

**TYPES AND OCCURRENCE OF TRICHOMES IN TWO SPECIES
OF THE GENUS *LAVANDULA* (LAMIACEAE).
II: *L. STRICTA* DEL., AND *L. CORONOPIFOLIA* LAM.**

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Abstract

The morphology and types of trichomes on the leaves, stems and floral parts of *Lavandula stricta* Del. (= *L. coronopifolia* Poir.) and *L. coronopifolia* Lam., were investigated. Both the species showed nonglandular trichomes with cells having warty walls. The two species also have glandular trichomes with unicellular, bicellular or multicellular heads. Nonglandular trichomes with smooth cell walls and branched glandular trichomes were not observed in *L. coronopifolia*. The trichomes of the two species could be grouped into 8 types comprising of 17 forms of nonglandular and 13 forms of glandular trichomes.

Introduction

A comprehensive study of the morphological characteristics of the members of the genus *Lavandula* L., including *L. stricta* Del., have been made by Chaytor (1937) but there is no mention of *L. coronopifolia* as a distinct species. The morphology of trichomes on the aerial parts of some members of the genus *Lavandula* L., have been studied (Bhatnagar & Dunn, 1960, 1961, 1963 ab,) but there does not appear to be any report on the types and occurrence of trichomes on the leaves, stems and floral parts of *L. stricta* Del. (= *L. coronopifolia* Poir.) and *L. coronopifolia* Lam. The presence of glandular and nonglandular trichomes on the leaves of *L. stricta* were reported and nonglandular trichomes described as simple, multicellular uniseriate and some of them characterized with a typically gland-like apical cell, forming a small head (Bhatnagar & Dunn, 1963b). Similarly the presence of nonglandular and glandular trichomes on the leaves and stem of *L. stricta* were also reported (Doaigey *et al.*, 1985), however there is no report dealing with the microscopic study of the trichomes on *L. coronopifolia* Lam.

The present study compares and contrasts the types and occurrence of trichomes on the leaves, stems and floral parts of *L. stricta* and *L. coronopifolia* which grow naturally under arid conditions of Saudi Arabia.

Material and Methods

The plant material of *L. stricta* was collected during the flowering season in 1980 from Abha area and *L. coronopifolia* from Taif area in 1981 in the Southern province of Saudi Arabia. The specimens were preserved in 70% ethanol. Trichomes of preserved stems and leaves of each species were prepared by stripping the epidermis and then mounting in 50% v/v glycerol. Trichomes of leaves and floral parts were mounted in 50% v/v glycerol after clearing with chloral hydrate. Dry stems, leaves and floral parts were soaked in water for 3-7 days before preparation of the mounts. Drawings were made using Reichert projecting screen. Cell wall thickness of the trichomes used was according to Doaigey *et al.*, 1985.

