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A morphological and systematical study on endemic *Nepeta baytopii* Hedge & Lamond (Lamiaceae) from Bingöl (Turkey).

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Abstract

In this study morphological characters of endemic *Nepeta baytopii* Hedge & Lamond investigated for the systematic purposes. At the end of the morphological studies by stereo microscope; leaf shape, leaf indumentum, calyx, corolla, gynoecium, androecium, connection of the filaments to theca and seed characters were determined and compared with Flora of Turkey and Dirmenci's (2003) study with *N. baytopii* [16]. In addition, stem and leaf indumentum, pollen characters and seed coat surface of *Nepeta baytopii* was examined by SEM. As a result, with this study new morphological properties for diagnostic purposes have determined and the description of *N. baytopii* have extended.

Key words: Taxonomy, *Nepeta*, morphology, systematic.

Bingöl'de ki (Türkiye) endemik *Nepeta baytopii* Hedge & Lamond (Lamiaceae) türü üzerine morfolojik ve sistematik bir çalışma.

Özet

Bu çalışmada endemik *N. baytopii* türünün morfolojik özellikleri sistematik açıdan araştırıldı. Stereo mikroskop ile yapılan morfolojik çalışmalar sonunda türün yaprak şekli, yaprak tüy örtüsü, kaliks, korolla, ginekeum, androkeum, filamentin tekaya birleşme ve tohum özelliği belirlendi ve Türkiye Florası ve Dirmenci'nin (2003) *N. boytopii* ile ilgili çalışmasıyla [16] mukayese edildi. Ek olarak *N. baytopii* türünün gövde tüy örtüsü, yaprak tüy örtüsü, polen ve tohum yüzeyi özellikleri SEM ile incelendi. Sonuç olarak, bu çalışma ile türün teşhisi için yeni morfolojik özellikler tespit edilerek, türün betimi genişletildi.

Bulduru sözcükleri: Taksonomi, *Nepeta*, morfoloji, sistematik.

Introduction

The genus *Nepeta* L. belongs to the Lamiaceae family, rarely annual, perennial and often pleasantly aromatic herbs found in temperate Europe, Asia, North Africa, in mountains of tropical Africa and comprises of approximately 250 species (1). *Nepeta* represented in Turkey by 40 taxa, 16 of them are endemic (ca. 40%) (2-4). The 40 *Nepeta* taxa growing in Turkey can be divided into 2 groups: 13 taxa Mediterranean and 21 taxa Irano-Turanian. The Irano-Turanian taxa are found in the central, south-east and east Anatolia, whereas the Mediterraneae taxa grow mainly in the Mediteranean, Marmara and Aegean regions. The other *Nepeta* taxa are widely distributed throughout Turkey. Eighteen taxa out of the 40 are endemic to Anatolia, and some of them are very local and endangered (5). *Nepeta* have not recognised any sections but have placed the species in three informal groups (designated A, B and C) based largely on flower colour and inflorescence characters in Flora of Turkey. Group A which consists of 14 taxa: flowers white, yellow or pinkish, nutlets tuberculate throughout or at apex; group B which consists of 16 taxa: flowers lilac or deep blue, nutlets tuberculate or smooth; and group C which consists of 3 taxa: flowers white, lilac or purple, nutlets tuberculate, ± spherical (5). *N. baytopii* is in the group B, an endemic species for Turkey and grows in local area in between Diyarbakır and Bingöl only (2), in addition *N. baytopii* with limited distribution and included in the lower risk and least concern category in the red data book of Turkey (6). *Nepeta* species are herbaceous perennial, rarely annual. Stems erect or procumbent, eglandular or glandular. External nutlet characters very important in the Iranian and Afghan species, are of limited taxonomic value in Turkey; however, detailed anatomical investigation of the pericarp might well yield useful new information. The exiting infra-generic classifications are extremely unsatisfactory. Many of these species are often pleasantly aromatic, rich in essential oils, and of potential economic interest (7-10). Several *Nepeta* species are used in folk medicine as diuretic, diaphoretic, antitussive, antispasmodic, antiasthmatic, febrifuge, emmenagogue, and sedative effects (5). In addition, many reports on phytochemical analysis of these genus, including essential oil analysis are found in the literature (11-13).

Many morphological characters in *Nepeta* are variable such as indumentum, leaf shape and size, calyx and corolla characters can vary among closely related species (14). As a result, diagnostic use of such characters above the species level is problematic. Nutlets are good characters for species recognition (15). In the present work, SEM and stereo microscop was used to determine the morphology of *N. baytopii* from Bingol (Turkey) province, both to improve the present knowledge of the *N. baytopii* and to evaluate the usefulness of this feature for systematic purposes. Furthermore with this study diagnostic characters to distinguish *N. baytopii* were rainforced and added new morpholical characters.

