ANATOMICAL STUDIES OF MENTHA MOZAFFARIANII (LABIATAE) AND A RELATED SPECIES

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Azizian, D. 1996 12 25: Anatomical studies of *Mentha mozaffarianii (Labiatae)* and a related species. *-Iran. Journ. Bot. 7 (1): 63-71.* Tehran.

The leaf and stem anatomy of *Mentha mozffarianii* was studied and compared with *M. longifolia* which differs from in it morphological characters. Although the two species have many anatomical characters common within the genus *Mentha* they differ in several aspects of leaf anatomy such as trichomes and stem characters.

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مطالعات تشریحی گونه‌های Mentha mozaffarianii و M. longifolia

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گونه *Mentha mozaffarianii* Jamzad که اخیراً از جنوب ایران (بندرعباس) جمع‌آوری و به عنوان گونه جدید گزارش شده‌بود، از نظر آناتومی بررسی و با گونه *Mentha longifolia* (L.) Hudson که از نظر مورفولوژی متفاوت می‌باشد، مقایسه شد.

نتایج حاصل از مطالعات تشریحی برگ و ساقه این دو گونه را از یکدیگر متمایز می‌نماید. خصوصیات آناتومیکی گونه *M. mozaffarianii* از جمله مزوفیل برگ با بافت پارانشیم نرده‌ای فشرده در بیش از یک لایه که تا لبه برگ ادامه یافته‌است و وجود غلاف آوندی اطراف رگبرگهای فرعی همراه با خصوصیات ظاهری گیاه، مشخصات گیاهی گزروفیت را نشان می‌دهد.

INTRODUCTION

Despite the fairly intensive collecting that has taken place in various parts of Iran for many years, there are still some unknown species to describe such as *Mentha mozaffarianii* Jamzad. This was a new species from southern Iran, near Bandar Abbas, 40 km North of the persian Gulf. According to Jamzad in 1987, *M. mozaffarianii* showed close affinities to *M. royleana* Benth. and differs from *M. longifolia* (L.) Hudson in various aspects of morphology. In this paper, anatomical investigation is made in collaboration with Mrs. Jamzad (1987) in order to discover; (a) whether *M. mozaffarainii* shows xeromorphic characteristics similar to some desert *Labiatae* (Bokhari & Hedge 1977) and (b) whether two mentioned species of *Mentha* could be distinguished by means of their leaf and stem anatomy.

Materials and Methods

Dried material was obtained from specimens in the herbarium of Research Institute of Forests & Rangelands (TARI), and the Herbarium of Shahid Beheshti University. Recently fresh material was kindly collected by Jamzad (1994) and Zehzad (1995), from its natural habitat in Bandar Abbas for further studies. 3 specimens of each two following species were examined:

1. *Mentha mozaffarianii* Jamzad.
Hormozgan: Geno, protected region, 850 m. March 1995. Zehzad, s.n.
2. *Mentha longifolia* (L.) Hudson
Bakhthiari: Ina pass between Noghan & Tehaghakhor, 2180 m. 22 Augest 1986, Zehzad 862257; Zanjan: south of Rasht towards Ghazvin, Molla-Ali, river bank, 650-700 m, 16.9.1989, Zehzad, Nourian, Pakravan and Taheri, 67157; Tehran: Djadrud, river bed, near Mahi-sara, 15 Nov. 1989, Zehzad and Pakravan 89513.

Dried herbarium material was revived by boiling in water, cooled and fixed in FAA for more than 24 hours and hand sections were taken from the stem and leaf lamina. Epidermal preparations were obtained by maceration using Jeffrey's solution (equal parts of 10% chromic acid and 10% nitric acid). Epidermal peels and sections were stained with Bismark Brown or safranin and fast green, then mounted in glycerin jelly. Light microscope fitted with a camera Lucida was used. All anatomical drawings and slides are deposited in the Biology Department of Shahid Beheheshti

University Tehran, for further reference.

