STUDIES IN THE FLORA OF AFGHANISTAN: VIII

Labiatae: Conclusions and Key to Genera

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GENERAL

Until quite recently, Afghanistan was by far the least-known country botanically in SW Asia. In the last two decades, however, there has been considerable exploration of the country combined with the appearance of several important publications about its plants. In particular, there have been the series entitled Symbolae Afghanicae published in Biologiske Skrifter from 1954 onwards by K. H. Rechinger and also several parts of Rechinger's Flora Iranica which covers Afghanistan and W Pakistan. It was the original intention for this set of papers to provide an up-to-date account of the Labiatae occurring in the Afghanistan region which could be used as a basis for the wider treatment of the family in Flora Iranica. Although as far as possible this has been done, it soon became quite clear, that, before definitive accounts can be prepared, there is much work yet to do. There are many parts of Afghanistan still to be explored —for example, the provinces of Ghorat, Orozgan, Girishk, Maymana and Badakshan. But even more important is the need for correlation with the work of Soviet botanists. There are numerous species common to the Central Asiatic, Afghanistan and Himalayan regions, but, in not a few cases, the same species may have a different specific epithet in each. The most difficult genera in this respect are *Scutellaria*, *Nepeta* and *Phlomis* but there are few genera where no problems of correlation exist.

With a total of thirty-eight genera and about one hundred and seventy-eight species*, a substantial range of morphological variation is represented. The general pattern in the family is similar to that at generic level where, for instance in *Salvia* and *Nepeta*, the number of species is not particularly high but the range of variation relative to the total range within the genus is very great. It would be a most interesting and probably rewarding study to investigate connections between geography and characters in the Labiatae throughout Eurasia. Is, for instance, the Afghanistan–Pamir-Alai–Tian Shan region richer in morphological diversity than anywhere else and is the Mediterranean a secondary centre of variation? This was certainly the impression formed while working on the Cruciferae of SW–C Asia and is apparently also true of several Labiate genera. The actual explanation of the great variation range in C Asia is probably quite simple. It is an ancient part of the world with an enormous diversity of available habitats. There are deserts, steppes, woods and forests all present in a very varied geological terrain and within an altitudinal range from c. 100 m up to the vegetational limits around 5000 m. Labiates are found in almost every available kind of habitat: semi-desert (*Thuspeinanta* sp.); steppe (most genera); rock crevice (*Scutellaria* sp.); marsh (*Mentha*); mobile scree (*Nepeta* sp.), high alpine (*Dracocephalum* sp.). In habit, most of the genera are herbaceous perennials but the species of *Lagochilus* and *Otostegia* are spiny sub-shrubs and those of *Perovskia* and *Plectranthus* are woody shrubs.

* In Symbolae Afghanicae, Biol. Skr. 8, 1, (1954) 29 genera and 119 species were considered.

Although there are about 18 annuals, distributed over the 38 genera, only a few of them, such as *Nepeta sewerzowii*, *N. bracteata Ziziphora tenuior* and *Lallemantia royleana* are at all common.

Sexual Diversity.

Throughout the Labiatae, there is an appreciable amount of variation in sexual patterns. In the genera considered, the most frequent phenomenon is gynodioecism. It is common in *Zataria*, *Hypogomphia*, *Mentha*, *Nepeta* sp., *Origanum*, *Thymus* and *Ziziphora*. In several genera it is of sporadic occurrence but apparently is quite absent in others such as *Phlomis* and *Eremostachys*. The highest frequency was found in *Mentha* where 50% of a fairly large number of gatherings were male-sterile sex forms. In most cases, the only feature associated with gynodioecism is that the corollas and calyces of male-sterile flowers are smaller than the bisexual flowers but in *Mentha* and *Origanum* the general facies is apparently altered in that the stems and inflorescences are elongated. These associated characteristics of gynodioecism have not infrequently resulted in new taxa being described on unisexual plants, as has happened in *Ziziphora* (cf. Hedge in Notes R.B.G. Edinb. 23: 209–221, 1961), *Nepeta*, *Hypogomphia* (Notes R.B.G. Edinb. 27: 169, 1967) and *Mentha*.

