, pilose. *Pedicels* 2-2.5 mm. *Calyx* $\pm$ regular, subcampanulate; teeth subequal, 1.5-6 $\times$ as long as tube, patent-pilose, tip softly herbaceous; mouth with weak hairy ring. *Corolla tube* included. *Stamens* slightly exserted from corolla tube. *Nutlets* ovoid with faint rings near base.

Type: *Zietenia orientalis* Gled. (*Stachys lavandulifolia* Vahl).—Monotypic.

Distribution: Anatolia, Caucasus, Iran, Afghanistan.

This section shows an affinity with sect. *Aucheriana* (particularly with *S. ixodes* Boiss.) from which it differs in having stellate hairs in the indumentum, larger non-spinescent calyx teeth, included corolla tube and inconspicuously bracteolate verticillasters. It also shows certain resemblances to sect. *Amblesia* ser. A, from which it differs in the nature of the indumentum, and the presence of larger patent-pilose calyx teeth and an included corolla tube. Considering overall resemblances, the systematic position of this section is intermediate between sections *Aucheriana* and *Amblesia*.

19. Sect. **Amblesia** Benth. Lab. Gen. Sp. 563 (1834).

Syn.: *Stachys* L. sect. *Stachyotypus* Benth. § *Amblesiae* Boiss., Fl. Or. 4:716 (1879) p.p.

S. sect. *Eustachys* Briq. § *Amblesiae* (Boiss.) Briq. in Engler & Prantl, Natürl. Pflanzenfam. 4(3a):265 (1896) p.p.

Suffruticose perennials without basal sterile rosettes, xerophytic. *Flowering stems* branched or unbranched. *Indumentum* densely or sparsely adpressed-tomentose with dendroid hairs. *Lower cauline leaves* ovate to oblong-lanceolate, entire, attenuate to cuneate at base, subsessile to sessile. *Floral leaves* similar but smaller, blunt to spinescent at apex. *Verticillasters* 2-6-flowered. *Bracteoles* lanceolate to linear, herbaceous, as long as or shorter than calyx tube. *Pedicels* 0.5-3 mm. *Calyx* ± regular, tubular to campanulate, teeth subequal, blunt or spinescent-tipped; fruiting calyx sometimes inflated; mouth with ring of hairs. *Corolla tube* exserted to subexserted. *Stamens* slightly exserted from corolla tube; anther cells usually subparallel. *Nutlets* obovoid to oblong.

Lectotype designated here: *S. inflata* Benth.

Distribution: E Egypt, Sinai, Palestine, Lebanon, Syria, N Iraq, E Anatolia, Iran, Transcaucasia, Afghanistan, Arabia, Ethiopia; South Africa (Cape Province). The following treatment excludes those taxa endemic to South Africa.

- | | | |
|----|---|----------|
| 1. | Calyx teeth triangular to oblong-lanceolate, tip obtuse | Series C |
| + | Calyx teeth lanceolate-subulate, tip spinescent | 2 |
| 2. | Leaves densely felted, ovate-orbicular | Series B |
| + | Leaves not densely felted, lanceolate | Series A |

Series A.

Syn.: *Stachys* L. sect. *Zietenia* (Gled.) Benth. in DC., Prodr. 12:489 (1848) p.p. excl. typ.

Leaves lanceolate; leaf indumentum not forming a thick felt. Calyx teeth lanceolate-subulate, tip spinescent.

Species: *S. tomentosa* Benth., *S. palaestina* L., *S. aegyptiaca* Pers., *S. laxa* Boiss., *S. turcomanica* Trautv., *S. demawendica* Bornm.

Distribution: Throughout the Asiatic range of the section.

Series B.

Leaves ovate to orbicular; leaf indumentum forming a dense felt. Calyx teeth lanceolate-subulate, spinescent-tipped.

Species: *S. kotschyi* Boiss.—Monotypic.

Distribution: N Iraq.

Series C.

Syn.: [*Stachys* L. sect. *Stachyotypus* Benth series *Inflatae* Knorr. in Fl. URSS 21:231 (1954) nom. inval.].

