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Morphological Variations in *Acinos alpinus* and *Acinos rotundifolius* (*Labiatae*) growing in Turkey

Abstract

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The genus *Acinos* Miller is a member of *Labiatae*. *A. alpinus* (L.) Moench is a decumbent, rarely ascending perennial herb which grows in 900-2200 m in Western Turkey. *A. rotundifolius* Pers. is also an erect or ascending annual (in Turkey) herb which grows in 0-2200 m and it is the most widespread *Acinos* species in Turkey (rare in extreme East). In the study, the diagnostic features, a detailed description and figures of the species are given of *A. alpinus* and *A. rotundifolius* are accepted as complex species which show variations from population to population.

Introduction

In the genus *Acinos* Miller (*Labiatae*), there are 10 species of hardy and half-hardy annuals or perennials. *Acinos* species are found mainly on alkaline soils, in dry and sunny areas throughout Europe, the Mediterranean, Central Asia, N. Africa and N. America (Bonnier 1927; Bown 1995). The genus *Acinos* is represented by 5 species comprising 6 taxa in the Flora of Turkey (Davis & Leblebici 1982). These are: *A. troodi* (Post) Leblebici subsp. *vardaranus* Leblebici, *A. troodi* (Post) Leblebici subsp. *grandiflorus* Hartvig & Strid, *A. alpinus* (L.) Moench, *A. suaveolens* (Sm.) G. Don fil. *A. arvensis* (Lam.) Dandy, *A. rotundifolius* Pers.

Some species of the genus *Acinos* are frequently used as herbal teas. While *A. alpinus* (L.) Moench subsp. *meridionalis* (Nyman) P. W. Ball is employed in folk medicine having beneficial effects an coughs and gastrointestinal disorders in Spain (Velasco-Negueruela & al. 1993), *A. rotundifolius* is used as herbal tea againts to influenza in Turkey (Denizli, Kütahya, Balikesır).

A. alpinus and *A. rotundifolius* are usually described as complex and variable species in the world (Davis & Leblebici 1982; Strid & Tan 1991) and they are represented by subpecies to group in different levels in monograf and floras (Silic 1979; Tutin & al. 1972; Kaya & al. 1999). Collecting samples from Kaz Mountain and Uludağ of *A. alpinus* had been published in Bitki Magazine of Leblebici (1974) as subspecies of *A. alpinus*. It had

emphasized that this subspecies had been done synonym each other and all the local populations of the species are different from one another in the Flora of Turkey. In addition, it determined that *A. rotundifolius* was also a very changeable species in the Flora of Turkey.

A great morphological variations also existed among populations of *A. alpinus and A. rotundifolius*. A comparative study with different populations and herbarium materials constituted the basis of our observations.

Material and Methods

A. alpinus and *A. rotundifolius* were collected from several populations in 1992-1995. Some of them were brought as herbarium material and they are kept in the Herbarium of the faculty of Pharmacy of Anadolu (ESSE). Furthermore herbarium materials were also examinated from the following herbaria: ANK, AEF, EGE, ESSE, GAZI, ISTE and HUF. Descriptions of species are based on living material which are collected from field. All measurements were made directly from herbarium specimens. Measurement were made from a lot sample for description of each specimen. General views, stem, calyx, corolla, nutlet, leaves, bract and bracteol of species had drawn. Wild M5 A stereomicroscope with drawing tube was used in drawings.

Results

Acinos alpinus (L.) Moench, Meth. 407 (1794). **Figs. 1-3**. Syn. *Thymus alpinus* L., Sp. Pl. 591 (1794); *Calamintha alpina* (L.) Lam., Fl. Fr. 2:394 (1779); *C. alpina* (L.) Lam. subsp. *nomismophylla* Rech. fil., Fl. Aeg. 529 (1943); *C. alpina* (L.) Lam. subsp. *aetnensis* (Strobl) Rech. fil. var. *hirsuta* (Hausskn.) Rech. fil., op. cit. 528 (1943); *A. alpinus* (L.) Moench subsp. *nomismophyllus* (Rech. fil.) Leblebici in Bitki 1: 405 (1974).

Perennial, 4.5-40 cm, simple or branched beneath. Stems decumbent or rarerly ascending, green seldom purple, recurved, adpressed-patent, rarerly erect, crispate-haired, 0.1-1.5 mm, rare glandular. Leaves green, seldom green-purple, ovate, orbicular or elliptic, 2-13 x 1.5-10.5 mm, petiole to 1-5 mm, apex generally acute, seldom acuminate, margin entire or shallowly serrate towards to apex, base rotundate to cuneate, the venation ± prominent, glabrous on both sides, or absent above; short and rare haired beneath or both of surface dense haired, glandular or not on both sides. Floral leaves 3-15.5 x 1.2-12 mm, petiole to 1-5 mm, ciliate, ovate, orbiculate or elliptic, trichomes like leaves. Bracteoles lanceolate or subulate, 1-1.8 mm, ciliate. Verticillasters 2-14 in the axils of the floral leaves, 2-10 flowered, distance between verticillasters 2-60 mm, from apex towards to base wide, flowers equal with floral leaves or longer, petiole 1.5-5 mm. Calyx green, seldom greenish-purple, 6-10 mm, 13-ribbed, sub-bilabiate, tube straight, prominently gibbous at the base, throat bearded, five-toothed, lower teeth two, 2.2-4 mm, subulate, upper teeth three, 1-2.5 mm, triangular-lanceolate, ciliate, glandular and eglandular, antrorsely, patent or crispate-haired, densely glandular. Corolla purple-violet, but yellowish-white in calyx and white-purple spots on the middle of lower lip, exserted of calyx, 7.5-20 mm, upper lip retus, 1.5-4.5 x 2.2-5 mm, lower lip 3-lobed, lobes rotundate or middle lobe seldom emarginate 2.5-6 x 3.5-8.5 mm, middle lobe longer and wider than laterals, glandular and eglandular,