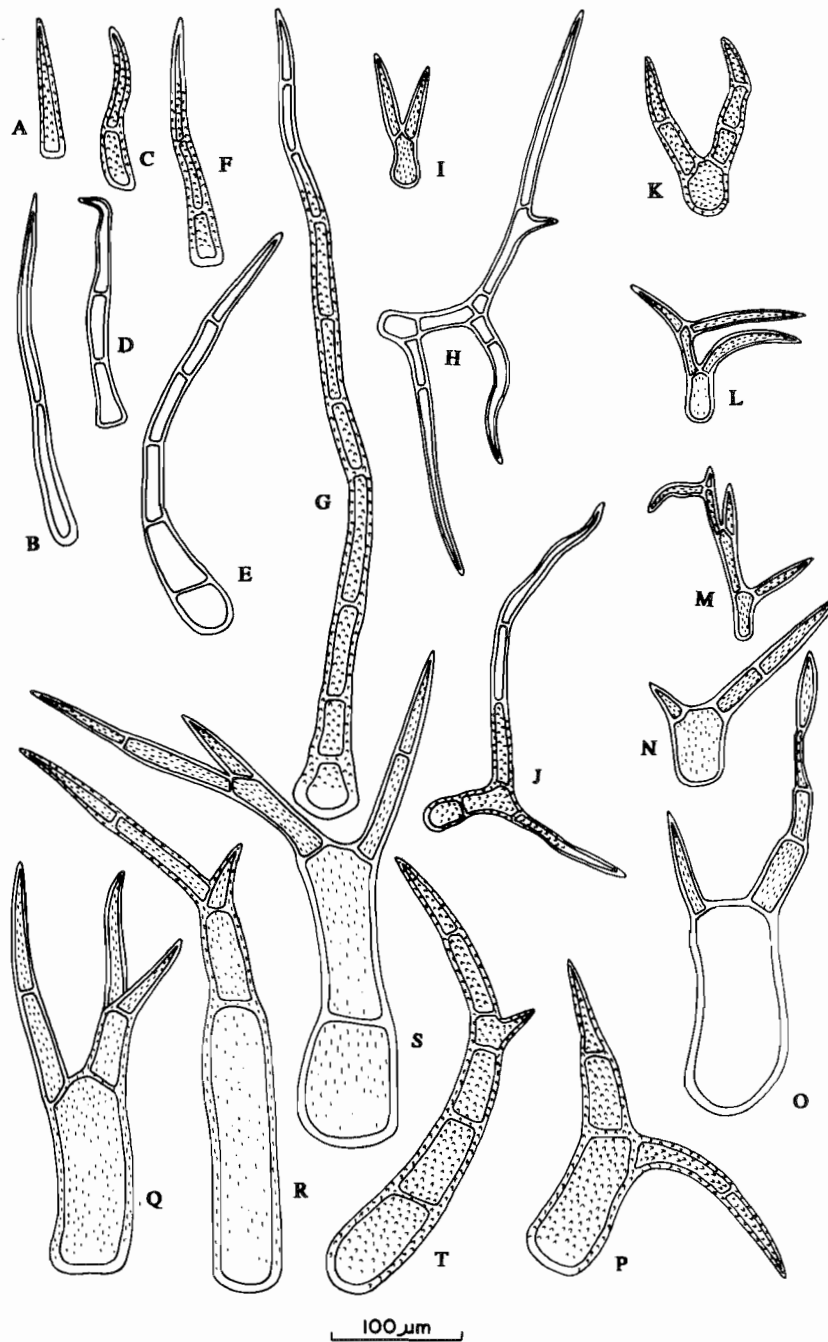


Fig. 1A-T. Nonglandular trichomes. (A, H & P) from *L. stricta*. (I-O & Q-T) from *L. coronopifolia*.

Results

The trichomes on the aerial parts of *L. stricta* and *L. coronopifolia* could be classified into 8 types including 17 forms of nonglandular and 13 forms of glandular trichomes as follows:

Type I: Nonglandular, unicellular, unbranched, with thick warty walls, wide lumen and acute apex (Fig.1A & Fig.2A).

Type II: Nonglandular, bicellular, uniseriate, unbranched.

Ila: Cells long with smooth, thick walls, wide lumen and acute apex (Fig.1B & Fig.2F).

Ilb: Cells short with warty, thick walls, wide lumen and acute apex (Fig.1C & Fig.2B).

Type III: Nonglandular, multicellular, uniseriate, un branched.

IIIa: Cells long with smooth thick walls, 3 to 6 cells long, wide lumina, tapering towards the terminal cell, and with acute apex (Fig.1D,E & Fig.2C,G).

IIIb: Cell long; with warty, thick walls; 3 to 10 cells long with wide lumina; tapering towards the terminal cell and with acute apex; basal cells occasionally swollen (Fig.1F,G & Fig.2H,I).

Type IV: Nonglandular, multicellular, uniseriate branched.

IVa: Cells with smooth walls; branching start above the first basal cells; two main branches: one with 3 celled long and the other more than 3 celled long and branched (Fig.1H & Fig.2K).

IVb: Cells with warty walls.

b1: Short, branching start above the first basal cell; two unicellular branches (Fig.1I & Fig.2L).

b2: Long, branching start above the first basal cell; two branches: one unicellular the other multicellular, both with acute apices (Fig.1J & Fig.2D).

b3: Short, branching start above the first basal cell; two branches: one bicellular, the other 3 celled long (Fig.1K & Fig.2E).

b4: Short, branching start above the first basal cell; two branches: one unicellular, the other multicellular and branched (Fig.1L,M, Fig.2J & Fig.4A).

b5: Short, branching start above the first basal swollen cell; two branches: one unicellular and the other bicellular (Fig.1N & Fig.2B)

b6: Long; branching start above the first basal swollen cell; two branches: one unicellular, the other multicellular (Fig.1O & Fig.2F)

b7: Long, branching start above the first basal swollen cell, two branches: each bicellular with thick walls, wide lumen and acute terminal cell (Fig.1P & Fig.4E).

b8: Long, branching start above the first basal swollen cell; two branches: one bicellular, the other multicellular uniseriate with two unicellular arms (Fig.1Q & Fig.4D).

b9: Long, branching start above the second basal swollen cells; two branches: one unicellular and the other bicellular, uniseriate; each with acute terminal cell (Fig.1R & Fig.2M).

b10: Long, branching start above the second basal cell; two branches: one bicellular the other multicellular uniseriate and branched, each with acute terminal cell (Fig.1S & Fig.2C).

