

MORPHOLOGICAL AND ANATOMICAL CHARACTERIZATION OF *SALVIA PLEBEIA* FROM MAHARASHTRA (INDIA)

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ABSTRACT

The present paper is focused on morphological and anatomical characterization of *Salvia plebeia* collected from Chikhaldara forest ranges (MS) India. The study includes morphological description, anatomy of stem and surface features like hairs and trichomes. All the results are supported with the respective photographs, drawings and tables. The specific odor of the plant, characteristic quadrangular and hairy stem and simple as well as glandular hairs are the prominent features of the plant.

Key Words: Anatomy, Morphology, *Salvia plebeia*, trichomes.

INTRODUCTION

Lamiaceae is commonly known as mint family and most of its species are aromatic and often used as spices, folk medicines and a source of fragrance (Werker *et al.*, 1985). *Salvia*, the largest genus of the family Lamiaceae, represents an enormous and cosmopolitan assemblage of nearly 1000 species displaying a remarkable range of variation. The genus comprises 500 species in Central and South America, 250 species in Central Asia/Mediterranean and 90 species in Eastern Asia (Walker *et al.*, 2004). India is a major diversity centre for most members of Lamiaceae in Asia (Vural and Adiguzel, 1996).

Salvia species are important group of useful plants which have not lose their importance since ancient times. The genus is named "*Salvia*" derived from "*Salveo*" which means "to save or to recover" in Latin (Hamlyn, 1969). *Salvia*, commonly known as sage, has multiple uses such as condiment, food additive, seasoning, spice and herbal tea (Demirci *et al.*, 2005). The seeds of *Salvia* species often produce mucilage on wetting (Hedge, 1982). This clear mucilage that the seeds give off on wetting is used to produce pleasant drinks (Estilai *et al.*, 1990). In the Eastern countries, that mucilage is used for the treatment of eye diseases. In addition to *Salvia* species (sage) were reported to be used for memory-enhancing purposes in European folk medicine (Perry *et al.*, 2003; Orhan *et al.*, 2007). Beside *Salvia* species have medicinal value; they are

also grown in parks and gardens as ornamental plants. The appearance of the young leaves, which are very hairy, may have played a role in the folk 'perception' of the external medical properties of the species (Pieroni *et al.*, 2004). Most of *Salvia* species have not been investigated in point of morphological and anatomical characters, except a few species (Ozdemir and Senel, 1999; Ozdemir and Senel, 2001; Ceja-Romeo *et al.*, 2005; Baran and Ozdemir, 2006; Kaya *et al.*, 2007). In addition there are the papers dealing with glandular hairs and essential oil characteristics of *Salvia* species (Corsi and Bottega, 1999; Kaya *et al.*, 2003; Avato *et al.*, 2005; Krstic *et al.*, 2006). Any morphological and anatomical study has found to be very rare. Therefore, in the present study, we aimed to introduce the morphological and anatomical characters of endemic *S. plebeia* in detail.

MATERIALS AND METHODS

The plant samples were collected from natural populations. Some samples were used for morphological and anatomical studies; some were dried as herbarium specimen and stored in Department of Botany, Shri Shivaji College, Akola (MS) India. Investigated species was collected from the location: Chikhaldara: Near Devi point and surrounding the lake area. The taxonomical description of the species follows Hedge (1982) and Dhore (2000). Anatomical studies were carried out on the samples kept in alcohol 70%.

The cross-sections of root, stem, leaf, petiole, calyx and corolla were prepared according to Ozkan *et al.* (2008). The classification of glandular hairs was made according to Werker *et al.*, (1985) and Ozdemir and Senel (2001).

RESULTS

Morphological properties:

The root of the taxon is 18 - 33 cm in length and taproot in shape. There is brown and hard bark on the root. The plant has two different stem. One of them has flowers; it is named as fertile stem. Another stem has no flowers; it is named as sterile stem. Sterile stem is prostrate, leafy, fertile stem is procumbent-ascending, unbranched. Leaves are trisect or pinnatisect with two pairs of lateral segments. Terminal segments are linear oblong. Leaves are 1.4-2.5 x 0.9-2 cm in size. Petiole is 0.3-0.8 cm in length. The flowers are at the base of bracts, arranged verticillately on the plant and the verticillasters are 2-6 (-8) flowered. The calyx shape is tubular-campanulate, 0.7-1.1 x 0.3-0.5 cm in size and is colored as pale green to yellow. The upper lip of calyx is tridentated and the lower lip is bidentate and its size is 0.4-0.7 cm. The corolla is pale violet to white. The stamen type of the plant is A. Filaments are 0.2 - 0.4 cm and style is 1- 1.5 cm long. The nutlets are pale-brown and rounded to trigonus, ovoid in shape and its size 1-2.3 x 2.5-3 mm. The species is distributed at the 400-1200 m height, Satpuda slopes, Chikhaldara forest ranges. The details of morphological parameters are shown in table-1 and figure-1.

