



## Taxonomical and morphological studies on the genus *Calamintha* Miller (Lamiaceae) in Turkey

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### Abstract

The genus *Calamintha* Miller is represented in the Flora of Turkey by 9 species and altogether 13 taxa six of which are endemic. In this study, 13 taxa belonging to the genus *Calamintha* have been examined taxonomical and morphological properties and the relationships of the following species were investigated: *Calamintha grandiflora* (L.) Moench, *C. betulifolia* Boiss. & Bal., *C. tauricola* P. H. Davis, *C. pamphylica* Boiss. & Heldr. subsp. *pamphylica*, *C. pamphylica* subsp. *davisii* (Quezel & Contandr.) Davis (end.), *C. pamphylica* subsp. *alanyense* S. Alan & A. Ocak (end.), *C. piperelloides* Stapf (end.), *C. sylvatica* Bromf. subsp. *sylvatica*, *C. sylvatica* subsp. *ascendens* (Jordan) P. W. Ball, *C. nepeta* (L.) Savi subsp. *nepeta*, *C. nepeta* subsp. *glandulosa* (Req.) P. W. Ball, *C. incana* (Sm.) Boiss., *C. caroli-henricana* Kit Tan & Sorger. In morphological studies, descriptions of each taxon have been given and general appearance of plants and their, leaf, bract, flower, calyx, corolla and fruit shapes have been illustrated. According to the results, a new identification key widening the limits for *Calamintha* species has been prepared and presented in the section of morphological results.

**Key words:** *Labiatae*, *Calamintha*, Taxonomy, Revision, Turkey

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### Türkiye *Calamintha* Miller (Lamiaceae) cinsi üzerine taksonomik ve morfolojik bir çalışma

### Özet

Türkiye Florası'nda *Calamintha* Miller (*Lamiaceae*) cinsi 6'sı endemik olmak üzere 9 tür ve 13 takson ile temsil edilmektedir. Bu çalışmada *Calamintha* cinsine ait 13 takson sistematik ve morfolojik yönden incelenmiş, birbirleriyle olan yakınlık dereceleri saptanmaya çalışılmıştır. Çalışılan taksonlar şunlardır: [*Calamintha grandiflora* (L.) Moench, *C. betulifolia* Boiss. & Bal., *C. tauricola* P. H. Davis (end.), *C. pamphylica* Boiss. & Heldr. subsp. *pamphylica*, *C. pamphylica* subsp. *davisii* (Quezel & Contandr.) Davis (end.), *C. pamphylica* subsp. *alanyense* S. Alan & A. Ocak (end.), *C. piperelloides* Stapf (end), *C. sylvatica* Bromf. subsp. *sylvatica*, *C. sylvatica* subsp. *ascendens* (Jordan) P. W. Ball, *C. nepeta* (L.) Savi subsp. *nepeta*, *C. nepeta* subsp. *glandulosa* (Req.) P. W. Ball, *Calamintha incana* (Sm.) Boiss., *Calamintha caroli-henricana* Kit Tan & Sorger]. Morfolojik çalışmalarda türlerin tanımları verilip, bitkilerin genel görünüşleri, yaprak, brakte, çiçek, kaliks, korolla ve meyve şekilleri ilave edilmiştir. Elde edilen sonuçlara göre *Calamintha* türlerinin daha geniş varyasyon sınırlarını içeren yeni ayırım anahtarı morfolojik sonuçlar bölümünde verilmiştir.

**Anahtar kelimeler:** *Labiatae*, *Calamintha*, Taksonomi, Revizyon, Türkiye

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## 1. Introduction

The genus *Calamintha* Miller spread out in the Europe, Central Asia, Mediterranean region, North Africa and America (Bonnier, 1959; Bown, 1995). *Calamintha* taxa are distributed most in the South, West and North Anatolia in Turkey and it is represented by nine species and four subspecies. *Calamintha pamphylica* Boiss. & Heldr. subsp. *alanyense* S. Alan & A. Ocak has been published in 2007 (Alan et al., 2007). Six species are endemic to Turkey. These are *C. tauricola*, *C. pamphylica* ssp. *pamphylica*, *C. pamphylica* ssp. *davisii*, *C. pamphylica* ssp. *alanyense*, *C. piperolloides*, *C. caroli-henricana* and all of them are perennial except for *C. caroli-henricana* (Davis & Leblebici 1982; Davis et al, 1982; Duman, 2000). The ratio of endemism is over 45%. The first systematical study about the genus *Calamintha* took place in Flora Orientalis. It was described under the section *Eucalamintha* with three subsections nine species. Eight of them had been collected in Turkey. Furthermore, several the genus had been treated as synonymous with some other genera such as *Acinos* Miller, *Clinopodium* L., *Satureja* L., and *Melissa* L. in different floras (Anzalone et al., 1982; Boissier, 1879; Butcher, 1961; Clapham et al.; 1981, Hayek, 1928; Hegi, 1964; Martin, 1965; Meikle, 1985; Quezel & Santa 1963; Rechinger fil. 1943; Rechinger 1982; Schmeil & Fitschen, 1960; Silic, 1979; Shishchkin, 1977; Stojanov et al., 1967; Strid and Tan, 1991; Tutin et al., 1972; Webb, 1966). The most comprehensive treatise of the genus about *Calamintha* of Turkey is in the Flora of Turkey (Davis & Leblebici 1982). Later, *Calamintha caroli-henricana* was added to the Flora of Turkey as a new species (Davis et al., 1988). *Calamintha* is known as “Güzel Nane, Dağ Nanesi, Miskotu, Tibbi Miskotu, Yabani Oğulotu” in Turkey and used as a folk medicine *Calamintha* species are used as stimulant, antispasmodic, emmenagogue, digestive, antiseptic, diaphoretic, expectorant and for strengthening central nervous system (Baytop, 1999; Bonnier, 1959; Bown 1995). They are also used for stomach ache, throat diseases, and kidney disorders and as a spice (Grieve, 1982; Viney, 1994). This study is a part of PhD Thesis named “Taxonomical, Morphological Anatomical and Chemical Studies on *Calamintha* (Lamiaceae) Genus in Turkey”. In this study, *Calamintha* materials belonging to 13 taxa growing in Turkey were investigated on systematically and morphologically.

## 2. Materials and methods

The materials for the study were collected from different populations in Turkey between 2001-2004. Voucher specimens are kept at the Herbarium of the Anadolu University, Faculty of Pharmacy (ESSE). The related specimens at the herbaria ISTE, ANK, HUB, EGE, OUFE, AKDU, AEF were also investigated. Species identifications were carried out using the Flora of Turkey and the East Aegean Islands (Davis & Leblebici, 1982). Each species was described by using samples which were softened in water before measurements. 15 samples were assessed for taxonomic characterizations. The measurements given in descriptions were obtained according to the large areas of related organs and the leaves. Morphological illustrations of organs as leaves or flowers were made by a Wild M5A stereomicroscope with a drawing tube.

## 3. Results

In the present study, different variation limits have been determined for leaf, bracteol, calyx and corolla sizes, flower numbers, eglandular and glandular hairs of *Calamintha* species growing in Turkey and were compared with the Flora of Turkey (Table 1). According to these data, the morphologic differences among the species have been found and arranged as a new key.

### 1. Annual

### 9. *caroli-henricana*

#### 1. Perennial

2. Stems 10-90 cm, leaves camptodromous, calyx 13- veined, corolla 5-20 mm, calyx prominently hairy at throat, upper calyx teeth shorter than the lower calyx teeth
3. Median leaves 4-16x3.5-14 mm, densely tomentose, entire or scarcely notched, corolla 5-10 mm, pedicillate on very short or obsolescent peduncles

### 8. *incana*

3. Median leaves 7-55x5-30 mm, puberulous, serrate-crenate-dentate, corolla 5-20 mm, peduncles conspicuous
4. Corolla 12-20 mm, calyx 5-8.5(-11)mm, lower calyx teeth 1.5-4 mm, densely long-ciliate

### 6. *sylvatica*

4. Corolla 5-12 mm, calyx 2.5-7 mm, lower calyx teeth 0.9-3 mm, sparsely short-ciliate

### 7. *nepeta*

2. Stems 5-60 cm, leaves craspedodromous, calyx 11-veined, corolla 8-40 mm, calyx glabrous at throat, upper calyx teeth equalling than lower calyx teeth
  5. Median leaves 12-75x10-40 mm, ovate-elliptic, with 6-13 teeth per side, calyx tube slightly curved, corolla 15-40 mm, inflorescence 3-40 cm, 2-20 flowered

### 1. *grandiflora*

5. Median leaves 4-30(-32)x3-25 mm, ovate-elliptic, triangular, broadly ovate, with (2-)3-7 teeth per side, calyx tube straight, corolla 8-26 mm, inflorescence 1-24 cm, 2-10(-11) flowered  
6. With (2-)3-5 teeth per side, median leaves broadly ovate, peduncles conspicuous, Labiatae type glandular hairs lack, corolla violet

### 3. *tauricola*

6. With 4-7 teeth per side, median leaves ovate, ovate-elliptic, usually obsolescent peduncles, Labiatae type glandular hairs, corolla lilac

### 2. *betulifolia*

7. Median leaves villous, densely long villose, short puberulent, 4-25(-32)x3-20(-25) mm, shallowly crenate-denticulate, distinctly crenate-dentate, with 3-7 teeth, upper calyx teeth recurved, 2-8(-11) flowered

### 4. *pamphylica*

7. Median leaves puberulent, 6-10 mm, margins obscurely serrulate, with 2-4 teeth, upper calyx teeth straight, 2 flowered

### 5. *piperelloides*

The morphological findings of *Calamintha* species and their couperisons have been presented in Table 1.

*Calamintha grandiflora* (L.) Moench (Figures 1 & 2)

Syn: *Melissa grandiflora* L., Sp. Pl. 592 (1753) *Satureja grandiflora* (L.) Scheele in Flora 26:577 (1843) *Clinopodium grandiflorum* (L.) Kuntze, Rev. Gen. 515 (1891) Ic: Fl. URSS 21: t. 23 f. 1 (1954); Polunin, Fls. Europe t. 114 no. 1154 (1969).

Perennial herbs. Stems ascending-erect, 14-60cm. Cauline middle leaves ovate-elliptic, (12-)15-60(-75)x10-40mm, with 6-13 teeth, craspedodromous. Inflorescence 3-40cm, 2-20 flowered. Calyx 6-15mm, distinctly 11 veined, tube slightly curved, hairy at throat, lower lip with 2 toothed, teeth 2.5-5mm, lower lip equalling than upper teeth. Corolla 15-40mm, pale or mauvish pink to red.