Materials and Methods

N. baytopii was collected from their natural habitat with Behçet and Kilic. *N. baytopii* (BIN-4) was collected from Bingöl, south of Genç, Şamdağı on september 2011 at an altitude of 1600-2100 m. Plant sample was dried according to standart herbarium techniques and stored in the Bingol University Herbarium (BIN). The taxonomic description of the plant sample was made according to volume 7 of Flora of Turkey (2) and all measurements were made directly on herbarium specimens. Leaf shape, leaf indumentum, gynoecium, androecium, corolla, calyx, seed and connection of the filaments theca of *N. baytopii* was detected by stereo microscope. In addition, the pollen characters, stem indumentum, leaf indumentum and seed coat surface of *N. baytopii* were examined with a Hitachi SU-1500 scanning electron microscope (SEM), coated with gold in Wilfrid Laurier University (Canada) Herbarium (Biology).

Result and Discussion

Morphological properties of *N. baytopii* Hedge & Lamond. from Flora of Turkey.

Perennial; stems arcuate ascending, c. 40 cm, shortly and retrorsely pilose and with scattered longer spreading hairs and sessile glands. Leaves ovate-triangular, 1.5-2.5 x 1.5-2 cm, ± crenate, shortly pilose with longer hairs on veins and numerous sessile glands beneath; upper pairs remote and much smaller; petiole 0-2 cm. Verticillasters confered into terminal heads. Bracteoles linear-lanceolate, 8-10 mm, attenuate-aristate at apex, membranous. Calyx ± tubular, c. 12 mm, straight or slightly curved, mouth oblique, teeth oblong-ovate to narrowly triangular, acumimate-aristate, ± membranous, lower lip cleft, with short antrorse hairs on veins, lilac-tinged. Corolla lilac (?), 22-25 mm, tube straidgt or slightly curved, exserted from calyx teeth. Nutlets ± oblong, trigonous, smooth, c. 2.3 x 1.2 mm. *Fl. 7.* (2).

Figure 1. General view of *N. baytopii*

Stem

The stem of *N. baytopii* is well developed and branched, 30-75 cm, erect or acruate ascending, shortly and retrorsely pilose long and scattered hairs and sessile glands.

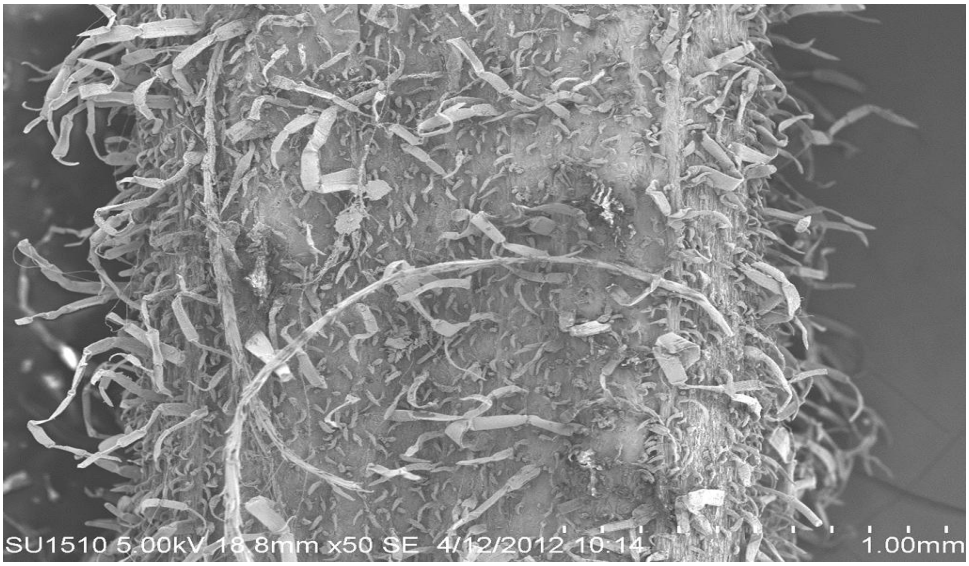


Figure 2. SEM photomicrographs of stem. *N. baytopii*

Leaves

Leaves of *N. baytopii* ovate-triangular, 1.5-3 x 1-2.5 cm, crenate, shortly pilose with longer hairs on veins and numerous sessile glands beneath; upper pairs remote and much smaller; leaves are petiolate, upper sessile and petiole 0-2.5 cm.