Observation

Leaf surface. Epidermis cellular of both surfaces are almost similar, but abaxial cells are smaller and more variable in shape and are covered with a well-developed cuticle. Stomata are often present on both surfaces, but more abundant on abaxial surface. Stomata are anomocytic and diacytic type in *Mentha mozaffarianii*, but anomocytic in *Mentha longifolia*. (Fig. 1).

Trichomes. Various kinds of hairs are present on both surfaces of the two species. In *M. mozaffarianii,* trichomes are short and abundant, they may be 1-3 celled, simple non-glandular hairs and the glandular hairs are usually short stalked with 4-8 cells head. Glandular hairs are sunken and frequently on the abaxial surface, while adaxial surface is covered only with short non-glandular hairs. In *M. longifolia*, galndular hairs are similar to *M. mozaffarianii* with 1-8 cells head but non-glandular hairs are long, curely and have more than 4 cells with narrow sharp tips. (Fig 2, a-g).

Mesophyll. Mesophyll in both species is clearly differentiated into palisade and spongy parenchyma tissue. But in *M. mozaffarianii* mesophyll of lamina has a well-developed palisade of 2-layers, and spongy mesophyll cells are in 2-4 layers, with parenchymatous bundle sheath on small veins.

Midrib. Midrib is a single collateral bundle, having a group of collenchyma on the upper and lower side of vascular bundle in both species. (Fig. 3, B, D)

Stem. The stem in a transverse seciton is quadrangular similar to the other *Mentha* species. Epidermis covered of hairs the same as leaf surface in both species, there is a continuous ring of 2-3 layers of collenchyma below the epidermis, particularly distinct in the corner of *M. longifolia*. Pericyclic fiber occurs more or less in strands which are more developed opposite the angles in *M. longifolia* (Fig. 4, C-D). Vascularization of *M. longifolia* is diffrent from *M. mozaffarianii*, and there are four distinct vascular bundles around the homogenous pith, while it is a continuous cylinder of xylem and phloem in *M. mozaffarinii* with scattered pericyclic fiber. (Fig 4, A- B).