Male sterile sex forms are most commonly found in species that are unusually polymorphic and have wide geographic distributions. There are examples in *Mentha*, *Thymus*, *Ziziphora*, *Dracocephalum* and *Salvia*. When gynodioecism does occur in taxonomically stable species, their geographic range is generally limited. Examples of this occur in three relict genera, *Hypogomphia*, *Zataria* and the Turkish endemic *Dorystoechas*.

Gynomonoecism is a rare or at least seldom reported phenomenon but in the species considered, it apparently occurs in *Zataria multiflora* Boiss.

Cleistogamy may be of fairly frequent occurrence in some genera but this cannot readily be observed on dried material and needs field observations to detect its presence.

Perovskia exhibits an unusual type of floral dimorphism which is illustrated in Studies in the Flora of Afghanistan vii: fig. 5. In at least *P. atriplicifolia*, two kinds of flower occur on different plants: either long-styled corollas with included anthers or short-styled corollas with exserted anthers.

Nutlets.

The size, shape, surface, texture and areole of the nutlets provide, in several genera, a valuable taxonomic character which has certainly been neglected in the past. For instance, in *Salvia* and *Nepeta* there is such a wide range of variation that from nutlet characteristics alone, it is usually possible to determine at least the species group to which a plant belongs. In *Salvia*, the variation is mostly in respect of the size, colour and shape of the nutlets but in *Nepeta*, taxonomically a most difficult genus, there is also much variation in surface texture and areole shape (see Studies in the Flora of Afghanistan vii: fig. 2). Although mature nutlets are often not present on specimens and in some genera they appear to be fairly uniform and of limited taxonomic value, there is little doubt that a detailed study of nutlet structure would be most rewarding.

ENDEMISM.

Because Afghanistan is purely a political area in that it is without any natural physical or geographic limits, any remarks about endemism are rather meaningless. However, if the adjacent regions of W Pakistan and Soviet C Asia are added on to Afghanistan, a more natural area is formed—one in which the degree of endemism is very high. Endemism is mostly at the specific level and taking the term to cover the area mentioned, about 33% of the Labiatae considered in this account are endemic. If the Central Asiatic species not recorded from Afghanistan were also included the figure would rise considerably higher. Although the great majority of the genera are widespread throughout Eurasia (and some such as *Salvia* and *Scutellaria* are well represented in the New World), there are a few isolated relic genera which are scarcely represented outside the area mentioned—*Chamaesphacos*, *Lagochilus*, *Stachyopsis*, *Hypogomphia* and *Zataria*.

PHYTOGEOGRAPHY.

Although it may seem unwarranted to make phytogeographical generalisations on the basis of one family, the Labiatae are such a well developed and widespread family that they do provide at least some guide towards an understanding of the country's phytogeography. It is certainly too early to subdivide Afghanistan on a map into phytogeographical territories but there are apparently three recognisable phytogeographical groups: Irano-Turanian, Saharo-Sindian and Sino-Himalayan. By far the greater part of the country comes within the first division.

1. *Irano-Turanian.* With the exceptions of a small area in the North-East and another in the South-West, all of Afghanistan is included in this territory. Climatically, it has great extremes of temperature and little rainfall. Some of its characteristic Labiate genera are *Eremostachys* (Notes R.B.G. Edinb. 27: 157, fig. 1, 1967), *Perovskia* (Studies in the Flora of Afghanistan, vii, fig. 4) and *Ziziphora* (fig. 1).

In Zohary's recent paper on the geobotanical structure of Iran (Bull. Res. Counc. Israel, Sect. D, Botany, Supplement to Vol. 11D, 1963), he subdivided the Irano-Turanian region into a western subregion with three provinces and an eastern subregion with two provinces. Included in the western subregion was the Irano-Anatolian province which he considered to cover the Anatolian steppe, Kurdistan, the Zagros range, the Iranian plateau, Khorasan and most of Afghanistan and N Baluchistan. In the eastern subregion, he recognised a Turanian province which comprised the steppes and deserts between the Aral and Caspian seas and the W & SW outskirts of the Central Asiatic mountain massifs.