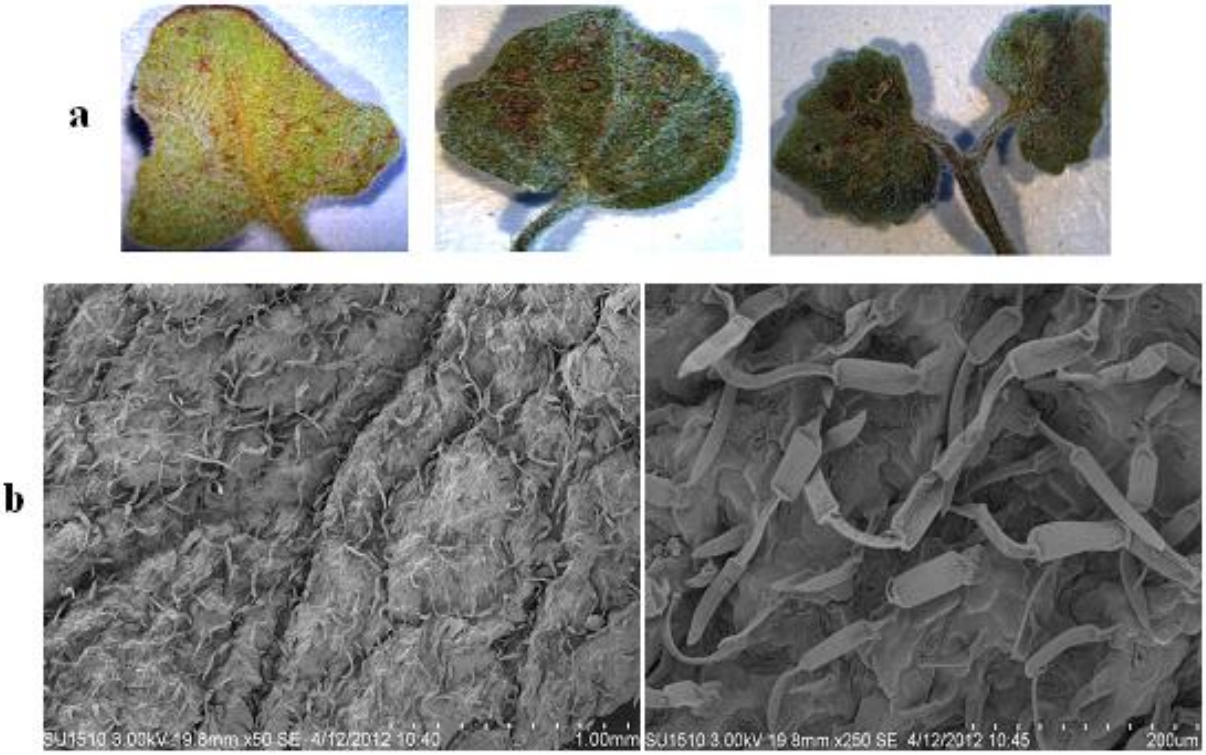


Figure 3. Leaves and leaf indumentum of *N. baytopii* (**a**: stereomicroscop, **b**: SEM).

Inflorescence

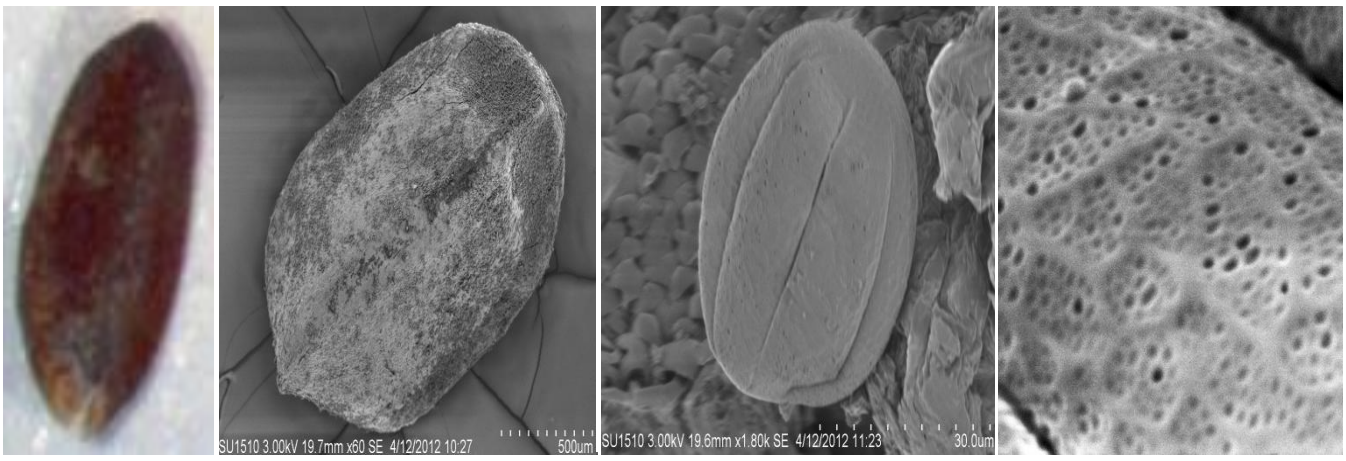
Flowers of *N. baytopii* are born in verticillaster and has an unbranched inflorescence and upper united like head. *N. baytopii* has lineare-lanceolate bracteoles, 8-13 mm and calyx of *N. baytopii* tubular approximately 5-9 mm., straight or curved. Mouth of flower is oblique, corolla colour lilac to light pink, corolla lenght is 18-23 mm., corolla tube straight or slightly curved, exerted from calyx teeth.

