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Scape anatomical studies in populations of *Urginea indica* Kunth. Liliaceae

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Abstract: The current study presents investigations on the scape anatomical characteristics of *Urginea indica* population, a geophyte growing in India, Africa and Mediterranean regions. For scape anatomical studies transverse sections of inflorescence axis were taken and studied for the first time. The twelve different population studied revealed that outer most epidermis of inflorescence is covered by thick cuticle. Cortex is differentiated into 3 regions outer chlorenchyma, middle collenchyma and inner parenchyma. But the shape and number of rows of cells vary in different populations collected from various localities of Karnataka. Vascular bundles are arranged in 3 rows, 2 rows in few populations and number. of vascular bundles vary. Larger bundles varies from 5-8, medium 8-12 and smaller bundles 5 to 21 in number. Xylem elements are uniseriate and biseriate in few. Some populations show Myelin structures and cell inclusions, based on their ecological habitat. The distinctions among cross sections of scapes are evident and our findings offer a comprehensive study using anatomical traits for delimitation and diagnosing populations of *U.indica* providing a platform for further taxonomic investigations.

Keywords : *Urginea indica*, Geophyte, Myelin, Scape

INTRODUCTION

Indian Squill *Urginea indica* Kunth. Liliaceae is a perennial bulbous geophyte native to India, Africa and Mediterranean regions and grows in slopes of hills and sandy grounds. (Shivakameshwari *et.al* 2010). It occurs both in southern and in peninsular part of Indian including the coastal belts as well as temperate regions of Himalayas. Squill bulbs has long been used as a source of Medicine. It is used as an anticancer agent, expectorant and cardiac stimulant, treating asthma, adema, rheumatism, gout, dropsy and allergies. Due to these properties Squill bulb has found its place in the British and European Pharmacopocias. The literature indicates that anatomical studies on *Urginea* are focused on the structure of the bulb, root and the leaf structure (Sultan *et al.* 2010) and on adventitious roots of *U. maritime* (Sharaf *et al.*, 2006).

The taxonomic value of foliar anatomical features in *U. indica* has been reported by Mustapha (2000); and on leaf anatomy and systematics of Hyacinthaceae by Anna H. Lynch *et al.* (2006). Ahmet *et al.* (2010) have provided a comprehensive description of the morphological and anatomical properties of *Bellevalia paradoxa*.Studies on inflorescence morphology and anatomy are common in families such as Poaceae (Vegetti and Anton 1995, 2000), Cyperaceae (Guarise and Vegetti, 2008), Aristolochiaceae (Gonzalez and Rudall 2001) but the studies are rare in Liliaceae member *U. indica*. Anatomy of scape and its potential use in systematics and delimitation of the populations of *U. indica* has been paid little attention. The aim of the present work was to provide a comprehensive scape anatomical study in *U. indica* populations.

MATERIALS AND METHODS

The specimens were collected from different localities of Karnataka, Kerala and grown in the germplasm garden of Department of Botany, Bangalore University under uniform environmental conditions. Anatomical characters of 12 populations of *U. indica* were studied by means of light microscope is presented in Table 1. Free hand sections were prepared and stained in Safranin and fast green solution (Gerlach, 1977) and permanently mounted using DPX. The sections were well examined using Carl leitz microscope and photographed.

RESULTS

The inflorescence of *U.indica* is a raceme which originates from the center of the bulbs suddenly after the first shower, without any leaves and in some populations with leaves which is characterstic. Scape anatomical studies in different populations of *U. indica* showed the following variations .Anatomy of scape shows that outermost layer of the inflorescence is the monolayered epidermis which comprises layer of almost square cells and is covered by a thick cuticle. The cortex is differentiated into 3 regions outer chlorenchyma ,middle

