

A Morphological Study on *Nepeta fissa* C.A.Mey. (Lamiaceae) from Bingöl (Turkey)

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Abstract- In this study morphological characters of *Nepeta fissa* C.A.Mey. investigated for the systematic purposes. At the end of the morphological studies by stereo microscope; leaf shape, leaf indumentum, calyx, corolla, gynoeceum, androecium, connection of the filaments to theca and seed characters were determined and compared with Flora of Turkey and Dirmenci's study with *N. fissa*. In addition, stem and leaf indumentum, pollen characters and seed coat surface of *N. fissa* was examined by SEM. Studied sample has shown some variations from Dirmenci's and Flora of Turkey sample in respect to some characters which are shown in Table 1. As a result, with this study new morphological characters for diagnostic purposes have detected and the description of *N. fissa* have extended.

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

I. INTRODUCTION

The genus *Nepeta* L. (Lamiaceae) rarely annual, perennial and often pleasantly aromatic herbs mostly found in temperate Europe, Asia, tropical Africa and contains approximately 250 taxa in the world [1]. *Nepeta* represented in Turkey by 40 taxa, 16 of them are endemic (endemism rate ca. 40%) [2-4]. In Turkey *Nepeta* taxa divided into 2 groups: Mediterranean (13 taxa) and Irano-Turanian (21 taxa). The Irano-Turanian taxa are mainly found in the central, south-east and east Anatolia, whereas the Mediterranean taxa are growing mainly in the Mediterranean, Marmara and Aegean regions. The other species of *Nepeta* are widely spreaded throughout Turkey. Some of endemic species of *Nepeta* are very local and endangered [5]. The stems of *Nepeta* taxa are generally erect or procumbent; eglandular or glandular; external nutlet characters and anatomical examination of the pericarp might well yield useful characters in the *Nepeta* taxa [6-7]. Many of *Nepeta* species are often pleasantly aromatic, rich in essential oils, and of potential economic interest. Several *Nepeta* species are used in folk medicine as diuretic, diaphoretic, antitussive, antispasmodic, antiasthmatic, febrifuge, emmenagogue, and sedative agents [8,9]. In addition, many researchs on phytochemical analysis of these genus, including essential oil analysis are found in the literature [10, 11].

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 (consists of 14 species): flowers white, yellow or pinkish, nutlets tuberculate throughout or at apex; group B (consists of 16 species): flowers lilac or deep blue, nutlets tuberculate or smooth; and group C (Sect. *Oxynepete* Benth., consists of 3 species): flowers white, lilac or purple, nutlets tuberculate, ± spherical [2]. *N. fissa* is in the group B. Many morphological characters in *Nepeta* taxa are variable; such as indumentum, leaf shape and size, calyx and corolla characters [12]. So, diagnostic use of such properties above the species level is problematic. Nutlets are good characters for recognition to *Nepeta* species [13].

In recent times the significance of scanning electron microscopy (SEM) in the study of nutlet surfaces and the taxonomic value of nutlet characters has been explained in many genera of the Lamiaceae [7, 14]. Nutlet morphology in the Labiatae family has proved useful to varying degrees at different levels of the taxonomic hierarchy [7] and the importance of the morphology of nutlet surfaces has already been demonstrated for *Nepeta* taxa [14,15]. In this study, SEM and stereo microscope was used to determine the micromorphology of *N. fissa* from Bingöl (Turkey) province, both to improve the present knowledge of the studied sample and to evaluate the usefulness of this characters for systematic purposes.

II. MATERIALS AND METHODS

N. fissa was collected from 15-20 km west of Bingöl - Şabanköy steppe, on August 2013, at an altitude of 1400-1500 m., by O.Kilic (collect no: 5347). Plant sample was dried according to standart herbarium techniques and

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stored in the Bingol University Herbarium (Herbarium no: 2918). The taxonomic description of the plant sample was made according to Davis (1982) [2] and all measurements were made directly on herbarium specimens. Morphological properties of plant sample and measurements and optical observations were carried out under a stereomicroscope wild M5. In addition, the pollen characters, stem indumentum, leaf indumentum and seed coat surface of plant sample was examined with a Hitachi SU-1500 scanning electron microscope (SEM). Dry mature nutlets, stem part, leaf part and stamen (which were shredded to get pollen) were mounted directly on stubs, using single adhesive tape, and coated with gold in Wilfrid Laurier University (Canada) Herbarium (Biology).