Specimens examined: A1(E) Kırklareli: between Mahyadağ-Bayındırlık hill, 980 m, 30.7.1974, G. Dökmeci, ISTE 30700, N.E. slope of Mahyadağ, Bayındırlık hill, 28.6.1974, G. Dökmeci, ISTE 30057, A2(A) Bursa: Uludağ, 7.7.1998, G. Tümen, ESSE 12727, Uludağ, Bakacık 3.8.1957, A. Baytop, ISTE 5101, Uludağ, 1850 m, forest, 2.8.1953, A. Baytop, ISTE 1207, Road to Uludağ, *Abies* forest, 1900 m, 25.8.1971, A. Baytop, ISTE 20965, A3 Bolu: Abant., 1300 m, *Fagus-Abies* forest, 26.8.2003, S. Alan, M. Alan, ESSE 14403, Kale serisi forest, Kırık ridge, 1600 m, 18.9.1987, K. H. C. Başer, ESSE 7862, Bolu-Yedigöller road, between Sarıkamış Yedigöl, forest, 12.10.1970, E. Leblebici, ISTE 18658, Bolu-Yedigöller road, 10 km after Bolu, 900 m, 11.8.1988, K. Alpınar, ISTE 59453, Abant, 25.9.1950, A. Baytop, ISTE 2506, province Abant lake, ca. 1350 m, 3.8.1984, Ö. Seçmen, EGE 17865, Öküzova plateau, 1400 m, 15.7.1978, Y. Akman, ANK 9598, Aladağ, Kartalkaya, 2000 m, 11.8.1960, Khan et al., ANK 479, Abant, 1500 m, *Fagus-Abies* forest, 10.8.1983, Eyüpoğlu, GAZI 2535, Kale, Kırıkyayla, 1550-1600 m, openings in forest, 23.8.1990, İ. Kılınç, GAZI 1280, A3 Ankara:Beypazarı, 1770 m, 19.7.1972, Huber-Morath, ANK 7210, Beypazarı, *Pinus sylvestris* forest, 2.7.1972, Y. Akman, ANK 8675, A4 Zonguldak:Bartın, Akçasu Kurtpınarı, 1100 m, 20.7.1983, M. Demirörs, ANK 1598, A4 Bolu:Aladağ, 800 m, 13.8.1960, Khan et al., ANK 556, Köroğlu, Volkanik, 1650 m, 22.6.1975, Y. Akman, ANK 6411, A4 Kastamonu:Araç-Hanözü village, Savuca plato, forest, 1100 m, 8.9.1990, Z. Aytaç & H. Duman, GAZI 3444, Küre, 1100 m, 13.7.1978, O. Ketenoğlu, ISTE 48194, Ilgaz Da, Baldıran brook, 1450 m, 25.7.1981, E. Yurdakulol, ISTE, 48281, Ilgaz Da., İsfendiyyar Da., foot of Yaralıgöz mountain, 3.8.1998, A. Baytop, ISTE 75174, A4 Çankırı: between Kastamonu to Ilgaz, Ilgaz Da. on the passway *Abies nordmanniana* forest, 1775 m, 19.8.1973, F. Holtz et P. Hanel, EGE 23435, Ilgaz, Ilgaz pasway, *Abies nordmanniana* forest, 1900 m, 9.8.1996, R. S. Göktürk, AKDU 522, Cide, *Castanea* zonu 400 m, 15.6.1977, Y. Akman, ANK 6919, Küre, 1100 m, 13.7.1978, O. Ketenoğlu, ANK 648, Ilgaz Da, Küçük Çal hill, 1800 m, 20.7.1981, E. Yurdakulol, ANK 11530, A5 Amasya:Akdağ, between Suluova-Ladik, upper sides of Eğribük village, Keldiştepe nr, 1500 m, 24.7.1977, K. Alpınar, ISTE 37905, Akdağ, upper sides of Eğribük village, Sivrikaya province, 1600 m, 14.8.1977, K. Alpınar, ISTE 38475, A5 Sinop:Ayancık, Çarpal böl., 1200m, 1.7.1958, Mgf., ANK 10622, A5 Çorum:İskilip, 900 m, 17.6.1977, M. Kılınç, ANK 6052, A6 Samsun:Ladik, upper Soğanlı village, Adıç plateau, moist places, 1300m, 9.10.1977, K. Alpınar, ISTE 38687, A7 Trabzon:Hamsiköy, Zigana Da, 20.9.1993, A. Baytop, ISTE 65553, 10.1993, A. Baytop, ISTE 65640, between Zigana-Maden, after 11 km from Zigana, forest, 1400 m, 20.7.1979, E. Tuzlacı, ISTE 43213, Upper village of Of, 9.1994, A. Baytop, ISTE 66401, A8 Trabzon:Çaykara, Uzungöl-Soğanlı road, ca 1300 m, 15.8.1984, Y. Gemici, Ç. Yılmaz, EGE 28271, Soğanlı Da, north slope, 1700 m, Davis et Hedge, ANK 32052, A8 Rize:Çamlıhemşin, Çat near, 1200 m, meadows, 17.7.1985, T. Ekim, GAZI 6517, Çamlıhemşin, Hala village- Ayder, 800 m, brook side, stony places, 16.8.1984, M. Vural, HUB 22707, Çamlıhemşin, Amlakut plateau, 1900-2000 m, *Rhododendron-Picea-Fagus* forest, 21.7.1974, A Güner, HUB 22704, Ardeşen, between Fırtına köprüsü-Bakoz, 10-200 m, sandy fields and forest, 28.6.1980, A. Güner, HUB 22705, İkizdere, Dereköy, Tulumboğar, 1100 m, 7.10.1982, E. Tuzlacı, ISTE 49838, between İkizdere-Cimil, 770 m, 17.7.1975, E. Tuzlacı, ISTE 33190, İkizdere Cimil road, 17.8.1975, E. Tuzlacı,

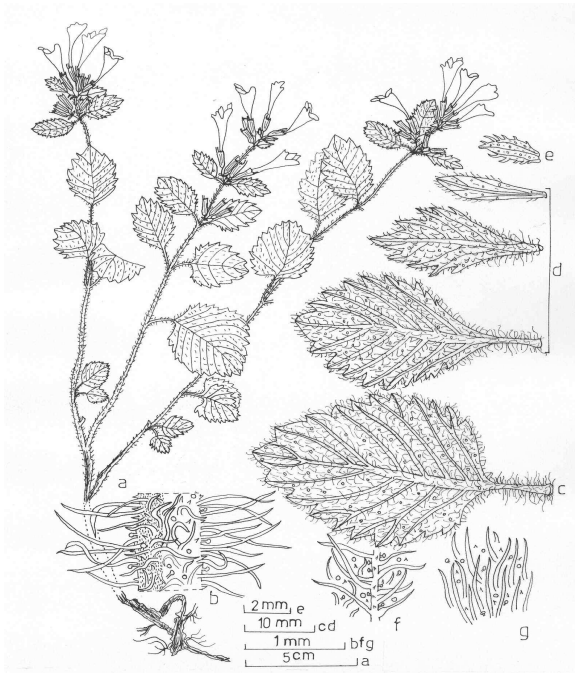


Figure 1. *Calamintha grandiflora* (ESSE 14380). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

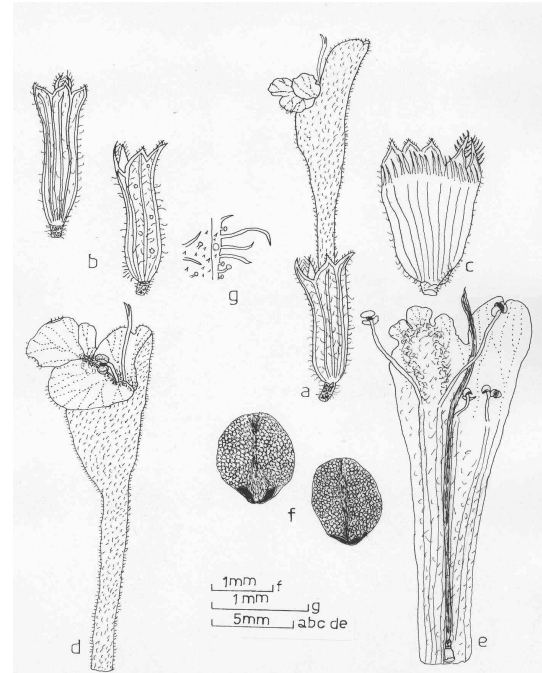


Figure 2. *Calamintha grandiflora* (ESSE 14380). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

ISTE 33220, A8 Artvin:Avcıklise around, *Fagus orientalis* forest, 1380 m, 16.7.1978, A. Düzenli, ANK 763, Murgul, Şevval hill, 1800 m, 21.7.1991, Z. Aytaç, GAZI 2938, A9 Artvin:1900 M, 19.6.1957, Davis et Hedge, ANK 29722, Ardanoç, Lahset meadows to foot of Kurdevan mountain, 1900-2900 m, 29.7.1982, N. Demirkuş, HUB 22710, A9 Kars:Posuf Kodyon nursery, Doğrular village, 1800-2200 m, 30.7.1985, N. Demirkuş, HUB 22696, B1 Balıkesir: Edremit, Kazdağ, 1500 m, *Abies* forest, 26.7.1968, Quezel-Pamukçuoğlu, HUB 22709, B2 Kütahya:Domanıç, Kocayayla, 1500 m, *Fagus* forest, 18.7.2001, S. Alan, M. Alan, ESSE 14380, Domanıç, Üç tepeler, 21.8.1991, A. Baytop, ESSE 9836, Domanıç-Dartepeler road, 10. km, 20.8.1992, K.H.C. Başer, ESSE 9870, Domanıç, Üç tepeler road, 11.9.1987, K.H.C. Başer, ESSE 8270, Domanıç, Üç tepeler road, forest, 21.8.1991, ISTE 63206, B3 Eskişehir:Türkmen Da., Efsun Baba, 14.8.2002, A. Ocak, ESSE 14413, Türkmen Da., 1350 m, 7.7.1977, T. Ekim, ANK 2419, Kalabak village, 1450-1500 m, *Pinus* forest, G.Hüner, OUF 9658!, ESSE 14387, C5 Mersin:Tahaner-Akarca, Nijhoff, ANK 1151, C6 Hatay: İskenderun, Amanus Da., 700 m, 20.7.1968, Y. Akman, ANK 7624.