Discussion

Present study of *M. mozaffarianii* and *M.*

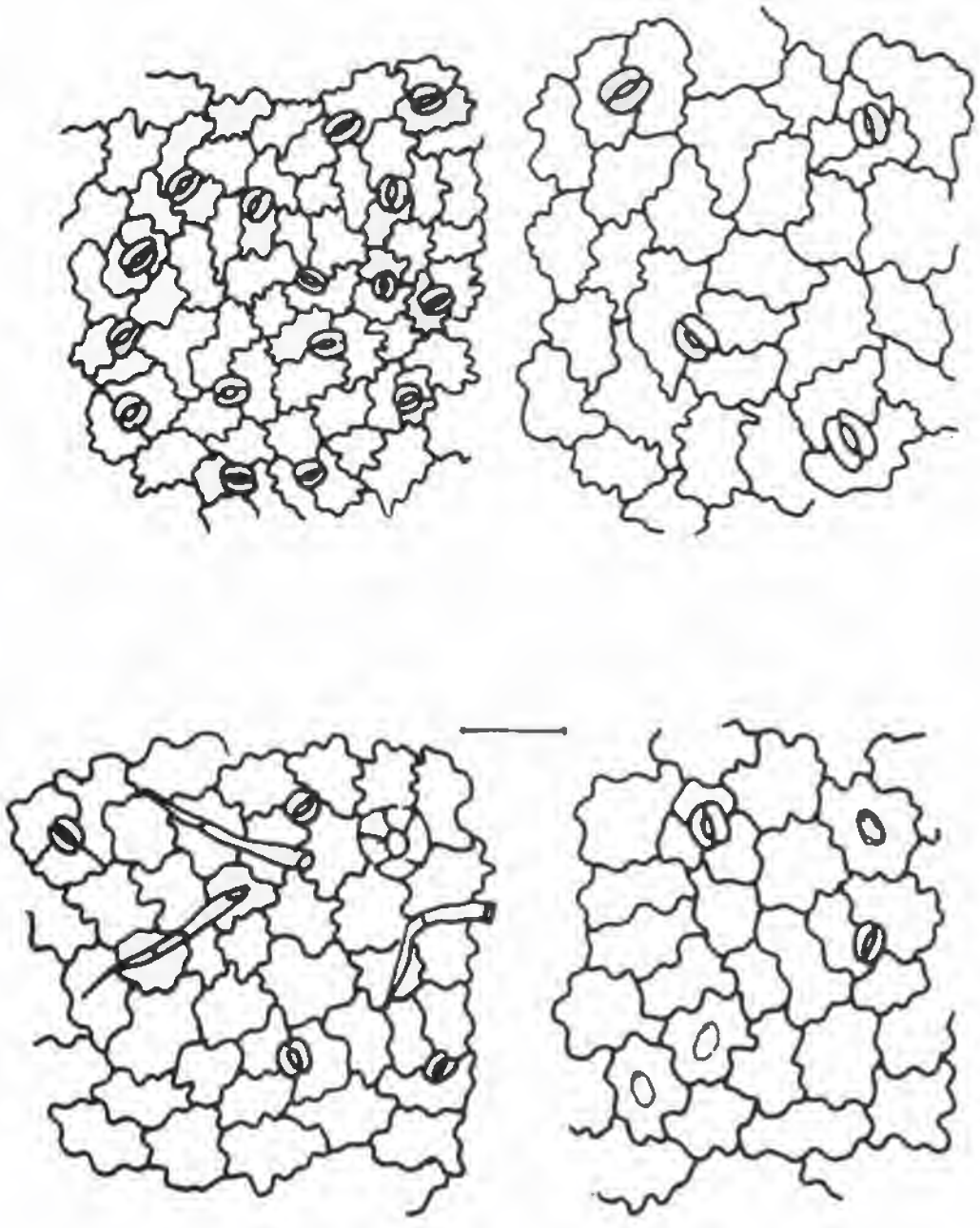

Fig. 1. Epidermis in *Mentha mozaffarianii* (upper) and *M. longifolia* (lower). -right: adaxial; left: abaxial (bar= 20 μm).

