VERSITA

Biologia **66**/3: 439—447, 2011
Section Botany
DOI: 10.2478/s11756-011-0036-z

Morphological, anatomical and cytological investigation on endemic *Lamium moschatum* var. *rhodium*

Pelin Baran & Canan Özdemir

Celal Bayar University, Faculty of Art and Science, Department of Biology, Manisa, Turkey; e-mail: pelinbaran@gmail.com, cozdemir13@gmail.com

Abstract: In this study, the morphological and anatomical features of endemic *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill (Lamiaceae) are described in detail. *Lamium moschatum* var. *rhodium* has an annual taproot. The stem is erect and clearly quadrangular. The leaves are broadly ovate to cordate-ovate or nearly suborbicular in shape. Inflorescense is verticillate cyme. The corolla is white and the tube is curved and bears an annulus inside, near the base. Cross-sections of the root, stem, petiole, leaf, calyx, corolla and generative organs were examined and the anatomical features of the taxon are discussed. Furthermore, glandular hairs distributed on the plant taxon are shown. In karyological research, chromosome numbers were determined as $2n = 18$. The results are presented with photographs and tables.

Key words: *Lamium moschatum* var. *rhodium*; anatomy; cytology; Lamiaceae; morphology

Introduction

The type genus of Lamiaceae is *Lamium* L. (Harley 2003) which comprises about 40 species of herbaceous annuals and perennials occurs from North Africa to Eurasia (Mennema 1989; Malberley 1997). The distribution area of the genus reaches from Western Europe to Eastern Asia, including Northern Africa, North of the Atlas Mountains and Macaronesia (Açores, Madeira and the Canary Islands), approximately between 65 and 30° Northern latitude. It is not quite clear whether the occurrence of the genus *Lamium* in Macaronesia is natural or due to introduction by man. Outside the natural area a small number of taxa was introduced and sometimes naturalized in Greenland and Iceland, in the Americas, Australia and Tropical and South Africa. The centre of diversity of the genus is obviously found in the Irano-Turanian and the Mediterranean regions (Mennema 1989). About 30 *Lamium* species naturally exist in Turkey and approximately 23 taxa including varieties and subspecies are endemic. *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill, the investigated taxon, is one of the endemic species in Turkey (Mill 1982; Davis et al. 1988; Güner et al. 2000).

Some *Lamium* species have been used in the official and folk medicines as blood tonic, uterotonic, anti-inflammatory, astringent, antispasmodic, mucolytic, antioxidant, antiseptic, anti-proliferative agents and are considered useful remedies in menorrhagia and intermenstrual bleeding, uterine hemorrhage, vaginal and cervical inflammation, prostatitis and in the treatment of scrofula, trauma, fracture, hypertension, leukorrhea, putrescence, injuries from falls, paralysis, chronic bronchitis or pharyngitis and for the regulation of sebaceous secretions in Anatolia, some parts of Europe and China (Bremness 1995; Baytop 1999; Cui al. 2003). For this reason, many studies were conducted on the phytochemical constituents of *Lamium* species and their biological activities (Savchenko et al. 2001; Flamini et al. 2005; Alipieva et al. 2007; Ersöz et al. 2007; Paduch et al. 2007). In addition, they are traditionally consumed as food in some countries (Bremness 1995; Baytop 1999; Cui et al. 2003). On the other hand, although *Lamium* spp. are self-pollinated and self-compatible, they are frequently visited by honeybees and bumblebee queens and serve as ecologically important hosts for a number of other insect species (Savchenko et al. 2001; Macior 1978; Sönmez & Altan 1992; Sıralı & Deveci 2002; Sabuncu et al. 2002; Eltz 2006). In addition, some *Lamium* species have been deemed ornamental and well suited to a variety of growing conditions (Rudy 2004).

A taxonomical revision of the genus *Lamium*, mainly based on the study of herbarium collections, was made by Mennema in 1989. Few studies on chromosome numbers and systematic implications of pollen morphology of some *Lamium* species are also available (Gill 1983; Abu-Asab & Cantino 1994). There is no morphological and anatomical study resembling this work belonging to *Lamium* species in the literature, except the study recently done on *L. lycium* (Baran & Özdemir 2009).

Material and methods

Plant samples were collected from natural populations and were used subsequently for morphological and anatomical

Table 1.Morphological values of *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill.