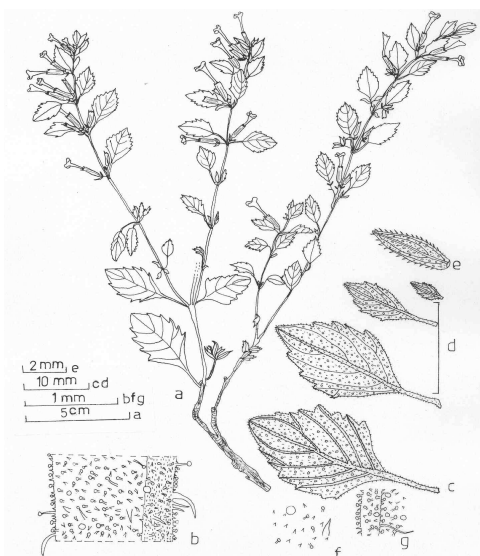


Figure 3. *Calamintha betulifolia* (Namrun; ESSE 14395). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

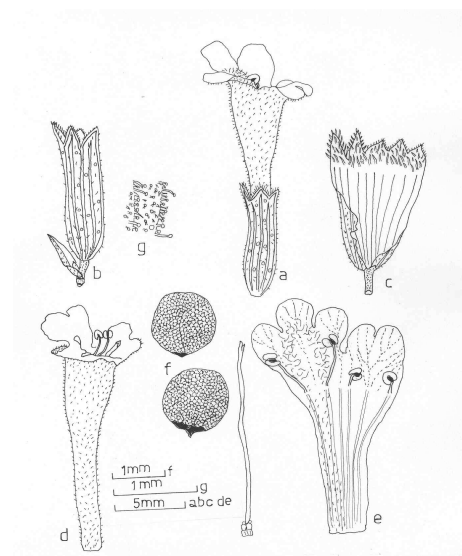


Figure 4. *Calamintha betulifolia* (Namrun; ESSE 14395). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

*Calamintha tauricola* P.H. Davis (Figures 6,7 ve 8)

Syn: *Nepeta anamurensis* Gemici & Leblebici in Candollea 50:50, f. 6D-F (1995).

Perennial herbs, decumbent or ascending, (5-)7-40cm, pruinose, densely glandular, cauline middle leaves broadly ovate, 7-30x5-24mm, with (2-)3-5 teeth per side, craspedodromous. Inflorescence 1-20cm, 2-8(-10) flowered, peduncles conspicuous, Labiatae type glandular hairs lack. Calyx 5-9.5mm, 11-veined, lower lip with 2 toothed, teeth 1.5-2.2mm, lower lip equalling than upper teeth, tube straight, throat glabrous. Corolla 8-18mm, violet. Endemic. Specimens examined: C4 İçel: Mut-Gülнар road, 17.km, 770m, 10.7.2003, S. Alan, M. Alan, ESSE 14391, Silifke, Uzuncaburç, 950m, 11.7.2003, S. Alan, M. Alan, ESSE 14392, Mut-Gülнар 17.km, roadside, 770m, 19.7.1995, K.H.C.Başer, H.Duman, ESSE 11570, C4 Antalya: Anamur, Abanoz plateau, rocky places, 1360 m, 18.7.1995, K.H.C.Başer, H.Duman, ESSE 11628, Anamur, Abanoz plateau, calcareous rocky places, 1400 m, 25.8.1993, Ö. Seçmen, Y. Gemici, EGE 26695, C4 Konya: Kazancı, Koçaş, Çırlağı around, 1580 m, 29.6.1980, E. Tuzlacı, ISTE 45219, C5 İçel: Erdemli, Kızilen village, rocky places, north slope, 10.7.1998, A.Ünver, ESSE 13180.

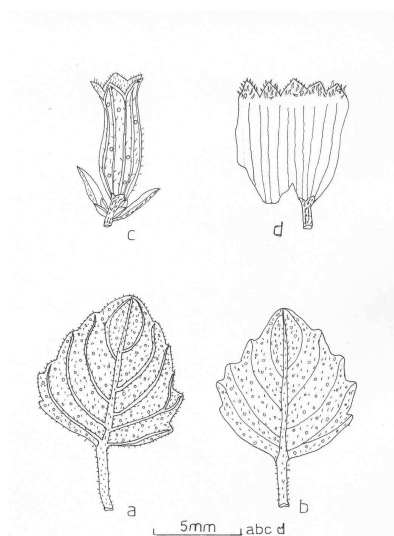


Figure 5. *Calamintha betulifolia* (Gözne; ESSE 14394). a: Leaves, b: Bracts, c: Calyx, d: Inside of calyx

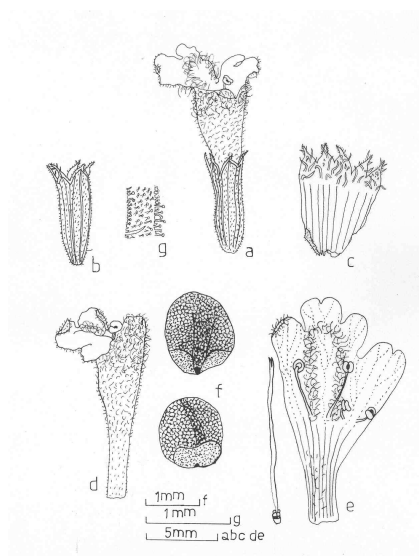


Figure 7. *Calamintha tauricola* (Silifke; ESSE 14392). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

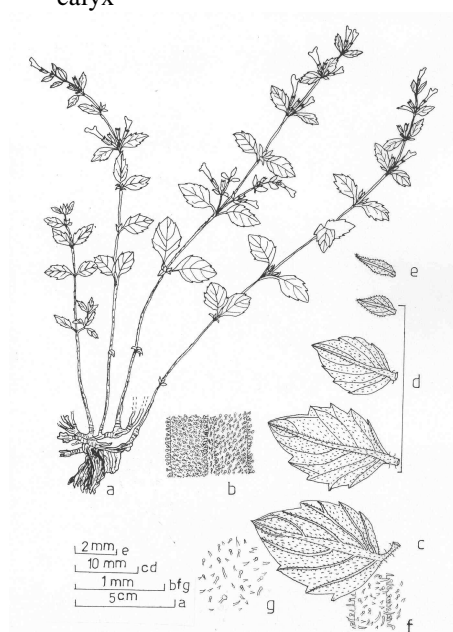


Figure 6. *Calamintha tauricola* (Silifke; ESSE 14392). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

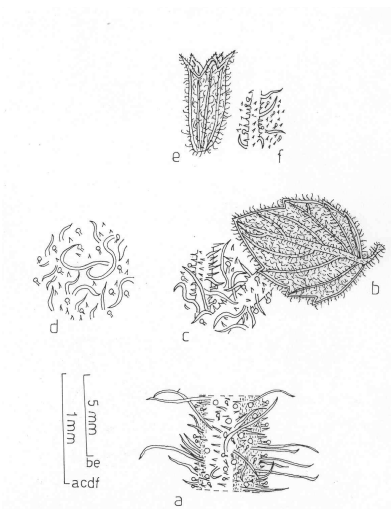


Figure 8. *Calamintha tauricola* (Mut; ESSE 14391). a: Stem, b: Leaves, c: Lower surface hairs of leaf, d: Upper surface hairs of leaf, e: Calyx, f: Hairs of calyx

*Calamintha pamphylica* Boiss. & Heldr. (Figures 9-14)

Perennial herbs, trailing, ascending, 5-35(-45)cm, villous, long villose, short puberulent or sparsely puberulent, sparsely glandular or densely short-stalked glandular, cauline middle leaves triangular or deltoid, ovate-broadly ovate or triangular, 4-32x3-25mm, truncate-subcordate, broadly cuneate or rounded cuneate at base, margins shallowly crenate-denticulate, distinctly crenate-dentate or clearly serrate, with 3-7 toothed per side, craspedodromous, petioles long villous or pilose. Inflorescence 2-17(-20)cm, 2-12 flowered. Calyx 4-12mm, 11(-12)-13-veined, bilabiate or sub-bilabiate, divided to 1/4-1/8, upper lip 3 toothed, teeth 0.6-2mm, triangular, curved, acute-acuminate, short-ciliate margined, lower lip with 2 teeth, teeth 1-2.5(-2.8)mm, acuminate-subulate or subulate, lower lip equalling or longer than upper teeth, tube straight, outside villous, villos and short puberulent sparsely glandular or densely short-stalked glandular, sparsely pale dotted, inside of tube and throat glabrous. Corolla 11-26mm, pale lilac. Endemic.

1. Stems and petioles villous or long villose and short puberulent, sparsely glandular, leaves 4-25mm, margins shallowly crenate-denticulate, distinctly crenate-dentate, upper calyx teeth 1-2mm, acuminate-subulate, lower lip equalling than upper teeth

2. Median leaves triangular-broadly ovate, 4-18x3-15mm, margins shallowly crenate-denticulate, truncate-subcordate at base, petioles long villous

subsp. **pamphylica**

2. Median leaves ovate-broadly ovate or triangular, 5-25x4-20mm, margins distinctly crenate-dentate, broadly cuneate at base, petioles pilose

subsp. **davisii**

1. Stems and petioles sparsely puberulent, densely short-stalked glandular, leaves 10-32x5-25mm, margins distinctly serrate, upper calyx teeth 0.6-1mm, acute-triangular, lower lip longer than upper teeth

subsp. **alanyense**

**subsp. pamphylica (Figures 9,10)**

Specimens examined: Type: C4 Antalya: ad rupes calcareis montium Pamphylicae orientalis regio superior montis Ghibelleis (Cebireis Da.), prope Alaya (Alanya), Heldreich (holo. G! Iso. K! WU!). Alanya, Cebelleis mountain, Dim cave, rocks crevices, 230 m, 4.VII.2002, S. Alan, M. Alan, ESSE 14385, Alanya, Dim brook sides, rocks crevices and under the waterfall, 50 m, 30.VI.2002, S. Alan, M. Alan, ESSE 14383, Alanya, Yerköprü-Türbelenos, rocks, 1200-1300m, 10.VIII.1994, H. Duman, ESSE 10709, GAZI 5621, C4 Konya: Ermenek, Koçaş, *Cedrus libani* forests, rocky slopes, 1500m, 11.VII.1978, M. Vural, KNYA 6410, GAZI 1096.

