OBERVATIONS AND RESULTS

Danthonidium gammiei (Bhide) C. E. Hubb.

Danthonidium gammiei (Bhide) C.E. Hubb. in Hook. Ic. Pl. Subt. 3331. 1937; Bor, Grass. Bur. Cey. Ind. Pak. 479. 1960; Laxmi. in Sharma *et al.* (eds.), Fl. Maharashtra, Monocot. 447. 1996; Moulik, Grass. Bam. India 2: 577. 1997. *Danthonia gammiei* Bhide in J. Proc. Asiat. Soc. Bengal (N. S.) 7:513, t. 6. 1912; Blatt. & Mc.C. Bombay Grass. 200. 1935. **(Fig.1.)**

Annual. Culms tufted, 10–45 cm high, nodes glabrous. Leaf sheath glabrous; ligule a fimbriate membrane; blade linear, 1.5–7 x 0.1–2 cm. Inflorescence spiciform, ovate–oblong, 1–5 cm long; peduncles puberulous; rhachis hairy. Spikelet elliptic–oblong, 10–20 mm long; pedicels short. Lower glume chartaceous, narrowly ovate, 10–20 mm long, 5–nerved, apex acuminate. Upper glume chartaceous, narrowly ovate, 8–12 mm long, 3–nerved, apex acute. Lemma coriaceous, oblong, 2.5–5 mm long, margin inflexed, bearded with long hairs, 7–9–nerved, 3–awned, lateral awns shroter, 4–7 mm long, straight, median awn geniculate, 10–25 mm long with tuft of hairs on either side, column twisted. Palea hyaline, oblong, 2.4–4 mm long, margins inflexed, 2–keeled, keels ciliate above, apex notched, 2–toothed. Rhachilla spathulate, 1–1.8 mm long, ciliate on margins. Lodicules 2. Stamens 3; anthers 1–2 mm long. Style 1 mm long; ovary linear,1-1.2 mm long. Caryopsis elliptic–obovate, 2.5–3 mm long, mature caryopsis dark brown colour, linear hilum present on ventral side of caryopsis, embryo present on dorsal side clearly visible in caryopsis.

Fl. & Frts.: September – October.