N*= 15	Min. – Max. (cm)	Mean ± S.D* (cm)		Min. – Max. (cm)	Mean ± S.D* (cm)
Root					
Root length	03.50–22.00	11.12 ± 05.36	Upper lip length	00.50–01.10	00.84 ± 00.18
Stem			Lower lip length	00.60–01.20	00.86 ± 00.21
Stem length	15.00–76.00	34.42 ± 22.20	Lobe of lower lip	00.30–00.55	00.44 ± 00.07
Leaf			Upper Filament	00.55–00.70	00.60 ± 00.05
Leaf length	00.55–06.30	02.47 ± 01.44	Lower Filament	00.80–01.00	00.86 ± 00.06
Leaf width	00.70–05.20	02.17 ± 01.25	Anther length	00.10–00.20	00.16 ± 00.04
Petiole			Pistil length	01.25–01.75	01.49 ± 00.17
Petiole length	00.40–07.00	03.16 ± 02.03	Bract		
Calyx			Bract length	00.90–06.80	02.88 ± 01.81
Calyx length	00.80–01.40	01.14 ± 00.21	Bract width	00.80–05.20	02.71 ± 01.49
Teeth length	00.40–00.95	00.68 ± 00.17	Bract stick	00.15–01.50	00.57 ± 00.43
Tube length	00.30–00.50	00.41 ± 00.08	Bracteole	00.15–00.80	00.34 ± 00.16
Corolla			Seed		
Corolla length	01.10–02.00	01.48 ± 00.31	Seed length	00.23–00.27	00.25 ± 00.01
Tube length	00.45–00.90	00.72 ± 00.15	Seed width	00.16–00.25	00.19 ± 00.02

* S.D. – standard deviation; N – Sample number

studies, or dried as herbarium specimens. Morphological measurements were made on 30 samples and the number of the anatomical values determined for each parameter was 15. Herbarium specimens were kept in Celal Bayar University Herbarium. The samples were collected from the following location:

C 2 Denizli: Pamukkale, ruins of Theatres of Hierapolis, 500 m a.s.l., 25.V.2008 *Baran* 105.

The taxonomical description of the species followed Mill (1982). Anatomical studies were carried out on samples kept in 70% alcohol prior to embedding. The paraffin method (Algan 1981) using rotary microtome was applied in addition to handle-blade sections taken for preparing the cross-sections of root, stem, petiole, leaf, calyx, corolla and generative organs. Sartur reactive (Baytop 1981), Safranin and Fast green were used for dying.

Cytological study was carried out according to the following steps. Seeds were germinated in sterilized Petri dishes. Then root tips were pretreated with saturated solution of α-mono-bromonaphtalene (16 h) and fixed in a mixture of ethanol and acetic acid for 24 h. Root tips were hydrolyzed with 1 N HCl for 12 min at 60 °C in an oven, then stained with Feulgen reagent for 1 h in darkness and finally squashed in 45% acetic acid. Squash techniques followed Elçi (1982). Cytological analysis was made on an Olympus BX50 research microscope and photographs were taken on Leica DW 3000 with a Leica DFC 295 camera.

Results

Morphological properties

The taproot was annual. The stem was clearly quadrangular and erect. The indumentum of stem was nearly glabrous and sparsely glandular between the base and the inflorescence, while it varied from glandular or pubescent to pilose within the inflorescence. The leaves were simple and broadly ovate to cordate-ovate or suborbicular in shape. The leaf edges were crenate to double crenate. The leaf apex was obtuse. The leaf base was cordate to truncate and the venation was reticulate-pinnate. The indumentum of the leaf ranged from glandular-pilose, sometimes pubescent to pilose and very rarely villous. The petiole was glandular and pilose. The bracts were ovate-triangular to broadly ovate, sometimes without but usually with a white or pinkish blotch. The number of verticillasters on each stem branch was 1–8 or 10 and the number of flowers in each verticillastrum was variable counting 2–6, 8 or 10. Verticillasters were arranged with gradually shortening distances towards the apex.

The calyx had 5 nearly equal teeth, which were glandular and ciliate. The bilabiate corolla was white in colour and glandular. The tube was curved and bore an annulus inside, near the base. The indumentum of the tube was glabrous or pubescent and puberulent. The upper lip bore long pilose hairs at the top and was sometimes villous in places. The stigma was bifid. The stamens were didynamus and the anther thecae were divaricate and hairy. The nutlets were obovoid to shield-shaped and olive brown in colour (Figs 1 A–J, Table 1).

Anatomical properties

Root: Peridermis was 5–11 layered at the outermost of the cross-section. Parenchymatous cortex under peridermis was 5–8 layered with large and oval or rectangular shaped cells in root. Endodermis was indistinguishable. Phloem region was small. Sclerenchymatic groups were absent in the cortex. Cambium was distinguishable. Vessels were enlarged and homogenously placed from the inner to the outer part. Xylem rays were 1–2 layered and heterogeneous. The centre of the root was filled with xylem elements (Fig. 2 A; Table II).