Zohary's sub-divisions are a most useful and important basis for further work but his delimitation of the Irano-Anatolian province appears to be too wide when he includes Afghanistan and Baluchistan. There seem to be many reasons why the Afghanistan area should be united with the eastern and not the western end of the Irano-Turanian region. Numerous examples can be cited. *Quercus*, whose numerous species in Turkey and Iran are most important in giving an impression of phytogeographical zones is represented in Afghanistan by only one species more or less restricted to the east of the

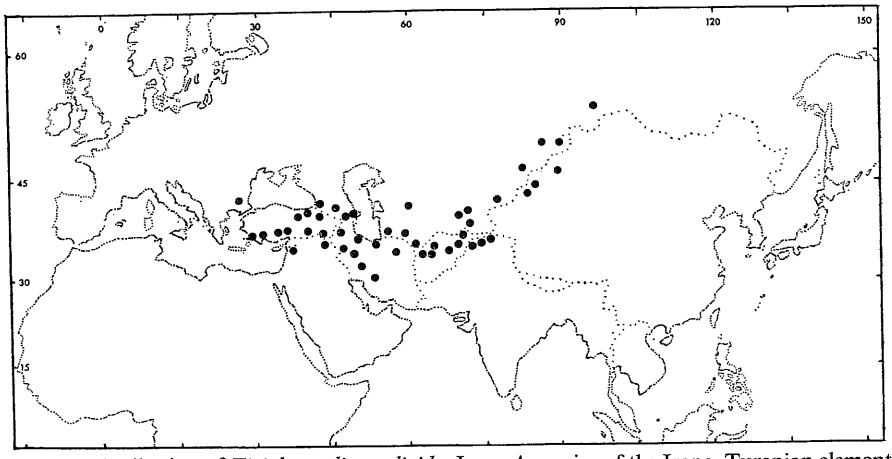

FIG. 1. Distribution of *Ziziphora clinopodioides* Lam. A species of the Irano–Turanian element extending into the Mediterranean area.

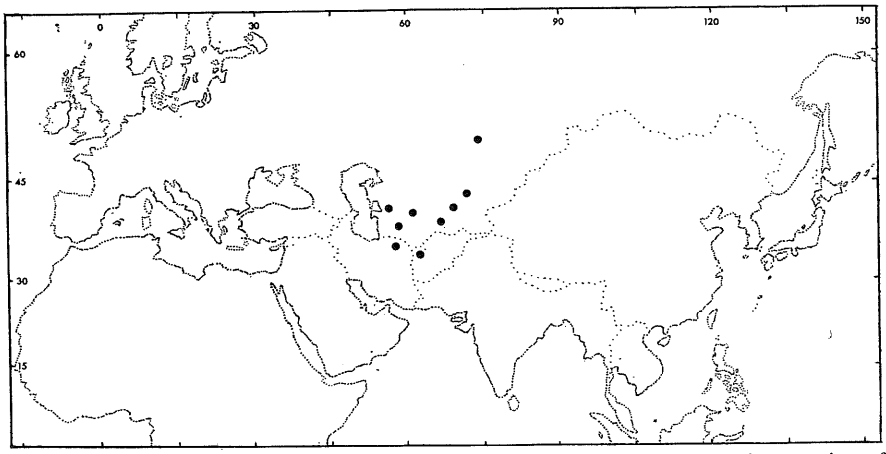

FIG. 2. Distribution of *Chamaesphacos ilicifolius* Schrenk. An Irano–Turanian species of the Turanian province.