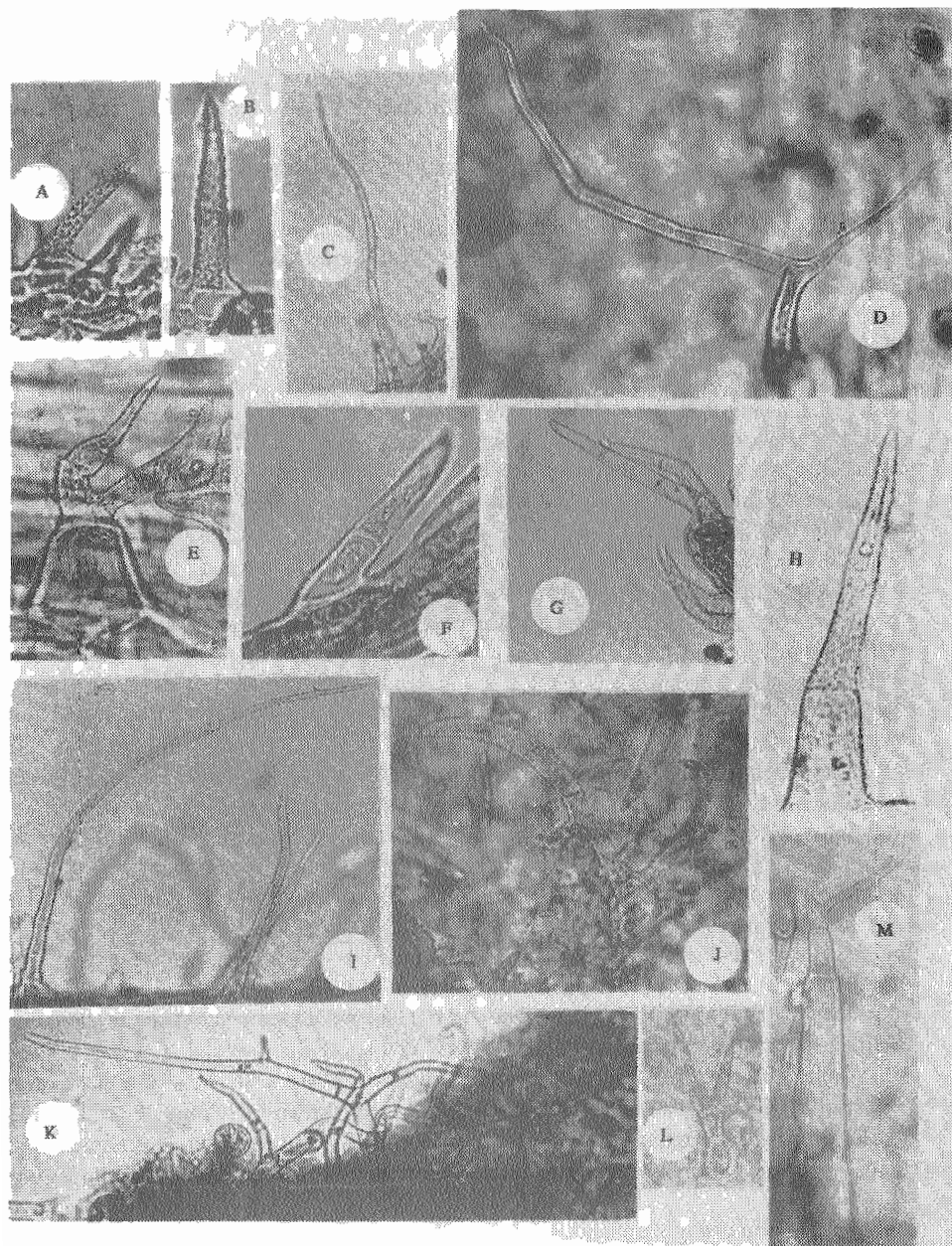


Fig.2A M (A D, F-I & K). Nonglandular trichomes. (E,J,L & M) from *L. stricta*

b11: Long, branching start above the third basal cells, two branches: one as an arm of the fourth cell and the other bicellular, uniseriate cells with acute terminal cell (Fig. 1T).

Type V: Glandular, stalk unicellular, unbranched.

V1: Short stalk cell with smooth walls, head unicellular (Fig. 3A & Fig. 5A).