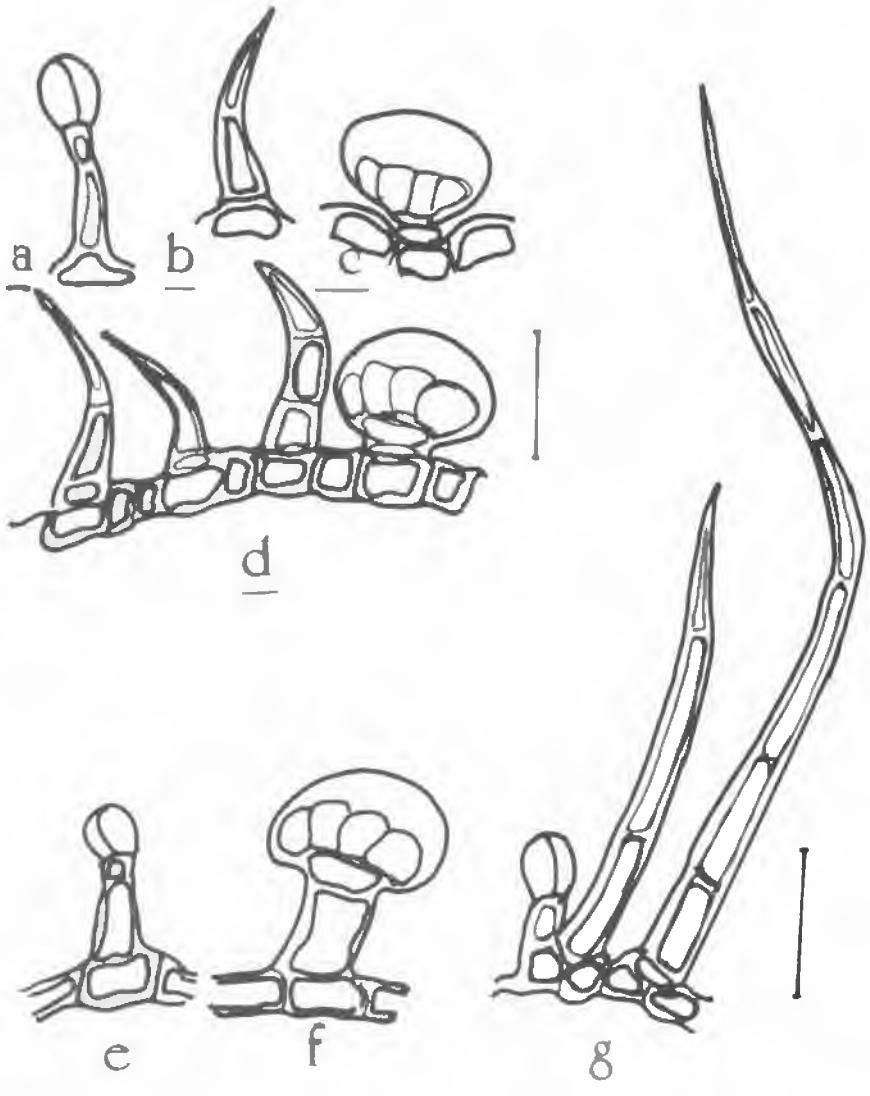

Fig. 2. Types of trichomes of *Mentha mozaffarianii* (a-d, bar=100 μm) and *M. longifolia* (e-g, bar= 20 μm).