**subsp. davisii (Quezel & Contandr.) Davis (Figures 10, 11)**

Syn: *Calamintha davisii* Quezel & Contandr. in Bull. Soc. Bot. Fr. 123:427 (1976). Davis in Kew Bull. 1949:397 (1949)

Specimens examined: C3 Antalya: Kemer, Kesme valley, *Pinus brutia* forests, limestone rocky crevices, 557 m, 5.VI.2003, S. Alan, M. Alan, ESSE 14389, :Kemer, Kesme valley, *Pinus brutia* forests, limestone rocky crevices, 77 m, 5.VI.2003, S. Alan, M. Alan, ESSE: 14390, Kemer, Tekirova, Yarıkkışme, rocks, brook sides, 50 m, 5.VI.2003, S. Alan, M. Alan, ESSE 14388, Kumluca, Adrasan, Ulupınar brook sides, rock crevices, 8.VI.2004, S. Alan, Y. B. Köse, ESSE 14404, Kemer, Kesme valley, Kuzdere road, rocky slopes, 80 m, 21.VI.1995, K. H. C. Başer, H. Duman, ESSE 11292, Kemer, 50-100 m, *P. H. Davis*, ANK: 15150, Kemer, Kesme valley, calcareous rocky places, *Pinus brutia-Cupressus sempervirens* forests, 150-300 m, 12.V.1978, H. Peşmen, Ş. Kaplan, ANK 3855, Kemer, Kesme valley, calcareous rocky places, *P. brutia-Cupressus sempervirens* forests, 150-300 m, 12.V.1978, H. Peşmen, Ş. Kaplan, ISTE: 52651, Kemer, near Kesme valley, 15.VII.1948, *P.H. Davis*, EGE 14071.

**subsp. alanyense S. Alan & A. Ocak (Figures 12, 13)**

Specimen examined: Type: Turkey. C4 Antalya: Alanya Kargı brook, 2.7.2002, rock crevices, S. Alan, M. Alan, ESSE 14384 (holotype ESSE; Isotypes: GAZI, Osmangazi Univ. Herb.).

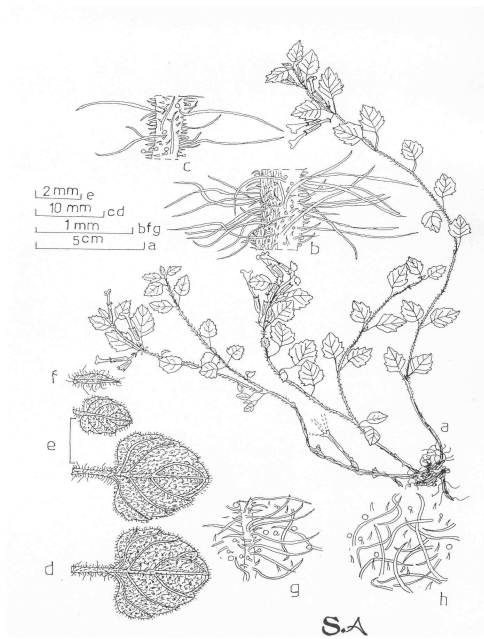


Figure 9. *Calamintha pamphylica* subsp. *pamphylica* (ESSE 14385). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

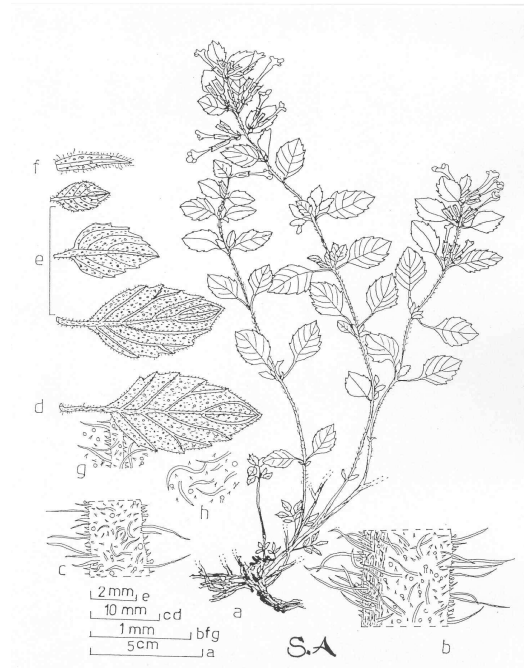


Figure 11. *Calamintha pamphylica* subsp. *davisii* (ESSE 14388). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

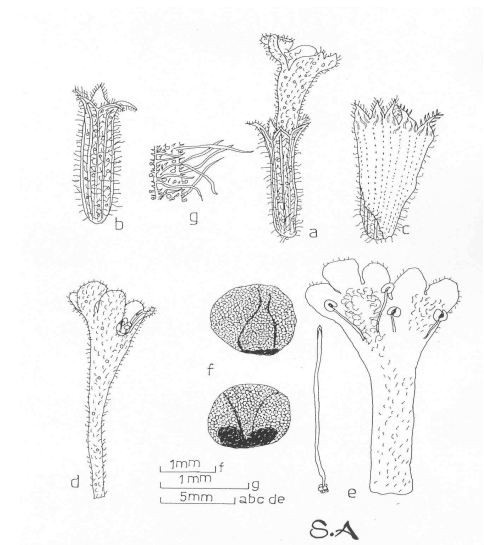


Figure 10. *Calamintha pamphylica* subsp. *pamphylica* (ESSE 14385). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

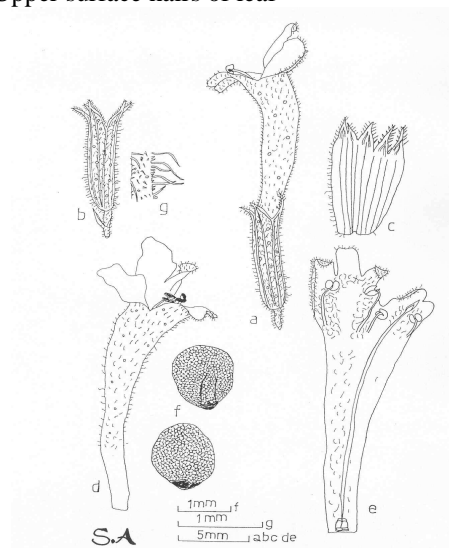


Figure 12. *Calamintha pamphylica* subsp. *davisii* (ESSE 14388). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx



Figure 13. *Calamintha pamphylica* subsp. *alanyense* (ESSE 14384). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

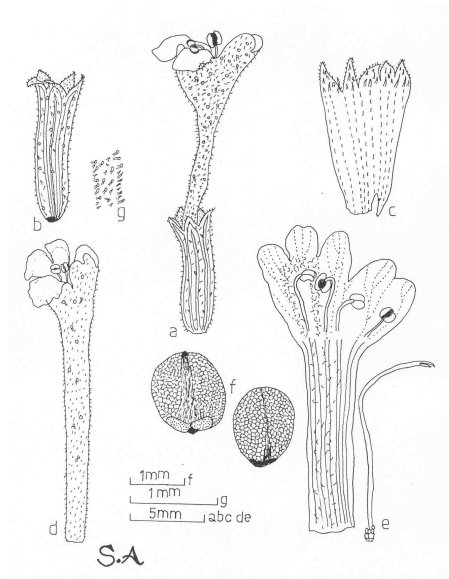


Figure 14. *Calamintha pamphylica* subsp. *alanyense* (ESSE 14384). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

*C. piperelloides* Stapf (Figures 15) (According to Flora of Turkey)

Perennial herbs, erect-decumbent, 5-10cm, cauline middle leaves broadly ovate, 6-10x5-8mm, puberulent, margins obscurely serrulate, with 2-4 teeth per side, craspedodromous, 2 flowered. Calyx 8-10mm, 11-veined, lower lip with 2 toothed, teeth 2.5-3mm, lower lip longer than upper teeth, upper teeth straight, tube straight, throat and teeth glabrous. Corolla 23-27mm. Endemic.

Specimen examined: C2 Antalya: Kaş, Lycia, Gölbaşı (Yavi), 4.5.1882, Luschan, Holotip WU.

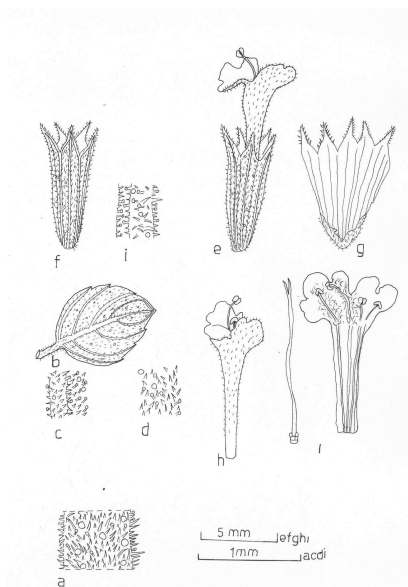


Figure 15. *Calamintha piperelloides* (from the type). a: Stem, b: Leaves, c: Lower surface hairs of leaf, d: Upper surface hairs of leaf, e: Flower, f: Calyx, g: Inside of calyx, h: Corolla, i: Inside of corolla, pistile and stamens, j: Hairs of calyx



*Calamintha sylvatica* Bromf. (Figures 16-19)

Perennial herbs, ascending to erect, 21-85cm, cauline middle leaves ovate-broadly ovate, (18-)20-55x10-30mm, pubescent, margins serrate-dentate, crenate-serrate, with 6-10 teeth per side, camptodromous. Inflorescence 5-34cm, peduncles conspicuous, 2-44 flowered. Calyx 5-8.5(-11)mm, 13-veined, lower lip with 2 toothed, teeth 2.5-4mm, long-ciliate, lower lip longer than upper teeth, tube straight, hairs at throat densely and exserted. Corolla 11-20mm, Lilac-blue to lavender.

1. Corolla 12-20mm, leaves margins serrate-dentate, calyx lower teeth 2.5-4mm  
subsp. **sylvatica**

1. Corolla 11-15mm, leaves margins crenate-serrate, calyx lower teeth 1.5-3mm  
subsp. **ascendens**

**subsp. sylvatica (Figures 16-17)**

Syn: ? *Calamintha menthifolia* Host, Fl. Austr. 2:129 (1832); *Satureja calamintha* (L.) Scheele subsp. *officinalis* sensu Gams in Hegi, III. Fl. Mittel-Eur. 5:2294 (1928).

Specimen examined: A3 Kocaeli: Maşukiye, Kartepe-Kuzuyayla, *Fagus-Castanea* forest, c.1000 m, 7. 9.2004, S. Alan, M. Alan, ESSE 14409.