V2: Short stalk cell with smooth walls; head bicellular (Fig. 3B & Fig. 5B).

V3: Short stalk cell with smooth walls; head multicellular, sphaerical in surface view (Fig. 3C & Fig. 5C).

Type VI: Glandular, stalk bicellular, uniseriate, un branched.

VIa: Stalk cells with smooth walls.

a1: Short stalk with cells having slightly thick walls, head unicellular (Fig. 3D,E & Fig. 5 E,G,H).

a2: Long stalk, basal cell swollen and longer than the second cell, and with multicellular clavate head (Fig. 3F & Fig. 5K).

VIb: Short stalk, cells with slightly thick warty walls and head unicellular (Fig. 3G,H & Fig. 5D,F).

Type VII: Glandular, stalk multicellular, uniseriate, un branched.

VIIa: Stalk cells with smooth thick walls; 3-5 cells long, cells having wide lumina, tapering towards the unicellular head (Fig. 3I,J & Fig. 5I,L).

VIIb: Stalk cells with warty, thick walls, 3-9 cells long, head unicellular, some trichomes with swollen bases, tapering towards the trichome head (Fig. 3K,L,M & Fig. 6A,C).

Type VIII: Glandular, stalk multicellular, uniseriate branched.

VIIIa: Stalk cells with smooth walls.

a1: Branching start above the first basal cell of the stalk; two branches: one branch with 3- celled stalks and unicellular head; the other nonglandular with two celled long (Fig. 3N & Fig. 6B).

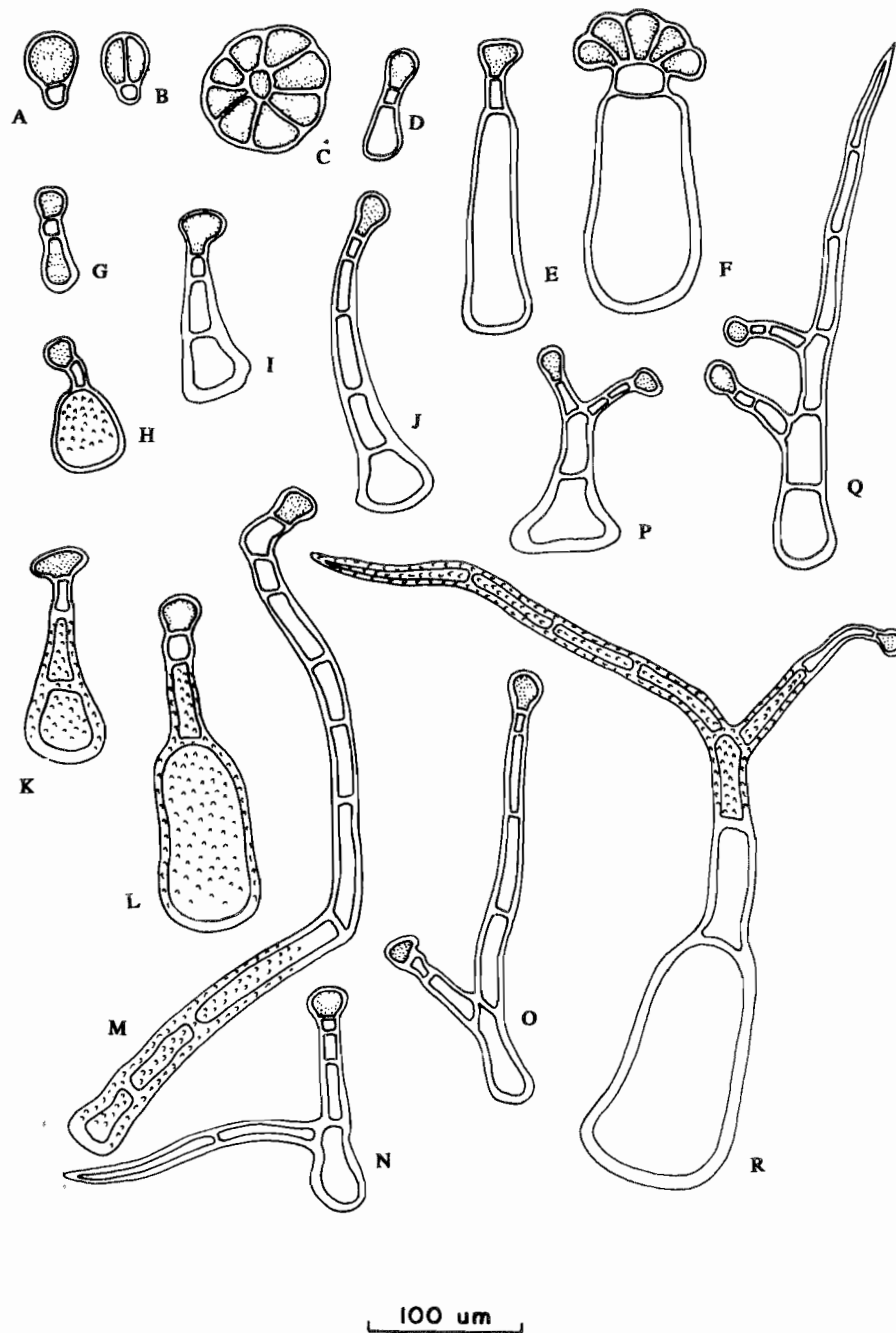
a2: Branching start above the first basal cell of th stalk; two branches: one branch with bicellular stalk and the other with 3 celled stalk, each with unicellular head (Fig. 3O & Fig. 5J).

