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RESEARCH ARTICLE

Botanical Properties of a Mild Sedative: *Ballota nigra* L. subsp. *nigra*

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Summary

Ballota nigra L. (Labiatae) *has been known for many eras as a traditional medicine. In Europe, its commercial preparations are commonly used for its sedative and tranquilizer properties. In this study, morphological and anatomical features of Ballota nigra* L. subsp. *nigra, which is a widespread subspecies, are described and discussed. The morphological properties of various organs of the plant such as stem, leaf, bracteol and flower are given with original photographs and drawings. The anatomical characteristics of the stem and leaves are presented for the first time.*
Key Words *: Labiatae, Ballota, Ballota nigra* subsp. *nigra, morphology, anatomy.*
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Hafif Sedatif Bir Bitkinin Botanik Özellikleri: Ballota nigra* L. subsp. *nigra
Özet

Ballota nigra L. (Labiatae) *uzun yıllardan beri halk ilacı olarak bilinmektedir. Avrupa'da ticari preparatları genellikle sedatif ve trankilizan özellikleri nedeniyle kullanılmaktadır. Bu çalışmada, yaygın bir alttür olan Ballota nigra* L. subsp. *nigra'nın morfolojik ve anatomik özellikleri tanımlanmış ve tartışılmıştır. Gövde, yaprak, brakteol ve çiçek gibi farklı organların morfolojik özellikleri, orijinal fotoğraflar ve çizimlerle verilmiştir. Gövde ve yaprak anatomik karakterleri ilk defa bu çalışmada gösterilmiştir.*
Anahtar Kelimeler : *Labiatae, Ballota, Ballota nigra* subsp. *nigra, morfoloji, anatomi*

INTRODUCTION

The genus *Ballota* L., which belongs to Labiatae, was represented by 11 species in the flora of Turkey[1]. This number was later increased to 12 with the discovery of a new taxon, *Ballota antalyense* F. Tezcan & H. Duman (nom. nub.)[2]. Among the *Ballota* species growing in Turkey, *Ballota nigra* L. consists of five subspecies, *B. nigra* subsp. *nigra, B. nigra* subsp. *foetida* Hayek, *B. nigra* subsp. *uncinata* (Fiori & Beg.) Patzak, *B. nigra* subsp. *anatolica* P.H. Davis, and *B. nigra* subsp. *kurdica* P.H. Davis, which are known by very similar taxonomic characteristics[1].

The name ballote was given to this plant as early as the time of Dioscorides, and leaves of *Ballota nigra* were used as an antidote for the bite of a mad dog at that time[3]. Nowadays, *Ballota nigra* has been used in mainly European countries as a traditional medicine, especially for its sedative and tranquilizer properties[4,5]. Moreover, in Europe, the presence of commercial preparations of Ballota nigra has been reported[5].

In Turkey, various local names are used for *B. nigra*, among them "yalanc› ›s›rgan", "boz ot", "leylim otu", "leylimkara", "elkurtaran", "köpek otu", and "kara

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yerp›rasas›"[6-8]. In our country, some subspecies of *B. nigra* are used externally for their wound-healing properties and internally against gastrointestinal disorders[7,8]. In our previous studies on *Ballota* species, we have reported that *B. nigra* subsp. *anatolica* and *B. larendana*, which are endemic to Turkey , have antidepressant activity. *B. larendana* has anxiolytic activity as well[9]. We have also described detailed botanical characteristics of *B. nigra* subsp. *anatolica*[10]. As a continuation of our studies on the *Ballota* species, in this study, we report morphological and anatomical features of *B. nigra* subsp. *nigra* along with its distribution and habitat.

EXPERIMENTAL

Plant material: *Ballota nigra* L. subsp. *nigra* were collected at flowering time from Çorum, ‹skilip, in July l997. The voucher specimens were deposited at the Herbarium of the Faculty of Pharmacy, Hacettepe University, Ankara, Turkey (HUEF 97051).□

A distribution map is provided (Fig. 1) according to localities where specimens were found, herbaria records at HUEF, HUB, AEF, ANK, GAZI, ISTE, ISTO and the citations of the Flora of Turkey and the East Aegean Islands[1].