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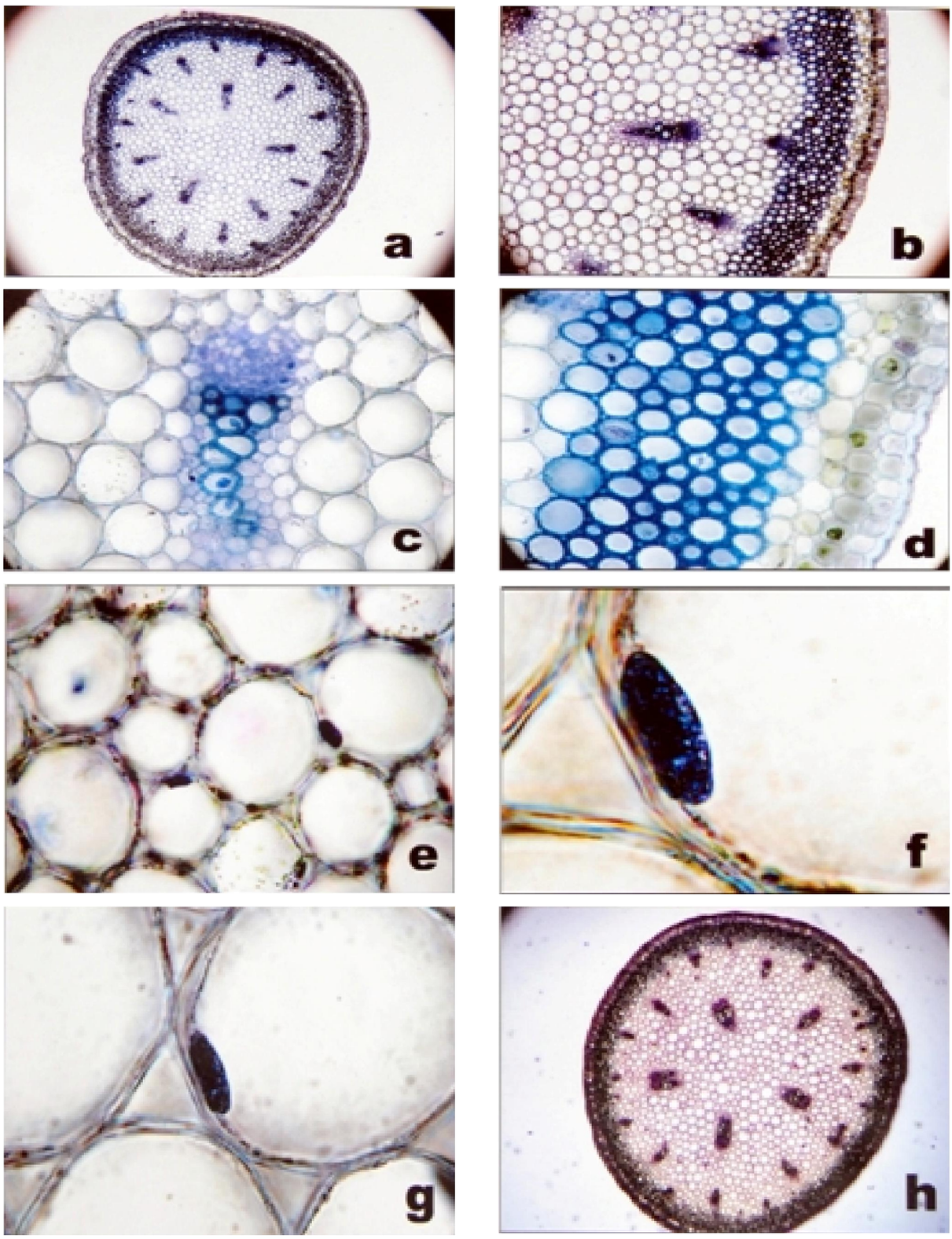
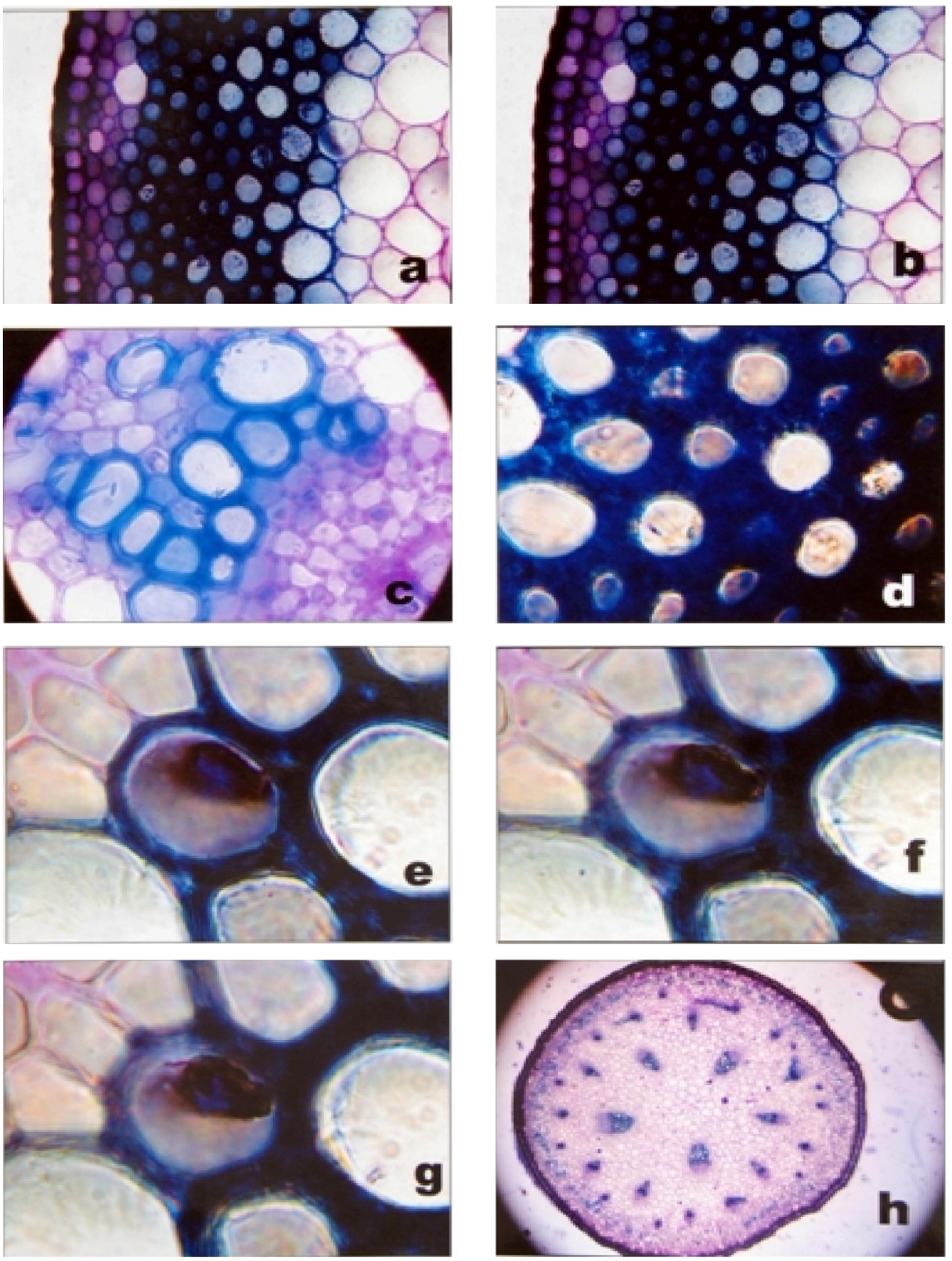
Table 1. Vascular Bundle in populations of *U.indica* based on their ecological habitats.