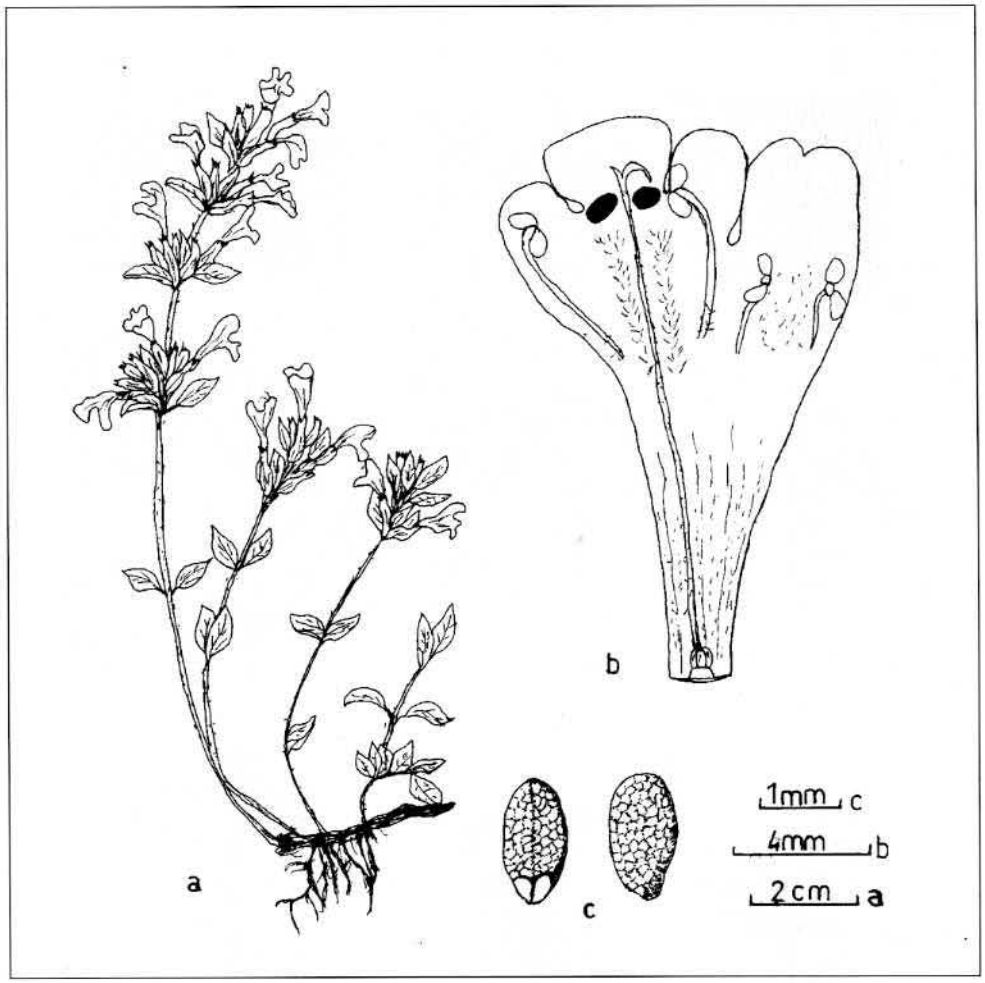

Fig. 1. *A. alpinus*, ESSE 10511: a - habit; b - corolla, pistil & stamens; c - nutlets.

indumentum dense and long in calyx outside, 2-row long-thick-haired in lower lip, short-haired in corolla tube. Stamens 4, didynamous, filaments white, 0.2-3 mm in upper pair and glabrous; 0.5-5.5 mm in lower pair and rare-haired base of the filament; anthers purple-white, 0.2-1.5 mm and 0.5-1.5 mm respectively. Ovary 0.5 mm, style purple-lilac, 6.5-17 mm, haired or not, branches unequal, short lobe subulate, erect, 0.2-0.5 mm, long lobe large and recurved 1-1.5 mm. Nutlets brown, reticulate, 1.5-2 x 0.8-1 mm, obovoid-oblong, trigonous, apex obtus.

Study materials: -**A2 (A) BURSA**: Uludağ, Çobankaya, 23.7.1992, H. Malyer, ESSE 10511!, Uludağ, between hotels-bakacak, meadowy place, 14.7.1987, H. Çakır, ESSE 9610!, Uludağ, hotels around, 1880 m, February 1986, Ö. Seçmen, Y. Gemici, EGE 28685!, Uludağ, 1900 m, 7.7.1963, Regel, E. Leblebici, EGE 11641!, Uludağ, 1500 m, around Sanatoryum, near water depot, 19.8.1972, Kesercioğlu, EGE 11626!, Uludağ,

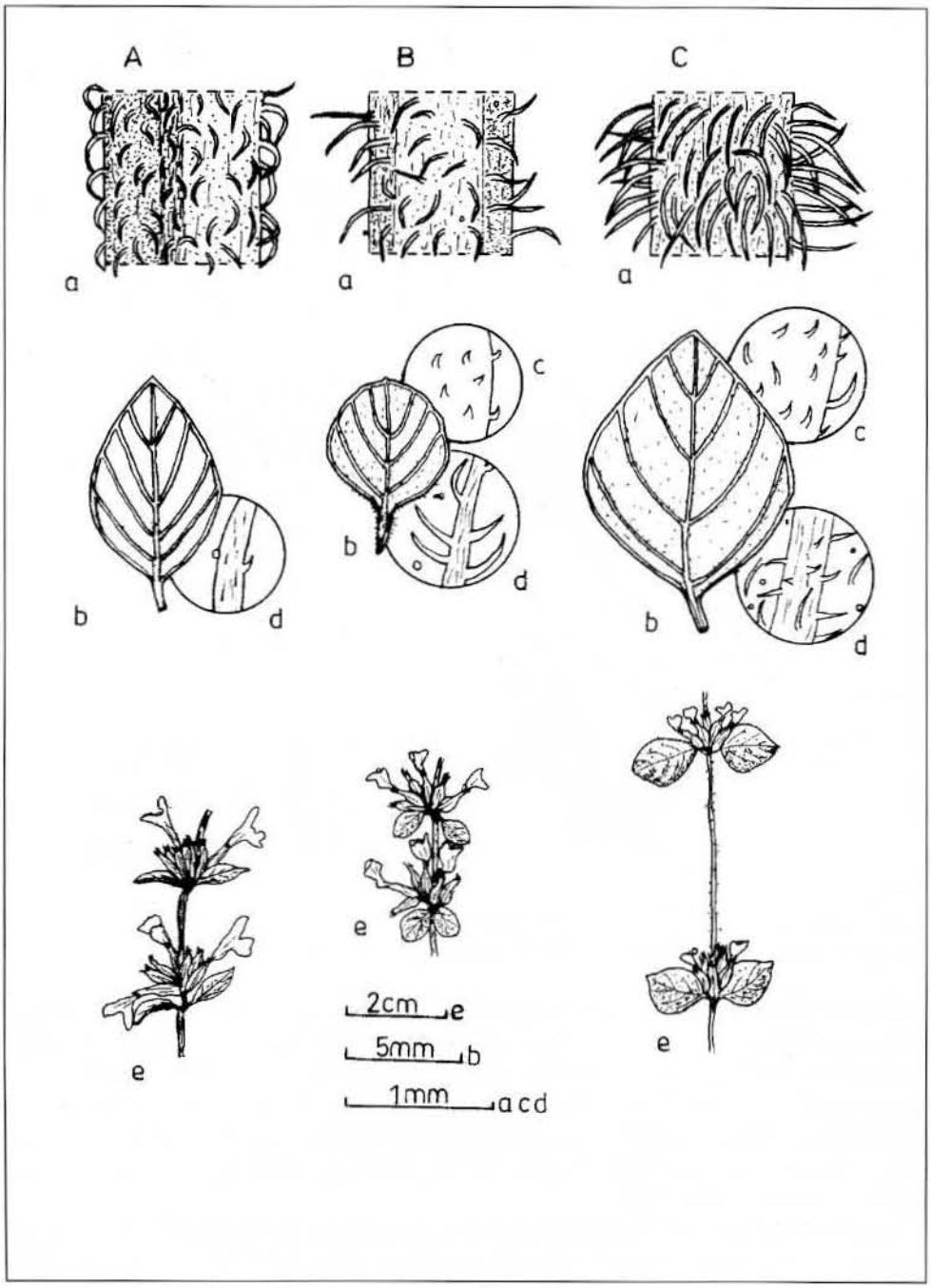

Fig. 2. *A. alpinus*: A - Bursa (ESSE 10511); B - Balıkesir (ESSE 10550); C - Manisa (ESSE 10527); a - indumentum of stem; b - leaves; c - trichomes in upper surface of leaves; d - trichomes in lower surface of leaves; e - vertisillasters.