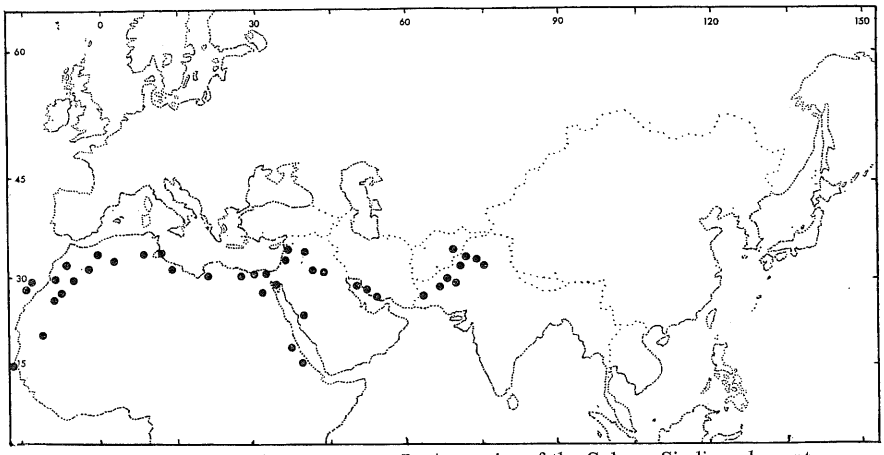

FIG. 3. Distribution of *Salvia aegyptiaca* L. A species of the Sahara-Sindian element.

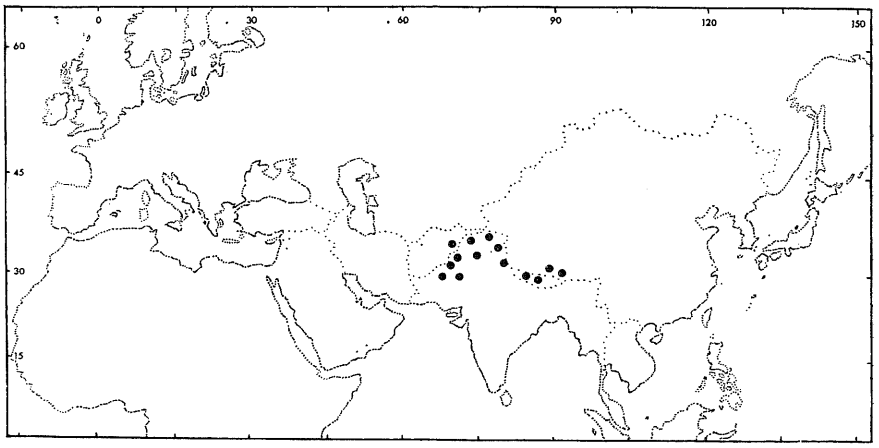

FIG. 4. Distribution of *Plectranthus rugosus* Wall. An example of numerous Himalayan species that reach their westernmost limits in NE Afghanistan (Nuristan). *Salvia nubicola* Sweet has almost exactly the same distribution.

country. *Astragalus* in Afghanistan is represented by a large number of sections which are not or scarcely found in Turkey and Iran. In the Cruciferae genera of SW Asia, the impression formed, during the preparation of numerous accounts for Flora Iranica, was that there was a strong floral connection with Central Asia and to a much lesser extent with Iran. Similarly, in the Labiatae there is a far greater connection with the flora of Central Asia than that of Iran.

In the table below, the six largest genera are analysed in regard to their distribution and affinities.

Genus	Number of species	Species also in			Endemics with affinities to species in			Endemics with no affinities	Widespread species
		Iran-Turkey	C Asia	Himalayas	Iran-Turkey	C Asia	Himalayas		
Nepeta	40	2	11	7	0	3	2	11	4
Salvia	23	6	1	3	1	4	0	4	4
Eremostachys	22	1	3	1	0	6	0	9	2
Scutellaria	15	1	1	3	0	4	1	4	1
Dracocephalum	9	0	7	0	0	1	0	1	0
Phlomis	9	1	2	4	1	0	0	1	0

In this chart the term 'C Asia' is applied in the context used in Komarov, Fl. URSS and 'Himalayas' for the southern slopes of the massif including Kashmir and Kumaon. 'Endemics with no affinities' includes many species whose affinities are with other Afghanistan endemic species; 'widespread species' covers both very wide-ranging species and also those which are known only from, for example, Afghanistan, Pamir-Alai and Himalayas.