Stem: Stem was clearly quadrangular in the cross-section. The single layered epidermis was formed by squarish, oval or rectangular shaped cells. 2–8 layered angular collenchyma was present only at the corners of the stem. Cortex formed by parenchymatous and oval or roundish cells was 4–6 layered. Subepidermal cortex cells were smaller than those near vascular bundles. Phloem was located in a small part upon the xylem.

Fig. 1. General appearance of *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill. A,B – In habitat; C – Herbarium; D,F – Inflorescence; H – Fruits; I,J – Seeds (a, uppermost bract; b, lowermost bract; c, upper lip; d, lower lip; e, lobe of lower lip; f, flower bud; g, indumentum; h, leaf).

1–2 layered cambium was visible between phloem and xylem in large vascular bundles. Tracheae were very orderly arranged in the large xylem. Vascular bundles at the corners were larger than those along the edges. A large pith region, consisting of parenchymatous and roundish cells with intercellular spaces, was present (Fig. 2 B, Table 2).

Petiole: The outermost epidermal layer was formed by cells which were mostly squarish, oval or nearly rectangular. The epidermis was covered with glandular hairs. Parenchyma with circular cells and intercellular spaces was 4–7 layered under epidermis. 1–4 layered chlorenchyma was present under epidermis. 1 layered discontinuous plaque collenchyma was present at the corners of the cross-section. There were two large collateral vascular bundles in the centre and also one

