

Comparative Anatomical Studies on Petioles of *Nepeta* L. Species (Lamiaceae) in NE Iran

Seyedeh Mona Mahdavi Shahri

Department of Biology, Mashhad Branch, Islamic Azad University
Rahnamaee 26 st. Mashhad, Iran

Azarnoosh Jafari*

Department of Biology, Mashhad Branch, Islamic Azad University
Rahnamaee 26 st. Mashhad, Iran

*Corresponding author

Homa Mahmoodzadeh

Department of Biology, Mashhad Branch, Islamic Azad University
Rahnamaee 26 st. Mashhad, Iran

Copyright © 2016 Seyedeh Mona Mahdavi Shahri et al. This article is distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

The present research has examined petiole anatomical characteristics of 10 *Nepeta* species (Lamiaceae family) growing in the Razavi, Northern and southern Khorassan provinces (NE) Iran. For this, cross sections of their petioles were prepared and stained by differential staining. In petiole internal structure, some differences such as the outline shape of petioles cross section, the shape of epidermis cells and vessels were noticed. Finally, based on above characteristics an identification key of studied *Nepeta* species was prepared.

Keywords: petiole, Lamiaceae, internal structure, *Nepeta*, vessel

Introduction

The genus *Nepeta* L., belongs to Lamiaceae, [2] comprises about 70 species in Iran [6, 4]. “This genus can be used to influence moods, its largely recognized as more of a relaxant than a stimulant. Also, *Nepeta* uses for Stomach ailments including colic, nausea, and motion sickness, Arthritis and exertion pain, Fever reducing, Anxiety and nervousness treatment, Headaches, Sleep disorders Amenorrhea” [7]. Despite many reports about medicine characteristics of *Nepeta*, there is no enough reports about anatomical features for this genus. Previous studies are following *Nepeta* (Lamiaceae) morphology and anatomy in Romania and their taxonomic significance [5], Comparative anatomical studies of some genera of Lamiaceae family in west Azarbaijan in Iran [3] and Comparative anatomical studies of some genera of *Lamiaceae* taxa [1]. According to the above studies, petiole internal structure of Iranian *Nepeta* species has been assessed. The aim of this research was to evaluate variation in petiole anatomical characteristics and to recognize its role in species identification. So petiole internal structure features of 10 *Nepeta* species in NE Iran was assessed.

Materials and methods

For anatomical study, cross sections of petioles of 10 dried Iranian *Nepeta* species (kept in FUMH) from NE Iran were prepared and stained by Carmin and methyl green. The list of studied species and their localities were presented in Table. 1. After that, the outline shape of petioles cross section, the shape of epidermis cells and vessels, VL/DVL ratio (ventral to dorsi-ventral axis length), the arrangement of vessels and the number of parenchymatous cell layers were evaluated.

Table. 1. The list of studied species of *Nepeta* and their localities.

Species	Locality
<i>N. kotschyi</i>	Torbat Heydarieh, Ghouchi village, 1790m, Borhan, 327 (FUMH); 15 km Kashmar to Neyshabour, 1500m, Faghihnia and Zangouei, 18455 (FUMH).
<i>N. ucranica</i>	Dargaz, Tandoure national park, between Shekarab and Chehelmir, 1000-2300m, Joharchi and Zangouei, 20505 (FUMH); Esferayen to Bojnourd, Garivan, 1800m, Faghihnia and Zangouei, 20135 (FUMH).
<i>N. saccharata</i>	Torbatjam, Salehabad, between Naeto and bagh Keshmir, 1100m, Joharchi and Zangouei, 39405 (FUMH).
<i>N. meyeri</i>	Shousef, Zahab mount, 1650m, Faghihnia and Zangouei, 18176 (FUMH).
<i>N. cataria</i>	East south of Bojnourd, Esferayen, 1450m, Joharchi and Hosseinzadeh, 33897 (FUMH); Dargaz, Tandoureh national park, Chehelmir, 850m, Faghihnia and Zangouei, 18995.

<i>N. binaludensis</i>	Binaloud mount, Farsagi, 2000m, Faghihnia and Zangouei, 17886 (FUMH).
<i>N. sewerzowii</i>	East south of Dargaz, Hatamghaleh, 300m, Joharchi and Zangouei, 23125 (FUMH).
<i>N. bracteata</i>	40 km Birjand to Ghaen , 1900m, Faghihnia and Zangouei, 21769 (FUMH); Torbat Heydarieh, Kadkan mount, 1850m, Faghihnia and Zangouei, 17561 (FUMH).
<i>N. glomerulosa</i>	West north of Torbat Heydarieh, Kadkan, 2000m, Faghihnia and Zangouei, 20691 (FUMH).
<i>N. isphahanica</i>	Shousef, Zahab mount, 1650m, Faghihnia and Zangouei, 18188 (FUMH); Between Gouneh and Nehbandan, Kalate Seyed Ali, 1600m, Faghihnia and Zangouei, 18125 (FUMH).