III.RESULT AND DISCUSSION

A. Morphological Properties

Systematic specifications of *N. fissa* C.A.Mey.

Perennial; stems ± erect, 20-95 cm, glabrous to densely and shortly puberulous. Leaves usually ± triangular, rarely rhomboid or reniform, 1.4-5 x 1.4-4.5 cm, base truncate or cordate, rarely cuneate crenate to coarsely dentate, lightly to densely puberulous; petiole 0.7-4.8 cm. Inflorescence usually lax, at least lower cymes pedunculate, flowers congested or loose. Bracteoles lanceolate-elliptic to elliptic-oblong, much shorter than calyx. Calyx ± tubular, ± straight, 6-8 (-9) mm, mouth oblique, teeth acuminate or blunt, ovate-oblong to triangular, much shorter than tube, lower lip deeply cleft, ± pubescent to scabridulous, glandular or not, often purple. Corolla blue or lilac to purple, 10-21 mm, exserted from calyx teeth. Nutlets elliptic to oblong, ± trigonous, smooth, c. 1.7 x 1 mm. Fl. 6-9. *Volcanic and serpentine rocks, screes, slopes, stepe, dry or moist banks, (540-) 100-1950 m.*



Figure 1. General view of *N. fissa*.

1) Stem

The stems of *N. fissa* is well developed and branched, 20-90 cm, erect with densely and shortly puberulous.