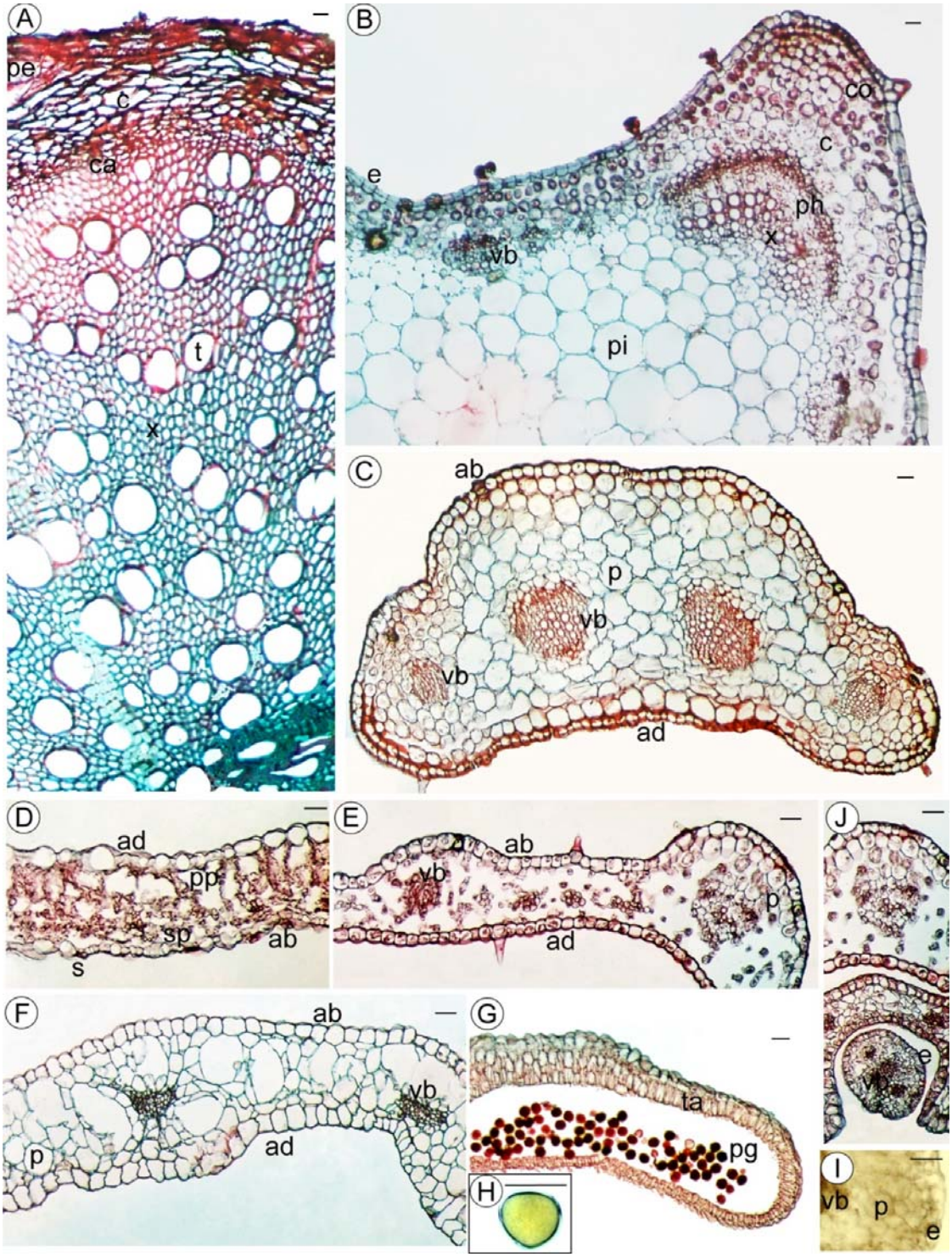

Fig. 2. Cross-sections of *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill organs. A – Root; B – Stem; C – Petiole; D – Leaf; E – Calyx; F – Corolla; G – Anther; H – Pollen; I – Filament; J – Pistil (e, epidermis; pe, periderm; co, collenchyma; c, cortex; ph, phloem; ca, cambium; x, xylem; t, trachea; ab, abaxial epidermis; ad, adaxial epidermis; vb, vascular bundle; p, parenchyma; pg, pollen grains; pp, palisade parenchyma; sp, spongy parenchyma; s, stoma; ta, tapetum; pi, pith; (scale bars = 34 μm).

smaller bundle was present at each end of the cross-section (Fig. 2 C, Table 2).

Leaf: Epidermis formed by oval, squarish or nearly circular cells was single layered on the adaxial and abaxial surface. Stoma cells were clearly visible both in the abaxial epidermis and the adaxial. The adaxial epidermis of the leaf was thicker than the abaxial one. Leaf was bifacial, consisting of palisade and spongy parenchyma. Palisade parenchyma was 1 or 3 layered with vertically elongated and parallely ordered cells. 2–3 layered spongy parenchyma consisted of smaller and variously shaped cells with large intercellular spaces, especially under the stoma guard cells. Adaxial and abaxial mesophyll cells adjacent to the median ribs were round in shape (Fig. 2 D, Table 2).