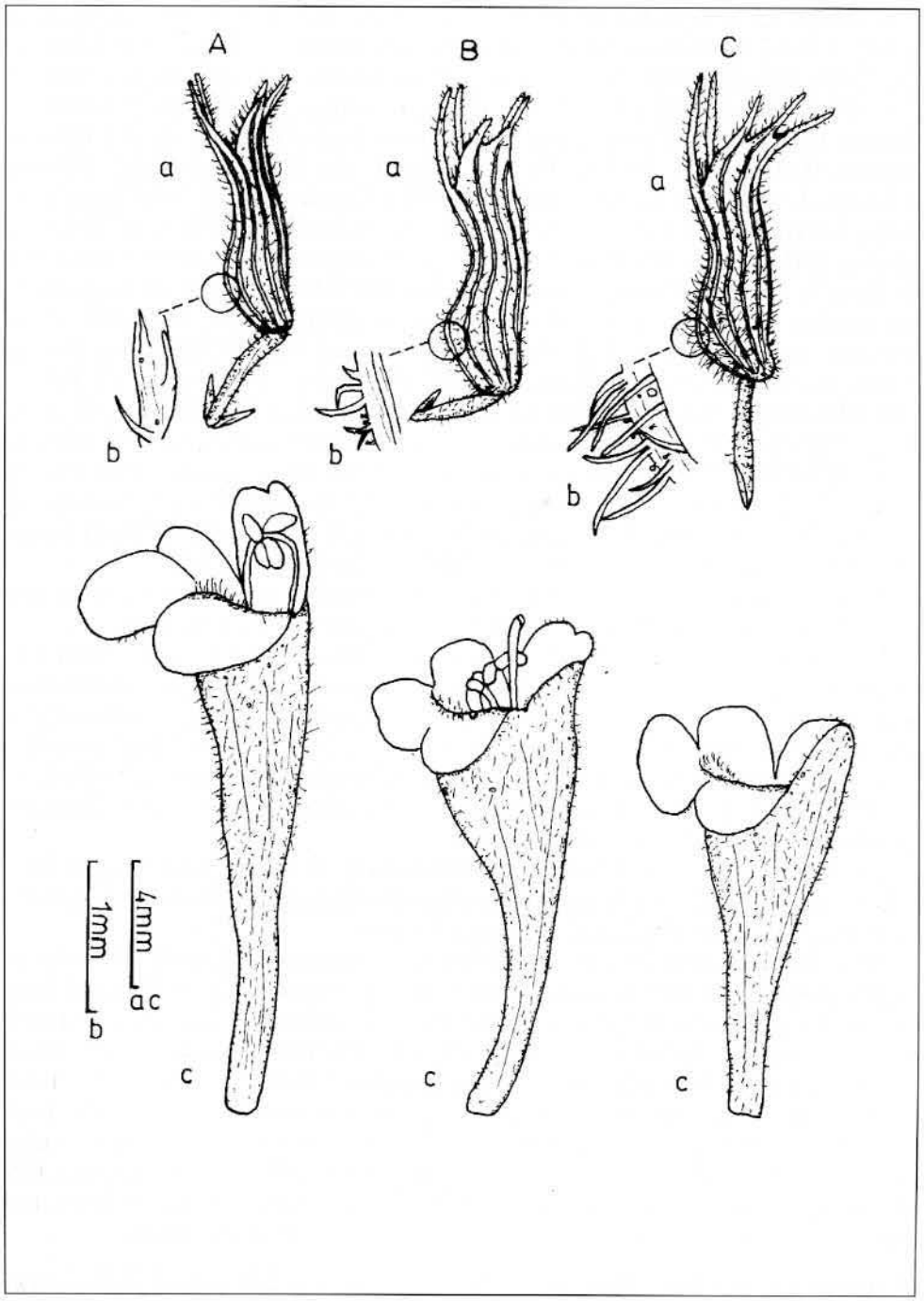

Fig. 3. *A. alpinus*: A - Bursa (ESSE 10511); B - Balıkesir (ESSE 10550); C - Manisa (ESSE 10527); a - calyx; b - trichomes of calyx; c - corolla.

Cennetkaya, 8.8.1949, A. Baytop, HUB 1201!, Uludağ, 1900 m, 13.9.1947, Davis, ANK 14835!, Uludağ, Cennetkaya, 8.8.1949, A. Baytop, ISTE 1201!, Uludağ, around ski-house, 26.7.1953, T. Baytop, ISTE 1202!, Uludağ, between Kilimli lake and buzlu lake, 2400 m, 3.8.1957 N. Gülen, ISTE 5111!, Uludağ, Bakacık, dombay çukuru road, 23.8.1971, A. Baytop, ISTE 20893!, Uludağ, between Kilimli lake buzlu lake 2400 m, 14.8.1988, K. Alpınar, H.t.Hart, ISTE 59550!, **-B1 BALIKESİR**: Kaz Mo., Sarıkız peak, 1650 m, 2.8.1995, A. Kaya, İ. Kaya ESSE 10550!, Kaz Mo. Karataş peak, 1750 m, 3.8.1995, A. Kaya, İ. Kaya ESSE 11476!, Kaz Da., Sarıkız road, Tozlu localty, 1370 m, 30.7.1971, A. Baytop, ISTE 20802!, **-MANİSA**: Spil Da., fire tower around, 1350-1450 m, 10.6.1994, A. Kaya, N. Ermin, A. Altıntaş, ESSE 10527!, **-İZMİR**: Ödemiş, Boz Da., Bozdağ village, mermeroluk localty, 1300 m, 10.6.1994, A. Kaya ESSE 10528!, Karaburun, above Çürükçü village, 700-900 m, 25.5.1980, L.Bekat, Y.Gemici, EGE 21427!, Ödemiş, Bozdağ village, mermeroluk localty 1350 m, 16.6.1972, E. Leblebici, Ö. Seçmen, EGE 11627!, **-B2 KÜTAHYA**: Domaniç, üç tepeler, 1800 m, 20.8.1992, K.H.C. Başer, F. Koca, A. Kaya, ESSE 10512!, Domaniç darıtepe, 1770 m, 20.8.1992, K.H.C. Başer, F. Koca, A. Kaya, ESSE 10513!, Radar around, 1750 m, 18.8.1992, K.H.C. Başer, ESSE 10514!, Radar around, 1750 m, 18.8.1992, M. Koyuncu, K.H.C. Başer, AEF 9631!, Domaniç, üç tepeler, 1800 m, 20.8.1992, M. Koyuncu, K.H.C. Başer, AEF 9674!, **-C2 DENİZLİ**: Honaz Mo., Baba tepesi, 2000 m, rocky place, 22.7.1973, E. Tuzlacı, ISTE 26482!.