a3: Branching start above the second basal cell of the stalk; two branches: one branch with unicellular stalk and unicellular head, the other bicellular stalk and with unicellular head (Fig. 3P & Fig. 6E).

a4: Branching start above the second basal cell of the stalk; three branches: one branch with 3 cells long the other two branches, each of them with bicellular stalk and unicellular head (Fig. 3Q & Fig. 6D).

VIIIb: Stalk cells with warty walls; branching start above the thrid basal cell of the stalk; two branches: one glandular with 2-celled stalks and unicellular head, the other nonglanduar with 4 celled long and acute apex; the two basal cells of the stalk with smooth walls (Fig. 3R & Fig. 6F).

The trichome types and forms on the leaves, stems and floral parts of *Lavandula stricta* and *L. coronopifolia* illustrated in (Fig. 1-6) show that both species have nonglandular and glandular trichomes with major differences as to the trichome features and their occurrence on the plant parts (Table 1). The trichomes on both the species under investigation could be classified into 8 types including 17 forms of nonglandular and 13

Fig.3A-R. Glandular trichomes from *L. stricta*.

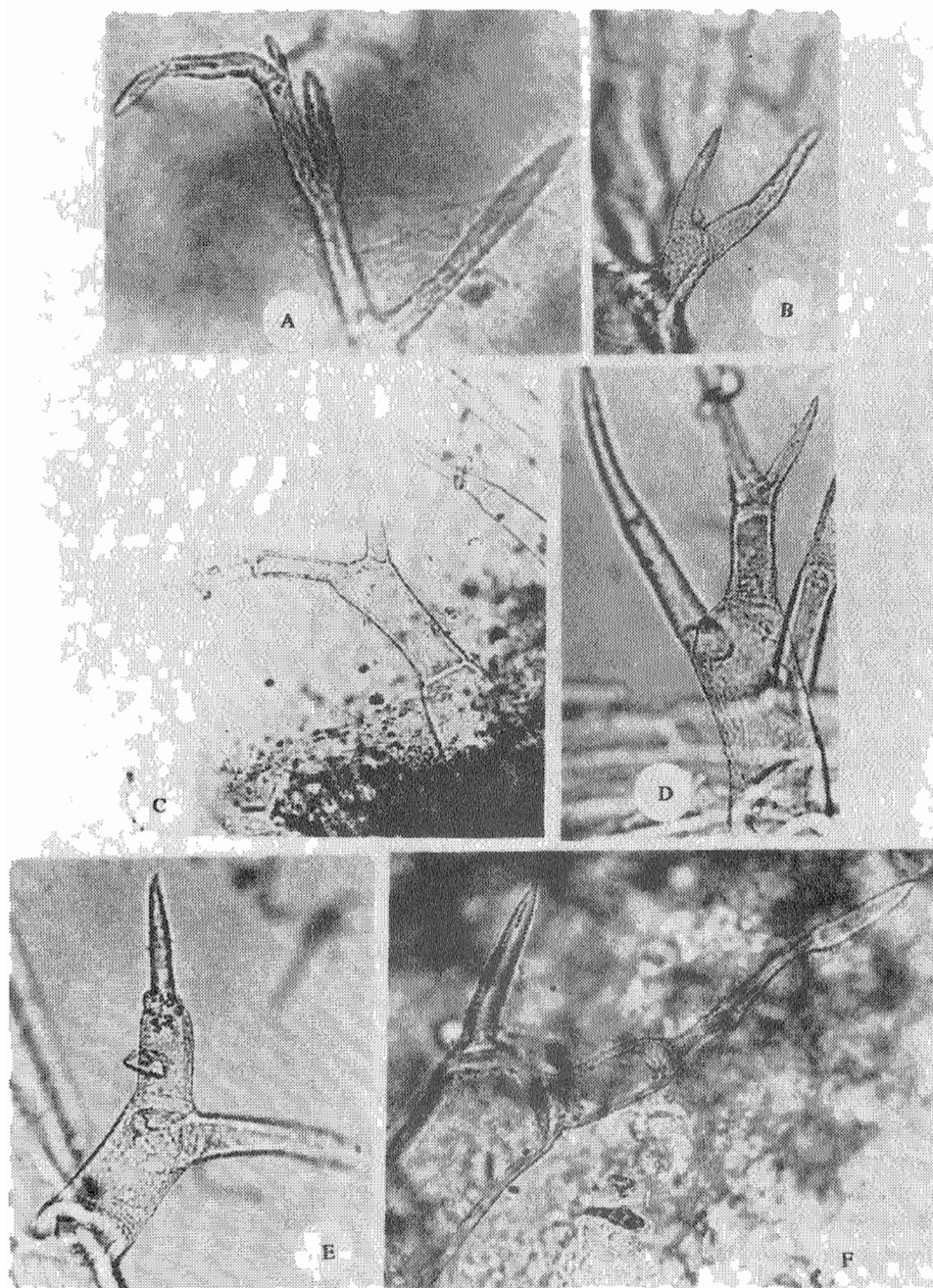


Fig.4A-F. Nonglandular trichomes from *L. coronopifolia*.

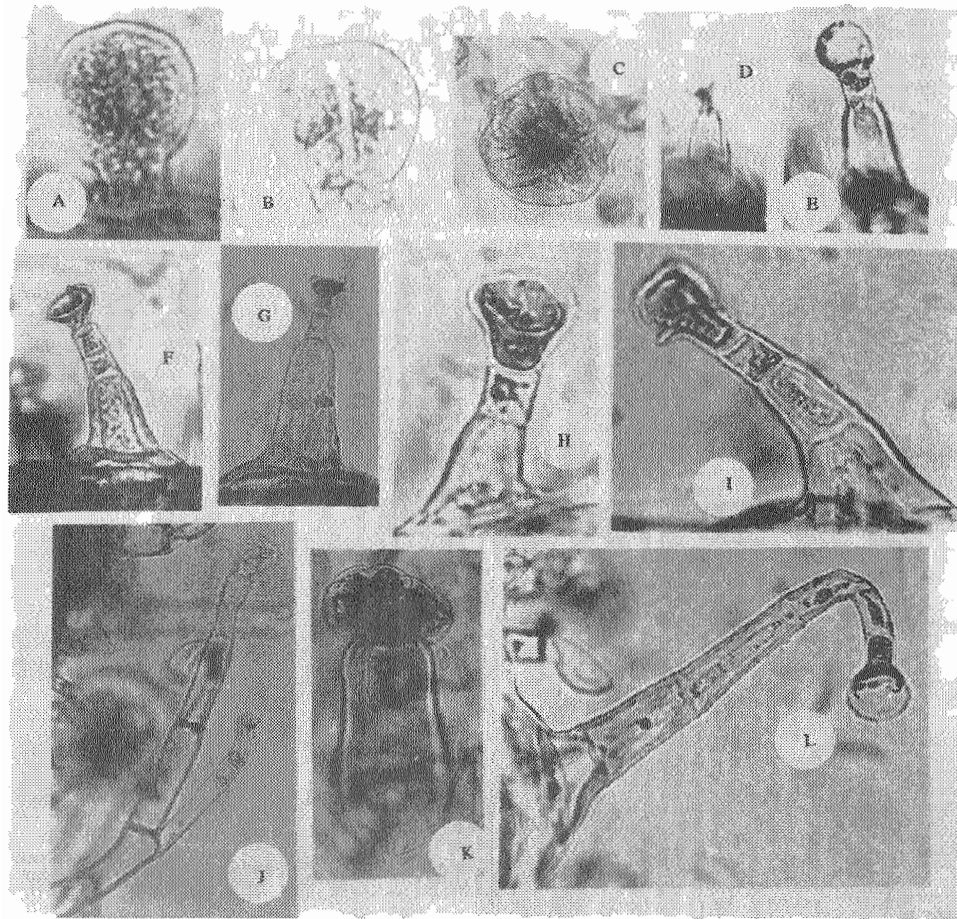


Fig.5A-L. Glandular trichomes from *L. stricta*.

forms of glandular trichomes (Table 1). These trichome types are in general agreement with those of the family Lamiaceae reported by Doaigey et al., (1985) and Metcalfe & Chalk (1950), but nonglandular multicellular, multiseriate, branched trichomes were not observed on the two species. However, both the species were found to have nonglandular trichomes with warty cell walls. In addition, they have glandular trichomes with unicellular, bicellular or multicellular heads which were found throughout the plant parts of either species. Nonglandular trichomes with smooth cell walls and branched glandular trichomes were not observed on *L. coronopifolia*.