Calyx: Adaxial and abaxial epidermis cells were squar-

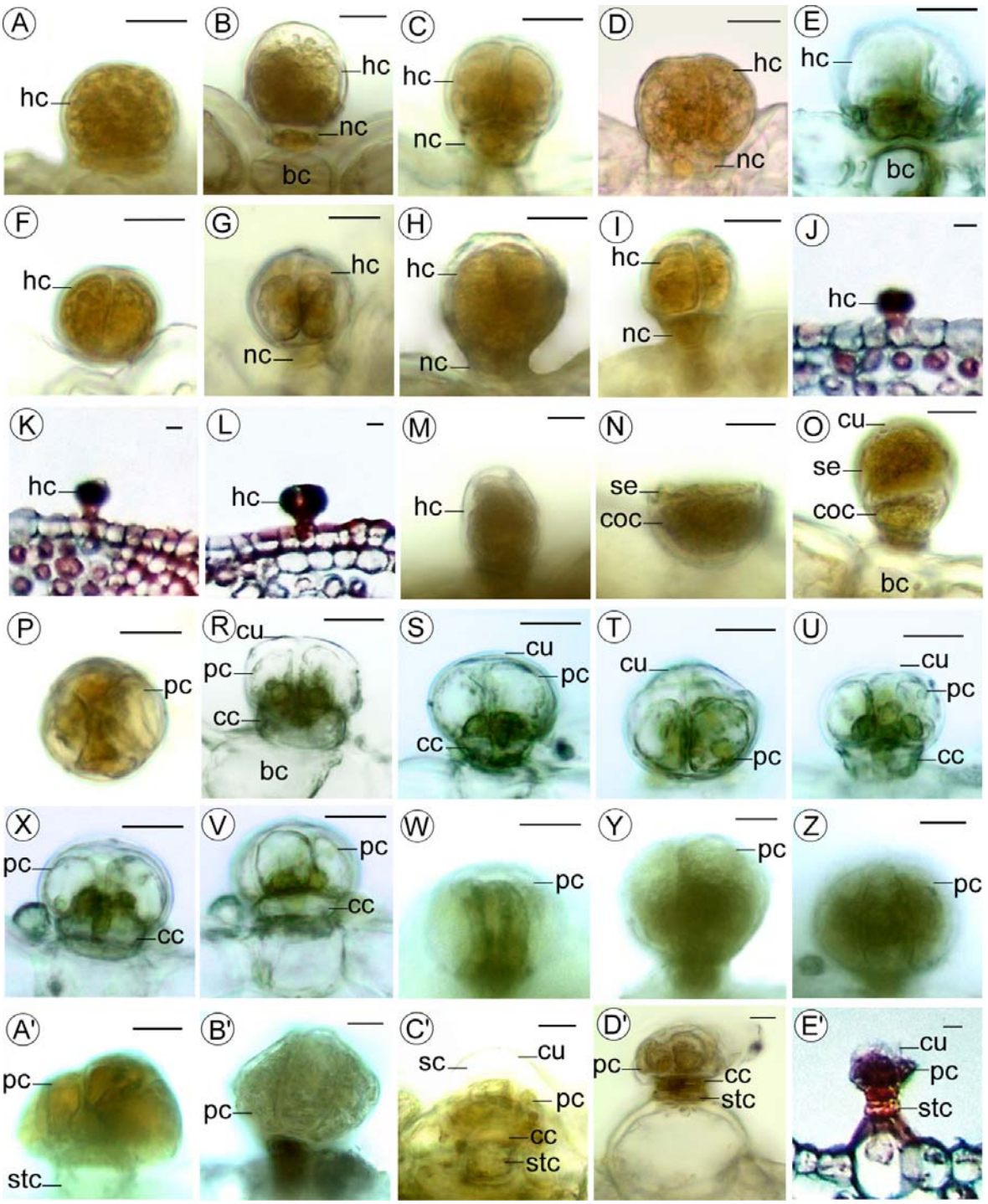

Fig. 3. Glandular hairs on *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill. A-O – Capitate glandular hairs; P-Z, A'-E' – Peltate glandular hairs; K,L,W,Y,Z,A',E' – Stem; E,B' – Petiole; U,R,S,T,X,V – Leaf; G,D' – Bract; A-C,F,I,M,N,O,P,C' – Calyx (hc, head cell; cu, cuticle; se, secretory material; coc, collapsed cell; nc, neck cell; stc, stalk cell; bc, base cell; pc, periphery cell; cc, central cell; scale bars: 10 μm).

ish or rectangular in shape in the cross-section. The outer surface of epidermis cells was smooth-walled and without papilla. Abaxial epidermis was thicker than the adaxial. Parenchyma was 3–8 layered and had very large intercellular spaces. Parenchymatous cells were usually roundish or oval in shape. Vascular bundles were arranged regularly in the cross-section. Parenchyma bore chloroplasts (Fig. 2 E, Table 2).

Corolla: The outer surfaces of epidermis cells were smooth-walled and covered by a thin cuticle. Adaxial and abaxial epidermis cells were nearly rectangular in shape. Parenchyma was 3–6 layered. Very large and clear intercellular spaces were located near vascular bundles. Parenchymatous cells varied in shape, being polygonal, roundish, rectangular or triangular (Fig. 2 F, Table 2).

Generative organs: The cross-section of the pistil was nearly orbicular in shape at the median level and cov-

Table 2. Anatomical values of *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill.