**subsp. ascendens (Jordan) P. W. Ball (Figures 18-19)**

Syn: *Calamintha ascendens* Jordan Obs.-Pl. Crit. 4:8 (1846)! *Satureja calamintha* (L.) Scheele subsp. *ascendens* (Jordan) Briquet, Lab. Alp. Marit. 3:435 (1895)! *Satureja calamintha* (L.) Scheele subsp. *menthifolia* sensu Gams in Hegi, III. Fl. Mittel-Eur. 5:2294 (1928). Ic: Jordan Obs. Pl. Crit. 4: t. 1 f. B (1846)

Specimens examined: A1(E) Kırklareli: Dereköy, on a hill with *Quercus* forest, 24.7.1968, A. Baytop, ISTE 14553, Dereköy-Demirköy road, beyond of Karadere, Şükrübey road, 500 m, 9.9.1976, N. ve E. Özhatay, ISTE 35940, A1 Balıkesir: Manyas, 7.11.1999, G.Tümen, ESSE 13183, A2(E) İstanbul: between Ormanlı village, under *Quercus*, 17.10.1968, A. Baytop, ISTE 14599, A8 Trabzon: Çaykara, Taşören village, 3.8.1994, G.Tümen, ESSE 10987, C5 Adana: Horzum plateau, brook side, 680 m, 19.9.1993, V. Zaimoğlu, ESSE 10375, C6 Adana: Amanos, Bahçe, Düldül Da., 1800 m, 27.8.1949, P.H.Davis, ANK 16394.

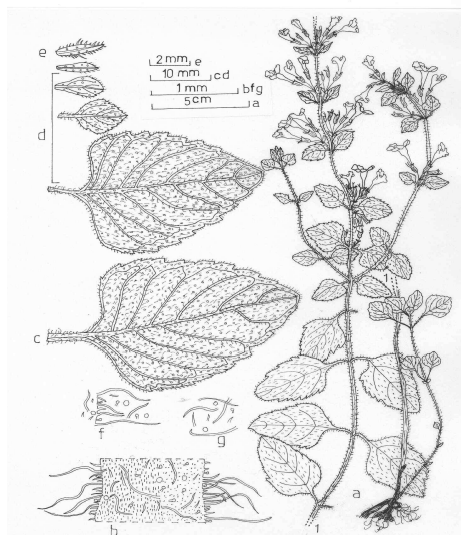


Figure 16. *Calamintha sylvatica* subsp. *sylvatica* (ESSE 14409). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

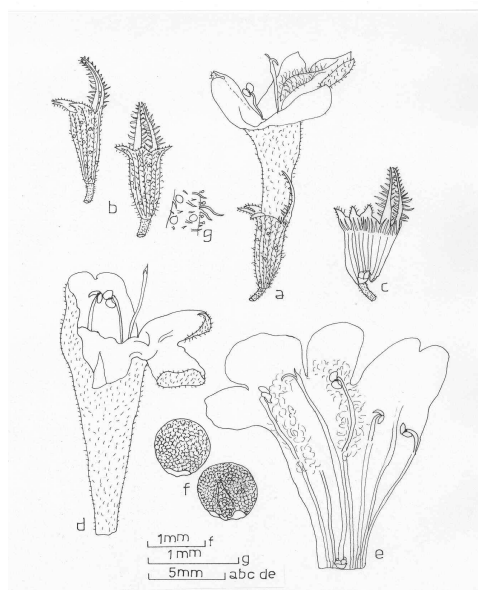


Figure 17. *Calamintha sylvatica* subsp. *sylvatica* (ESSE 14409). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

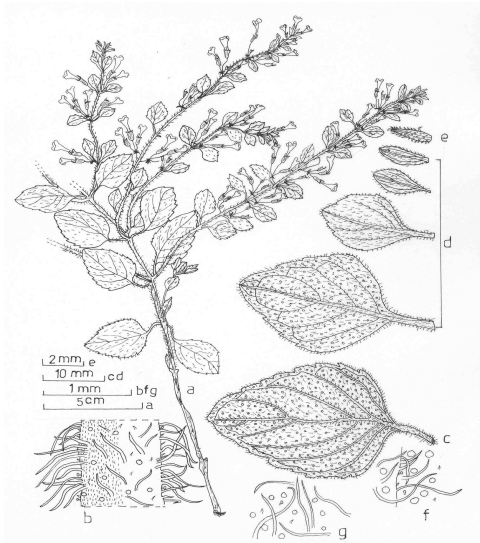


Figure 18. *Calamintha sylvatica* subsp. *ascendens* (ESSE 10375). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

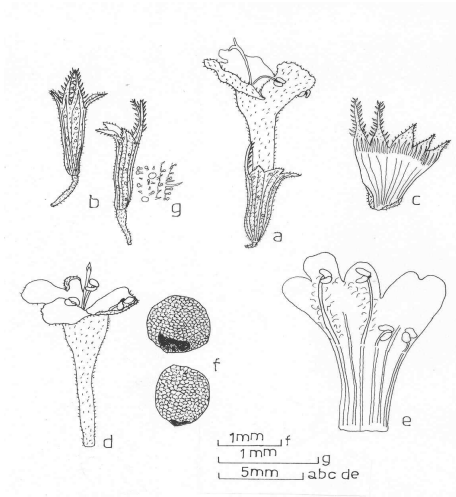


Figure 19. *Calamintha sylvatica* subsp. *ascendens* (ESSE 10375). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistil and stamens, f: Fruits, g: Hairs of calyx

*Calamintha nepeta* (L.) Savi (Figures 20-23)

Perennial herbs, ascending to erect, 17-90cm, cauline middle leaves ovate-broadly ovate and ovate, 7-31(-43)x5-25mm, pubescent, margins usually serrate-dentate or crenate-dentate, with 5-8 teeth per side, camptodromous. Inflorescence (0.5-)1.5-43cm, verticillasters lax or dense, peduncles 0.5-20mm, pedicel 0.5-13mm, peduncles conspicuous, 2-40(-50) flowered. Calyx 2.5-7mm, 13-veined, lower lip with 2 toothed, teeth 0.9-3mm, sparsely short-ciliate, lower lip longer than upper teeth, tube straight, hairs at throat densely and exserted. Corolla 5-12 mm, mauve to pink.

1. Median leaves 8-31(-43)x5.5-20mm, calyx 2.5-7mm, verticillasters lax, peduncles (2-)4-20mm, pedicel 1.5-13mm, leaves margins usually serrate-dentate

subsp. **nepeta**

1. Median leaves 7-21(-25) x5-17mm, calyx 3.2-6mm, verticillasters dense, peduncles 0.5-6 (-13)mm, pedicel 0.5-5mm, leaves margins usually crenate-dentate

subsp. **glandulosa**

**subsp. nepeta (Figures 20 & 21)**

Syn: *Melissa nepeta* L. Sp. Pl. 593 (1753)! *Calamintha nepetoides* Jordan, Obs. Pl. Crit. 4: t. 2f. B (1846)

Specimens examined: A4 Bartın:Yılanlı hill, 100 m, 15.7.1984, M. Demirörs, ANK 1599, Kurucaşile, sea level, 28.8.2003, S. Alan, M. Alan, ESSE 14402, B1 Balıkesir:Edremit, Akçay, 17.7.1962, K. Çilenti, GAZI 1991, B5 Adana: Feke, forest road between Feke-Bakırdağ, 900 m, roadside slopes, 31.7.1979, E. Tuzlacı, M. Saraçoğlu, İSTE 43390, C3 Antalya: Döşemealtı, Ahırtaş village, Kocain cave, 700 m, 5.12.1999, M.Gökçeoğlu, O. Ünal, AKDU 621, C4 İçel: Silifke, Uzuncaburç, *Pinus-Quercus* forest 1150 m, 11.7.2003, S. Alan, M. Alan, ESSE 14393, C5 İçel:Tarsus, Darıpınarı village, gullies, 950 m, 12.7.2003, S. Alan, M. Alan, ESSE 14398, Çamlıyayla, İkiyüzalan around, 1600 m., 16.7 1995, Z. Aytaç, GAZI 7061, C5 Adana: Osmaniye, from Osmaniye 8. km after, Osmaniye to Yarpuz road, 455 m, 20.7.1995, K.H.C.Başer, H. Duman, ESSE 11548, C6 Adana: Haruniye, Düziçi, 20.8.1994, G.Tümen, ESSE 10787, Haruniye, Amanus Da., P.H.Davis, ANK 16375, C6 Hatay:Belen, province source of Atik plateau water, 15.8.1994, G.Tümen, ESSE 10712, Dört Yol, Çökel plateau, Amanus Da., 600 m., 21.9.1967, Y Akman, ANK 7625.

**subsp. glandulosa (Req.) P. W. Ball (Figures 22 & 23)**

Syn: *Melissa calamintha* L., Sp. Pl. 593 (1753)! *Calamintha officinalis* Moench, Meth. 409 (1794); *Thymus glandulosus* Req. In Ann. Sci. Nat. Ser. Ser. 1, 5:386 (1825); *Calamintha subnuda* (Waldstein & Kit) Host, Fl. Austr. 2:130 (1832); *Calamintha glandulosa* (Req.) Bentham, Lab. Gen. Sp. 387 (1834) *Calamintha byzantina* C. Koch in Linnaea 21:672 (1848); *Calamintha spruneri* Boiss., Diagn. ser. 1(12):53 (1853) *Calamintha nepeta* (L.) Savi var. *spruneri* (Boiss.) Hayek, Prodr. Fl. Balc. 2:326 (1931) *Calamintha nepeta* (L.) Savi subsp. *byzantina* (C. Koch) Hayek, loc. cit. (1931). Ic: Jordan, Obs. Pl. Crit. 4: t. 2 f. A (1846)

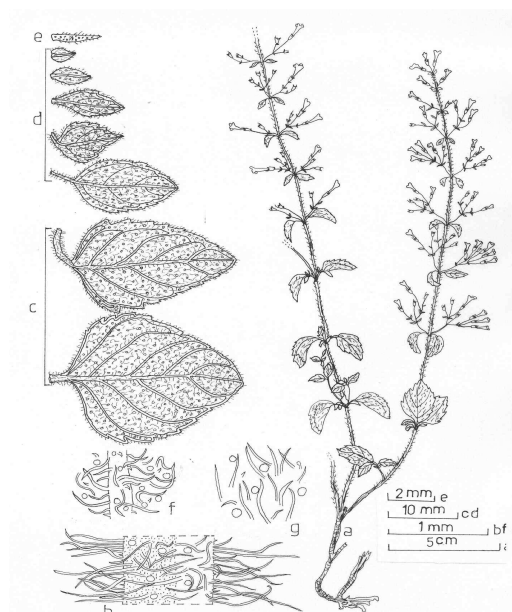


Figure 20. *Calamintha nepeta* subsp. *nepeta* (ESSE 14393). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