Chromosome number: n = 10

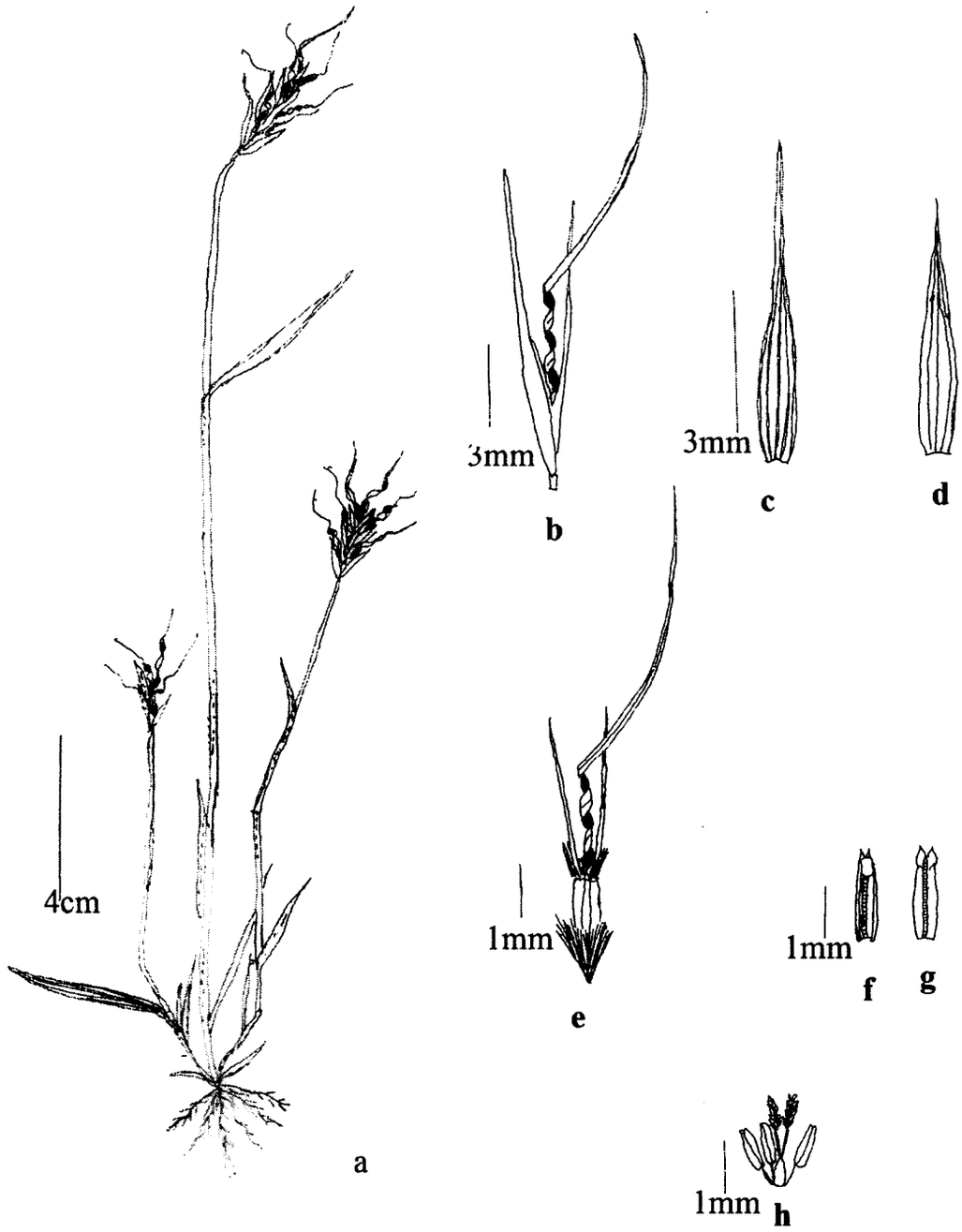


Fig.1.Danthonidium gammiei C. E. Hubb. a. Habit, **b.**Spikelet, **c.** Lower glume, **d.**Upper glume,**e.**Lemma,**f & g.** Palea,**h.** Stamens & Pistil.

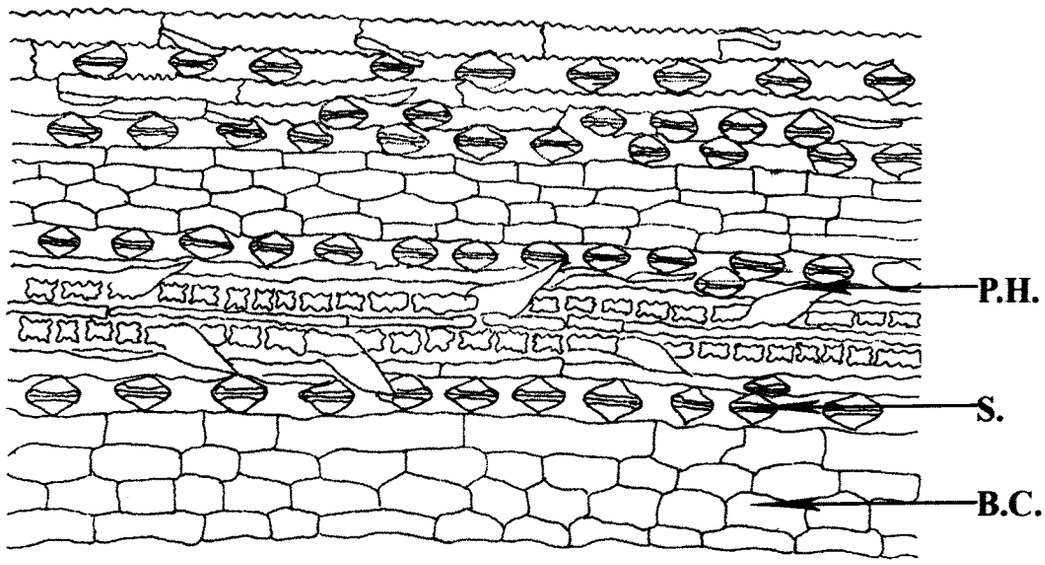


Fig.2.A. Adaxial leaf epidermis of ***Danthonidium gammiei*** C.E.Hubb. x 200.