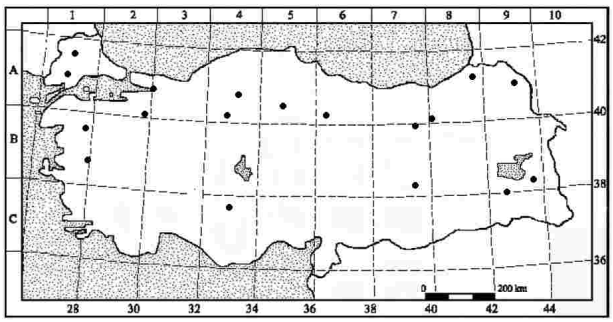

Figure 1. Distribution of *Ballota nigra* subsp. *nigra*.

All measurements in morphological studies were made directly on fresh samples. Taxonomic description of the plant was made according to Davis and Doroszenko[1].

The materials used for anatomical studies were fixed in 70% alcohol. Anatomical studies were performed on the hand cut transversal sections and surface preparations of the leaves and stem. All preparations and sections were stained with Sartur reagent[11].

RESULTS

Morphological Characteristics

Ballota nigra subsp. *nigra* are 46-153 cm tall perennial herbs. The stem is erect, ascendant 4-angled, simple or usually branched below, glandular and pubescent. Cauline leaves are ovate-orbicular to ovate, 25-78 x 30-60 mm. Middle and upper cauline leaves are 1-1.5 x long as broad; lower cauline leaves are almost as long as broad, acute(-mucronate), crenate-dentate, rotundate, truncate or sometimes reniform at base, distinctly petiolate, pubescent on both sides. Inflorescence is long, lax below. Floral leaves are ovate to elliptic-ovate, 3-38 x 2-31 mm. Each flower has 2 bracteoles, which are sessile, linear-subulate, shorter than calyx tube, 2.5-4 mm, acute, entire, pubescent on both sides. Verticillasters are 2-40 (-48) flowered. Calyx is persistent, 6-10 mm, obconical to obconical-campanulate, dilated above into 5 teeth. Calyx teeth are 2-3(-5) mm, longer than broad, triangular-acuminate, porrect, and mucronate. Margins and outside of calyx are densely glandular and non-glandular hairy, inside is not dense, 10-veined. Corolla is purple, 9-13 mm, longer than the calyx, tube with a ring of hairs inside, bilabiate, upper lip is concave, emarginate, long non-glandular hairy. The four stamens are didynamous, not included in the corolla tube (Figs. 2-4). Plant grows in scrubs, up to 1650 m in height. Flowering period of the plant is 6-7 (-11) months.