Type I is one form which was found on the stem and floral parts of *L. stricta*, but was observed in all plant parts of *L. coronopifolia* (Table 1). Type II which consists of two forms: IIa form was seen only on the floral parts of *L. stricta* and IIb form on both the species, specially on the leaves and stems (Table 1). Type III subdivided into two forms:

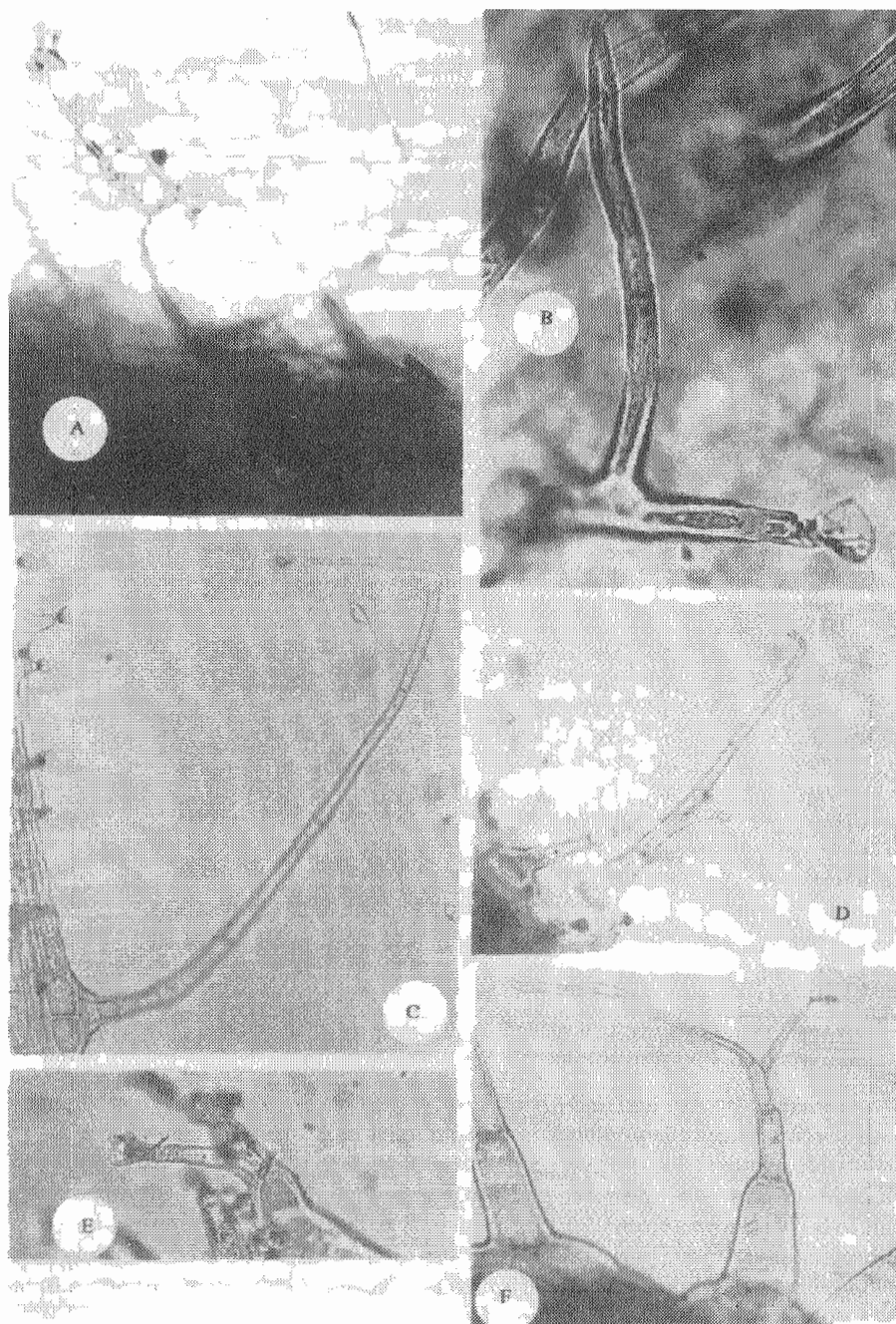


Fig.6A-F. Glandular trichomes from *L. stricta*.