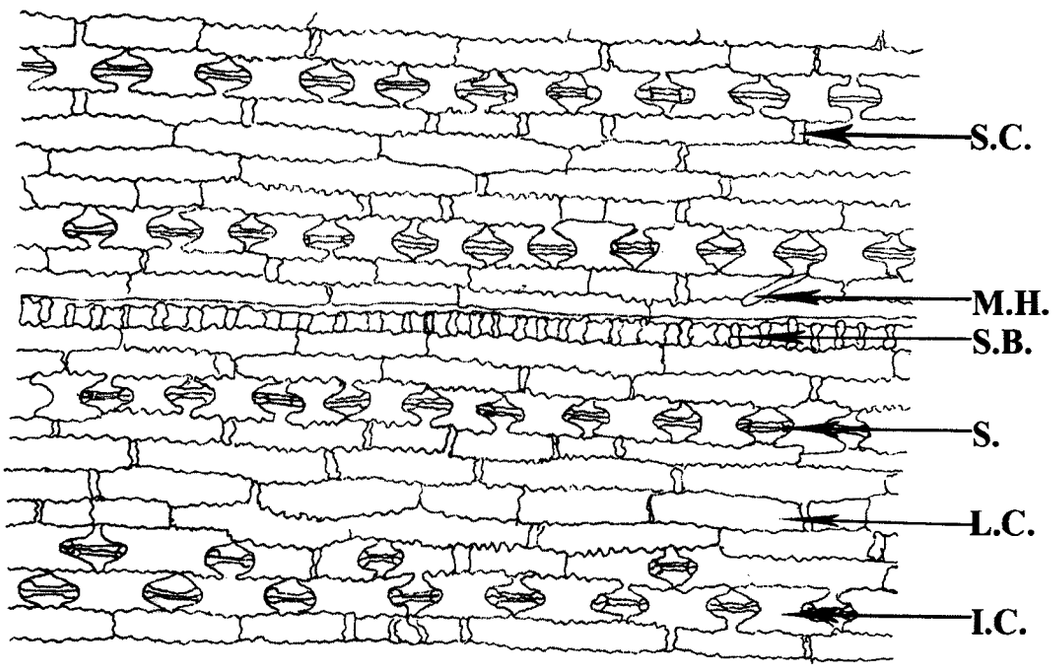


Fig.2.B. Abaxial leaf epidermis of ***Danthonidium gammiei*** C.E. Hubb. x 200.

Bulliform cell (B.C.),Interstomatal cell (I.C.),Long cell (L.C.), Microhair (M.H.), Prickel hair (P.H.), Stomata(S.),Short cell (S.C.),Silica bodies (S.B.)

Adaxial Epidermis:

Adaxial epidermis shows distinction between intercostal and costal region. Intercostal region consists of usually four rows of bulliform thin walled cells. The bulliform cells are rectangular in shape. On either side of intercostal region there are 1-2 rows of stomata. Stomata are with triangular subsidiary cells and equidistantly placed. Costal regions (the region over the vein) consist of 2-3 rows of long cells and 3-5 rows of short cells. The walls of both short and long cells are sinuous. On either side of costal region there is row of regularly and equidistantly placed prickle hairs. The short cells give rise to pointed prickle hairs. Row of microhairs is present along each stomatal row. Macrohairs are usually absent. However, rarely they are found in distal part of leaf. **(Fig.2.A.and Plate-I .a.)**

Abaxial epidermis:

Abaxial epidermis also shows some distinction between intercostal and costal region .Intercostal region consists of about 13 rows of short cells and long cells, usually parallel 2 rows of stomata. Long cells usually alternate with short cells. The walls of intercostal cells are sinuous. The stomata with triangular low dome shaped subsidiary cells are equidistantly placed. Two intercostal rows of stomata are separated by about 5 rows of rectangular long and short cells.Microhairs are present usually on each long cell and of Panicoid type. In costal region (over vein) there is single row made up of dumbbell shaped silica body. **(Fig.2.B.and Plate-I .b.)**

T. S. of. Lamina:

Adaxial surface with low ribs with slightly rounded apices and separated by 'U' shaped furrows. Ridges and furrows are of equal size. Bulliform cells fan shaped grouped at bases of furrows with large central cell. Interfurrrow adaxial epidermis is made up of small barrel shaped cells of unequal size.Abaxial epidermis made up of uniform barreled cells of somewhat unequal size and covered with thick cuticle. Mesophyll made up of non radiate chlorenchymatous cells. Keel inconspicuous and contain solitary median vascular bundle more or less similar to lateral large vascular bundle. Median keel bundle with single adaxial girder. Vascular bundle with outer sheath made up of large colourless cells extended to adaxial sclerenchyma by 2-3 colourless cells. Inner bundle sheath incomplete on abaxial side. Lateral large vascular bundle very similar to median bundle but differs