Condensing the figures given above in the six largest genera, there are:

Species	Affinities to			Endemics without affinities	Widespread
	Iran–Turkey	C Asia	Himalayas		
117	13	43	21	29	11

When the remaining genera were taken into account, most of which contained wide-ranging species, the final total is:

Species	Affinities to Iran–Turkey	C Asia	Himalayas
178	22	52	28

Comparable analyses of other families are needed before any definite general conclusions can be reached, but, on the basis of the Labiatae, the facts emphasise that the floristic connections between Afghanistan and Iran are much less than previously thought and that the main connections are with the Central Asiatic flora.

Turning now to consider the Turanian province as a sub-division of the Irano-Turanian region most of which is in Soviet territory, Zohary listed (l.c. 33) numerous genera of the Chenopodiaceae with species characteristic for this rather ill-defined province. Many of them occur in the lowlands of N Afghanistan and there appear to be substantial reasons for recognising this sub-division in the NW fringes of Afghanistan. Labiates characteristic of this area are few but two species that can be cited are *Hypogomphia turkestana* and *Chamaesphacos ilicifolius*. (fig. 2).

Clearly the Irano-Turanian region can and probably should be divided into several subregions but in Afghanistan it is premature to recognise anything other than the two broad divisions discussed above. Possibly two further sub-divisions should be made for the N and S side of the Hindu Kush. Certainly there are considerable differences between them. For example, there are many species restricted to either one side or the other of the range; the *Pistacia* communities, one of the most important on the N side of the Hindu Kush, are poorly represented on the S side; numerous members of the Chenopodiaceae are on the N side but not on the S. Similarly, the flora of Khorasan, Kopet Dagh and NW Afghanistan gives the impression of a separate subregion, but the recognition of such sub-divisions, if they are to have any real basis, will only follow when the vegetation and its constituent elements are much better known.

2. *Saharo-Sindian*. Although some recent authors such as Zohary (Bull. Res. Counc. Israel, Sect. D, Botany, Supplement to Vol. 11D, 1963), have recognised a Saharo-Arabian and a Sudanian element which largely, though not entirely, covers Eig's original division, there is considerable uncertainty about the boundaries of these two territories and accordingly the term Saharo-Sindian has been retained. In Afghanistan there are a few species, characteristic of this element, that reach their eastern limits in the SW of the country. One example is *Savignya parviflora* (Del.) Webb in the Cruciferae which extends throughout more or less desert areas from N Africa through Egypt to SW Afghanistan and Pakistani Baluchistan. Among the Labiatae, *Salvia aegyptiaca* L, whose distribution is shown on fig. 3, is characteristic of the Saharo-Sindian element. Although it has not yet been recorded from SW Afghanistan this is probably a result of under collecting in that little known area.

3. *Sino-Himalayan.* The limits of this region are fairly clearly defined in Afghanistan where it is restricted to the Nuristan area, mostly within the provinces of Nangarhar and Paktia. Characterised by a moister climate than the rest of Afghanistan, it is the westernmost extremity of the monsoon area. The vegetation is essentially mesophytic with many tree species represented—among the Coniferae, the genera *Abies*, *Picea*, *Cedrus* and *Pinus* are present. There are numerous 'marker-species' for this area and among the Labiatae may be mentioned *Salvia nubicola*, *Plectranthus rugosus* (fig. 4), *Nepeta laevigata* and *Thymus* sp.

High Alpine vegetation.

The number of collections from high altitudes in Afghanistan is fairly few but it is very clear that the affinities of this flora are with the Pamir-Alai and the other mountain massifs at the western end of the Himalayan range. Many examples from different families could be cited; for instance, in the Cruciferae, *Draba* has eleven alpine species in Afghanistan all of which either are in the mountains of the Pamir-Alai—Tian Shan—Karakoram or else their affinities are with species from these areas. Exactly the same pattern is apparent in the high alpine species of *Dracocephalum*, *Nepeta* and in *Lamium rhomboideum*.