Sl. No.	Place of collection	Rows of vascular bundles	Vascular bundles	Myelin structure	Number of larger vascular bundles	Number of medium vascular bundles	Number of medium vascular bundles	Length of inflorescence Cm.	Ploidy	No. of flowers	Blooming time
1	B.R. Hills Gundlupet	3	Uni	Present	3	6	16	65	36	10	Night
2	Kerala	2	Bi	Absent	5	-	20	75	-	10	Evening
3	Shimoga	2	Bi	Absent	5	0	22	8	20	20	Day blooming
4	Pillaly	2	Uni	Present	8	-	16	10	20	20	Afternoon
5	Karighatta Near Mysore	3	Bi	Absent	7	8	20	75	34	11	Afternoon
6	Bellur Mysore	3	Uni	Absent	6	12	21	35	40	6	Night
7	Gulbarga	2	Uni	Absent	6	-	12	9	36	15	Fore noon
8	Banganwadi Mysore	3	Uni	Present	6	5	15	15	40	4	Noon
9	Nagarahole Coorg	2	Uni	Present	5	-	5	5	32	8-32	Evening
10	Magadi	3	Uni	Present	7	7	9	70	22	14	Evening
11	Ramanagaram Bangalore	3	Bi	Absent	5	5	15	80	20	16	Evening
12	Bettahalli Talakadu	3	Bi	Absent	5	5	20	65	-	6	-