Anatomical properties

Root anatomy: The surface of root is covered, by multilayered, phellem cells, outer most cells dark crushed and sometimes exfoliated. Cambium is not distinguishable. Xylem elements are located in large region of root. The pith consists of paranchymatous ovoidal cells (Table-1).

Stem anatomy: The stem is roughly quadrangular. Epidermis is single layered, thin walled and consists of flat oval or elliptical cells. Cortex is 4-8 layered 1-2 rows of cortex cells flattened. Sclerenchyma sheets present on the phloem elements. Cambium cells are not distinguishable. The pith is large and consists of parenchymatous ovoid cells (Figure 2 and Table 1).

Leaf anatomy: There is a single layered epidermis having flat-elliptical cells on abaxial and adaxial surface of leaf. Epidermis cells are bigger and more on the abaxial surface than adaxial surface. Palisade parenchyma cells are 2-4 layered. There are 3-5 layered spongy cells. Glandular and eglandular hairs are present on both adaxial and abaxial epidermis (Figure 1 and Table 1).

Anatomical features of Petiole: Petiole is covered by cuticle and regular layered ovoidal epidermal cells. There is a single-layered collenchyma cell under the epidermis. Epidermal cells are 36-85 x 18-54 μ m in abaxial surface and 18-54 x 12-48 μ m in adaxial surface. Parenchymatic cortex is present under epidermis cells are 6-12 layered. These cells are 36 - 120 μ m in diameter and ovoidal in shape. There is large vascular bundle on median region petiole and small vascular bundles are located on the end part of petiole cross section. The large vascular bundles are surrounded by sclerenchymatic cells. Type of vascular bundle is collateral. There are a lot of glandular and eglandular hair on epidermal cells. Most of them are glandular hair (Figure 2 and Table 1).

Detailing calyx and corolla: Adaxial epidermis cells are smaller than the abaxial epidermis. Cuticle on the abaxial epidermis is thicker than the adaxial epidermis. Parenchyma consists of flat ovoidal cells. Vascular bundle is surrounded by a sclerenchymatic sheath. There are hairs on epidermis and most of them are glandular. The glandular hairs are type I capitates with head cell (Figure 1 and Table 1).

In the cross-section, cuticle is present on both the outer and inner epidermis. The abaxial and adaxial epidermis cells are nearly the same size. Parenchyma cells are different from each other in size and with intercellular space cells. There are hairs on epidermis and most of them eglandular hairs (Figure 1 and Table 1).

Hair properties: As shown in Figure 2 D & E, *S. plebeia* has the various glandular and non-glandular hairs at stem, leaf, petiol, calyx and corolla. There are the capitate hairs which has head cells. The capitate hairs vary greatly in structure, size, proportions, occurrence on plant organs and manner of secretion (Figure 2).

DISCUSSION

The information on morphological and anatomical features along with surface characteristics is rare in the literature.

Table 1: Morphological and Anatomical measurements of plant organs of *S. plebeia*.

Morphological measurements			Anatomical measurements			
Parameters	Min- (cm)	Max	Mean SD	Parameters	Width (mm)	Height (mm)
Root length	12- 30		2.00 5.00	Root vessels	15.25 - 60	
Stem length	15-50		12.00 5.50	Root pith cell	25- 80	
Leaf length	1.5 – 3.5		2.00 0.50	Stem epiderm + Cuticle	08- 24	5.6- 10.8
Calyx length	0.60- 1.10		0.50- 0.01	Stem cortex	7.5 – 20	10.5-30.6
Corolla length	0.50 – 1.30		0.20 -0.11	Stem pith cell	25.5- 65	
Pedicel length	0.30- 0.50		0.04 – 0.05	Leaf abaxial epiderm	5.5 – 12	5.25-10.5
Stamen length	1.00-1.50		0.50- 0,14	Leaf adaxial epiderm	5.00- 10.5	7.5- 12.7
Style length	1.00-1.50		0.20- 0.02	Leaf palisade cells	30.5- 45.00	18- 25.5