Notes: Some morphological variations were determined in flower, leaves and the type of indumentum of *A. alpinus* samples which collected from different localities.

The corolla length in Manisa (7.5-11(-13) mm) and İzmir (11.5-14 mm) is smaller than in Balıkesir (9.5-17 mm), Bursa (9-20 mm) and Kütahya (10-18.2 mm). Distance between verticillasters is longer in Manisa samples (to 60 mm), especially at middle and lower part, than the others (Balıkesir, İzmir , Bursa and Kütahya). 2-8 flowered in each verticil in Manisa and Balıkesir, 2-4 in İzmir , 2-6 in Bursa and Kütahya was observed, but 10-flowered in Kütahya. While flowers are almost same level with floral leaves in Manisa samples, they exceeds floral leaves in the others.

The wide of the floral and stem leaves in Manisa (f.l. 12 mm, s.l. 10.5 mm) and İzmir (f.l. 8.5 mm, s.l. 10 mm) are larger than the others (Balıkesir f.l. 8 mm, s.l. 6.5 mm, Bursa f.l. 6 mm, s.l. 6.5 mm, Kütahya f.l. 7.5 mm, s.l. 8 mm).

While indumentum of the stem is 0.1-1.5 mm in Manisa and İzmir, it is 0.1-0.8 (-1) mm in Balıkesir, 0.1-0.5 mm in Bursa and Kütahya. Both surface of leaves in Manisa and İzmir are densely glandular and eglandular hairs which is 0.1-0.8 mm. The leaves of Balıkesir are dense glandular. Eglandular hair is 0.1 mm on the upper surface; 0.8 mm on the lower surface. Eglandular hairs in Bursa and Kütahya are absent on the upper surface; to 0.1 mm on the lower surface and rare. Glandular hairs in Kütahya samples are rare on the lower surface. They are also very rarely on both sides in Bursa. Indumentum of calyx in Manisa and İzmir (0.3-0.8 mm) are longer than the others (in Balıkesir, Bursa and Kütahya; 0.2-0.5 mm). Moreover, while calyx hairs are strongly curved to upwards in Bursa and Kütahya, they are always patent and crispate in Manisa, İzmir and Balıkesir.

Acinos rotundifolius Pers., Syn. Pl. 2:131 (1806), **Fig. 4-7.** Syn: *A. purpurascens* Pers., Syn. Pl. 2: 131 (1806); *Thymus graveolens* Bieb. , Fl. Taur. - Cauc. 2: 60 (1808); *A. graveolens* (Bieb.), Link, Enum. Pl. Horti Berol. 2: 117 (1822); *A. incanus* Griseb., Spic.

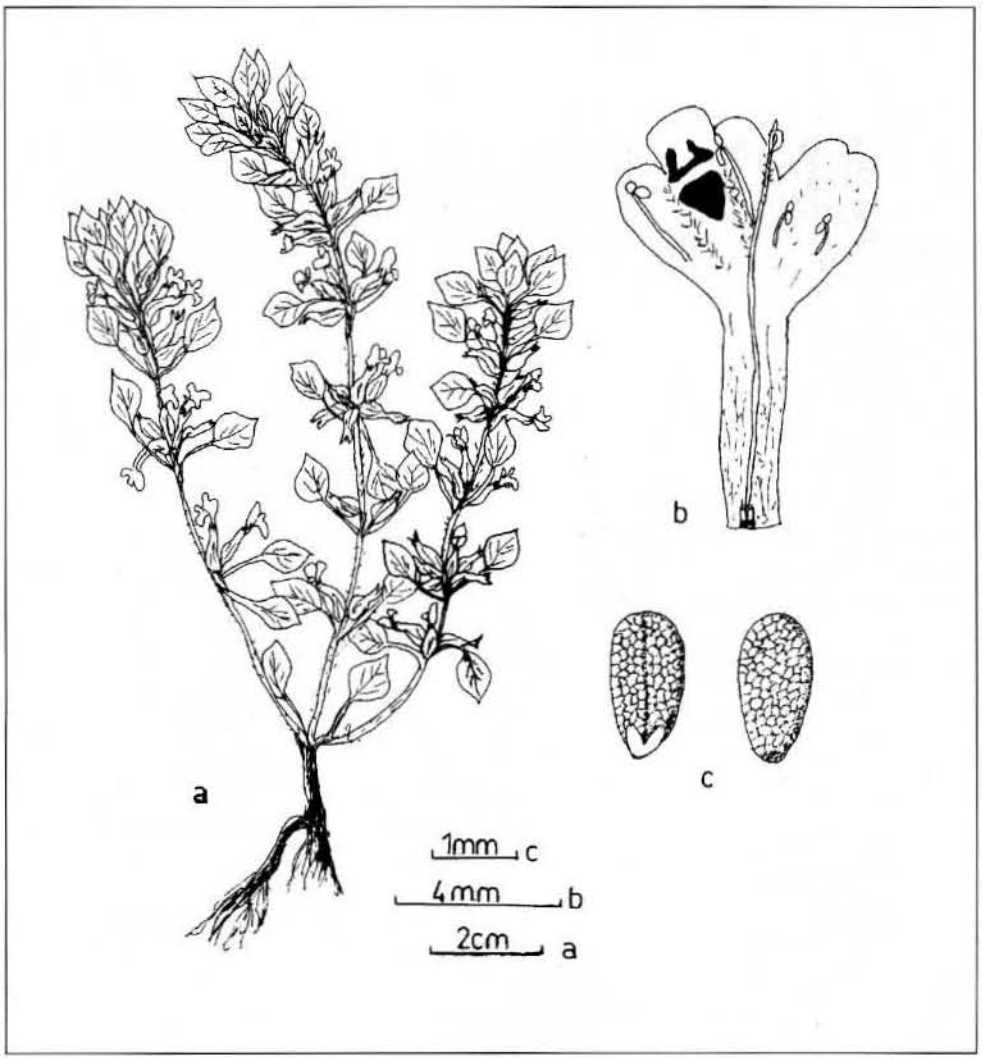

Fig. 4. *A. rotundifolius*, ESSE 10518: a - habit; b - corolla, pistil & stamens; c - nutlet.

2:123 (1844) non *Calamintha incana* (Sm.) Boiss. (1848); *C. graveolens* (Bieb.) Bentham in DC., Prodr. 12:231 (1848); *C. maritima* Bentham in DC., loc. cit. (1848); *C. stenostoma* Stapf in Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 50(1): 95 (1885); *Satureia rotundifolia* (Pers.) Briq. in Engler & Pratl, Natürl. Pflanzenfam. 4 (3a): 301 (1896); *C. exigua* (Sibth. & Sm.) Hal., Consp. Fl. Graec. 2: 546 (1902).