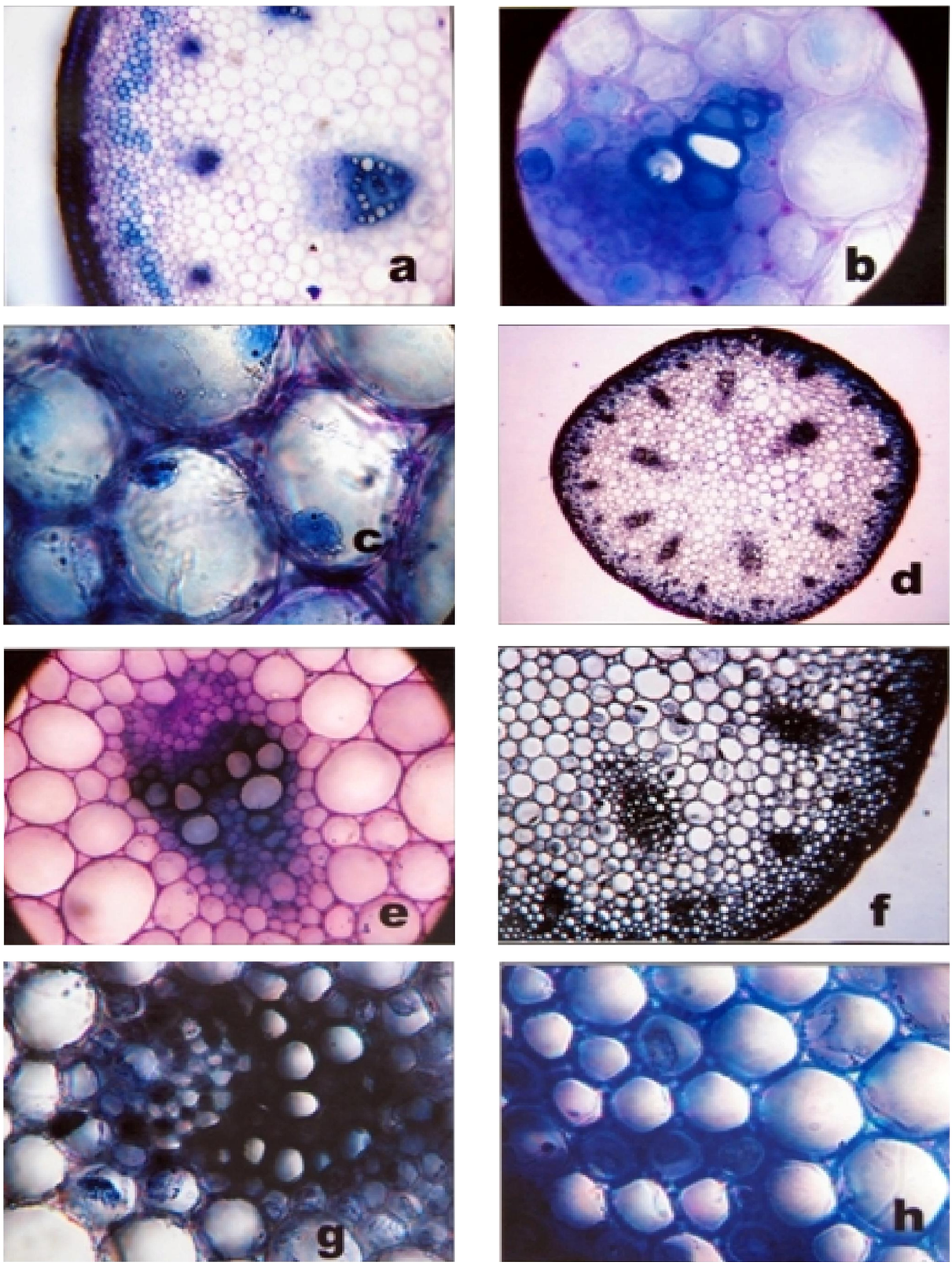
Uni - Uniseriate, Bi - Biseriate



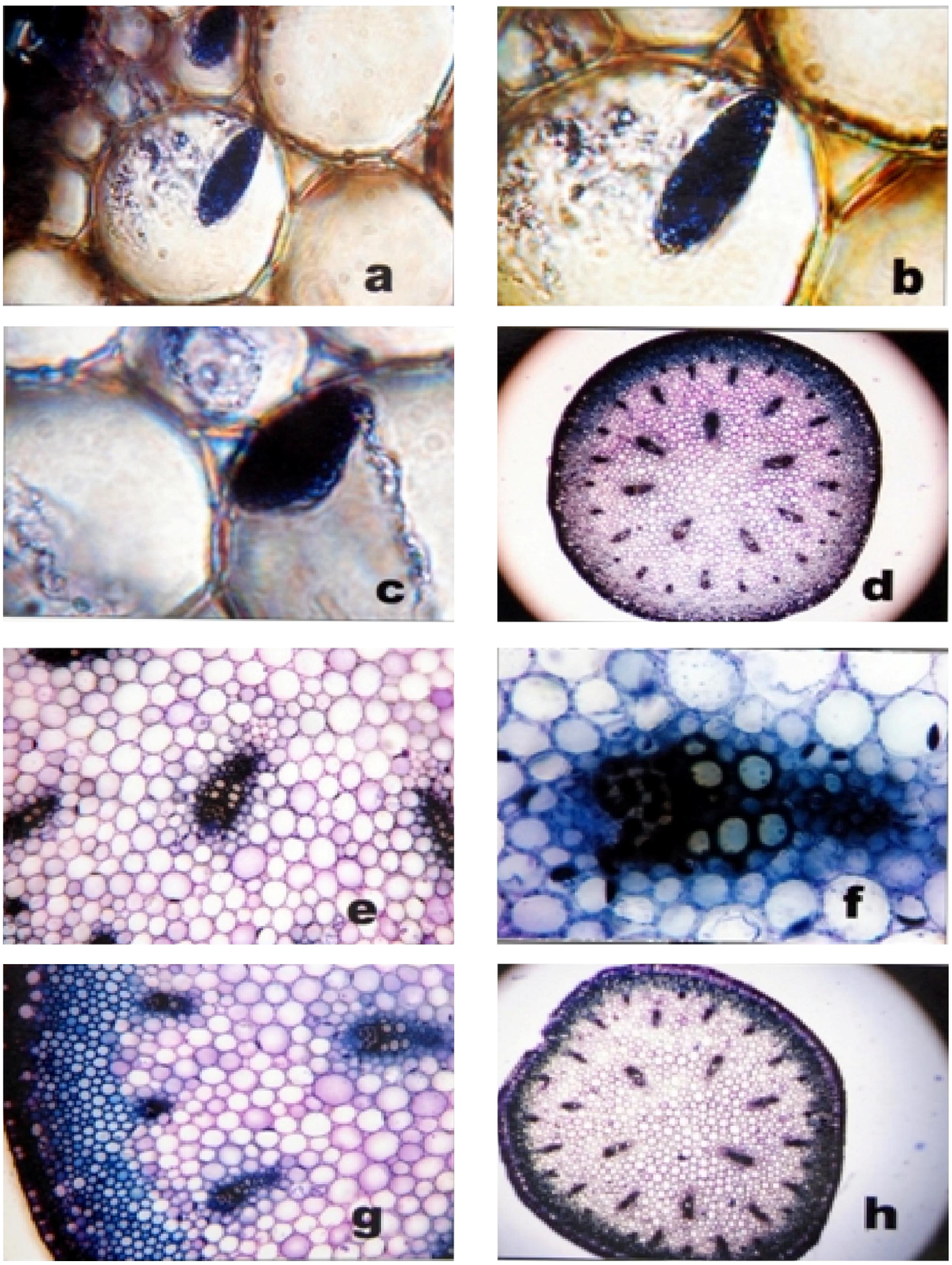
Figs. 1.(a-g) *Biligirirangana hills. (a) T.S. of scape (b) A portion enlarged (c) Single vascular bundle (d) Collenchyma arranged in 7 rows (e) Plasmodesmatal connections between cells (f) Myelin structure (g) Enlarged view of cell showing Myelin structure (h) Kerala T.S.of Scape.*