Results

The results indicated a few variation and transition characteristics in the shape of epidermis cells, the number and shape of upper and lower parenchyma cell layers. The detail information were presented in Figs. 1A-J and Tables.2, 3.

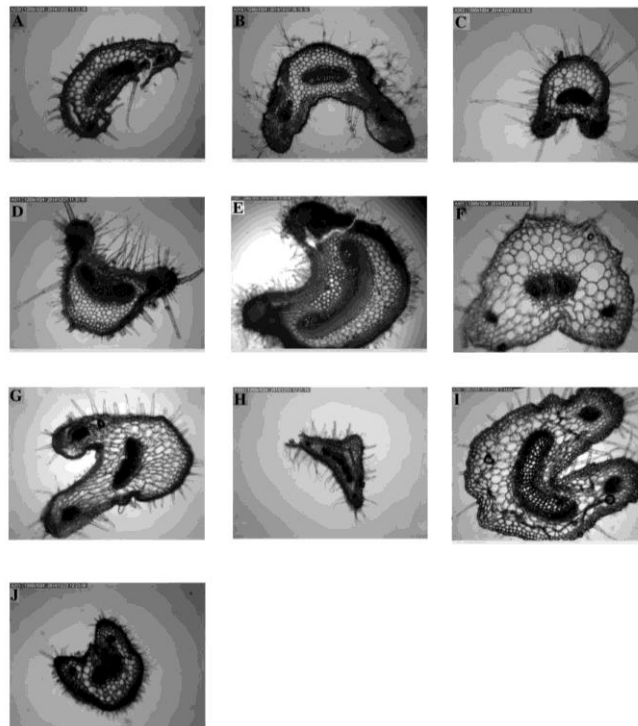


Fig. 1. Cross section of petiole A) *N. bracteatae*. B) *N. binaloudensis*. C) *N. sewerzowii*. D) *N. kotschyi*. E) *N. glomerulosa*. F) *N. isphahanica*. G) *N. saccarata*. H) *N. ucranica*. I) *N. cataria*. J) *N. meyeri*.

Table 2. The qualitative anatomical characteristics of petiole of studied *Nepeta* species.

Species	The shape of upper parenchymatous cells	The shape of lower parenchymatous cells	Epidermis cell shape	O.C.S.
<i>N. bracteata</i>	irregular or elliptical	Irregular, circular or ovate	irregular or circular-rectangular	Crescent shaped
<i>N. binaludensis</i>	irregular or circular-elliptical	Irregular, elliptical or circular	rectangular	Open V-shaped
<i>N. sewerzowii</i>	irregular or ovate	Irregular, elliptical or circular	Irregular, elliptical or rectangular	Open U-shaped
<i>N. kotschyi</i>	Irregular, elliptical or rectangular	Irregular, circular	elliptical or rectangular	Open V-shaped
<i>N. glomerulosa</i>	Circular, elliptical-ovate	Irregular, circular	elliptical or rectangular	D-shaped
<i>N. ispahanica</i>	Irregular, elliptical or rectangular	Irregular, circular or ovate	Irregular, elliptical or rectangular	Open V-shaped
<i>N. saccharata</i>	Irregular, rectangular	Irregular, elliptical or rectangular	Irregular, elliptical or rectangular	V-shaped
<i>N. ucranica</i>	Irregular, ovate or rectangular	Irregular, elliptical or rectangular	Irregular, elliptical or rectangular	triangular
<i>N. cataria</i>	Irregular, elliptical or rectangular	Irregular, elliptical or circular	Rectangular or circular	U-shaped
<i>N. meyeri</i>	Irregular, elliptical	Irregular, elliptical	Irregular or rectangular	D-shaped

O.S.P.C: outline shape of petioles cross section.

Table. 3. The quantitative anatomical characteristics of petiole of studied *Nepeta* species

species	VL/DVL	The number of collenchyma cell layer	The number of upper parenchyma cell layer	The number of lower parenchyma cell layer
<i>N. bracteata</i>	1.16	2-3	3	3-4
<i>N. binaludensis</i>	1.33	3-4	4-5	4-5
<i>N. sewerzowii</i>	0.93	3	4	5-6
<i>N. kotschyi</i>	0.78	5-6	5-6	7-8
<i>N. glomerolosa</i>	1,16	4-5	8-9	7-8
<i>N. ispahanica</i>	0.67	1-2	4-5	5-6
<i>N. saccharata</i>	0.97	3-4	3-4	7-8
<i>N. ucranica</i>	0.37	3-4	3-4	8-9
<i>N. cataria</i>	1.01	2-3	5-6	5
<i>N. meyeri</i>	0.89	2	4	5-6