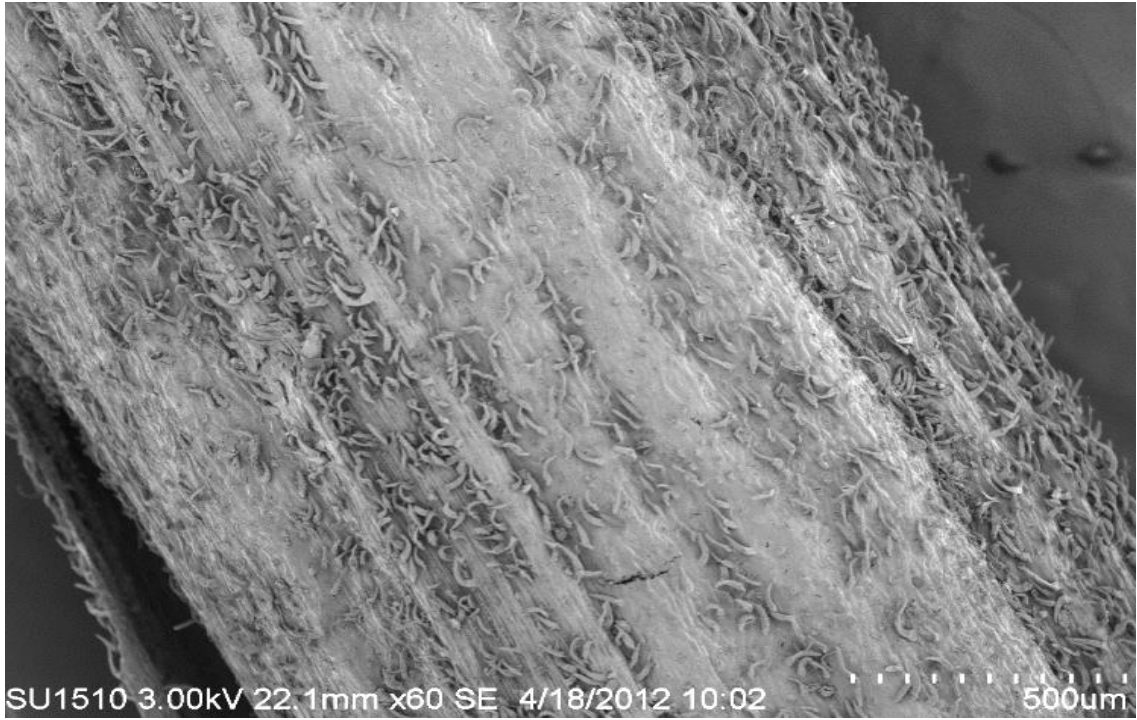


Figure 2. SEM photomicrographs stem of *N. fissa*

2) Leaves

N. fissa has \pm triangular, rarely rhomboid or reniform, 1-4.5 x 1.4-4.5 cm., leaves. The leaf basis of plant sample is cordate and the margins are crenate, all leaves petiolate and petiole 0.7-3 cm. Indumentum of *N. fissa* leaves are glabrescent to short densely puberulous and densely hairs.

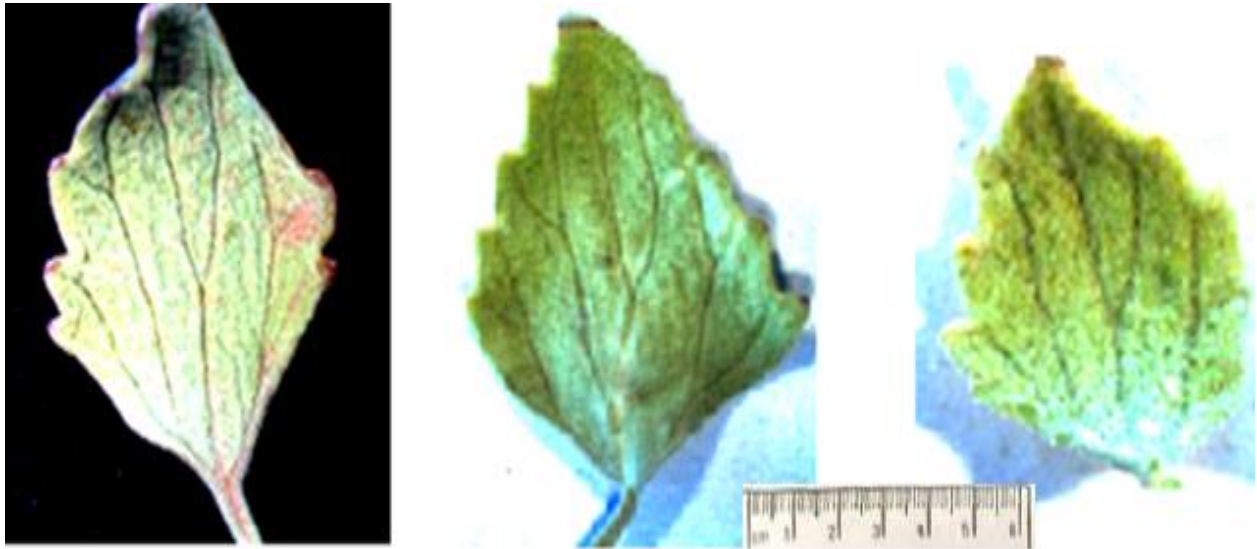


Figure 3. Leaves of *N. fissa* (stereo microscop).