Leaves ovate to lanceolate; indumentum on leaf densely felted. Calyx teeth triangular to oblong-lanceolate, blunt and not spinescent at tip.

Species: *S. inflata* Benth, *S. obtusicrena* Boiss., *S. nivea* Labill., *S. trinervis* Aiton.

Sect. *Ambleia* is rather isolated in its relationship with other sections of *Stachys*. If it is considered that the stellate indumentum has been replaced by the dendroid indumentum (or *vice versa*) in the course of evolution, a certain affinity can be traced with sect. *Zietenia*. Considering other morphological characters of sect. *Ambleia*, series A (particularly *S. tomentosa*) shows the closest similarity to sect. *Zietenia*, from which it differs in having shorter calyx teeth and different indumentum type. Probably these two sections have been derived from a common stock and diversified later in the process of evolution, becoming ecologically and geographically separated.

II. Subgenus *Betonica* (L.) Bhattacharjee, stat. nov.

Syn.: *Betonica* L. Gen. Pl. ed. 5:250 (1754); Sp. Pl. ed. 1:573 (1753).

Flowering stems unbranched. Leaves usually deeply crenate-dentate. Upper floral leaves abruptly becoming smaller than the lowermost pair. Verticillasters 16–20-flowered. Bracteoles numerous, oblong-lanceolate, scarious or herbaceous, spinescent-tipped with broad hardened base. Calyx sessile, $\pm$ regular, tubular, teeth $\pm$ equal, lanceolate-subulate, spinescent-tipped, mouth hairy. Corolla tube exserted, usually exannulate, rarely annulate (*S. alopecuroides*). Anther cells subparallel to parallel. Nutlets flattened and sharply trigonous; apex usually irregularly lobed, rarely smooth; marginal and apical wing distinct; ventral rib prominent.

Petiole anatomy: adaxial phloem usually present in the vascular bundle.

Nutlet anatomy: inner sclerenchymatous layer of mesocarp without pitted unthickened area.

Type: *S. officinalis* (L.) Trev.

Distribution: Europe, N Anatolia, Caucasus, N Iran to C Asia.

For key to sections see p. 74.

20. Sect. *Betonica*.

Syn.: *Stachys* L. sect. *Alopecuroides* Benth, Lab. Gen. 532 (1834) & sect *Betonica* Benth, loc. cit. (1834).

Herbaceous perennials, rarely annual (*S. serbica*). Basal leaves ovate to ovate-oblong. Indumentum with simple hairs and usually bicellular glands. Corolla tube exannulate, rarely annulate (*S. alopecuroides*).

Type: *S. officinalis* (L.) Trev.

Other species: *S. alopecuros* (L.) Benth., *S. monieri* (Gouan) P. W. Ball, *S. macrantha* (W. Koch) Stearn, *S. serbica* Pančić.

Distribution: throughout the range of the subgenus.

21. Sect. **Macrostachya** Bhattacharjee, sect. nov.

Perennes herbaceae. *Folia basalia* oblongo-lanceolata. *Indumentum* pilis simplicibus stellatisque et interdum glandulis bicellularibus obsitum. *Tubus corollae* exannulatus.

Type: *S. macrostachya* (Wend.) Briq.

Other species: *S. discolor* Benth., *S. scardica* (Griseb.) Hayek, *S. betonicifolia* Rupr.

Sect. *Betonica* and sect. *Macrostachya* are closely allied to each other but the former is distinguished by its leaf shape and the nature of its indumentum. Subgenus *Betonica* shows affinity with sect. *Eriostomum* of subgenus *Stachys* in its outward appearance and general habit, but is distinguished from it by characters such as the hardened base of the bracteoles, sessile flowers, flowering shoot lateral to rootstock, and nutlet sclerenchyma without pitted thickening.

Previously *Betonica* was divided by Bentham (*Lab. Gen. Sp.*, 1834; Bentham in DC., *Prodr.* 12, 1848) into two groups, *Betonica* and *Alopecuros*. In the group *Alopecuros* Bentham included two species, *S. alopecuros* and *S. jacquinii*, mainly on the characters of a yellow corolla with annulate tube. These two taxa are now treated as the single species *S. alopecuros*.

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