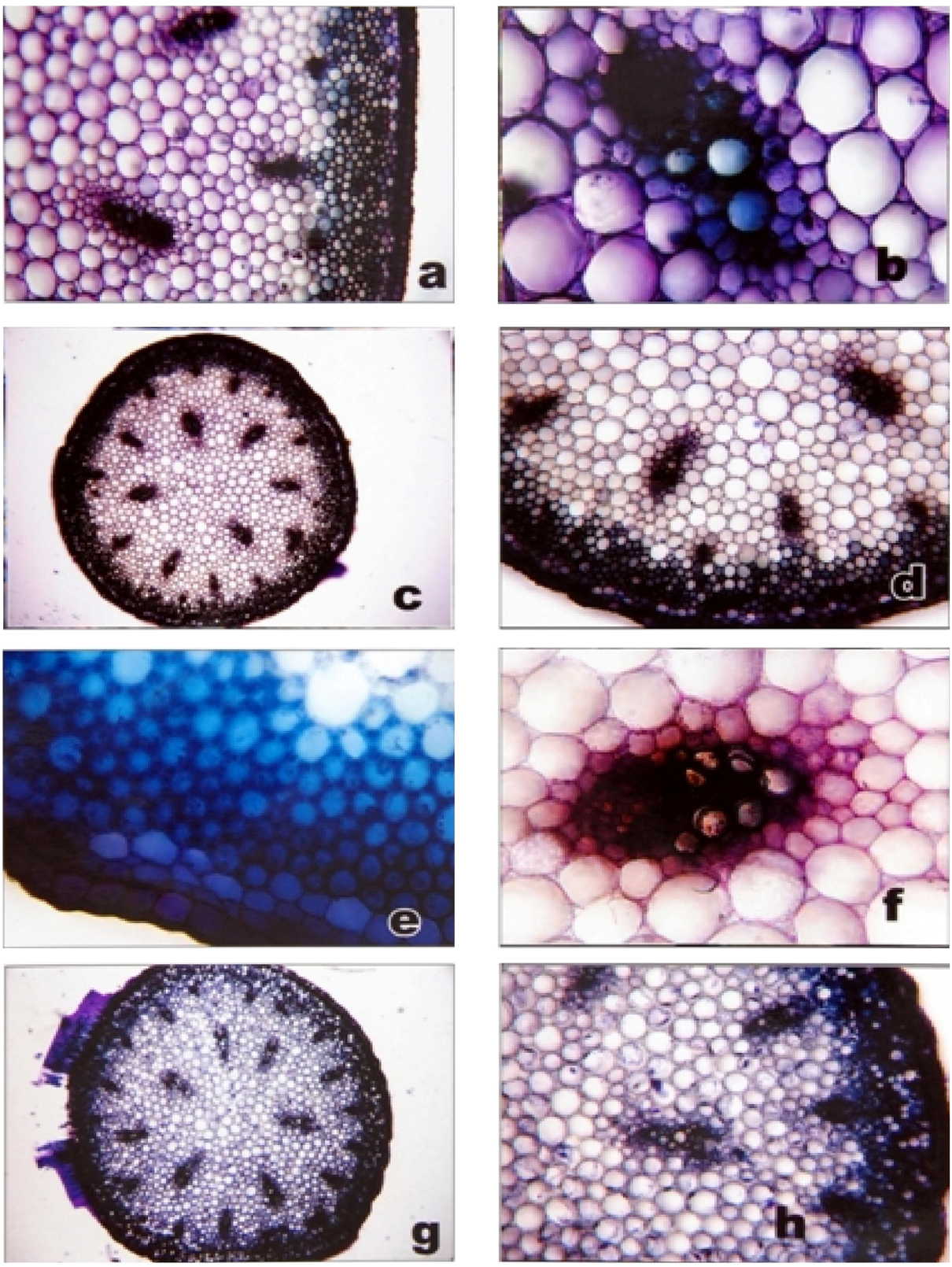
Figs. 2. (a-g). *Kerala. a and b: A portion enlarged. c: Xylem elements biseriate. d: Collenchyma cells. e, f and g: cell inclusions, (h) Shimoga.*