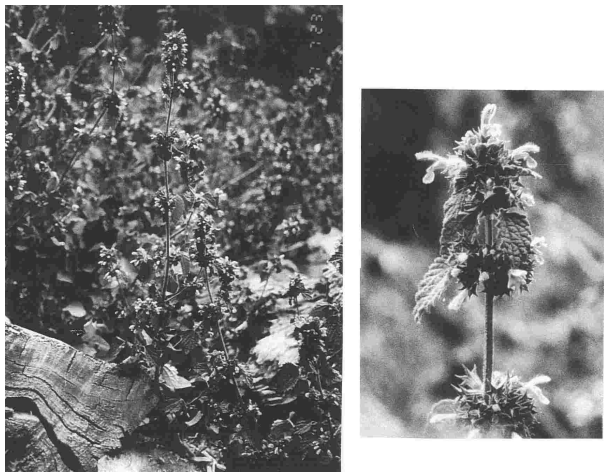

Figure 2. Habitat and floral part of *Ballota nigra* subsp. *nigra*

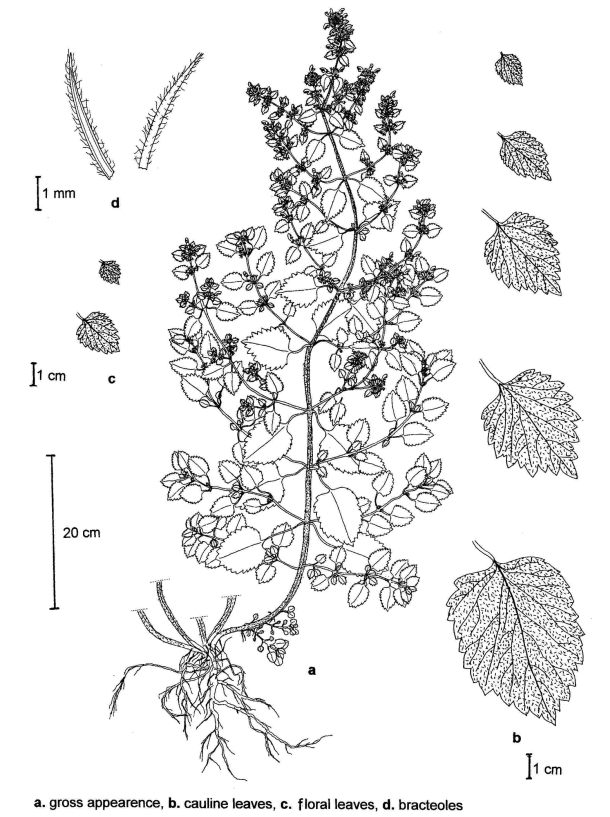

Figure 3. Morphological characteristics of *Ballota nigra* subsp. *nigra*.

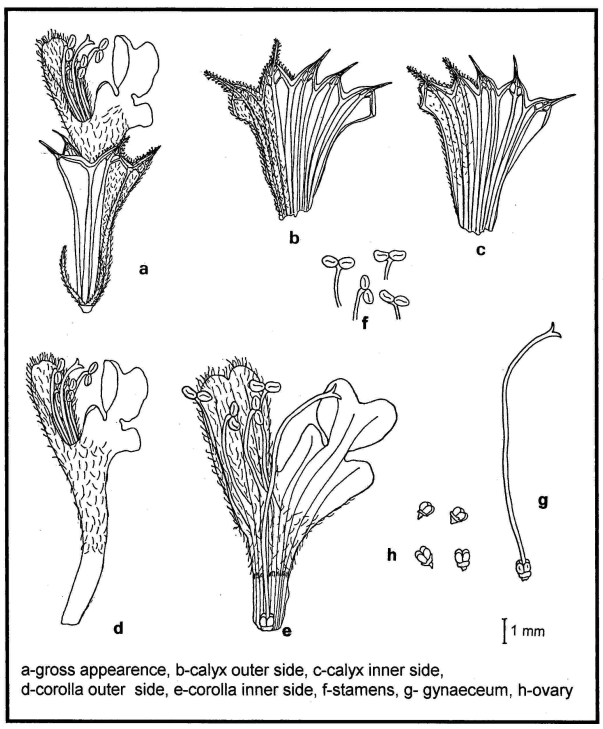

Figure 4. Floral parts of *Ballota nigra* subsp. *nigra*

Anatomical Characteristics

The stem is 4-angled in transversal sections. Epidermal cells are covered by cuticle. Non-glandular hairs are 1 celled, short or 2-5 celled, long. Different types of glandular hair are observed: head 1,2,4,8 celled, stalk 1 celled and short; head 1 celled, stalk 2 celled and long; or head 2 celled, stalk 3,4 celled and long. Multilayer collenchyma that is well-developed in the corners is present under the epidermis. Under the collenchyma, starch-containing parenchyma cells and closed ring of endoderm cells are observed. Groups of sclerotic cells are under this strand. In the phloem, cells are crushed and small. Between the phloem and xylem, only a few strands of cambial cells are observed. The xylem, which consists of radially oriented tracheas and tracheids, is well-developed. The pith is large, and large parenchymatous cells and some crystal idioblasts are observed in the pith region (Figs. 5,6).

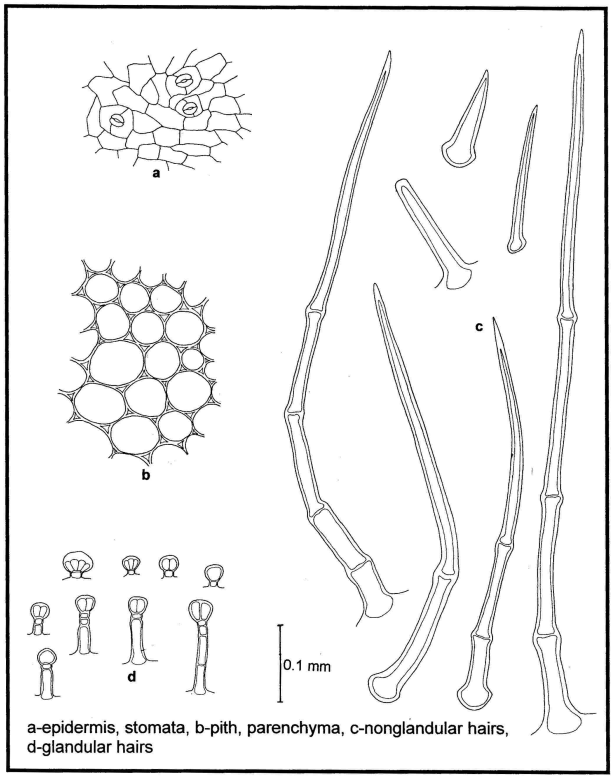

Figure 5. Anatomical characteristics of the stem.