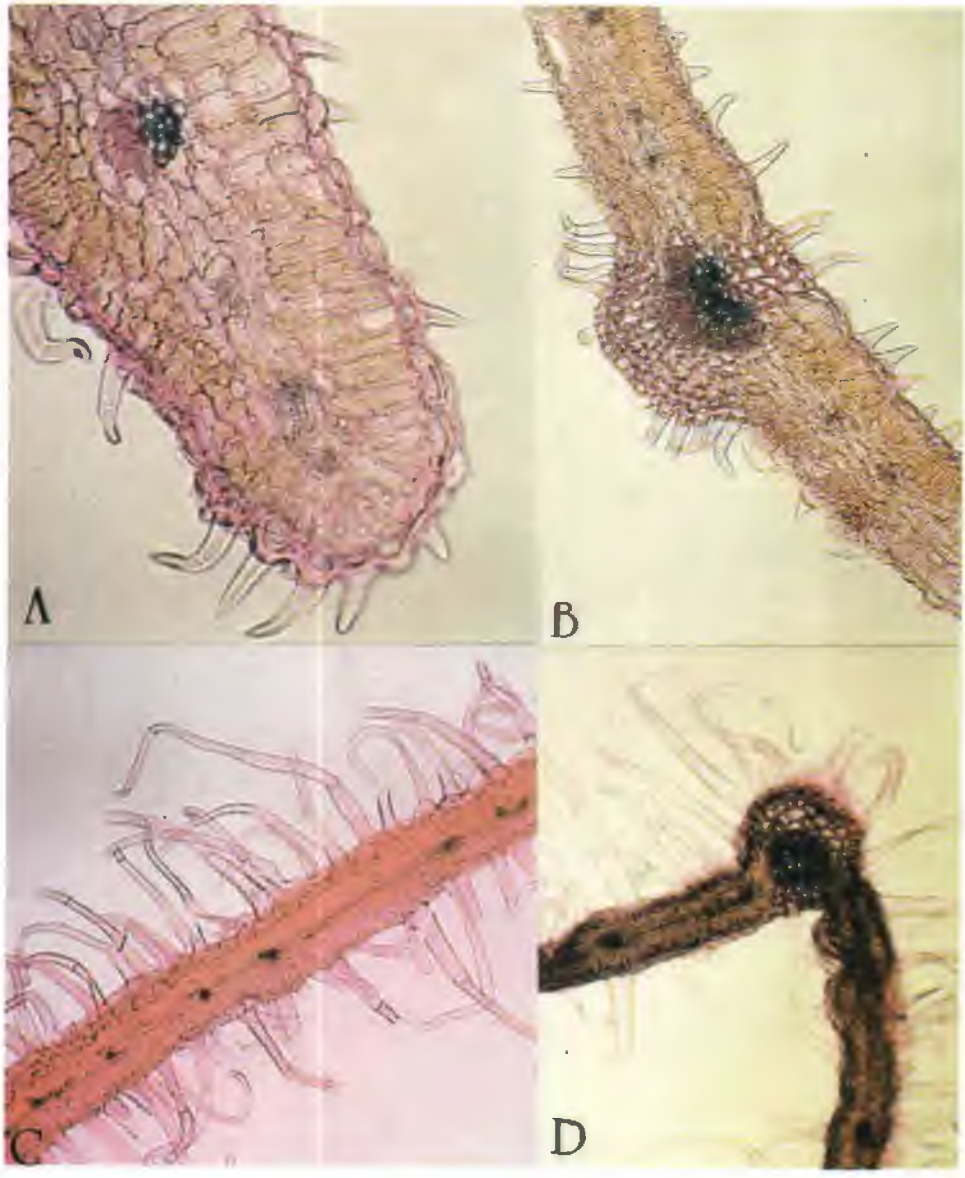

Fig. 3. Leaf t. s. of *Mentha mozaffarianii* (A-B) and *M. longifolia* (C-D). -A. Part of leaf showing bundle sheath around small vein (x 320). -B. Midrib with collenchyma on the upper and lower sides of vascular bundle (x 200). -C. Trichomes on both sides of lamina (x 100). -D. Midrib and mesophyll (x 100).