Key to the genera as they occur in Afghanistan

1. Fertile stamens 2 2
+ Fertile stamens 4 7

2. Flowers in axillary whorls; corolla inconspicuous, lobes subequal . . . . . *Lycopus*
+ Flowers in terminal heads, spikes or racemes; corolla conspicuous, bilabiate 3

3. Flowers in dense terminal heads or ± contiguous spikes . *Ziziphora*
+ Inflorescence ± lax 4

4. Annual; posterior stamens fertile, anthers unilocular with fused thecae . . . . . *Hypogomphia*
+ Perennial; anterior stamens fertile, anthers bilocular or thecae separated 5

5. Thecae widely separated by a connective, one frequently sterile . *Salvia*
+ Thecae not separated, both always fertile 6

6. Tall growing shrubs 60–120 cm; leaves linear, lanceolate or elliptic, soft-textured, deeply incised or crenata . . . . . *Perovskia*
+ Low growing herb 15–30 cm; leaves broad ovate, rigid, serrate-pectinate . . . . . *Nepeta* (*N. korshinskyi*)

7. Spiny sub-shrub 8
+ Unarmed sub-shrubs, herbs or annuals 9

8. Calyx limb not expanded, ± equally 5-lobed . . *Lagochilus*
+ Calyx limb widely expanded, ± bilabiate with lower lip often enlarged . . . . . *Otostegia*

9. Upper lip of corolla very short or absent; nutlets with large oblique or lateral attachment scar 10
+ Upper lip of corolla evident; nutlets with small basal attachment scar 11

10. Upper lip of corolla absent, lower 5-lobed . . . . . *Teucrium*
+ Upper lip of corolla short, 2-fid, lower 3-lobed . . . . . *Ajuga*

11. Posterior stamens longer than anterior 12
+ Posterior stamens shorter than anterior 16

12. Calyx expanding in fruit with 5 equal membranous reticulately veined lobes . . . . . *Hymenocrater*
+ Calyx not expanding in fruit, bilabiate or equally 5-toothed . . 13

13. Anthers with weakly divergent thecae . . . . *Lophanthus*
+ Anthers with clearly divergent thecae 14

14. Corolla with prominent fold in upper lip; bracts with awned teeth; pedicels flattened; annual . . . . . *Lallemantia*
+ Upper lip of corolla without a fold; teeth of bracts seldom awned; pedicels not flattened; perennial or annual 15

15. Calyx bilabiate with 3 upper and 2 lower teeth, or ± equally 5-lobed, base of sinuses without protuberances . . . . . *Nepeta*
+ Calyx bilabiate with 1 upper and 4 lower teeth or if 3 upper and 2 lower then base of sinuses with obvious protuberances . . *Dracocephalum*

16. Annual 17
+ Perennial 25

17. Calyx with one enlarged upper lip and 4 smaller teeth; stamens declinate (cultivated) . . . . . *Ocimum* (*O. basilicum*)
+ Calyx equally 5-toothed* or with 3 teeth to upper lip and 2 to lower; stamens not not declinate 18

18. Calyx bilabiate with 3 upper teeth and two lower, fruiting pedicels often flattened . . . . . *Calamintha*
+ Calyx ± equally 5-toothed, pedicels never flattened 19

19. Leaves broadly ovate, apex obtuse, base truncate or cordate, margin crenate 20
+ Leaves linear to elliptic, apex acute, base cuneate, margin entire, crenate or dentate 21

20. Corolla tube included in calyx; anthers glabrous *Stachys* (*S. arvensis*)
+ Corolla tube exserted from calyx; anthers pilose . . . . . *Lamium* (*L. amplexicaule*)

21. Flowers in dense terminal spikes . . . . . *Elsholtzia*
+ Inflorescence ± lax; 22

22. Calyx 2–4 mm, teeth linear; leaves linear to narrow-lanceolate (cultivated) . . . . . *Satureia* (*S. hortensis*)
+ Calyx 6–9 mm, teeth triangular to oblong; leaves elliptic . . 23

* *Leucas*, as represented by annual species with c. 10 calyx teeth, has not been keyed out. Although reported, none of these annual species has been seen.

