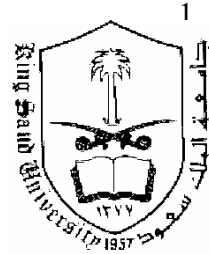


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**ANATOMICAL STUDIES ON SUBFAMILY  
STACHYOIDEAE SPECIES (LAMIACEAE)  
GROWING NATURALLY IN THE  
KINGDOM OF SAUDI ARABIA**

By

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## SUMMARY

This study deals with the epidermal and internal anatomy of the stems, leaves, floral parts and pollen grains of the following 14 species of the subfamily Stachyoideae

(Lamiaceae), *Marrubium vulgare*, *Micromeria biflora*, *Mentha microphylla*, *Nepeta deflersiana* and *N. septemecrenata*; *Otostegia fruticosa* var. *fruticosa* and *O. fruticosa* var. *schimperii*; *Salvia aegyptiaca*, *S. deserti* and *S. spinosa*; *Stachys aegyptiaca*, *S. schimperii* and *S. yemensis*; *Thymus decussatus* and *T. aff. vulgaris*.

Epidermal characters indicate that cells are polygonal isodiametric with sinuous or straight anticlinal wall; cells arranged in a parallel rows at the veins of the leaves, stems and floral parts (calyx and corolla) and stem angles. Stomata present on both epidermises of intercostal regions, leaves are amphistomatic (stomata on the lower and upper surfaces) and absent at the veins of the leaves and floral parts, stomata commonly diacytic or anomocytic, occasionally anisocytic, occur more frequently on the lower surface, number of stomata per mm<sup>2</sup> of leaf or flowers on lower surface are higher than those of the upper surface. Number of stomata range from 600 – 50/mm<sup>2</sup>.

Trichomes are numerous on both plant vegetative and floral parts. Trichomes divided to glandular and nonglandular and occur intermixed; Nonglandular trichomes consist of four forms:

1. unicellular, unbranched
2. bicellular, uniseriate, unbranched
3. multicellular, 3 – 8 uniseriate unbranched

These three types occur in all species under study except *Stachys* species.

4. multicellular, multiseriate branched (tufted) exist only in *Stachys* species: *S. aegyptiaca*, *S. schimperii*, and *S. yemensis*.

Glandular trichomes consist of 10 forms:

1. stalk unicellular with unicellular round head (capitate 1).
2. stalk unicellular with bicellular round head (capitate 3).
3. stalk bicellular with unicellular round head (capitate 2).
4. stalk bicellular with bicellular round head (capitate 3).
5. stalk multicellular, 3 – 5 with unicellular head (capitate 2).
6. stalk multicellular, 3 – 5 with bicellular head (capitate 3).
7. stalk multicellular, 3 – 5 with head multicellular 3 or 4 (capitate 3).
8. stalk multicellular, multiseriate branched with one branch having a unicellular head, occur rarely and exist only in *Stachys schimperi*.
9. stalk unicellular with multicellular (4 – 8 celled) spherical shaped head (peltate).
10. stalk unicellular with multicellular (more than 8) large spherical shaped head (peltate).

The internal structure of the species under investigation indicate a unique similarity in their anatomical characters in spite of belonging to different genera e.g. in leaf midrib region, all species having a ground tissue consists of lamellar collenchyma, parenchyma cells surrounding the vascular bundle, the vascular tissue is one vascular bundle arched to rounded, the mesophyll at the intercostal regions differentiated into palisade type cells and spongy type cells, except in *Salvia aegyptiaca* and *S. spinosa*, where the mesophyll is palisade short cells only.

In stems, presence of lamellar collenchyma at the stem angles and parenchyma or chlorenchyma in between with a noticeable hypodermal. The cortex is characteristic with a bundle sheath followed by outer phloem fibers with un lignified cell walls, mostly as strands well developed at the angles, xylem and phloem in four large vascular bundles forming continuous or discontinuous cylinder. Pith, is characteristic with a polygonal homogenous parenchymous cells with thin cellulosic cell walls.