Annual, 2-34 cm. Stems erect or ascending, generally branched to base, green or purplish usually irregular curved, densely long and crispate-haired, 0.1-1.5 mm, glandular or absent. Leaves green, green-purple, lanceolate-ovate or obovat to orbicular, 5-22 x 2-16 mm, petiole to 2-13 mm, apex acute or mucronate, margin entire or shallowly or conspicuously serrate towards to apex, base generally cuneate-atenuate, rare obtus, veins promi-

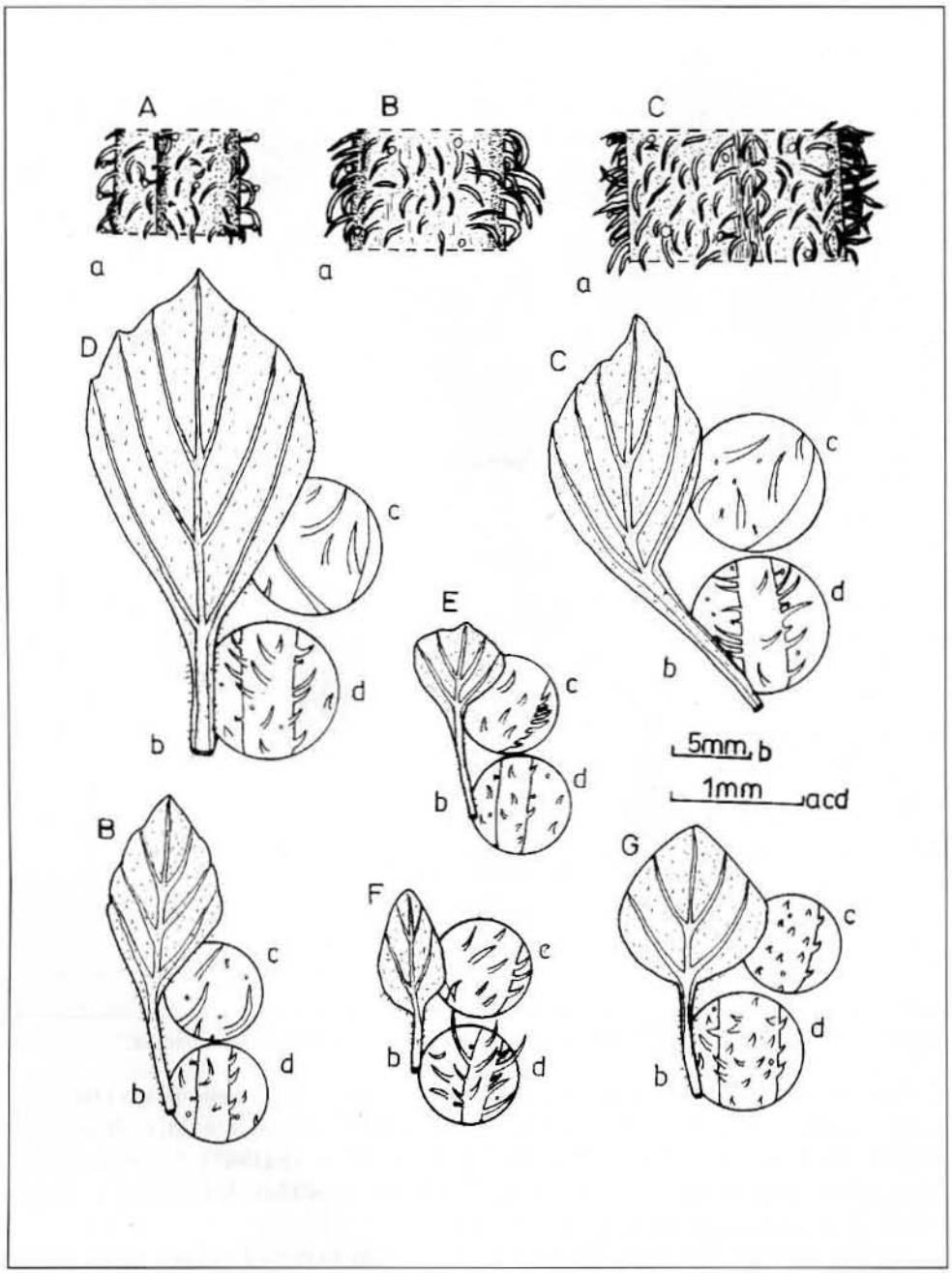

Fig. 5. *A. rotundifolius*: A - Kütahya (ESSE 10520); B - Bilecik (ESSE 1503); C - Balıkesir (ESSE 10521); D - Kütahya (ESSE 10519); E - Çorum (ESSE 9609); F - Eskişehir (ESSE 10524); G - Ankara (ESSE 8490); a - indumentum of stem; b - leaves; c-d - trichomes in lower and upper surface of leaves.

nent beneath, both of surface puberulous to crispate or densely long-haired or rarely short-haired; below surface of leaves densely glandular haired, upper surface absent or only base of leaves, petiol ± ciliate. Floral leaves ovate-obovate to lanceolate, 4.5-25 x 2-13 mm, exceeded to flowers, petiole to 3-12 mm, apex acute or mucronate, margin entire or upper part shallowly or conspicuously serrate and ciliate, base cuneate-atenuate, the venation and trichomes like leaves. Bracteoles 0.5-1.5 mm, subulate-lanceolate, ciliate. Verticillasters 1-20 in the axils of floral leaves, 2-20 flowered, distance between verticillasters 2-65 mm, petiole 1-5.5 mm. Calyx green, greenish-purple, 5-11 mm, 13-ribbed, sub-bilabiate, tube straight, prominently gibbous at the base, throat bearded, five toothed, lower teeth two, 2-3.8 mm, upper teeth three, 1-2.5 mm, subulate, ciliate, upper teeth projecting lower teeth, parallel or spreading to recurved, densely long-crispate haired, hirsut, densely long or short glandular haired. Corolla purple-lilac, white in calyx, with purple spots in the middle lobe of lower lip, upper part of tube outside of calyx, (5-) 6.5-12 (-14) mm, bilabiate, upper lip erect, slightly emarginate, 1.2-2.8 x 1.8-3.5 mm, lower lip 3 lobed, 1.8-3 x 2.8-5.5 mm, middle lobe longer and wider than laterals, apex obtus-truncate or rarerly emarginate, margine entire, glandular and eglandular, towards to base short haired, glandular lower of lips, with parallel 2 rows long-thick haired in lower lip, rare and thin-haired in upper lip, partly or completely dense or rare haired in the tube. Stamens 4, didynamous, filaments white, 0.6-3.5 mm in the lower pair, 0.1-1.8 mm in the upper pair, glabrous; anthers purple-white, 0.2-1 mm. Ovary 0.3-0.5 mm, style white, purple in the apex, (5.5-) 8-13 mm, slightly haired towards to apex, branches unequal, short lobe erect, subulate 0.3-0.5 mm, long lobe larger and recurved 0.8-1 mm. Nutlets brown, reticulate, 1.5-2 x 0.8-1 mm, obovoid-oblong, trigonous, apex obtus-rotundate.