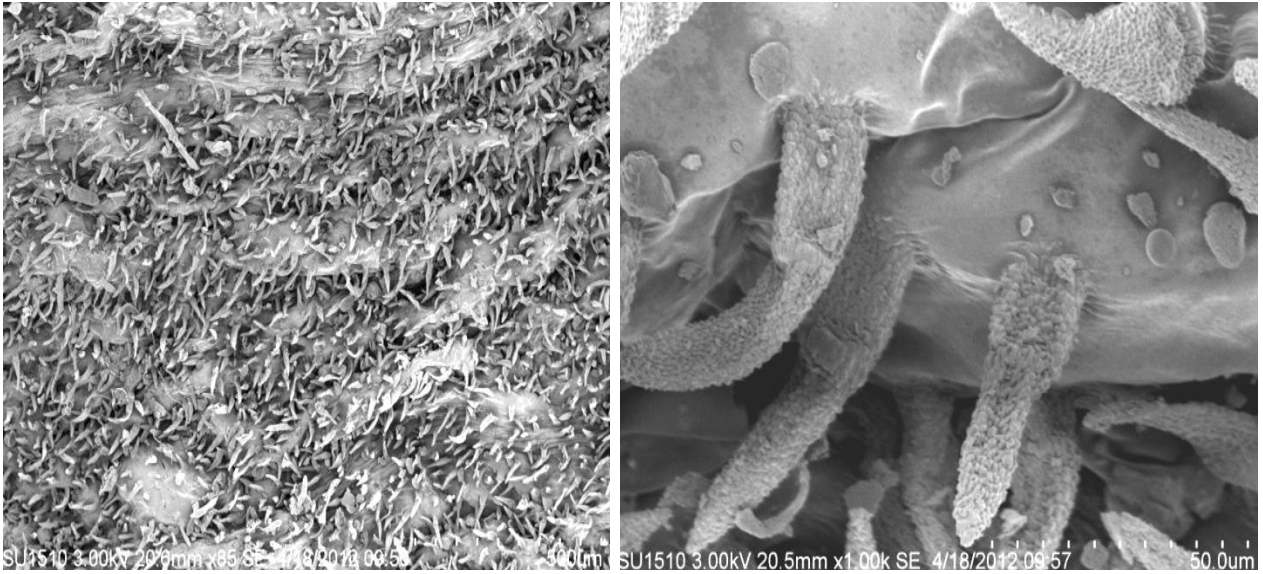


Figure 4. Leaf indumentum of *N. fissa* (SEM).

i. Inflorescence

Flowers of plant sample is born in verticillaster. Inflorescence of *N. fissa* usually scarcely, chymes pedunculate, flowers usually dichasium. *N. fissa* has lanceolate-elliptic to elliptic-oblong bracteoles and calyx tubular approximately 5-9 mm length. Mouth of flower is oblique, corolla colour of *N. fissa* lilac or blue to purple. Corolla length of *N. fissa* is 10-15 mm.