	Width (µm)		Length (µm)	
N*= 15	Min. – Max.	Mean ± S.D.*	Min. -Max.	Mean ±S.D.*
Root				
Peridermis cell	15.90 – 90.00	57.64 ± 27.14	15.90 – 58.20	34.42 ± 14.58
Parenchyma cell	15.90 – 52.90	37.66 ± 12.02	10.60 – 26.50	15.63 ± 5.65
Vessel	21.20 – 95.30	66.71 ± 27.62		
Stem				
Epidermis cell	10.60 – 42.40	23.62 ± 12.40	13.20 – 31.80	21.66 ± 7.30
Parenchyma cell	15.90 – 74.10	44.47 ± 22.37	13.20 – 52.90	33.10 ± 13.22
Collenchyma cell	14.50 – 40.80	26.28 ± 9.67	16.20 – 42.50	26.80 ± 9.11
Trachea cell	10.60 – 42.40	24.32 ± 10.04		
Pith cell	21.20 – 158.80	89.40 ± 42.90		
Petiole				
Adaxial Epidermis cell	7.90 – 47.60	23.83 ± 12.98	10.60 – 34.40	22.38 ± 9.12
Abaxial Epidermis cell	10.60 – 37.10	25.94 ± 9.26	7.90 – 39.70	24.31 ± 10.12
Parenchyma	26.50 – 121.80	75.18 ± 28.10		
Vessel	10.60 – 26.50	19.15 ± 6.14		
Leaf				
Adaxial cuticle	6.40 – 10.60	8.58 ± 1.74		
Abaxial cuticle	2.70 – 13.20	7.69 ± 4.38		
Adaxial epidermis cell	21.20 – 79.40	52.87 ± 20.37	15.90 – 55.60	37.08 ± 12.28
Abaxial epidermis cell	13.20 – 79.40	36.52 ± 22.97	10.60 – 79.40	24.62 ± 10.88
Spongy cell	18.50 – 52.90	35.15 ± 12.13		
Palisade cell	21.20 – 42.40	30.31 ± 7.74	45.00 – 71.50	60.28 ± 9.24
Vessel	5.30 – 26.50	15.88 ± 7.71		
Calyx				
Adaxial epidermis cell	18.50 – 42.40	30.32 ± 6.91	10.60 – 31.80	21.45 ± 6.78
Abaxial epidermis cell	10.60 – 47.60	27.29 ± 12.67	13.20 – 52.90	25.82 ± 11.12
Parenchyma	26.50 – 37.10	31.80 ± 5.30		
Vessel	7.90 – 15.90	12.58 ± 3.10		
Corolla				
Adaxial cuticle	10.60 – 18.50	14.55 ± 2.77		
Abaxial cuticle	7.90 – 13.20	10.58 ± 1.87		
Adaxial epidermis cell	10.60 – 42.40	26.05 ± 8.60	10.60 – 47.60	24.62 ± 9.00
Abaxial epidermis cell	21.20 – 52.90	32.39 ± 8.02	15.90 – 52.90	40.71 ± 9.73
Parenchyma	13.20 – 58.20	27.00 ± 11.50	10.60 – 26.50	19.95 ± 4.59
Vessel	5.30 – 18.50	11.80 ± 3.99		

* S.D. – standard deviation; N* – sample number

ered by an epidermis. The pistil bore one central and two small lateral vascular bundles and was filled with parenchyma with roundish cells. The filament was orbicular in shape at the median level and covered by an epidermis. One vascular bundle was located in the middle and covered by parenchyma in the cross-section. Each anther bore two thecae with two pollen sacs. Pollen sacs were filled with a number of pollen grains. The tapetum covered the pollen grains (Fig. 2 G-J).

Trichome properties

Glandular and non-glandular hairs were distributed on the stem, leaf, petiole, bracts, calyx and corolla. Non-glandular hairs were uniseriate and 1- or multi-celled. Glandular hairs were of two types: capitate and peltate hairs. Three different types of capitate glandular hairs, type I, II, III, were detected. The capitate glandular hairs had a 1-2- or 4-celled head and a 1-2-celled stalk or no stalk. Peltate glandular hairs had a large head consisting of 4,6 or 8 cells and a 1- or 2-celled centre and sometimes an additional unicellular stalk. Capitate and peltate glandular hairs were especially abundant on leaf, bract, calyx and corolla (Figs 3 A–Z, A'–E').

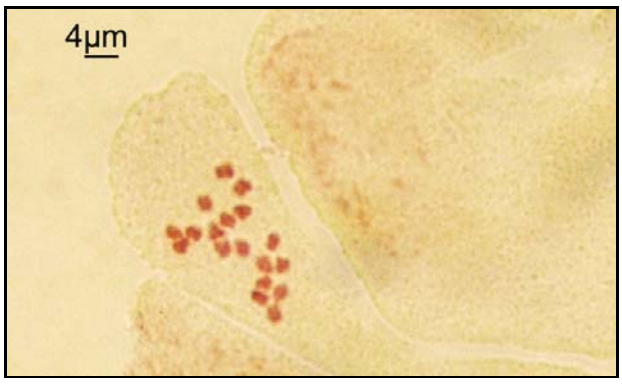

Fig. 4. Chromosomes of *Lamium moschatum* Miller var. *rhodium* (Gand.) R. Mill.

Cytological properties

Somatic chromosome number of *Lamium moschatum* var. *rhodium* was counted as 2n = 18. The chromosome pairs were observed as short-cylindrical (Fig. 4).