Study materials: -A1 BALIKESİR: Erdek-ocaklar village, 5.5.1972, K.H.C. Başer, ESSE 154!, Marmara Island, from saraylar village to radar peak 520 m, 7.5.1978, E. Tuzlacı, ISTE 39273!, **-TEKİRDAĞ:** Kayacık village, near saray, 21.5.1974, A. Baytop, E. Tuzlacı, ISTE 28192!, Değirmenköy 5.5.1967, A. Baytop, G. Atila, ISTE 10977!, **-EDİRNE:** Edirne-Lalapaşa road, 20 km from Edirne, stone slopes on river against, 22.5.1978, N. & E. Özhatay, ISTE 39494!, **-A2 İSTANBUL:** above Florya 11.5.1958, A. Baytop, ISTE 5162!, Çatalca, around subaşı village wheat field, 24.5.1972, N. Özhatay, E. Tuzlacı , ISTE 21883!, Hadımköy, 23.4.1961, A. & T. Baytop, ISTE 6333!, **-BURSA**: Bursa-İznik road, Yeni sölöz village, 250 m, 12.5.1982, K. Alpınar, ISTE 48669!, Mudanya, kumkaya, 5.5.1974, B. Çubukçu, T. Avcıgil, ISTE 278591!, **-A3 BİLECİK:** Osmaneli içmeleri, slopes, 19.5.1982, K.H.C. Başer, ESSE 1503!, **-SAKARYA:** near Hayrettin village, 27.5.1963, A. Baytop, ISTE 7382!, **-ESKİŞEHİR:** Sakarı Ilıcaları, 19.6.1991, A. Kaya, ESSE 10524!, 8. km, Gökçekaya Dam-Alapınar road, 605m, 3.6.1994, K.H.C. Başer, A. Kaya, ESSE 10531!, 3. km, Başören-Gökçekaya Dam, 3.6.1994, K.H.C. Başer, A. Kaya, ESSE 10532!, **-A4 KASTAMONU:** Araç-İhsangazi road, 5 km to Araç, 700 m, 4.7.1993, A. Kaya, İ. Kaya, ESSE 10516!, Kastamonu-Araç road, 10 km to Araç, above Karakaya 750 m, 4.7.1993, A. Kaya, İ. Kaya, ESSE 10538!, **-ANKARA:** Kızılcahamam, pine forest, dereboyu, 7.7.1950, M. Kılınç, ANK 3418!, between Ankara-Kızılcahamam, kargasekmez locality, 900 m, 29.6.1983, A. Güner, HUF 5036!, Kızılcahamam, Işık M., 1500 m, 12.6.1976, M. Koyuncu, Demircioğlu, AEF 87! Ayaşbeli, 1000-1150 m, 1.6.1985, Z. Aytaç, GAZI 2029!, **-A5 ÇORUM:** Boğazkale-Hattusaş, ibikçam mah., 10. km, 1200 m, 4.7.1991, İ. Saraçoğlu, ESSE 9609!, **-A9 KARS:** Göle, Toptaş village, çorak tepe localty,

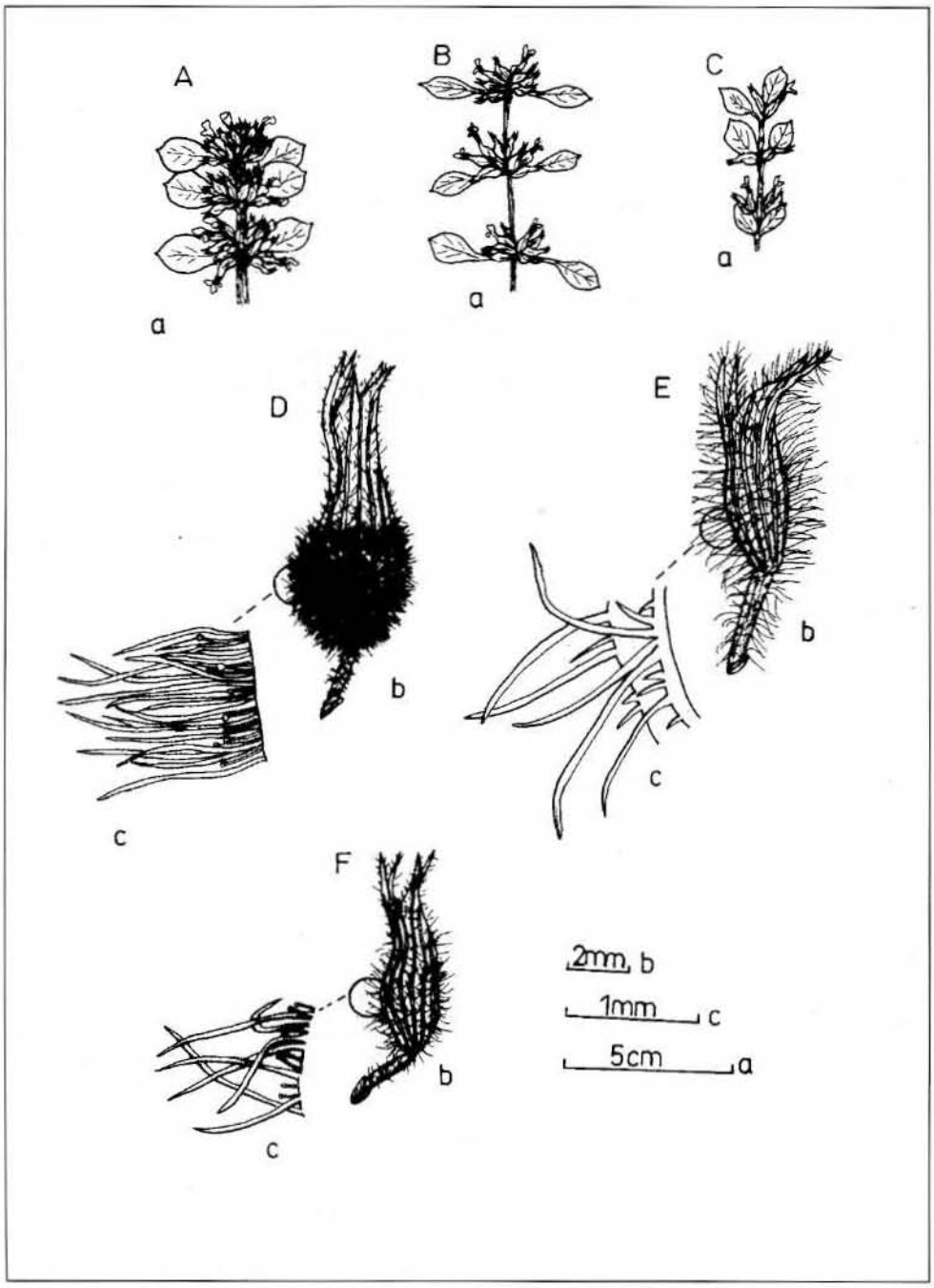

Fig. 6. *A. rotundifolius*, A - Kütahya (ESSE 10519) B -İzmir (ESSE 10523) C - Eskişehir (ESSE 10531) D - Ankara (ESSE 8490) E - Eskişehir (ESSE 10524) F - Balıkesir (ESSE 154) a-vertisillasters b-calyx c- trichomes of calyx.