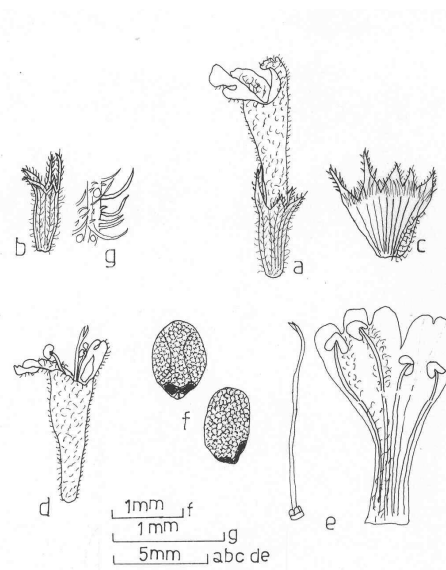


Figure 21. *Calamintha nepeta* subsp. *nepeta* (ESSE 14393). a: Flower, b: Calyx, - c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

Specimens examined: A1(A) Balıkesir: Marmara island, 23.8.1995, G. Tümen, ESSE 12045, Marmara islands, S., roadside, 16.6.1968, A. Baytop, T. Avcıgil, ISTE 13678, Erdek, 7.1989, K.H.C.Başer, ESSE 8938, A2(A) Istanbul: near Beykoz, Yuşa hill, 18.8.1981, E. Tuzkacı, F. Altuğ, ISTE 47502, A2(E) Istanbul: E ridges of Kağıthane, 8.9.1975, N. ve E. Özhatay, ISTE 33806, W hills of Kilyos, 10.10.1970, A. Baytop, ISTE 18532, Yıldız parkı, 30.8.1982, A. Baytop, ISTE 49683, A2 Bursa: Gemlik, 30.6.1936, Gassner, ANK 568, Uludağ, 600m, 14.9.1947, P.H. Davis, ANK 14871, Görekle University campus, 10.11.1993, G. Tümen, ESSE 10201, İnegöl, Mezitler, 6.10.1984, K.H.C. Başer, ESSE 6764, İnegöl, Mezitler, 21.8.1987, K.H.C.Başer, ESSE 7815, A3 Kocaeli: Kandıra, Kerpe d. s. 24.7.1983, K. Alpınar, ISTE 51698, Maşukiye, Kartepe, Kuzuyayla, roadside, *Castanea-Fagus* forest, 1000 m, 7.9.2004, S. Alan, M. Alan, ESSE 14410, A3 Bilecik: Between Bilecik-Bozüyük, 10 km from Bilecik, gullies, 6.9.1979, E. Tuzlacı, A. Meriçli, ISTE 43555, A3 Bolu: Between Düzce-Akçakoca, roadside, 6.9.21004, S. Alan, M. Alan, ESSE 14407, A3 Zonguldak: Kozlu, 26.8.2003, S. Alan, M. Alan, ESSE 14400, Kozlu, Iliksu province, gullies, 6.9.2004, S. Alan, M. Alan, ESSE 14406, Kozlu, 6.9.2004, S. Alan, M. Alan, ESSE 14411, Kozlu, roadside, 26.8.2003, S. Alan, M. Alan, ESSE 14400, Alaplı, Kozlu, 5 m, 6.9.2004, S. Alan, M. Alan, ESSE 14408, Devrek, Akçasu around, Kızılcakeş, 300m, 7.8.1984, ANK 1552, A3 Adapazarı: Adapazarı, 19.9.1986, Gassner, ANK 722, from Pamukova to Sapanca, Örencik village, ca. 40m, 31.7.1984, Ö. Seçmen, Y. Gemici, EGE 17904, Zonguldak, 24.9.1944, H. Birand, ANK 145, A4 Bartın: Amasra roadside, forest, 27.8.2003, S. Alan, M. Alan, ESSE 14401, A4 Kastamonu: Cide, Deniz Konak village, 50 m, 7.10.1980, O. Ketenoğlu, ANK 1211, Cide, macchie, 100m, 7.10.1980, O. Ketenoğlu, ANK 1210, A5 Samsun: Bafra, Çakırlar province, roadside, 17.9.1966, E. Leblebici, Ersoy, EGE 12420, A6 Samsun: İncesu brook, near the military camping, 17.9.1966, E. Leblebici, EGE 7320, A6 Ordu: Samsun road, Çakatünel locality, roadside, 23.8.1992, G. Tümen, ESSE 9830, A7 Trabzon: Maçka, ca. 320m, 12.8.1981, Y. Gemici, EGE 30134, A7 Giresun: river side in Giresun Castle, on the stone, 20.9.1993, G. Tümen, ESSE 10139, A8 Artvin: Artvin, 19.8.1994, K.H.C.Başer, ESSE 10946, B1 Balıkesir: Erdek, Ocaklar village, 7.1989, K.H.C.Başer, ESSE 8494, Edremit, Avcılar village, 15.6.1991, R. Usta, ESSE 9601, B1 İzmir: Torbalı, 29.4.1968, M. Öztürk, EGE 11625, Balçova, near the dam, roadside, ca. 40-50m, 27.8.1982, G. Görk, Y. Gemici, EGE 26497, Kemalpaşa-Kavaklıdere village, roadside, 18.2.1974, E. Leblebici, EGE 11929, Kiraz, Kiraz-Hisar village, 320m, 15.11.1992, G. Tümen, ESSE 9983, B2 Bursa: İnegöl, Güney Kestane village, 14.6.1991, K.H.Başer, A.Kaya, ESSE 9147, B2 İzmir: Kiraz, 320m, 29.10.1992, F. Yılmaz, ESSE 10109, B2 Manisa: Turgutlu, Sart (Anthemis) ruins, bottoms of rock, 29.7.2001, S. Alan, M. Alan, ESSE 14381, B4 Kastamonu: Küre, Baki baba mausoleum, rocky places, 1330m, 12.9.1990, Aytaç, Otan et al. GAZI 3391, C2 Denizli: Başarcı village, Babadağ, Ornaz, rocky slopes, 900m, 2.7.2003, Y. B. Köse, ESSE 14399, Çamlık road, roadside, 13.7.1947, K. Karamanoğlu, ANK 13237, C4 Konya: Ermenek, plateau of Kazancı Town, Kırk kuyu locality, 1800m, 17.5.1985, H. Sümbül, 3280 ANK, C4 Mersin: Anamur, Kayancı road, Kızılalan locality, 1400m, 24.6.1984, H. Sümbül, 3060 ANK, C5 Niğde: Ulukışla, Bulgar Da, Alikoca, 1200130 m, 3.9.1949, P.H. Davis, ANK 16523.

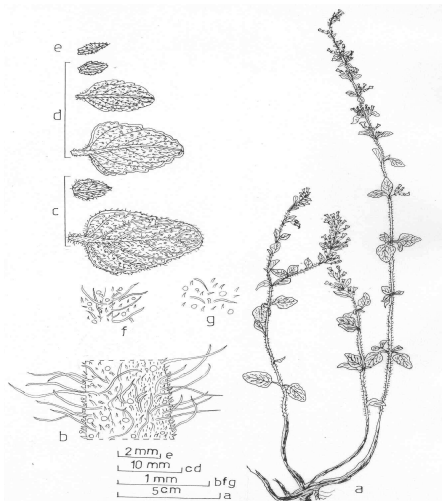


Figure 22. *Calamintha nepeta* subsp. *glandulosa* (ESSE 14381). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

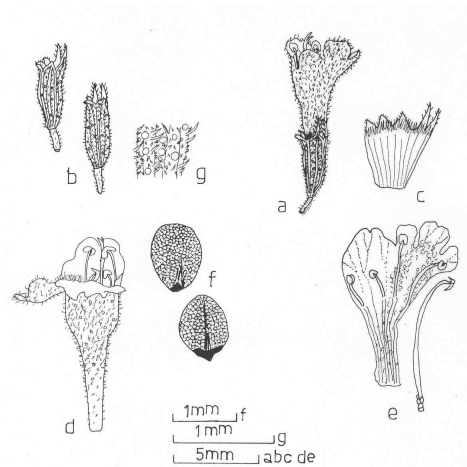


Figure 23. *Calamintha nepeta* subsp. *glandulosa* (ESSE 14381). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

*C. incana* (Sm.) Boiss. (Figures 24 & 25)

Syn: *Thymus incanus* Sm. in Sibth. & Sm., Prodr. Fl. Graec. 1:421 (1809); *Melissa incana* (Sm.) Benth. Lab. Gen. Sp. 386 (1834). Ic: Sibth. & Sm., Fl. Graeca 6: t. 672 (1825)

Perennial herbs, ascending to decumbent, (5-)10-48 (-55)cm, cauline middle leaves ovate-orbicular, 4-16x3.5-14mm, canescent-tomentose, entire or scarcely notched, camptodromous. Inflorescence (1.5-)4-36cm, pedicellate on very short or obsolescent peduncles, 2-10 flowered. Calyx 3-5mm, 13-veined, lower lip with 2 toothed, teeth 1-2 mm, lower lip longer than upper teeth, tube straight, hairs at throat exerted. Corolla (5-)7-10mm, mauve.

Specimens examined: C2 Muğla: Dalaman, Salsola village, sea level, 1 m, 22.7.1998, H. Sümbül, O. Düşen, AKDU 636, Kale, Yavi village, 12.6.2004, S. Alan, M. Alan, ESSE 14405, C3 Antalya: at the end Düden waterfall, 8.1993, G. Tümen, ESSE 10188, Termessos, 18.7.1994, K. H. C. Başer, ESSE 10040, Akseki, Sinanhoca village, 300 m, breakers of rock, 29.7.1993, Y. Gemici, S. Oluk, EGE 28890, C4 Antalya: Alanya, Dim brook, roadside, 30.6.2002, S. Alan, M. Alan, ESSE 14382, Alanya, Mahmutlar-Hadim road, 300 m, 7.7.2002, S. Alan, M. Alan, ESSE 14386, Alanya, P. H. Davis, ANK 14487, Alanya, 21.9.1996, S. H. Beis, K. H. C. Başer, ESSE 12190, Alanya, 22.2.1997, K.H.C. Başer, ESSE 12268, C4 İçel: Silifke, Uzuncaburç, 150 m, road side, 11.7.2003, S. Alan, M. Alan, ESSE 14397, C5 İçel: Gülnar, 24.9.1995, G. Tümen, ESSE 11937.