Calyx Corolla Gynoecium Androecium Brakteol

Figure 4. Plant parts of *N. baytopii* (stereo microscop).

Seed and Pollen

Nutlets of *N. baytopii* is ± oblong, smooth, c. 2.4x1.3 mm., and colour is blackish-light brown. Whereas Dirmenci (2008) reported that, *N. baytopii* nutlet 2-2.3 × 0.8-1.2 mm, oblong, blackish-brown and nutlet coate surface is smooth. Pollen type of *N. baytopii* was found sphaeroidea and pollen surface of *N. baytopii* is reticulate.



a **b** **c** **d**

Figure 5. *N. baytopii*, **a)** seed (stereomicroscope) **b)** seed (SEM), **c)** pollen, **d)** pollen surface.

In conclusion, this study was carried out morphologically in order to assist the identification of *N. baytopii*. The results obtained from morphological studies were generally consistent with the

description given in Flora of Turkey and Dirmenci's (2003) study [16]; but in respect to some characters the results of this study differ from Flora of Turkey and Dirmenci's (2003) study [16] as seen in Table 1. So, with this study new morphological properties have determined for diagnosic purposes and the description of *N. baytopii* have extended. More detailed about this study can be seen in Table 1.

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Table 1. Morphological characters of *N. baytopii* samples.

CHARACTERS	IN FLORA OF TURKEY	DIRMENCI'S STUDY (2003) [16]	STUDIED SAMPLE
Leaves	Ovate-triangular, 1.5-2.5 x 1.5-2 cm	Ovate-triangular, 1.5-3 x 0.8-2.4 cm	Ovate-triangular, 1.5-3 x 1-2.5 cm
Leaf indumentum	Shortly pilose with longer hairs on veins and numerous sessile glands beneath	Shortly pilose with longer hairs on veins and numerous sessile glands beneath	Shortly pilose with longer hairs on veins and sessile glands beneath
Stem	Stems arcuate ascending, c. 40 cm, shortly and retrorsely pilose and with scattered longer spreading hairs and sessile glands	Numerous from base, curved like bow, 25-70 cm, retrorsely short pilose and scattered lond hairs and sessile glands	Well developed and branched, 30-75cm, erect or acruate ascending, shortly and retrorsely pilose long and scattered hairs and sessile glands
Calyx	± Tubular, c. 12 mm., straight or slightly curved, with short antrorse hairs on veins, lilac-tinged	± Tubular, 11-13.5 mm., straight or curved, with short antrorse hairs on veins, papillate-sessile glandular , slight lilac.	Tubular, c. 5-9 mm., curved, with short antrorse hairs on veins, ± lilac.
Bracteoles	Linear-lanceolate, attenuate-aristate at apex, membranous	Linear-lanceolate, 7-12 mm, attenuate-aristate at apex, edge membranous.	Linear-lanceolate, 8-13 mm, attenuate-aristate at apex, edge membranous.
Corolla lenght and colour	22-25 mm, lilac (?), tube straight or slightly curved, exerted from calyx teeth.	21-25 mm, lilac, tube straight or slightly curved, exerted from calyx teeth with pilose hairs throughtly and numerous sessile glands	18-23 mm, lilac to light pink, tube straight or slightly curved, exerted from calyx teeth, with scarcely pilose hairs and sessile glands.
Nutlets	± oblong, trigonous, smooth, c. 2.3 x 1.2 mm	Oblong, oblong-trigonous, smooth, c. 2.5 x 1.2 mm	Oblong, smooth, c.2.4x1.3 mm.
Petiole	0-2 cm	0-3 cm	0.5- 3.1 cm
Upper leaf	Upper pairs remote and and much smaller	Fer from each other and smaller than lower leaves.	Petiolate, triangular and smaller than lower leaves.
Theca surface	-	-	granulate
Filamental connection	-	-	normal
Pollen (Pollen axis)	-	-	27.5 um
Pollen (Equatorial axis)	-	-	30.65 um
Pollen type	-	-	Sphaeroidea