23. Leaves entire-margined or with few unarmed teeth . . . 24
\+ Leaves spiny-pectinate . . . . . *Chamaesphacos*

24. Whorls 2–3-flowered; flowers pink; calyx pendant in fruit, teeth without awns . . . . . *Thuspeinanta*
\+ Whorls 4–6-flowered; flowers yellowish; calyx erect in fruit, teeth awned at apex . . . . . *Sideritis* (*S. montana*)

25. Calyx bilabiate with 2 entire lips, often with a scutellum on the upper lip; corolla tube many times longer than calyx . . . *Scutellaria*
\+ Calyx either equally 5-toothed or bilabiate with 3 upper and 2 lower teeth; corolla tube exserted from calyx or not 26

26. Calyx clearly bilabiate with 3 upper and 2 lower teeth . . . 27
\+ Calyx not bilabiate, 5-toothed 30

27. Flowers resupinate; erect shrubs . . . . . *Plectranthus*
\+ Flowers not resupinate; erect or prostrate herbs 28

28. Calyx with conspicuous tufts of hairs in throat; corolla subequally 5-lobed . . . . . *Thymus*
\+ Calyx without tufts of hairs in throat; corolla clearly bilabiate . . 29

29. Bracts ± orbicular, often purple-coloured . . . . *Prunella*
\+ Bracts ± linear, not purple-coloured . . . . *Calamintha*

30. Indumentum of at least some stellate hairs 31
\+ Indumentum of simple hairs only 34

31. Calyx 15–25 mm; corolla 20–40 mm 32
\+ Calyx 5–10 (–12) mm; corolla 6–15 mm 33

32. Nutlets densely hairy at apex; flowers usually yellow, leaves often pinnate or pinnatifid . . . . . *Eremostachys*
\+ Nutlets ± glabrous at apex; flowers usually pinkish, leaves always simple . . . . . *Phlomis*

33. Verticils dense, many-flowered . . . . . *Marrubium*
\+ Verticils lax, few-flowered . . . . . *Stachys*

34. Lamina of leaves up to 25 mm long 35
\+ Lamina of leaves exceeding 30 mm long 39

35. Leaves ± thin, herbaceous, glands if present not punctate; calyx with conspicuous tufts of white hairs at throat; bracts ± conspicuous . . . . . *Origanum*
\+ Leaves ± thick, firm-textured, usually conspicuously glandular-punctate; calyx seldom with tufts of hairs at throat; bracts inconspicuous . 36

36. Leaves linear to narrow elliptic, (5)–10–25 mm, flat, apex ± blunt 37
\+ Leaves ovate to orbicular, 4–10 mm, if lanceolate then ± folded and apex subulate 38

37. Calyx 5–8 mm with obvious protuberances at base of sinuses *Hyssopus*
\+ Calyx 3–4 mm without protuberances at base of sinuses *Gontscharovia*

38. Corolla 2–4 mm, scarcely exceeding calyx; leaves without a prominent marginal nerve; leaf buds densely covered with white hairs . *Zataria*
\+ Corolla 5–10 mm, clearly exceeding calyx; leaves usually with a prominent marginal nerve; leaf buds not covered in white hairs . *Micromeria*

39. Corolla up to 5 mm with 4 ± equal lobes, upper emarginate; plant strongly aromatic . . . . . *Mentha*
\+ Corolla at least 10 mm, clearly bilabiate; plant scarcely aromatic . 40

40. Anthers pilose 41
\+ Anthers glabrous 42

41. Corolla tube exserted from calyx; flowers white or if rose then dwarf herb with densely tomentose leaves . . . . . *Lamium*
\+ Corolla tube included in calyx; flowers rose-coloured, erect growing herb with sparsely hairy leaves . . . . . *Stachyopsis*

42. Nutlets truncate, densely hairy at apex . . . *Eremostachys*
\+ Nutlets truncate or rounded, glabrous 43

43. Leaf margins deeply and unevenly incised, lower often palmately lobed . . . . . *Leonurus*
\+ Leaf margins entire, crenate or evenly serrate, not palmately lobed 44

44. Calyx campanulate with triangular teeth; filaments exappendiculate . . . . . *Stachys*
\+ Calyx tubular with subulate teeth; filaments appendiculate at base or not 45

45. Calyx teeth 5; corolla 10–20 mm; bracts conspicuous . . *Phlomis*
\+ Calyx teeth c. 10; corolla c. 10 mm; bracts minute . . *Leucas*