Discussion

According to the above results, the minimum and maximum VL/DVL ratio were observed in *N. ucranica* (0.37) and *N. binaludensis* (1.33) respectively. Based on the outline shape of petiole cross section, studied species was divided into four major types: U and V-shaped, crescent-shaped, D-shaped and triangular. Another researchers such as, Hatamnia *et al.*, mentioned 3-4 collenchyma layers and 6-8 parenchyma layers in corners, 2 and 1-2 median and lateral vascular bundles in *N. cataria* petiole [3]. Also, Akçin *et al.*, 2011 in study of petiole anatomy of another genera such as *Ajuga*, *Prunella*, *Lamium*, *Salvia*, *Scutellaria* found some differences in the petiole shape, the arrangement and number of vascular bundles, hair types and the presence of collenchymas [1]. Also, Padure mentioned “different shapes for petiole for example, strongly flatted and lenticular in *N. nuda* or semicircular in *N. cataria*, *N. parviflora* and *N. ucranica*. The petiole presented a prominent adaxial ditch in all species or it lacked in *N. nuda*. Adaxial crests at

the petiole level: strongly prominent in *N. parviflora* or absent in *N. nuda*. Angular collenchyma: discontinuous at the level of petiole in *N. parviflora* and continuous at the level of petiole –"hypodermal muff" –in *N. nuda*" [5]. Finally, variation in the outline shape of petioles cross section and epidermis cell shape led to present an identification key for studied *Nepeta* species as below.

- 1) Crescent shaped outline shape of petioles cross section....*N. bractatae*
Benth.
-) V- shaped outline shape of petioles
crosssection.....2
- 2) Circular or rectangular epidermis cells.....*N. cataria*
L.
-) irregular, elliptical and rectangular epidermis
cells.....3
- 3) Collateral vascular bundle.....*N. sewerzowii*
Regel
-) Bi-collateral vascular
bundle.....4
- 4) elliptical or rectangular epidermis cells..... *N. kotschyi*
Boiss.
-) Irregular elliptical or rectangular epidermis
cells.....5
- 5) with long and thin wing..... *N. saccharata*
Bunge
-) with short and thick wing
.....6
- 6) open V- shaped outline shape of petioles cross
section..... *N. ispahanica*
Boiss.
-) triangular outline shape of petioles cross section
.....7
- 7) irregular, elliptical or rectangular epidermis
cell..... *N. ucranica*
Pojark
-) rectangular epidermis
cell.....8
- 8) two leaf trace in each corner *N. binaludensis*
Jamzad
-) one leaf trace in each

- corner.....9
- 9) 5-6- layered lower parenchyma cell, elliptical vascular bundle
.....*N. meyeri*
Benth.
-)7-8- layered lower parenchyma cell, crescent shaped vascular
bundle.....*N. glomerulosa*
Boiss.

From the present research can be concluded that anatomical characteristics of petiole can be informative features to recognize studied species circumscription of studied *Nepeta* species.

References

- [1] Ö.E. Akçin, M.S. Özyurt, and G. Şenel, Petiole anatomy of some Lamiaceae taxa, *Pak. J. Bot.*, **43** (2011), no. 3, 1437- 1443.
- [2] Angiosperm Phylogeny Group, An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III, *Botanical Journal of the Linnean Society*, **161** (2009), no. 2, 105–121.
<http://dx.doi.org/10.1111/j.1095-8339.2009.00996.x>
- [3] A.A. Hatamnia, M. Khayami, A. Mahmudzadeh, S. Hosseini Sarghein and M. Heidari, Comparative anatomical studies of some genera of Lamiaceae family in west Azarbaijan in Iran, *Botany Research Journal*, **1** (2008), no. 3, 63- 67.
- [4] K. Javidnia, A.R. Mehdipour, B. Hemmateenejad, S.R. Rezazadeh, M. Soltani, A.R. Khosravi and R. Miri, Nepetalactones as chemotaxonomic markers in the essential oils of *Nepeta* species, *Chem. Nat. Comp.*, **47** (2011), 843-847. <http://dx.doi.org/10.1007/s10600-011-0080-5>
- [5] I.M. Padure, *Nepeta* (Lamiaceae) morphology and anatomy in Romania and their taxonomic significance, *Conference Plant, Fungal and Habitat Diversity Investigation and Conservation*, Proceedings of IV BBC – Sofia, (2006), 34-38.
- [6] K.H. Rechinger, *Flora Iranica, Lamiaceae*, **150** (1982), 108-216. Akademische Druck-U. Verlagsanstalt, Graz.

- [7] E. Renther, Catnip: Growing your own Medicine. Natural society transform your health naturally. 2013, Available in www.naturalsociety.com/catnip

Received: August 2, 2016; Published: September 19, 2016