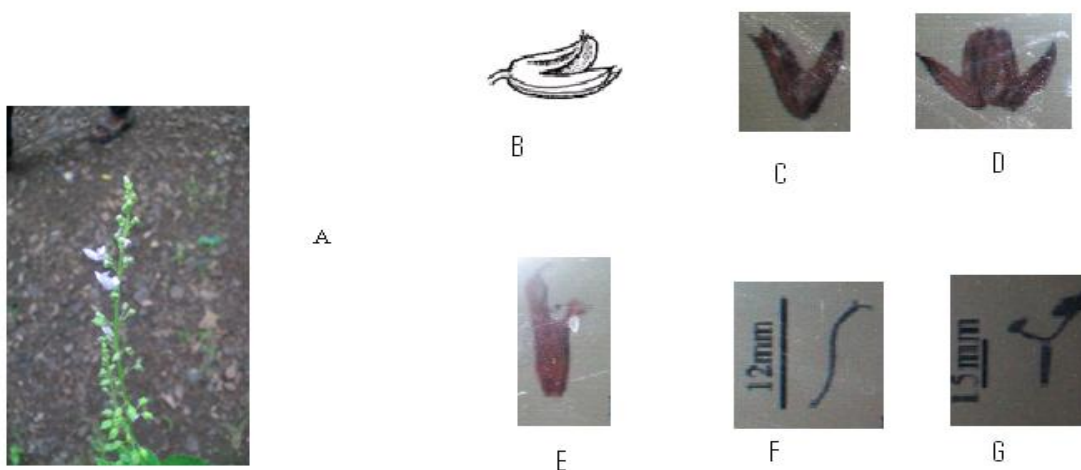


Fig: 1, General appearance of Fertile plant B- Flower C & D Calyx E - Corolla F- Pistil G- Stamen

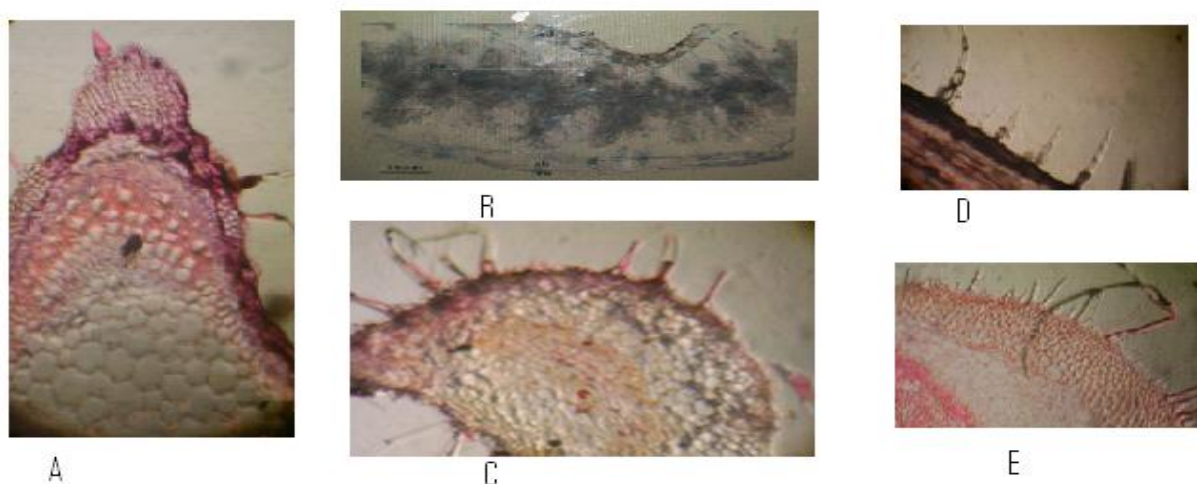


Fig: 2, A- T. S. of Stem B- T. S. of Leaf C- T. S. of Petiole D& E - Trichomes &Hairs

The presented results here are therefore compared with other similar studies on the members of family Lamiaceae. Metcalfe and Chalk (1972) demonstrated that the characteristic feature of family Lamiaceae is the quadrangular stem with well developed collenchymas and supporting tissues at the corners. On the contrary, *S. plebeia* has less developed collenchyma at the corners and the cortex is made of only parenchymatous cells. Leaf mesophylls are entirely parenchymatous while

some collenchyma traces are found around intercellular spaces. This feature is in analogy with the reports given by Metcalfe and Chalk (1972) and Walker *et al* (2004). Apart from these, this genus is found to have both glandular as well as non-glandular hairs.

ACKNOWLEDGEMENT:

The authors are grateful to UGC for financial assistance.

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