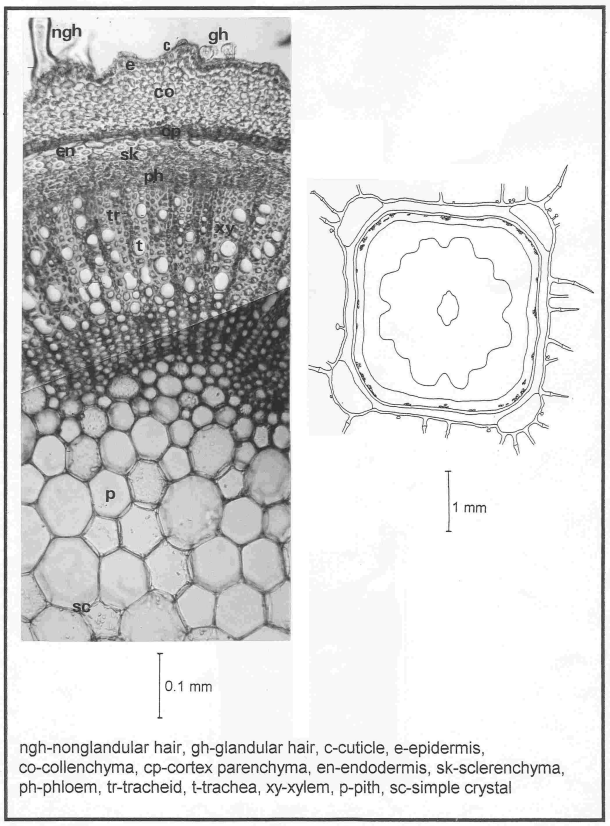

Figure 6. Transverse sections of the stem.

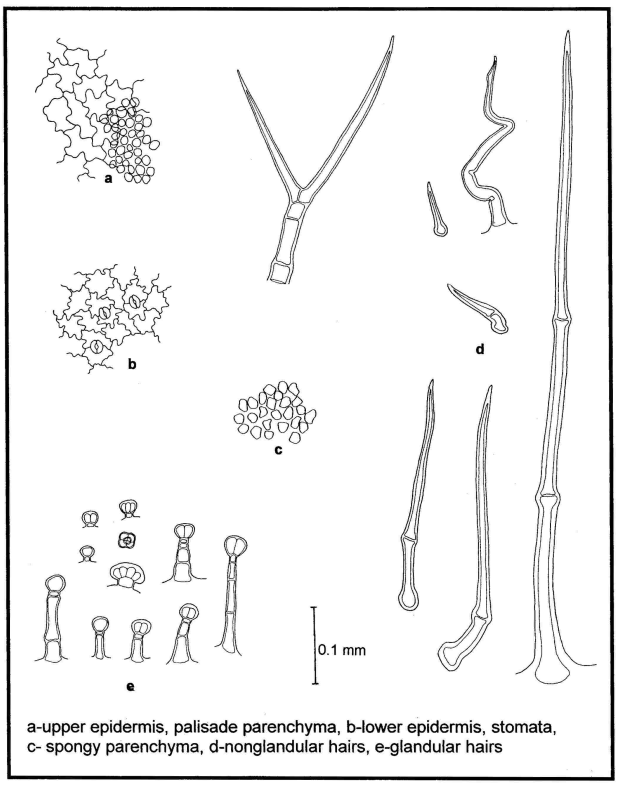

Figure 7. Anatomical characteristics of the leaves.

In transversal section of the leaves, upper and lower epidermal cells are covered by a thin cuticle. Lower epidermal cells are smaller than the upper. Both epidermis have non-glandular and glandular hairs. Simple, rarely branched, sometimes curved, 1-3 celled of varying length non-glandular hairs and head 1,2 celled, stalk 3,4 celled, long; head 1,2,4 celled, stalk 1 celled, short; and head 8 celled, stalk unicellular, very short glandular hairs which are widespread in Lamiaceae, are present together in a single leaf. Stomata are observed only on lower side of leaves. Mesophyll is dorsiventral, palisade, usually 1-rowed, 3x long as broad, and spongy mesophyll is 1-2-rowed with large intercellular spaces (Figs. 7,8).