2400 m, 15.7.1990, S. Varlı, ESSE 10535!, from Posof mezarlık around to Posof brook 1550-1580 m, 13.6.1986, A. Demirkuş, HUF 3510!, -**B1 BALIKESİR:** Edremit, Kaz M. 5.7.1991, G. Tümen, ESSE 10522!, Ayşebacı village, field, 1400 m, 13.5.1987, M. Başol, ESSE 8455!, -**İZMİR:** Ödemiş-Bozdağ 9. km, 23.5.1993, K.H.C. Başer, A. Kaya, ESSE 10523!, Bornova, çamköy, ikiz lake, 600-700 m, 27.4.1971, E. Leblebici, EGE 11630!, Kemalpaşa, ulucak 620 m, 15.2.1969, E. Leblebici, EGE11631!, Karşıyaka, between karagöl-yamanlar kampı, 5 km from karagöl, 800 m, 4.5.1963, Peşmen, EGE 11628!, Ödemiş, between Bozdağ-gölcük, maquis, 1050 m, 3.4.1972, E. Leblebici, Ö. Seçmen, EGE 11638!, Kemalpaşa, Nif Mountain summit, alpinic, 1320 m, 16.6.1975, E. Leblebici, Ö. Seçmen, EGE 23970!, Karaburun, kösedere village, 320-350 m, 12.4.1980, Y. Gemici, EGE 21428!, -**MANİSA:** Akhisar, sındırgı forest, kertil localty, *Pinus brutia* forest, 23.4.1973, Ö. Seçmen, M. Öztürk, EGE 11635!, -**B2 MANİSA:** 90 km to Demirci, 16.5.1978, Ö. Seçmen, E. Leblebici, EGE 17000!, Spil M. 24.5.1995, K.H.C. Başer, ESSE 10542!, Yeniköy-Demirci, *Pinus nigra* forest, 18.6.1965, H. Peşmen, EGE 11634!, Akhisar, Gölmarmara, near ılıcak river, steppe place 8.5.1995, G. Tümen, ESSE 10548!, -**KÜTAHYA:** Domaniç, develi sırtları, 1600 m, 20.8.1992, K.H.C. Başer, A. Kaya, ESSE 10520! Tavşanlı, Dedeler village-Tavşanlı road 12.7.1983, K.H.C. Başer, ESSE 5942! Radar, 18.8.1992. K.H.C. Başer, G. Tümen, ESSE 10519!, Gediz, Murat M., Çukurören village, azmak locality, E. Leblebici, EGE 11632!, between Simav-Abide, 24. km towards Abidiye, 910 m, 2.6.1972, E. Leblebici, EGE 11629!, - **BALIKESİR:** Bigadiç, Alan village, 9.6.1989, G. Tümen, ESSE 10521!, Kesput road, 10. km, steppe, 8.5.1995, G. Tümen, ESSE 10543!, Susurluk, Yıldız village, ılıca locality, 19.3.1995, G.Tümen, ESSE 10540!, -**B3 ESKİŞEHİR:** Anadolu Üniversitesi Yunus Emre Campus, 20.5.1988, A. Kaya, ESSE 8420!, 21.5.1993, A. Kaya, ESSE 10518!; 4.5.1995, ESSE 10541!, Alpu, karakütük forest depot, 2.6.1989, A. Kaya, ESSE 8614!, Eskişehir-Sarıcakaya, 21.km, 1100 m, 4.6.1981, H. Malyer, K.H.C. Başer, ESSE 1070!, Eskişehir-Kütahya road, 10.km, 23.5.1993, F. Koca, ESSE 10517!, Sivrihisar, above Kilise-Gavur hamam, 900-1500 m, 3.6.1993, A. Kaya, İ. Kaya, ESSE 10515!, Alpu, margı area, 1100 m, 3.6.1994, K.H.C. Başer, A. Kaya, ESSE 10533!, Bozüyük-Dodurga road, fallow fields, 13.6.1990, K.H.C. Başer, ESSE 8849!, Bozdağ, Süleyman'ın öldüğünün meadow, 3.6.1995, A. Kaya, ESSE 10545! Çatacık, Mı hlıkaya tower, 3.6.1995, K.H.C. Başer, ESSE 10544!, -**BİLECİK:** Bozüyük-Dodurga road, fallow fields, 13.6.1990, K.H.C. Başer, ESSE 8849!, -**AFYON:** Between Çiğil tepe-Ahmet Paşa, *Cistus laurifolius* forest 1500 m, 15.6.1982, H. Malyer, T.Ekim, ESSE 2649!, Kayadibi, 2.5.1983, H. Malyer, ESSE 2989!, Sandıklı, Akçaalan village, derin yol localty, 900 m, 20.6.1979, E. Leblebici, EGE 16975!,- **B4 ANKARA:** Haymana-Yenice 4. km, 27.5.1989, K.H.C. Başer, A. Kaya, ESSE 8490!, Beytepe, 1000 m, 10.5.1993, A. Kaya, ESSE 10536!, Gazi Education Fac. Garden, 850 m, 8.6.1983, M. Vural, GAZI 2244!, Dikmen, 31.5.1936, L. Gassner, ANK 414!, -**B5 YOZGAT:** Akdağmadeni, Yavuz-Faraş brook 1.km, 1350 m, 20.7.1980, T. Ekim, ANK 4826!, -**NEVŞEHİR:** 1 km west of Uç hisar, 1300 m, 23.5.1989, M. Vural, GAZI 4987!, -**B6 SİVAS:** Gölet, 11.5.1995, M. Kaya, ESSE 10546!, -**B7 TUNCELİ:** Between Pertek-Hozat, 1200 m, 10.7.1986, M. Koyuncu, AEF 7318!, -**B9 VAN:** Molla Kasım village, near lake, 1750 m, 12.6.1984, A. & T. Baytop, ISTE 54265!, -**B10 IĞDIR:** Doğubeyazıt-Iğdır 30.km, 1480 m, 13.7.1979, E. Tuzlacı, ISTE 42819!, -**C2 DENİZLİ:** Çardak, başçeşme, çanaksu localty, field side, 450 m, 27.6.1968, H. Peşmen, EGE 11628!, Acıpayam, Alaattin town, gavlaklar localty, 9.5.1995,

G. Tümen, ESSE, 10547!, -**MUĞLA:** Marmaris, günnücek area 10 m, 9.5.1967, E. Leblebici, EGE 11636!, -**ANTALYA:** Elmalı, çığlıkara, suluçukur, *C. libani* forest 1700 m, 25.6.1975, R. Çelik, ANK 1998!, -**C3 ANTALYA:** Kemer, *C. libani* forest 1700 m, 6.6.1979, H. Peşmen, ANK 4277!, -**ISPARTA:** Eğirdir, 2 km south of yaka village, 1400-1500 m, 28.5.1944, H. Peşmen, HUF 1330!, Eğirdir, sivri peak, south slopes, 1400 m, 6.6.1974, Ödemiş, EGE 11974!, -**C4 ANTALYA:** Gazipaşa, meadow edge plateau, 1700 m, 14.7.1983, H. Sümbül, HUF 2316!, -**KARAMAN:** Ermenek, around Damlacal,1500 m, M. Vural, 26.5.1979, ANK 1727!, -**C7 URFA**: Siverek, north slopes of karacadağ, 1250 m, 19.5.1957, Davis & Hedge, ANK 28305!.