Discussion

A detailed morphological and anatomical description of *Lamium moschatum* var. *rhodium*, a species endemic to Turkey, was provided. Our morphological findings were generally consistent with the description of the taxon given in the Flora of Turkey (Mill 1982) and the study of Mennema (1989), with some exceptions in the numerical data. Mill (1982) reported the stem length as 8.5–65 cm, the petiole length as 0.8–7.5 cm, the leaf dimensions as 1.2–5.0 × 1.0–3.5 cm, the teeth of leaf per edge as (5–) 7–9 (–12), bracteoles as (0.2–) 0.25–0.45 (–0.6) cm, the calyx length that is distinguishing for the investigated variety as 0.8–1.2 (–1.3) cm, and the calyx teeth as 0.5–0.8 (–0.9) cm, the corolla as (1.4–) 1.5–2.3 cm, the corolla tube as 0.6–1.1 (–1.4) cm, the lobe of upper lip as 0.5–1.0 (–1.2) cm, the seed dimensions as (0.20–) 0.23–0.30 × 0.14–0.20 (–0.22) cm while we have determined them as 10–76 cm, 0.40–0.70 cm, 0.55–6.30 × 0.70–5.20 cm, 5–10 (11–12), 0.15–0.80 cm, 0.8–1.4 cm, 0.40–0.95 cm, 1.1–2.0 cm, 0.45–0.90 cm, 0.5–1.1 cm, 0.23–0.27 × 0.16–0.25 cm, respectively. These findings showed that the intervals between the upper and the lower limits of the measureable values of the plant parts mentioned above are larger than previously reported. The difference in the number of the collected plant samples in "Flora of Turkey" and also the changes in the climatic conditions through the years may be responsible for these discrepancies in our numerical data. According to the diagnosis key, the investigated taxon is discriminated from the other taxon of the species, var. *moschatum,* by its seeds' whitish spots and its shorter calyces. Our examinations on a large number of seeds showed that the amount of whitish spots on the seeds has great variation. Whitish spots on some seeds of the plant samples are obviously visible even by naked eye, while on others they are hardly visible even by stereo microscope. The woody rhizomes are lacking in the annual taxa of the genus *Lamium* (Mennema 1989). *L. moschatum* var. *rhodium*, an annual taxon, has shown the same characteristic in contrast to *L. lycium*, which is an endemic perennial in Turkey (Baran & Özdemir 2009).

The anatomical analysis given in this work provides the first detailed description of *L. moschatum* var. *rhodium* and is comparable with those of Metcalfe & Chalk (1972) and some other investigated Lamiaceae members, including a few *Lamium* species, with reference to root, stem, petiole anatomy and glandular hairs (Park & Kim 1995; Özdemir & Şenel 1999, 2001; Kaya & Başer 2002; Uysal 2002; Baran & Özdemir 2006; Özdemir et al. 2008; Baran et al. 2008a,b; Dinç & Öztürk 2008; Aktaş et al. 2009; Özdemir et al. 2009; Baran & Özdemir 2009; Baran et al. 2010). According to Metcalfe & Chalk (1972), pith rays of Lamiaceae family are 2–12 or more rowed and quite heterogeneous in structure. Analysis of the root cross-section of *L. moschatum* var. *rhodium* showed that the pith rays were 1 or 2 rowed and heterogeneous. It is reported that the root centre is filled with primary xylem in some Lamiaceae members (Özdemir & Şenel 1999; Uysal 2002; Baran & Özdemir 2006; Özdemir et al. 2008, 2009) in contrast to some others (Özdemir & Şenel 2001; Aktaş et al. 2009). The root centre of *L. moschatum* var. *rhodium* is filled with xylem elements while the old root of *L. lycium* has parenchymatous cells in the centre in contrast to the young root that is filled with primary xylem in it (Baran & Özdemir 2009). On the other hand, it can be clearly seen that the vessels in the root of *L. moschatum* var. *rhodium* are more frequent throughout the cross-section and larger in diameter than those of *L. lycium* root (Baran & Özdemir 2009).

The characteristic features of Lamiaceae family are a quadrangular stem, a well-developed collenchyma-type supporting tissue at the corners of the stem and a developed sclerenchymatic tissue surrounding the vascular tissue (Metcalfe & Chalk 1972). A well-developed angular collenchyma at the corners of the cross-sections of the quadrangular stem and 1-layered plaque collenchyma at the cross-sections of the petiole were clearly distinguishable in *L. moschatum* var. *rhodium,* while *L. lycium* has plaque collenchyma in the stem and petiole (Baran & Özdemir 2009). However, the sclerenchyma of phloem was hardly seen in the cross-sections of either the stem or the root of *L. moschatum* var. *rhodium,* similarly to *L.* lycium (Baran & Özdemir 2009). Endodermis in the root was indistinguishable in contrast to *L.* lycium (Baran & Özdemir 2009) and *Sideritis galatica* Bornm. (Kaya & Başer 2002). The vascular cambium was distinguishable as reported in *L. lycium* (Baran & Özdemir 2009), the herbaceous stems of *Stachys yildirimli* M. Dinç (Dinç & Öztürk 2008), and the stems of some *Salvia* species (Özdemir & Şenel 2001; Baran et al. 2008a), unlike the stems of *Sideritis galatica* (Kaya & Başer 2002) and some other *Salvia* species (Özdemir & Şenel 1999; Baran & Özdemir 2006; Özdemir et al. 2008). *L. moschatum* var. *rhodium* has a large pith of parenchymatous cells in the stem centre (Fig 2 B) as in *L. lycium* (Baran & Özdemir 2009).