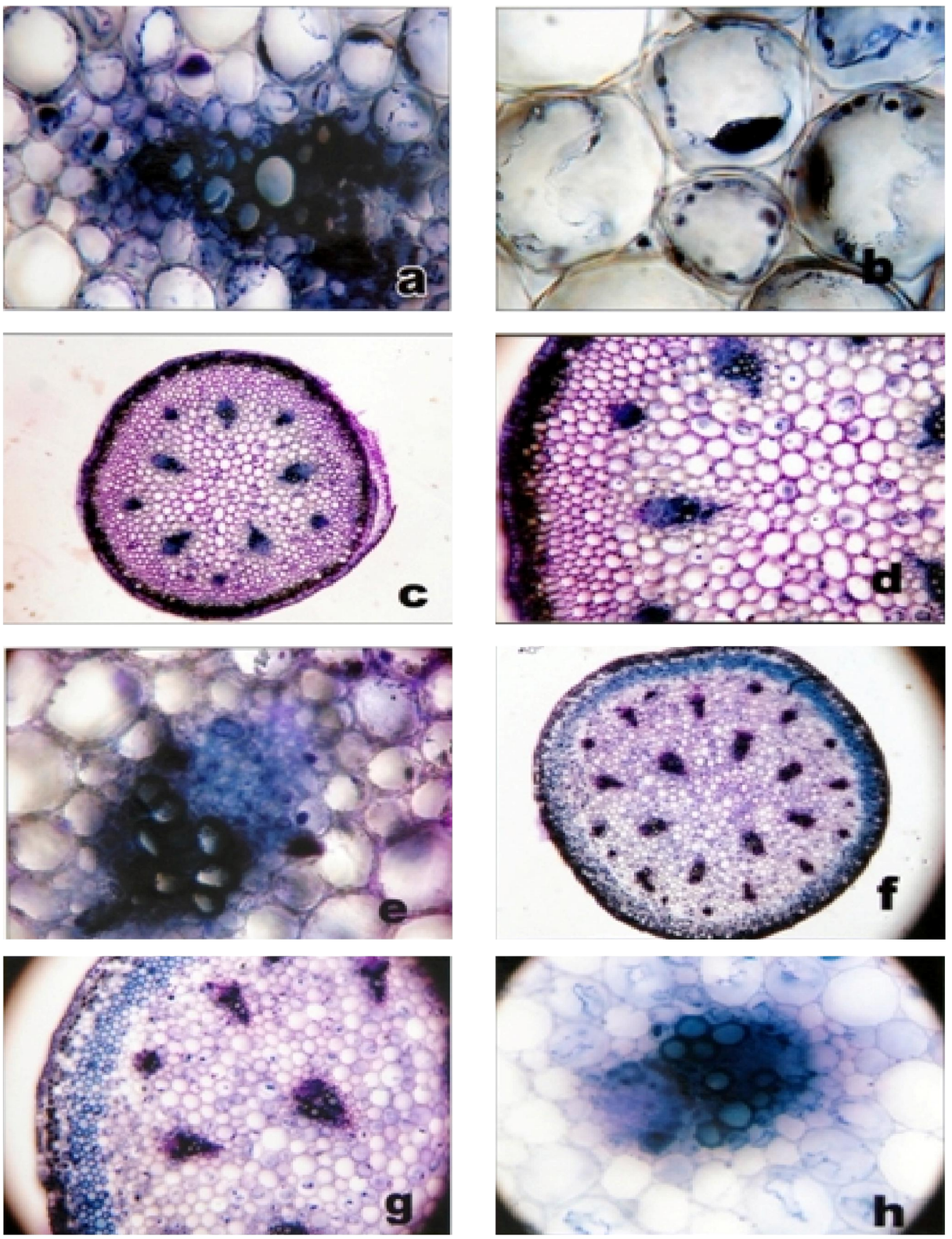
Figs. 3. (a-c). *Shimoga. (a and b) Vascular bundles (biseriate) (c) Myelin structure (d-h) Pillaly (d) T.S. of Scape (e) Vascular bundles (biseriate) (f) Scape - A portion enlarged (g and h) Myelin structures and Cell inclusions.*