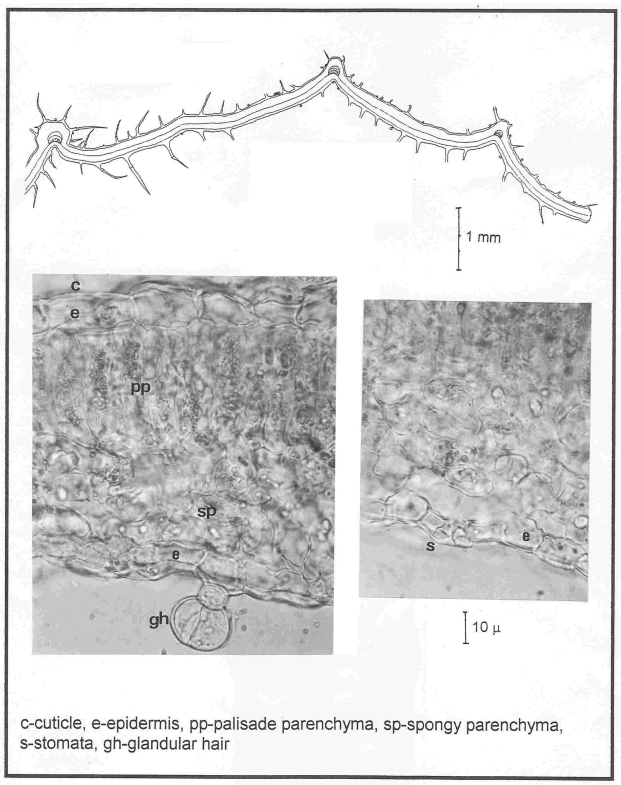

Figure 8. Transverse sections of the leaves.

DISCUSSION

B. nigra subsp. *nigra* is close to *B. nigra* subsp. kurdica and *B. nigra* subsp. *anatolica* in the identification key, in the Flora of Turkey and the East Aegean Islands[1]. However, *B. nigra* subsp. kurdica is known only from one location (Bitlis, Tatvan) and only a few identified samples exist in the herbaria. On the other hand, *B. nigra* subsp. *anatolica*, which is also widespread, is present in the same geographic region with *B. nigra* subsp. *nigra* and the two are frequently confused. According to results determined in this study, *B. nigra* subsp. *nigra* differs from *B. nigra* subsp. *anatolica* and other subspecies by its calyx morphology. While *B. nigra* subsp. *nigra* has obconical to obconical-campanulate calyx with porrect teeth, *B. nigra* subsp. *anatolica* has tubular-obconical calyx with recurved calyx teeth[10].

The findings were compared with those of the Flora of Turkey and the East Aegean Islands, and some differences were determined between this study and the characteristics given in that resource[1]. According to our studies, stem is 46-153 cm, erect or ascendant, branched below. In the above-mentioned resource, the plant is reported as up to 100 cm tall, erect and branched above. Moreover, cauline leaves are reported as 20-70 x 20-50 mm, truncate or rounded at base; however, we measured the cauline leaves as 5-78 x 3-60 mm, not rounded at base, and in addition, with some being reniform.

Furthermore, some morphological characteristics were not given in the Flora of Turkey and the East Aegean Islands, such as the shape of middle and upper cauline leaves, size of floral leaves and bracteoles, and number of flowers in each verticillaster (Figs. 2-4).

Consequently, the differences between our findings and those mentioned above and additional characteristics as determined in the present study show that the margin of variation has widened for *B. nigra* subsp. *nigra*.

Anatomical properties of the stem and leaves as explained in this study were also resemble those of *B. nigra* subsp. *anatolica*, which we studied previously10. Metcalfe and Chalk reported some anatomical features of the stem and leaves of the family Labiatae[12]. Branched multicellular non-glandular hairs and different types of glandular hairs, such as head 2 celled with a long stalk, head 4 celled with a short stalk, and head 8 celled with a very short stalk, which are characteristics for the genus *Ballota* according to Metcalf & Chalk, were also observed during our anatomical studies on leaves. Moreover, in addition to these trichomes, we determined the presence of different types of glandular and non-glandular hairs on stem and leaves (Figs. 5,7).

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