The structure of vascular bundles in the cross-section of the petiole in Lamiaceae species may be important for taxonomy (Metcalfe & Chalk 1972). The analysis of the petiole cross-section, as illustrated in Fig. 2 C, showed that 2 collateral vascular bundles were present in the centre and 1 bundle was present at each end of the cross-section. Similarly, 2 or 3 central vascular bundles were reported for the petiole of *L. lycium* (Baran & Özdemir 2009). Identical results were reported for the petioles of the perennial *L. album* f. *album* and *L. album* f. *barbatum*, while 3 central vascular bundles were reported for the perennial *L. takesimense* (Park & Kim 1995). Further investigations on other *Lamium* species may illuminate whether any taxonomical implication concerning the petiole anatomy

of the genus *Lamium* is present or not. We compared the anatomical findings of the generative organs of *L. moschatum* var. *rhodium* with the studies made on *L. amplexicaule* L. (Lord 1980, 1982). We found that the results were similar as for the anatomical structure of pistil, filament and anther.

Mennema (1989) reported that glandular hairs were not observed on the leaves of the genus *Lamium*. According to the morphological description of *L. moschatum* var. *rhodium* by Mill (1982), the calyx is glandular. However, our anatomical observations discovered that in the investigated taxon glandular hairs are present on the stem, petiole, leaf, bract, bracteole, calyx and corolla alike (Figs 3 A–Z, A'–E'), as also reported for *L. lycium* (Baran & Özdemir 2009). In almost all species studied in Lamiaceae, two main types of glandular trichome, peltate and capitate, which can be distinguished by head size and stalk length occur (Abu-Asab & Cantino 1987). We distinguished both capitate and peltate hairs in *L. moschatum* var. *rhodium*. The capitate hairs corresponded to the type I capitate glandular hairs described by Werker et al. (1993), Ascensão et al. (1995), Ascensão & Pais (1998), Bisio et al. (1999) (Figs 3 A–L) and to the type II capitate glandular hairs described by Werker (1993), Serrato-Valenti et al. (1997) (Fig. 3 M) and to the type III capitate glandular hairs described by Werker et al. (1993) (Figs 3 N–O). In recent studies, these three different types of capitate glandular hairs were reported for some *Salvia* species, namely *S. viridis* L., *S. cryptantha* Montbret et Aucher ex Bentham, *S. tchihatcheffii* (Fisch. & Mey.) Boiss. *, S. argentea* L. (Baran et al. 2008b; Özdemir et al. 2008; Aktaş et al. 2009; Baran et al. 2010). The most common structure of peltate hairs of Lamiaceae is a secretory head of four central cells and 6–14 peripheral cells (Werker 1993). In addition to the peltate hairs with a four-celled head, as reported earlier for *Lamium galeobdolon* (L.) L. (Uphof & Hummel 1962), peltate hairs with raised head upon epidermis, previously described by Corsi & Bottega (1999), were also detected in *L. moschatum* var. *rhodium* (Figs 3 A'-E'). These two kinds of peltate hairs were also reported for *L. lycium* (Baran & Özdemir 2009).

Studies on the cytological properties of this genus are very limited (Gill 1983). In this study, the chromosome number of *L. moschatum* var. *rhodium* has been determined for the first time as $2n = 18$.

In conclusion, we aimed at providing a comprehensive morphological, anatomical and cytological description of *L. moschatum* var. *rhodium*, an annual herbaceous plant taxon, endemic to Turkey. As a result of this study, the morphological description of the investigated taxon has been expanded, contributing to the knowledge of the Flora of Turkey (Mill 1982). Furthermore, numerical morphological data characterizing the anther, filament, pistil, lower lip, calyx tube and calyx teeth of *L. moschatum* var. *rhodium* have been reported in this study for the first time. On the other hand, the anatomical findings presented here and the chromosome number of the taxon is the first data available for *L. moschatum* var. *rhodium* in the literature.

Acknowledgements

We would like to thank to Celal Bayar University, The Unit of Scientific Research Projects for financial support.

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Received January 29, 2010
Accepted July 14, 2010