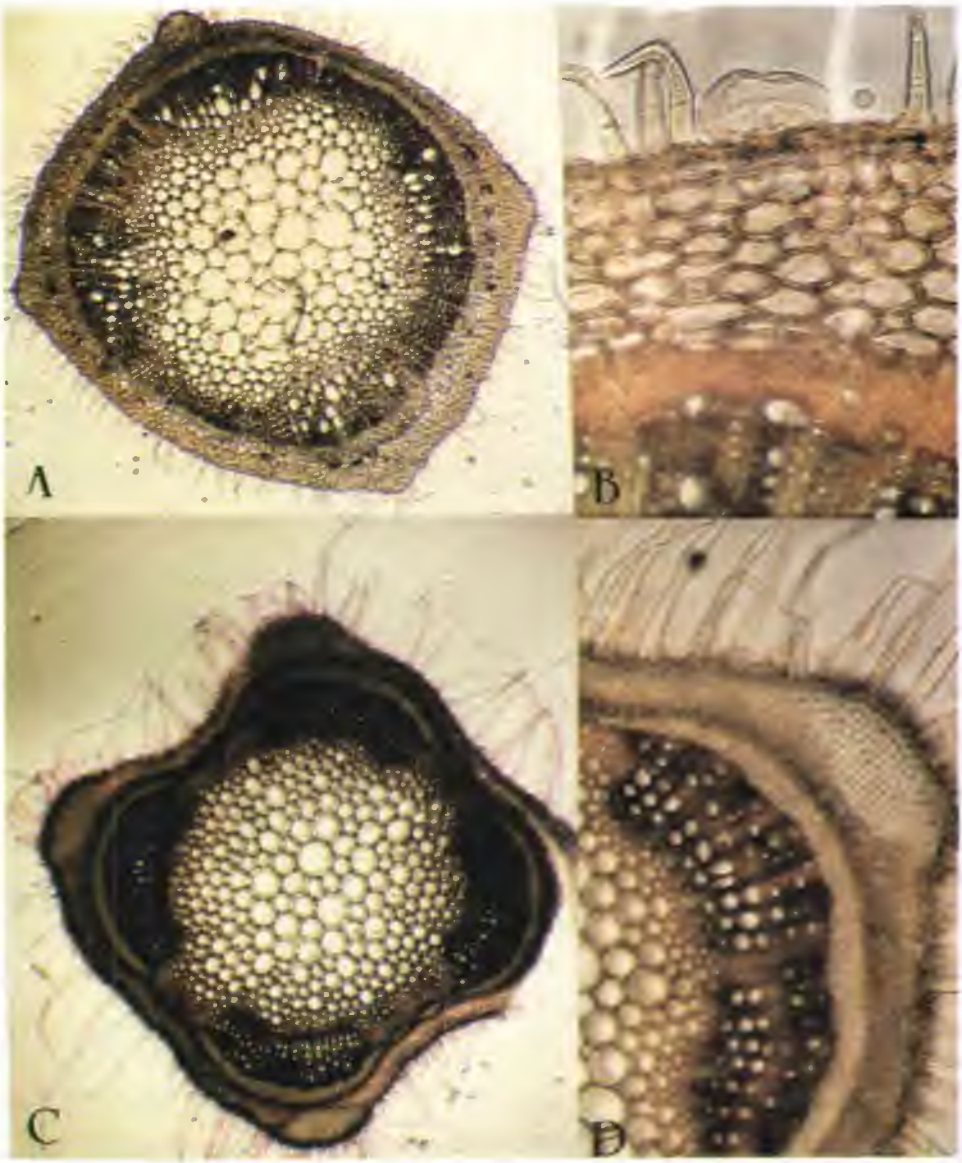

Fig. 4. A-B, *Mentha mozaffarianii*. -A, t. s. of quadrangular stem (x 40). -B. Thick cuticle with glandular and non-glandular hairs (x 320). -C-D. *Mentha longifolia*. -C. t. s. of quadrangular stem coverd with long hairs (x 40). -D. Collenchyma in the corner and subepidermal collenchyma in 2-3 layers (x 320).

longifolia showed that the two species have many characteistic features in the family *Labiatae* as described by Metcalfe & Chalk(1950).

Anatomically, *M. mozaffarianii* has several notable features which distinguish it from the related species *M. longifolia*, and shwoed several xeromorphic characters. These characters include the type of trichomes, the presence of parenchymatous bundle sheath on small veins and mesophyll of lamina with well-developed palisade in 2-layers (Fig 3, A- B). In both species there are also well-developed patch of collenchyma on the upper and lower side of the midrib.

The differences between the leaf anatomy of *M. mozaffarianii* and *M. longifolia* are striking in view of variation in vegetative morphology. *M. mozaffarianii* possess a number of xeromorphic feature such as samll leaves with dense trichomes. The reduction of the external surface is often accompanied by certain changes in the internal structure as emphasized on some North African species of *Salvia* (Bokhari & Hedge 1977) and Brazilian species of *Eriope* and *Hyptis* (Rudall 1979, 1986).

Stomata of two kinds present anomocytic and diacytic in *M. mozaffarianii*, and only anomocytic stomata in *M. longifolia*, as recorded in other genera of *Labiatae* by Inamdar & Bhatt (1972).

Another striking feature which distinguishes *M. mozaffarianii* from *M. longifolia* is the type of trichomes. Glandular hairs short-stalked, sometimes very large, nonglandular hairs unbranched 1-2 cells long present in *M. mozaffarinii.* While large multicellular hairs with up to 4 cells long present on both sides of *M. longifolia.*

Two species have also a characteristic stem anatomy. In *M. longifolia* there is an interrupted phloem around the xylem cylinder with a characteristic continuous subepidermis ring of collenchyma while in *M. mozaffarianii* phloem and xylem form a continuous cylinder around the homogynous pith, with scattered precyclic fiber aorund the phloem.

Acknowledgments

I would like to thank Mrs. Z. Jamzad for suggesting the investigation of this anatomical study. I am grateful to Mr. B. Zehzad (Herbarium of Shahid Beheshti University) for access to his collection of

herbarium material and for supplying fresh material as well, and also to N. Keshavarz, A. Sonboli and J. Kasaian for their technical assistace.

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