In spite of the similarity in most epidermal and internal anatomical characters of these species under investigation the results show that the 15 species of the Subfamily *Stachyoideae* which is growing naturally in the Kingdom of Saudi Arabia can be divided into two groups.

**Group 1.** this group includes 11 species: *Marrubium vulgare*; *Micromeria biflora*; *Mentha microphylla*; *Nepeta deflersiana* and *N. septemecrenata*; *Otostegia fruticosa* var. *fruticosa* and *O. fruticosa* var. *schimperi*; *Salvia aegyptiaca*, *S. deserti* and *S. spinosa* and *Thymus decussatus* and *T. aff. vulgaris*. These species are characterized by the presence of nonglandular, unbranched trichomes, either unicellular, bicellular or multicellular uniseriate and glandular unbranched trichomes (capitate 1, 2) and peltate, 4 – 8 celled heads. Stomata, 50 – 600/mm<sup>2</sup>; outer phloem fibres are small or large groups of unligified cell walls; vascular tissue in continuous or discontinuous cylinder.

This group can be divided into two **subgroups** with reference to the types of glandular trichomes: **Subgroup 1** includes: *Marrubium vulgare*; *Micromeria biflora*; *Mentha microphylla*; *Nepeta deflersiana* and *N. septemecrenata* and *Thymus decussatus* and *T. aff. vulgaris* which are characterized by peltate glandular trichomes with 4 – 16 celled heads. **Subgroup 2** include *Otostegia fruticosa* and *Salvia aegyptiaca*, *S. deserti* and *S. spinosa* which are characterized by the presence of peltate glandular trichomes with 4-8 celled heads.

**Group 2.** This group contains the 3 species of *Stachys* (*S. aegyptiaca*, *S. schimperi* and *S. yemensis*) which are characterized by presence of branched multicellular multiseriate nonglandular trichomes, unbranched glandular trichomes (capitate 1 and 2) and branched glandular trichomes with unicellular head. Stomata 50-200/mm<sup>2</sup>, vascular tissue in continuous cylinder and with small groups of outer phloem fibers having lignified cell walls.

The suggestion of grouping the 14 species of the Subfamily *Stachyoideae* into two groups is in general agreement of Briquet (1897) whereas *Stachys* species (group 2) may be considered as tribe *Stachyae* and the rest of the species (group 1 with two subgroups) as tribes *Marrubieae* and *Salviae*, however, dividing these species into 2 groups may agreed with Cantino et al. (1992) where they put the genera of these species in two different tribes.

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**ANATOMICAL STUDIES ON SUB FAMILY  
STACHYODEAE SPECIES (LAMIACEAE)  
GROWING NATURALLY IN THE  
KINGDOM OF SAUDI ARABIA**

**BY**

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## LIST OF ABBREVIATIONS

<b>bd</b>	=	beading
<b>bg</b>	=	branched glandular trichomes
<b>bng</b>	=	branched nonglandular trichomes
<b>bsh</b>	=	bundle sheath
<b>c par</b>	=	cortical parenchyma
<b>cam</b>	=	cambium
<b>ch</b>	=	chlorenchyma
<b>col</b>	=	collenchyma
<b>cr</b>	=	crystals
<b>cst</b>	=	cuticle striations
<b>cut</b>	=	cuticle
<b>cw</b>	=	cell wall
<b>ep</b>	=	epidermis
<b>g</b>	=	glandular trichomes
<b>hy</b>	=	hypodermis
<b>ng</b>	=	nonglandular
<b>p par</b>	=	pith parenchyma
<b>pal</b>	=	palisade tissue
<b>pap</b>	=	papillose
<b>par</b>	=	parenchyma
<b>pc</b>	=	procambium
<b>pg</b>	=	peletate glandular trichomes
<b>ph</b>	=	phloem
<b>phf</b>	=	phloem fibers
<b>sp</b>	=	spaces
<b>spo</b>	=	spongy tissue
<b>st</b>	=	stomata
<b>ue</b>	=	upper epidermis
<b>vb</b>	=	vascular bundle
<b>vc</b>	=	vascular cambium
<b>xy</b>	=	xylem