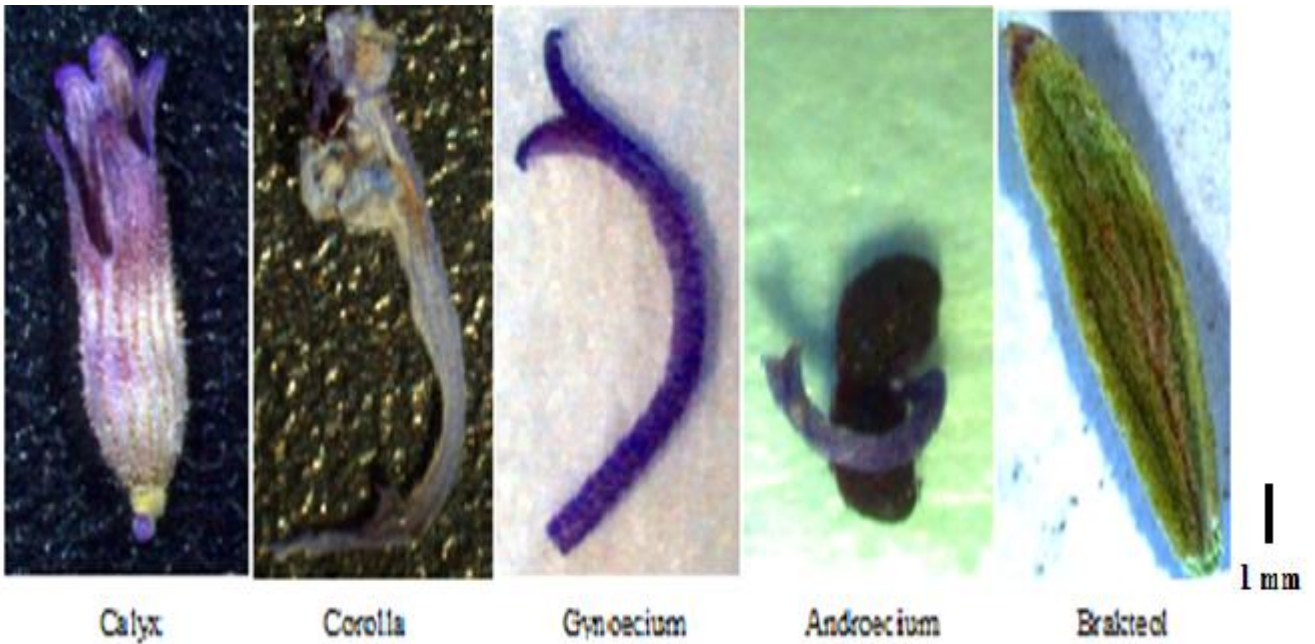


Figure 5. Plant parts of *N. fissa* (stereo microscope).

ii. Seed and Pollen

Nutlets of *N. fissa* is elliptic to oblong, trigonous, smooth, c. 1.5x1 mm. Nutlets colour is blachish-brown. Pollen type of *N. fissa* was found suboblata and pollen surface was determined reticulate.