Table 1. Type and occurrence of Trichomes on *Lavandula stricta* and *L. coronopifolia*.

Trichome Types	<i>L. stricta</i>						<i>L. coronopifolia</i>						
	Stem		Leaf			Flower	Stem		Leaf			Flower	
	U	L	UE	LE	PT	P	FP	U	L	UE	LE	P	FP
Type I	+	+	-	-	-	-	+	+	+	+	+	+	+
Type IIa	-	-	-	-	-	+	+	-	-	-	-	-	-
IIb	+	+	-	-	-	+	+	+	+	+	+	+	+
Type IIIa	-	-	+	+	-	+	+	-	-	-	-	-	-
IIIb	+	+	+	+	+	+	+	+	+	+	+	-	-
Type IVa	-	-	-	-	-	-	+	-	-	-	-	-	-
IVb1	-	-	-	-	-	-	-	-	-	-	-	+	+
b2	+	+	-	+	+	-	-	-	-	-	-	-	-
b3	-	-	-	-	-	-	-	-	-	-	-	+	+
b4	-	-	-	-	-	-	-	-	-	-	-	-	+
b5	-	-	-	-	-	-	-	+	+	+	+	+	+
b6	-	-	-	-	-	-	-	-	-	+	+	-	-
b7	-	-	-	-	-	-	-	+	+	+	+	+	+
b8	-	-	-	-	-	-	-	-	-	+	+	-	-
b9	-	-	-	-	-	-	-	-	-	+	+	-	-
b10	-	-	-	-	-	-	-	-	-	+	+	-	-
b11	-	-	-	-	-	-	-	-	-	+	+	-	-
Type V 1	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+	+
Type VIa1	+	+	+	+	+	+	+	-	-	-	-	-	-
a2	+	+	+	+	+	+	+	-	-	+	+	-	-
VIb	+	+	+	+	+	+	+	+	-	-	-	-	-
Type VIIa	+	+	+	+	+	+	+	-	-	-	-	-	-
VIIb	+	+	+	+	+	+	+	-	-	-	-	-	-
Type VIIIa1	-	-	+	+	+	+	+	-	-	-	-	-	-
a2	-	-	+	+	+	+	+	-	-	-	-	-	-
a3	-	-	+	+	+	+	+	-	-	-	-	-	-
a4	-	-	+	+	+	+	+	-	-	-	-	-	-
VIIIb	-	-	+	+	+	+	+	-	-	-	-	-	-

U = stem upper part, epidermis, L = stem lower part epidermis. UE = Leaf, upper epidermis. LE = Leaf, lower epidermis. PT = petiole epidermis. P = peduncle epidermis. + = present. - = absent.

IIIa form was seen on the leaf and floral parts of *L. stricta* and IIIb form on all plant parts of both species except the peduncle and floral parts of *L. coronopifolia* (Table 1). Type IV subdivided into 12 forms: IVa forms were reported on the floral parts of *L. stricta* whereas IVb forms were commonly seen on the leaf and floral parts of *L. coronopifolia* except IVb 2 which was formed on the stem and peduncle of *L. stricta* (Table 1). Type V comprized three forms and each of them was seen on all plant parts of the two species (Table 1). Type VI subdivided into three forms: VIa and VIb forms occurred on all plant parts of *L. stricta* and VIa2 was seen on the leaf of *L. coronopifolia* (Table 1). Type VII subdivided into two forms and both were found on all plant part of *L. stricta* (Table 1). Type VIII consisting of five forms were observed on the leaf, peduncle and floral parts of *L. stricta* (Table 1).

Discussion

The results indicated that both the species have some trichome forms in common (Table 1), on the other hand, each species has some specific trichome forms (Table 1). Although, types VII and VIII are characteristic of *L. stricta*, whereas form IVb is characteristic of *L. coronopifolia* except form IVb2 which was not observed (Table 1). Branching of nonglandular trichomes start above the first basal cell of the stalk in *L. stricta* whereas it starts above the first, second or third basal cells of the stalks in *L. coronopifolia*, whilst branching of glandular trichomes occur frequently and start, above the first, second or third basal cells of the stalks in *L. stricta*. Some features of the trichomes observed in this study could be used to distinguish the two species. On the other hand the cell wall structures and branching of trichomes may provide substantial criteria to their taxonomy.

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