Notes: Some morphological variations were determined in the type of indumentum, the shape and length of leaves, numbers of vertisil and flower and the length of calyx teeth of *A. rotundifolius* samples which collected from different localities.

While glandular hairs on stem were rarerly observed in Kütahya (Radar, Domaniç), Balı kesir (Edremit, Kaz Da., Erdek), Kars (Göle) populations and rarerly sessile glands in Balı kesir (Susurluk), Sivas (Gölet), Bilecik (Osmaneli), Eskişehir (Gökçekaya-alapınar, Başören-gökçekaya) populations, both of them are also observed in Kastamonu (Araç), and Balıkesir (Bigadiç). However, glandular hairs on stem are absent in the other populations (İzmir (Ödemiş), Ankara (Haymana), Balıkesir (Kepsut, Ayşebacı), Çorum (Boğ azkale), Manisa (Spil Da., Akhisar), Kütahya (Tavşanlı), Kars (Posof), Denizli (Ac?payam), Antalya (Gazipaşa), Yozgat (Akdağ madeni), Eskişehir (Sivrihisar, Üniversite campus, Kütahya road, Sakarı ılıcası, Margı, Çatacık, Bozdağ, Alpu-Mihalıççık, Karakütük, Bozüyük-dodurga, Sarıcakaya)).

Sessile glands and glandular hairs are observed in both surface of leaves in Kastamonu (Araç), Balıkesir (Bigadiç), and Bilecik (Osmaneli). But, they are only found in lower surface of leaves in Kütahya (Radar, Domaniç), İzmir (Ödemiş), Balıkesir (Susurluk, Kepsut, Ayşebacı), Çorum (Boğazkale), Kars (Göle), Manisa (Spil Da., Akhisar), Denizli (Acı payam), Sivas (Gölet), Antalya (Gazipaşa) and Eskişehir (Üniversite campus, Sakarı ılı cası, Margı, Çatacık, Bozdağ, Sarıcakaya, Başören-Gökçekaya, Gökçekaya-Alapınar, Bozüyük-dodurga) populations. While there are sessile glands in the upper surface in Ankara (Haymana), Sivas (Gölet) populations, glandular hairs the upper surface in some populations of Kütahya (Domaniç, Tavşanlı), Çorum (Boğazkale) and Eskişehir (Başören-Gökçekaya, Gökçekaya-Alapınar). There are sessile glands in the lower surface in Ankara (Haymana), Balıkesir (Kaz Da.), Kütahya (Tavşanlı) and Kars (Posof).

The indumentum type of calyx is different in among populations. The base of the calyx is wholly whitish in, especially, Ankara (Haymana), Yozgat (Akdağ madeni) and Çorum (Boğazkale) populations because of densely long-haired; moreover, long glandular hairs are also observed in this populations. While the length of eglandular hairs in Eskişehir (Sakarı ılıcası) population is covered wholly calyx, it is usually densely long-haired in base and rarerly short-haired in upper parts in the other populations. The level of the calyx teeth is almost parallel or the lower teeth slightly exceeding the upper in Ankara (Haymana), Yozgat (Akdağ madeni) and Çorum (Boğazkale) populations. The level of the calyx teeth is almost parallel or the upper teeth are slightly exceeding the lower in Balı kesir (Erdek), Kars (Göle), Manisa (Akhisar), Eskişehir (Sivrihisar, Üniversite campus, Kütahya, Alpu-Mihalıççık, Karakütük) and Ankara (Beytepe) populations. On the other-

hand; the upper teeth prominenty exceeding the lower in the other populations (Kütahya (Tavşanlı, Radar, Domaniç), İzmir (Ödemiş), Kastamonu (Araç), Balıkesir (Bigadiç, Susurluk, Kepsut, Kaz Mo., Ayşebacı), Manisa (Spil Mo.), Kars (Posof), Denizli (Acı payam), Sivas (Gölet), Antalya, Bilecik (Osmaneli), Eskişehir (Sakarı ılıcası, Margı area, Çatacık, Bozdağ, Sarıcakaya, Başören-Gökçekaya, Gökçekaya-Alapınar, Bozüyük-Dodurga) and Afyon (Çiğil tepe).

The numbers of the verticil and flower are different according to the populations; vertisil number is 14-18, flower number is 16-20 in Kütahya (Domaniç, Radar) and Balıkesir (Bigadiç); vertisil number is 6-13, flower number is 6-10 in Kastamonu (Araç), Kars (Göle), and İzmir (Ödemiş-Bozdağ) populations; vertisil number is 3-9, flower number is 2-6 (-8) in Balıkesir (Erdek, Edremit), Bilecik (Osmaneli), Çorum (Boğazkale), Manisa (Spil, Akhisar), Afyon (Çiğil tepe, Kayadibi), Ankara (Beytepe, Haymana), Yozgat (Akdağ madeni), Sivas (Gölet), Denizli (Acıpayam) and Antalya (Gazipaşa) populations.

Discussion

A. alpinus and *A. rotundifolius* samples collected from very different localities in grids A2(A), B1-2, C2 for *A.alpinus* and A1-5, A9, B1-7, B9-10, C2-4 and C7 for *A. rotundifolius* were investigated and compared. Some morphological variations were determined in the type of indumentum, number of verticillasters, length of corolla, floral and stem leaves for *A. alpinus* and in the type of indumentum, number of verticillasters and flower, the shape and length of leaf and length of calyx teeth for *A. rotundifolius*. This variations had been given at the end of description of each species under as detailed and extrem differences had been also emphasized by figures (Figs. 2-3, 5-6). *A. alpinus* and *A. rotundifolius* had not been separeted as subspecies because of very intricate and to show this variations in same populations time to time. In this situation, we can say only connecting with ecological conditions of variations base on the our observations. *A. alpinus* is distributed in West Anatolia and grows in various habitat types in 900-2030 m. *A. rotundifolius* is also the most widespread in Turkey (rare in extreme East) and grows in various habitat types altitute from sea level to 2200 m. It is the most tolerant as ecologic. *A. alpinus* and *A. rotundifolius* are accepted as complex species which show variations from population to population. The compositions of the essential oils of *A. alpinus* (Kaya & al. 1999) and *A. rotundifolius* (Kaya & al. 1999) are of a complex nature. Results of chemical analysis also supported morphological differences.

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