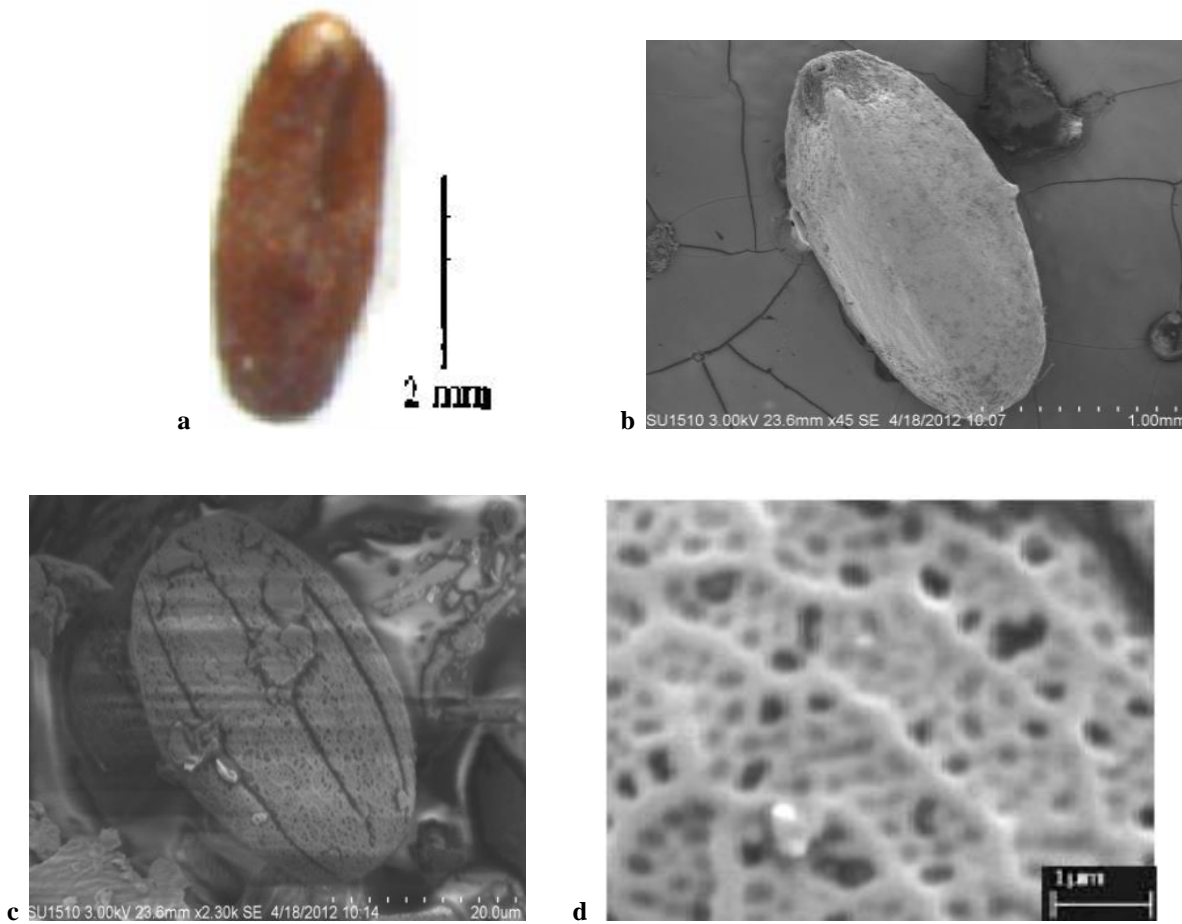


Figure 6. *N. fissa*, a-b) seed, c) pollen, d) pollen surface.

N. fissa was investigated morphologically in order to assist in identification of this species. The results obtained from morphological studies were generally consistent with the description given in Flora of Turkey [2].

Corolla and nutlets characters are among the important characters in the identification of *Nepeta* taxa. Our sample has shown some variations from Dirmenci's and Flora of Turkey samples in respect to some characters. These variations and more detailed comparison of species are shown in Table 1.

Jamzad et al. (2000) investigated the nutlet surface of the annual species of *Nepeta* from Iran and in the event *Nepeta* species are divided into 2 sections: Micrantheae, nutlet surface coarsely tuberculate to finely granular, and Micronepeta, nutlet surface smooth. In this study the nutlet surface of *N. fissa* was found to be smooth. The pistil colour of studied sample was purplish and about 8 mm. The pollen characters of studied (Table 1).

In conclusion, with this study, new morphological properties for diagnostic purposes of *N. fissa* have detected and the description of studied sample have enlarged.

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

| CHARACTERS | IN FLORA OF TURKEY | DIRMENCİ'S STUDY [16] | STUDIED SAMPLE |
|---------------------------------|--|--|--|
| Leaves | Usually ± triangular, rarely rhomboid or reniform, base truncate or cordate, lightly to densely puberulous 1.4-5 x 1.4-4.5 cm, petiole 0.7-4.8 cm. | Usually ± triangular, rarely rhomboid or reniform, base truncate or cordate, 1-4.5x1.4-4.5 cm, petiole 0.7-3 cm. | Usually ± triangular, rarely rhomboid or reniform, base truncate or cordate, Glabrescent to short densely puberulous 1-4.5 x 1.5-5 cm, petiole 0.6-3.5 cm. |
| Stem | Perennial, stems ± erect, 20-95 cm, glabrous to densely and shortly puberulous | Stem erect, 20-100 cm, glabrous to densely and shortly puberulous | Well developed and branched, 20-90 cm, erect with densely and shortly puberulous |
| Inflorescence | Usually lax, at least lower cymes pedunculate, flowers congested or loose. | Usually lax, sometimes congested, cymes pedunculate, flowers usually dichasium. | Usually lax, cymes pedunculate, flowers usually dichasium and loose. |
| Calyx | Pubescent to scabridulous, glandular or not, often purple, 6-8 (-9) mm. | Pubescent to scabridulous, glandular or not, often reddish purple, 5.5-8 (-9) mm. | Pubescent to scabridulous, glandular or not, light purple 5-9 mm. |
| Bracteoles | Lanceolate-elliptic to elliptic-oblong, much shorter than calyx. | Lanceolate-elliptic to elliptic-oblong, much shorter than calyx, 1.5-3.5 mm. | Lanceolate-elliptic to elliptic-oblong, shorter than calyx, 1.2-3.4 mm. |
| Corolla (mm) | Blue or lilac to purple, 10-21mm, exerted from calyx teeth. | Blue or lilac to purple, 10-15 (21) mm, exerted from calyx teeth. | Blue or lilac to purple, 10-15 mm, exerted from calyx teeth. |
| Nutlets | Nutlets elliptic to oblong, ± trigonous, smooth, c. 1.7 x 1 mm | Nutlets elliptic to oblong, ± trigonous, c. 2 x 1 mm | Nutlets elliptic to oblong, trigonous, smooth, c. 1.5x1 mm |
| Upper leaf | - | - | Sessile, amplexicaule |
| Theca surface | - | - | granulate |
| Filamental connection | - | - | With a appendage |
| Pollen (Pollen axis) | - | - | 30.50 um |
| Pollen (Equatorial axis) | - | - | 3.70 um |
| Pollen type | - | - | Suboblata |