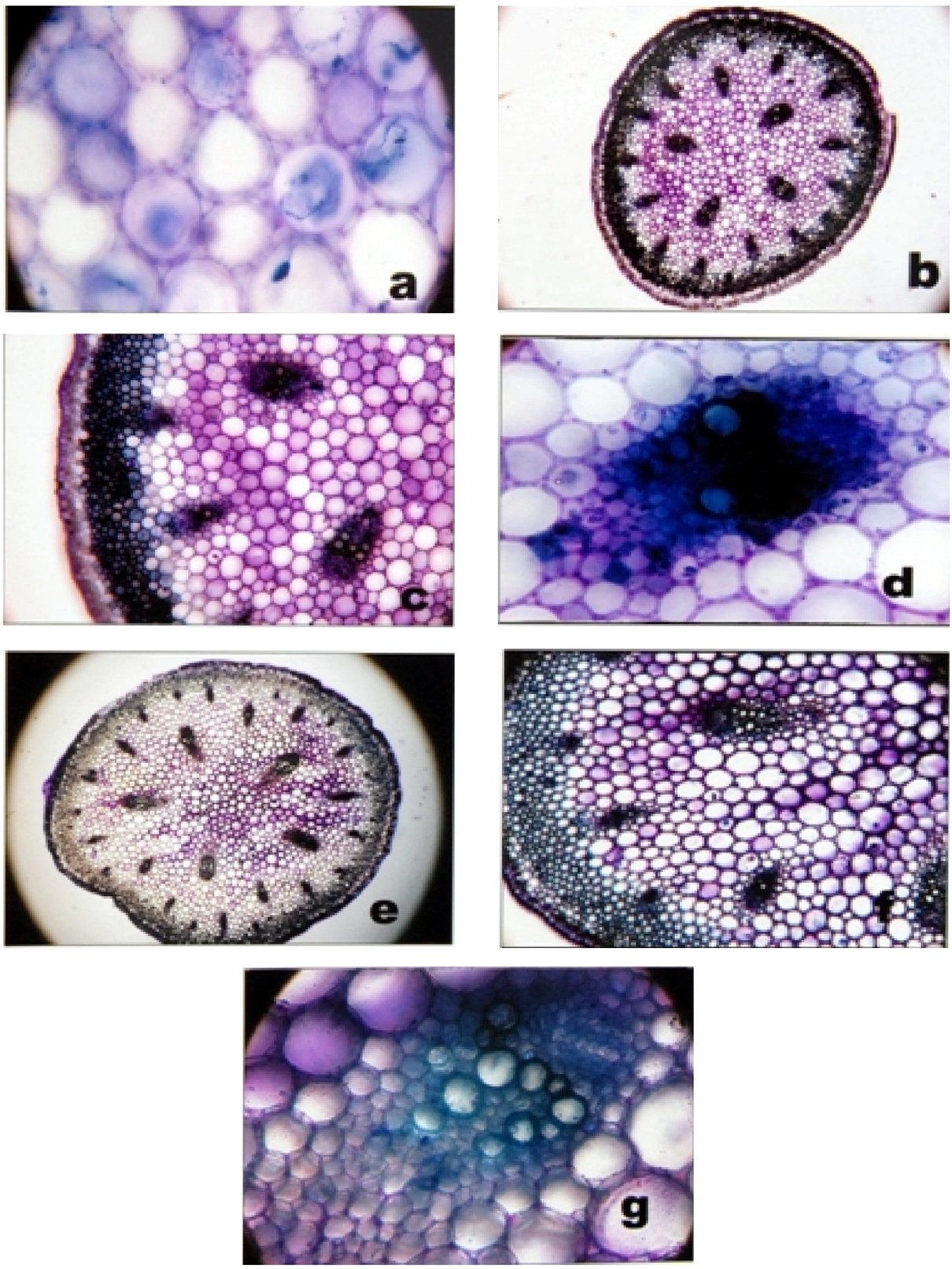
Figs. 4. (a-c) *Pillaly (a-c) Myelin structures enlarged (d-g) Karighatta (d) T.S. of Scape (e and f) Vascular bundles (biseriate) (g) Scape - A portion enlarged (h) Bellur.*



Figs. 5. (a-b) *Bellur (a) A portion enlarged (b) Vascular bundles (c-f) Gulbargha (c) T.S. of scape (d) A portion enlarged (e) Epidermis with thick cuticle (f) Vascular bundle (g- h) Banganwadi (g)T.S. of scape (h) A portion enlarged showing thick cuticle.*



Figs. 6. *(a-b) Banganwadi (a and b) Myelin structures and other cell inclusions (c-e) Nagarahole (c) T.S. of Scape (d) A portion enlarged (e) Cells surrounding vascular bundles showing Myelin structures (f- h) Magadi (f)T. S. of Scape (g) A portion enlarged (h) Vascular bundle.*



Figs.7. *(a). Magadi. Myelin structures (b)T. S. of Scape (c) A portion enlarged (d) Vascular bundles (biseriate) (e-g) Bettahalli variety (e) T. S. of Scape (f) A portion enlarged (g)Vascular bundles (biseriate).*

collenchyma and inner parenchyma. These are common features observed in all the twelve populations studied.

Kerala : (Fig. 1. h) and (Fig. 2. a-g) Vascular bundles in 2 rows 5 larger bundles biseriate and remaining 20 smaller bundles (Fig.1.h) (Fig. 2. C) cell inclusions noticed in collenchyma (Fig. 2. d, e, f and g).

Shimoga : (Fig. 2. h) (Fig. 3. a-c) Vascular bundles in 2 rows 5 larger central bundles are biseriate and 22 smaller bundles (Fig. 2. h). Myelin structure is present (Fig. 3. c)

Pillaly : (Fig. 3. d-h) (Fig. 4. a-c) Vascular bundles in 2 rows (Fig. 3. d-h) (Fig. 4. a-c) Vascular bundles in 2 rows 8 larger biseriate (Fig. 3. c) and 16 smaller bundles (Fig. 3. d). The collenchyma is bulged with cell inclusious (Fig. 3. f, g, h) Myelin structure prominent (Fig. 3. a, b and c)

Karighatta : (Fig. 4. d-g) Vascular Bundles in clear 3 rows (Fig. 4. d) 7 larger central bundles are biseriate (Fig. 4. e, f and g). 8 medium and 20 smaller bundles

Bellur : (Fig. 4. h) (Fig. 5. a-b) Vascular bundles in 3 rows, 6 larger12 medium and 21 smaller bundles. No cell inclusions noticed.