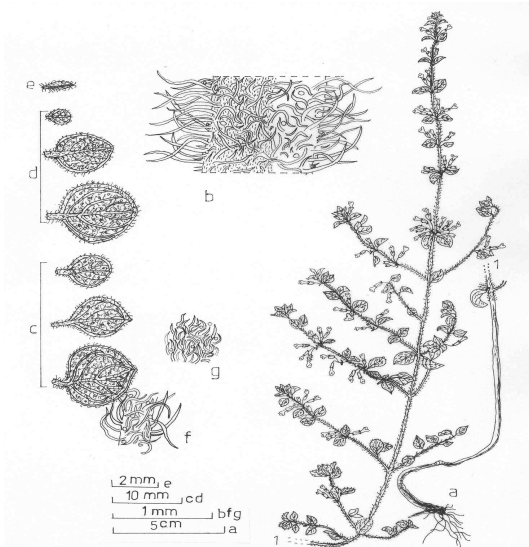


Figure 24. *Calamintha incana* (ESSE 14382). a: Habit, b: Stem, c: Leaves, d: Bracts, e: Bracteole, f: Lower surface hairs of leaf, g: Upper surface hairs of leaf

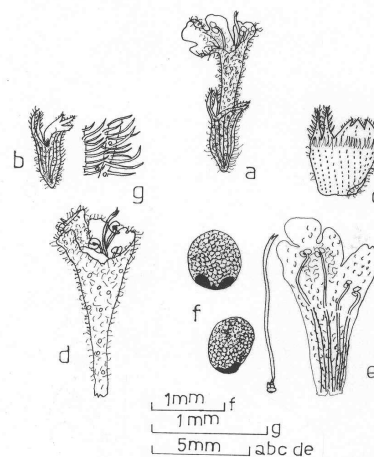


Figure 25. *Calamintha incana* (ESSE 14382). a: Flower, b: Calyx, c: Inside of calyx, d: Corolla, e: Inside of corolla, pistile and stamens, f: Fruits, g: Hairs of calyx

*C. caroli-henricana* Kit Tan & Sorger (Figure 26) (According to Flora of Turkey)

Annual herbs, erect, 4-7cm, cauline middle leaves obovate to elliptic obovate, 8-14x5-8mm, glabrescent to sparsely puberulent, margins entire, upper obscurely serrulate or notched, 10-12 flowered. Calyx 4.5-5.5mm, 13-veined, lower lip with 2 toothed, teeth 2mm, lower lip longer than upper teeth, tube straight, hairs at throat. Corolla 4mm, rose-pink. Endemic.

Specimen examined: Type: Turkey B10 Van: ca. 30 km N.E. of Çaldıran, 7.7.1982, Sorger 82-47-49 (holo. Hb. F. Sorger iso. E).



Figure 26. *Calamintha caroli-henricana* Kit Tan & Sorger. a: Habit.

Type: (Turkey B10) Van: c. 30 km NE Çaldıran, Kalkfels von lavamassen ungeben, offene Vegetation, 2400-2700 m, 7.VII.1982, Sorger 82-47-49 (holo. Hb. F. Sorger iso. E)

#### 4. Discussion

According to our results 9 species and 13 taxa of *Calamintha* grow in Turkey. *Calamintha* samples belonging to 13 taxa were evaluated systematically and morphologically, and familiarity degrees of these samples were recorded.

The morphological results of *Calamintha* species are given in Table 1. According to these results, some properties of the species are as follows;

*C. grandiflora*, *C. betulifolia*, *C. tauricola*, *C. pamphylica*, *C. piperelloides*, *C. sylvatica*, *C. nepeta*, *C. incana* are perennial, *C. caroli-henricana* is annual (Davis et al 1988; Duman, 2000). The height of *C. grandiflora*, *C. betulifolia*, *C. tauricola*, *C. pamphylica*, *C. piperelloides* is shorter than the other species. In these species, leaf veins are craspedodromous, calyx 11(-12)-veined. In *C. sylvatica*, *C. nepeta* and *C. incana* leaf veins are camptodromous, and calyx 13-veined. For the perennial species, features of the plants such as plant height, stem form, leaf shape, number of tooth, venation form, peduncle size, calyx and corolla sizes, and their forms, and indumentum have been identified as diagnostic.

The largest leaf and flower sizes were observed in *C. grandiflora*. In *Calamintha betulifolia*, the stem is ascending, and the stem, leaves and calices are pruinose. In *C. tauricola*, stem is decumbent or ascending, and the stem, leaf and calyx are pruinose. The Labiatae type glandular hairs are lacking. Numbers of leaf tooth (2-)3-5 and numbers of flowers 2-8(-10) are lower than the other species. The shortest inflorescence length (2-17 cm) is observed in *C. pamphylica*. The two subspecies of *C. pamphylica* can be differentiated with their leaf shape, covering hairs and leaf margins. Two subspecies of *C. sylvatica* can be distinguished by the properties of stem, lower teeth of calyx, length of corolla and number of flower. *C. nepeta* samples have larger limits than the other species with stem length (17-90 cm), inflorescence length [(0.5-) 1.5-43 cm], peduncle length (0.5-20 mm), and pedicel length (0.5-13 mm). The two subspecies of *C. nepeta* are differentiated by their verticillate appearance, leaf and peduncle sites, leaf margins, and indumentum characters. *C. incana* is significantly smaller than the other species with its characteristics such as leaf length, shape and margins, flower and peduncle length, calyx form, and indumentum.

On the other hand, different variation limits have been determined for leaf, bracteol, calyx and corolla sizes, flower numbers, covering and glandular hairs of *Calamintha* species as compared with those in the Flora of Turkey. According to these data, the morphologic differences among these species were found and arranged as a new key.

Particularly in *C. betulifolia*, *C. tauricola* and *C. pamphylica* more clear differences among the populations were observed and these differences are presented in the figures. According to the results of this study, *C. betulifolia*, *C. tauricola* and *C. pamphylica* can be defined as complex and close by related specimens. In *C. betulifolia* samples collected from İçel: Gözne population inflorescence length is longer (2-24 cm), and verticillasters number is more (2-12) than the others. The length of calyx upper teeth is shorter (0.5-1mm), and the shape is triangular. The lengths of upper and lower tooth are equal. In the other populations (İçel: Namrun, Tarsus: Güzeldere) upper teeth length is 1-1.5mm, shape acuminate-triangular and lower teeth are longer than upper. The length and width of bracts are longer and larger than the others (İçel: Namrun 5-15x1.5-12mm), (İçel:Gözne 2.3-30x1-20mm). While the leaf shape of the samples from İçel: Gözne is broadly ovate, base of the leaf is rounded cuneate-reniform, margins are crenate-dentate, leaf shape is ovate-elliptic, base is cuneate and margins are serrate in other populations (Figure 5). In the populations of *C. tauricola* while covering hairs of the samples collected from İçel: Mut are dense, long, crispate, and short-soft, the others (from İçel: Erdemli, Silifke, Antalya: Anamur) are sparsely, short and soft. Sizes of leaf, bract, and bracteol for the samples of Mut: Gülnar are longer and broader than the others (10-30x7-24mm), (7-25x4-21mm), (2-9x0.5-4mm). In other populations, they are shorter and more narrow (7-25x5-18mm), (5-18x3-14mm), (2-4x0.8-1mm) (Figure 8) According to this, *C. betulifolia*, *C. tauricola* and *C. pamphylica* may be defined as complex and similar species.

*C. pamphylica* is represented with two subspecies; subsp. *pamphylica* and subsp. *davisii* in the Flora of Turkey. *C. pamphylica* subsp. *pamphylica* grows in Alanya: Dim Çayı and Cebelleis mountain, in humid and shade fields, in rock crevices, near the rivers and under the waterfalls, at an altitude of between 1 and 230 m. Subsp. *davisii* is naturally distributed in Antalya: Kemer, Tekirova and Kumluca regions, in rock crevices, near the rivers or river beds, and also in humid and shady places, an altitude of at 50-557 m, under the *Pinus brutia-Cupressus sempervirens* forests. The samples collected from Alanya: Kargı river from on the isolated hillsides away from water, on chalk, sunny rock, crevices at sea level. The samples collected by Davis and Leblebici in Alanya: Kargı river population were treated as *C. pamphylica* subsp. *pamphylica* in the Flora of Turkey. We found differences in morphological and indumentum properties of *C. pamphylica* subsp. *pamphylica* from Kargı river. In Kargı river samples plant height is taller than the other taxa of the same species [8-35(-45) cm]. Stem, leaf and calyx are sparsely, short and soft hairy, and more densely glandular. Sizes of leaf and bract are longer and wide [(10-32x5-25 mm) (4-30x1.5-22 mm)]. Shape of leaf and bract are usually ovate. Basement is round cuneate. Margin is clearly serrate. Terminal is acute. Samples harvested from this population are more (2-11) flowered compared to (2-6) flowers in others. The shape of bracteol is linear-lanceolate, while the others are lanceolate-acuminate. Shape of the lower teeth of calyx is acute-triangular and longer than the upper teeth; however, in the other populations, lower teeth are shorter than upper teeth. While the length and shape of the upper teeth were determined for Kargı samples as 0.6-1 mm and acute-triangular, other populations were 1-2 mm and acuminate-subulate (Figures 13-14). Taking into account all morphological and ecological variations, we concluded that specimens obtained from province Kargı river can be presented as a new subspecies (*Calamintha pamphylica* subsp. *alanyense* S.Alan & A.Ocak).

*C. piperelloides* could not be found despite many excursions to the site of its type specimen. According to the Flora of Turkey, this species had been collected by Luschan in 1882 and identified from the type. In addition, the typus of *C. piperelloides* was requested from Vienna University and compared with the related species. It has been determined that *C. piperelloides* is related to *C. pamphylica* subsp. *davisii* in the description of Flora of Turkey and probably it has no distinguishable characters. The locality of this sample has been visited so many times, but it has not been found. According to the records *C. piperelloides* is different from the others due to its number of leaf teeth and glabrous for calyx throat.

Status of three species of *Calamintha* have been determined as endemic rare (R) plants, *C. caroli-henricana* is En: Endangered, *C. pamphylica* subsp. *pamphylica* and *C. pamphylica* subsp. *davisii* are in category NT: Near threatened, *C. tauricola* is in VU: Vulnerable. *C. piperelloides* is in K (not well known), DD: (data deficient), *C. betulifolia* is in non endemic rare (R) plants category, but in the group of insufficient data (DD). The results of our excursions and investigations are parallel to the earlier categorisation of these taxa (IUCN, 2001).

*C. grandiflora* and *C. nepeta* subsp. *glandulosa* have been defined as the most widely distributed and the highest ecologically tolerant species of Turkey.

The regions where *Calamintha* taxa are most populated are in South, West and North Anatolia in Turkey and the genus is represented by 9 species and 13 subspecies (Figure 27). *C. grandiflora* (B3 square) and Eskişehir, *C. nepeta* subsp. *nepeta* (A4, C4 squares) and Bartın, *C. sylvatica* subsp. *ascendens* (C5 square) are new records. *C. sylvatica* subsp. *sylvatica* samples harvested from Kocaeli and *C. nepeta* subsp. *glandulosa* samples harvested from Bartın and Kocaeli are harvested samples from these locations for the first time. *C. incana* is new record for C2 square.