REFERENCES

- [1] Mabberley D.J., *The Plant Book*, Cambridge University Press, 1997.
- [2] Davis P.H., *Flora of Turkey and East Aegean Islands*, University Press, Edinburgh: 7, 1982.
- [3] Ozhatay N., and Kultur Ş., "Check-list of add. taxa to the supp. Flora of Turkey III," *Turk. J. Bot.*, vol. 30, pp. 281-316, 2006.
- [4] Ozhatay N., Kultur Ş., and Aslan S., "Check-list of additional taxa to the supp. Flora of Turkey IV," *Turk. J. Bot.*, vol. 33, pp. 191-226, 2009.
- [5] Dirmenci T., Yıldız B., and Tümen G. Threatened Categories of Four *Nepeta* L. (Lamiaceae) Species Endemic to the East Anatolia. *Turk J Bot.*, vol. 28, pp. 221-226, 2004.
- [6] Guner A., Ozhatay N., Ekim T., and Baser KHC., *Nepeta* L. in: Guner A (ed), *Flora of Turkey and East Aegean Islands.*, vol. 11, 2000.
- [7] Aytac Z., and Yıldız G., "A new record for the Flora of Turkey," *Turk. J. Bot.*, vol. 20, pp. 385-386, 1996.
- [8] Budantsev AL., and Lobova TA., "Fruit morphology, anatomy and taxonomy of Tribe Nepeteae (Labiatae)," *Edinburgh J. Bot.*, vol. 54, pp. 183-216, 1997.

- [9] Tzakou O., Haruda C., Galati EM., and Sanogo R., “Essential Oil Composition of *Nepeta argolica* Bory et Chaub. subsp. *argolica* subsp. *argolica*,” *Flavour Fragr J.*, vol. 32, pp.115-118, 2000.
- [10] Rapisarda A., Galati EM., Tzakou O., Flores M., and Miceli N., “*Nepeta sibthorpii* Betham (Lamiaceae): Micromorphological analysis of leaves and flowers,” *Farmaco.*, vol. 56, pp. 413-415, 2001.
- [11] Kilic O., Hayta S., and Bagci E., “Chemical Composition of Essential Oil of *Nepeta nuda* L. subsp. *nuda* (Lamiaceae) from Turkey,” *Asian J. of Chem.*, vol. 6, pp. 2788-2790, 2011.
- [12] Kilic, O., Behcet L., and E. Bagci., “Essential oil compounds of three *Nepeta* L. Taxa From Turkey, and Their Chemotaxonomy,” *Asian J. of Chem.*, 25 (14), pp. 8181-8183, 2013.
- [13] Hedge IC., and Lamond J., “Studies in the Flora of Afghanistan: VII, Labiatae Lam.,” *Notes Roy. Bot. Gard.*, vol. 28, pp. 97-123, 1968.
- [14] Jamzad, Z., Harley, MM., Ingrouille, M., Simmonds, MSJ., and A. Jalili A., ‘Pollen exine and nutlet surface morphology of the annual species of *Nepeta* L. (Lamiaceae) in Iran. - In: Harley MM, Morton GM & Blackmore S (eds.), *Pollen and Spores: Morphology and Biology*, pp. 385-397, 2000.
- [15] Mosquero, MAM., Juan, R., Pastor, JE., Morphological and anatomical studies on nutlets of *Nepeta* L. (Lamiaceae) from South-West Spain. *Acta Bot Malacitana.*, vol. 27, pp.15-26, 2002.