Gulbarga : (Fig. 5. c-f) Thick cuticle (Fig. 5. c) vascular bundles in 2 rows larger 6 uniseriate (Fig. 5. f) 12 smaller bundles. Collenchyma small closely packed. (Fig. 5. e)

Banganwadi : (Fig. 5. g-h) (Fig. 6. a, b) Vascular bundles in 3 rows, (Fig. 5. g) Collenchyma are lesser in nos. only 4 layers. (Fig. 5. h) Myelin structure prominent (Fig. 6. a and b)

Nagarahole : (Fig. 6. c-e) Vascular bundles 10, 5 larger and 5 smaller in 2 rows (Fig. 6. c) compactly arranged Collenchymas in 6 to 7 rows (Fig. 6. d) smaller Myelin structure noticed (Fig. 6. e)

Magadi : (Fig. 6. f-h) (Fig.7. a) Vascular bundles in 3 rows 7 big vascular bundle 7 medium and 9 bundles smaller. (Fig. 6. f) Collenchyma in 4 to 5 rows (Fig. 6. g) Larger Vascular bundles are biseriate (Fig. 6. h) small Myelin structure is observed (Fig. 7. a)

Ramanagaram: (Fig. 7. b-d) Section shows compactly arranged (Fig. 7. b) vascular bundles in 3 rows (Fig. 7. a) xylem biseriate (Fig. 7. d)

Bettahalli: (Fig. 7. e-g) Collenchyma compactly arranged (Fig. 7. f) Vascular bundles in 3 rows. 5 larger biseriate (Fig. 7. e-g). 5 medium and 20 smaller.

DISCUSSION

U. indica forms a relatively heterogeneous and well characterized group regarding taxonomical and molecular systematical studies. Previous investigations, revealed that anatomical investigations offer valuable features for characterizing natural groups or distinguishing species from each other (Fritsh, 1988, Uysal, 1999). The current study provides a comprehensive survey for the application of anatomical data in delimiting and diagnosing within *U.indica* species. i.e. intra specific variations.

Systematics is a broad field of enquiry that uses characteristics and data from many disciplines to carryout its primary objectives of describing, naming, classifying, identifying and determining relationship among plants. Anatomy broadens the base of systematic investigation by providing another set of characters that indicate relationships with external features. Anatomical characters are more or less reliable than characters from other parts of the plants. In the present, study variation have been observed in Scape anatomy and these variations are of systematic value. Anatomical characters can also help the identification when morphological features are indistinct .

The common features found in all the twelve population studied were, epidermis single layered with square cells and is was differentiated into 3 regions outer chlorenchyma, middle collenchyma and inner parenchyma. They varied in their vascular bundles. In every populations under study there were 3 rows of vascular bundles. Larger vascular bundles varied from 5 to 8, medium sized bundles from 5 to 12 and smaller bundles from 5 to 21, but populations collected from Kerala, Shimoga, Pillaly,, Nagarahole and Gulbarga showed 2 rows of vascular bundles. Vascular bundles are biseriate in populations from Kerala, Shimoga, Karighatta, Ramanagara and Bettahalli ,the remaining populations were uniseriate. Regarding Myelin structure, in B.R. Hills, Pillaly, Bangawadi, Nagarahole, Magadi, it was large and prominent and was absent in the remaining populations. The length of inflorescence varied from 5 – 80cms, smallest in Nagarahole and longest in Ramanagaram. Nagarahole population vary in there length, few bulbs showed 5 cms with 8 flowers and few showed 75 cms with 32 flowers. This showed that were intra population variations in Nagarahole population. Number of flowers in 12 populations varied from 4 to 32.The flowering and blooming time also varied in different populations of *U.indica* which might have played an important role in evolution and speciation.

Table 1 showed that genotype need not be correlated to morphological changes. The phenotype and genotype dynamics were different in this contest. So far, the anatomies of scapes of *U.indica* populations have been used for taxonomical purposes. However, our work provides the first detailed anatomical findings in scapes of *U.indica* which reveals some distinctions in scape anatomy. Hence, these results can be used in addition to the data obtained from other anatomical studies of *U.indica* species. Similar studies have been made in *Allium* (Miryeganeh and Movafeghi, 2009), in Bromeliaceae members (Suzana and Maria.,2008) and in Eriocaulaceae (Marcelo *et al.*,2010).

Conclusion

Scape anatomy of the twelve populations of *U.indica* growing in different localities of India showed less differences in their anatomical details but variations were observed in the number and shape of the cells in the cortex. The arrangement , number and size of the vascular bundles varied in these populations. Presence of uniseriate and biseriate xylem elements , myelin structures and cell inclusions are characteristic of few populations. The,anatomical traits played an important role in delimiting taxa at the population level. The anatomical details are no where connected to ploidy.

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