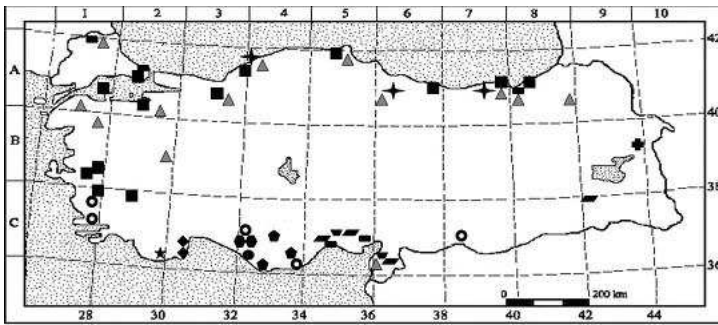
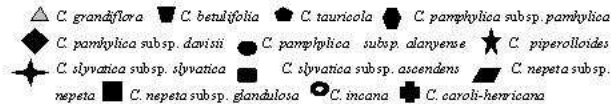


Figure 27. Distribution of *Calamintha* species in Turkey



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Table 1. Morphological characteristics of Calamintha species (Figures 1-27).

Calamintha	<b>grandiflora</b>	<b>betulifolia</b>	<b>Tauricola</b>	<b>pamphylica</b> subsp. <b>pamphylica</b>	<b>pamphylica</b> subsp. <b>davisii</b>	<b>pamphylica</b> subsp. <b>alanyanse</b> <sup>+</sup>	<b>piperelloides</b>	<b>sylvatica</b> subsp. <b>sylvatica</b>	<b>sylvatica</b> subsp. <b>ascendens</b>	<b>nepeta</b> subsp. <b>nepeta</b>	<b>nepeta</b> subsp. <b>glandulosa</b>	<b>incana</b>	<b>caroli-</b> <b>henricana</b>
<b>Plant (cm)</b>	14-60	9-40	(5-)7-30	5-27	(5-)10-33	8-35(-45)	5-10	40-85	21-45	17-80	17-90	(5-)10-48(-55)	4-7
<b>Stems</b>	ascending to erect	Ascending	decumbent or ascending	trailing, ascending	trailing, ascending	trailing, ascending	erect-decumbent	ascending to erect	ascending to erect	ascending to erect	ascending to erect	ascending to decumbent	erect
<b>Hairs of Stem</b>	densely spreading-pilose and sparsely glandular	sparsely pilose and densely glandular-pruinose	usually sparsely hirtellous and densely glandular-pruinose	Villous and sparsely glandular	long villose, short puberulent and sparsely glandular	sparsely puberulent, densely short stalked glandular	puberulent	densely short straight-haired and sparsely puberulous, sparsely glandular	densely short straight-haired and sparsely puberulous, sparsely glandular	long and short straight-haired and/or crispate to puberulous, sparsely glandular	long and short straight-haired and/or crispate to puberulous, densely glandular	canescent-tomentose and sparsely glandular	puberulent, glandular and eglandular
<b>Leaves (mm)</b>	ovate-elliptic, (12-)15-60(-75)x10-40	ovate, ovate-elliptic, 15-30x10-23	broadly ovate, 7-30x5-24	triangular or deltoid, 4-15(-18)x3-15	ovate-broadly ovate or triangular, 5-25x4-20	broadly ovate, 10-32x5-25	broadly ovate, 6-9x5-8	ovate-broadly ovate, 20-55x10-30	ovate-broadly ovate, (18-)20-55x10-30	ovate-broadly ovate, 8-31(-43)x5.5-25	ovate 7-21(-25)x5-17	ovate-orbicular 4-16x3.5-14	obovate to elliptic-obovate, 8-14x5-8
<b>Base of Leaves</b>	truncate-cuneate	cuneate or rounded cuneate-reniform	rounded or rounded-cuneate	truncate-subcordate	broadly cuneate	rounded-cuneate	rounded to broadly cuneate	cuneate	cuneate	rounded-cuneate	rounded-cuneate	cuneate	—

Table 1. (cont.)

<b>Bracteoles (mm)</b>	elliptic-lanceolate 2-6(-10)x1-1.5	lanceolate 0.5-6x0.1-2	elliptic-lanceolate 2-9x0.5-4	lanceolate-acuminate 1-5	lanceolate-acuminate 1-5x0.2-1.5	linear-lanceolate 1-3	subulate, 1.5	lanceolate to subulate 1.5-4x0.5-1	lanceolate to subulate (0.5-)1-4x(-)	subulate 1-3.5x0.2-0.5	lanceolate-subulate 1-5x0.2-1	lanceolate 1-2x0.2-0,5	lanceolate-subulate
<b>Margin of Calyx (mm)</b>	dentate	serrate	Serrate	shallowly	distinctly crenate-	clearly serrate	obscurely	serrate-	0.9-2	serrate-	crenate-	entire-	serrulate
<b>Number of Veins and Shape of Calyx</b>	11-veined, bilabiate	dentate, 9-veined, bilabiate	11-veined, serrate-bilabiate	denticulate, bilabiate	11(-12) -13 -veined, bilabiate to 1/5-1/4	11-veined, bilabiate to 1/8	11-veined, bilabiate 1/5	13-veined, bilabiate acute	13-veined, bilabiate	13-veined, bilabiate acute	13-veined, bilabiate acute	13-veined, bilabiate obtuse	13-veined, bilabiate broadly ovate
<b>Curvature and Shape of Veins</b>	Slightly craspedodromous	Straight craspedodromous	Straight prominently craspedodromous	Straight craspedodromous	Straight craspedodromous	Straight craspedodromous	prominently craspedodromous	Straight camptodromous	Straight camptodromous	Straight camptodromous	Straight camptodromous	Straight prominently constricted at middle	straight, slightly constricted at middle
<b>Hairs of Calyx</b>	pubescent glandular	pubescent or not and glandular	sparsely hirtellous, glandular	Villos, sparsely glandular	villos and short puberulent, glandular	short densely glandular	puberulous	puberulous -pilose, glandular	puberulous-pilose, glandular	puberulous, glandular	puberulous, glandular	puberulous, glandular	puberulent, glandular
<b>Number of Teeth</b>	6-13	densely glandular	6-13 densely glandular	6-13 glandular	6-13 glandular	5-6(-7)	2-4	6-13 glandular	6-13 glandular	6-13 glandular	5-8	-	---
<b>Indumentum of Calyx</b>	hairy at throat	glabrous at throat	glabrous at throat	glabrous at throat	glabrous at throat	glabrous at throat	glabrous at throat	hairy at throat	hairy at throat	hairy at throat	hairy at 5-43	hairy at 36	hairy at throat
<b>Number of Elements (mm)</b>	2-3(4)	0.3(0.5)	0.8(1.5)	2-6	2-8(-11)	0.4-2	1.5-2.2	2-10	4-44	0.4-1.6	0.34(-20)	0.3(1)	0.7-1.8
<b>Pedicel (mm)</b>	2-3.5, equalling than uppers	0.5-2.5, distinctly shorter than uppers	1.5(2.2), equalling than uppers	1-2(-2.5), mostly equalling than uppers	0.5-4(5(2.8)), mostly equalling than uppers,	1-2(1) longer than subulat	2.5-3, equalling than uppers	2-3(4), longer than uppers	1-3(8), longer than uppers	(2.8)2-3(10), longer than uppers	0.5-6(-10) longer than uppers	1-4, longer than uppers	2, longer than uppers
<b>Pedicel (mm)</b>	1-9(-12)	0.5-6	1-3	uppers	obovate-	1-7	---	2.5-10	3-11	1.5-13	0.5-5	2-7	---
<b>Bract (mm)</b>	ovate-elliptic, 5-60x1-37	ovate, ovate-elliptic,	broadly ovate to elliptic,	triangular-subovate, 4-15x2.5-12	subulate triangular-broadly ovate,	broadly ovate, 4-30x1.5-22	---	broadly ovate to linear-	broadly ovate to linear-	ovate to broadly ovate,	ovate, 2-15(-20)x1-10	ovate-orbitulare, 2-13x2-13	---
<b>Corolla (mm)</b>	15-40	1.2-4(10)x1-1.2	8-18x3-21	14-24	12-22x1-18	11-20	23-27	linear-ovate	linear-ovate	3-12x0.5-1.5	5-12	(5-)7-10	4
<b>Colour of Corolla</b>	pale or mauvish pink to red	blue	Violet	pale lilac	pale lilac	pale lilac	---	blue-blue to white	blue-blue to white	mauve to pink	mauve to pink	mauve	rose-pink
<b>Size of Fruit</b>	1-1.5x0.8-1.1	0.9-1x0.9-	0.9-	(0.9-)1 -	1-1.3x0.9-1.2	1.2-1.5x1-1.2	---	0.4(0.5)-3(1)	1-1.2x0.9-	0.9-1x0.5-	0.9-1x0.5-0.8	0.7-	1.2-0.7

(mm)		1.5	1.2x0.9-1	1.3x0.8-1.2					1.2	0.6		0.9x0.4-0.5	
<b>Flowering period</b>	June-October	April-July	June-September	June-July	June-July	June-July	May	July-October	August-September	August-September	June-September	June-August	July
<b>Habitat</b>	Damp and shady places, in forests and scrub, often on limestone	Rocky places on limestone	On limestone rocks	On limestone rocks, often <i>Pinus brutia-Cupressus sempervirens</i> forest	On limestone rocks, often <i>Pinus brutia-Cupressus sempervirens</i> forest	On limestone rock crevices	—	Forests and gullies	Scrub, banks	Dry river bed bank, phrygana, grassland, scree, open areas	<i>Fagus-Castanea</i> forest, sandy and rocky limostene slopes, fields and river banks, ruins, sandy beach	Rocky calcareous places, stepe	Limostene boulders near lava rock
<b>Altitude (m)</b>	300-2450	150-1300	940-1900	-1-230	-1-230	-1-20	50-500	s. 1-2000	s.1-900	300-2100	s.1.-1200	25-400	2400-2700
<b>Distribution in Turkey</b>	N.W. Turkey, N. Anatolia, Amanus	S Anatolia	S Anatolia	S.W. Anatolia	S.W. Anatolia	S.W. Anatolia	S.W. Anatolia	N. Anatolia	N.W. Turkey, N.E. & S. Anatolia	N.W Turkey, S. & E. Anatolia	N. Turkey, W. Anatolia, Islands	S.W., S.& E. Anatolia, Islands	E. Anatolia

†*C. pamphylica* subsp. *alanyanse* :subsp. *nova*