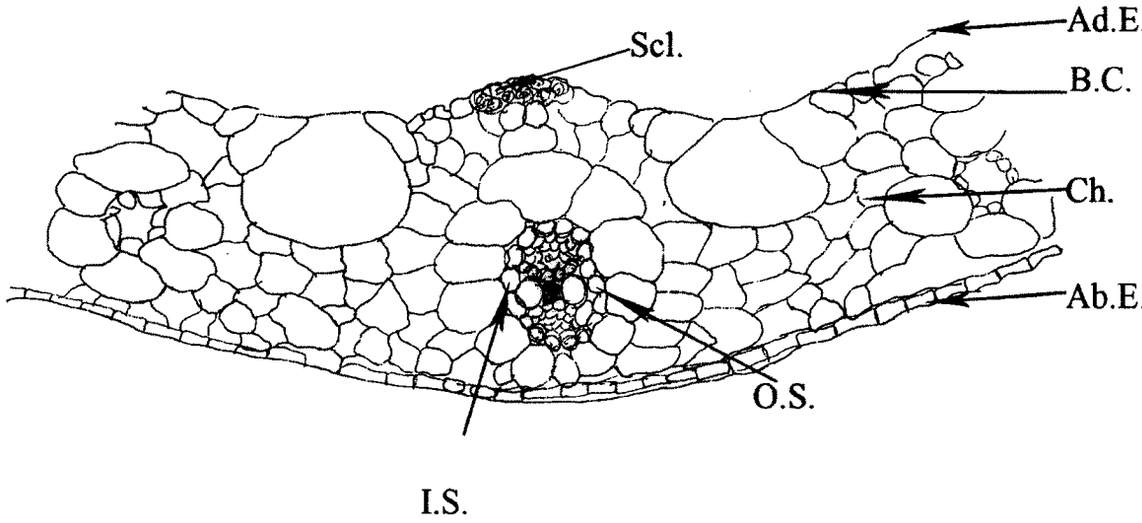


Fig.3.A. T.S.showing mid keel bundle of ***Danthonidium gammiei*** **C.E.** x 250.

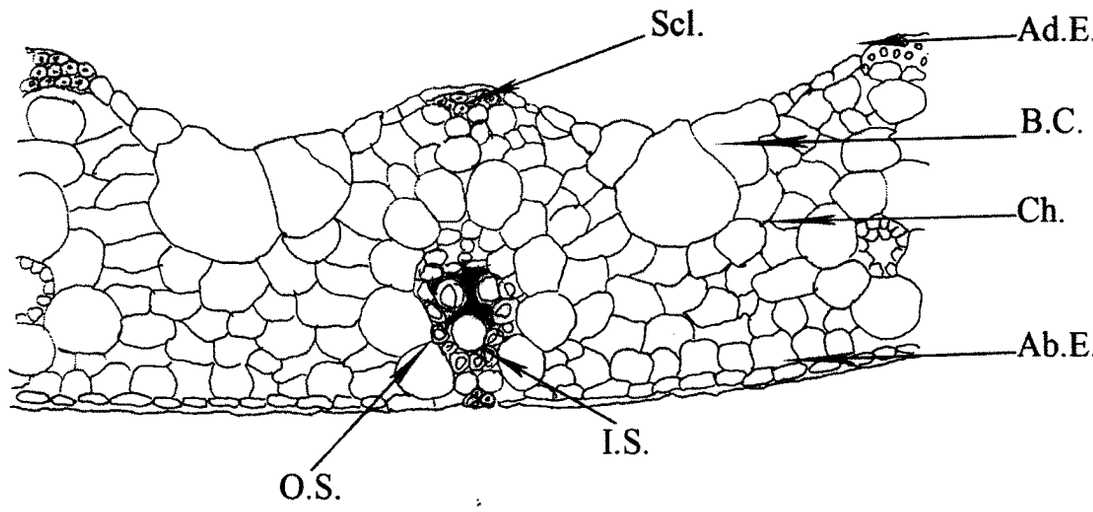


Fig.3.B.T.S.of leaf showing lateral vascular bundle with sclerenchymatous girders in ***Danthonidium gammiei*** C.E. x 250.

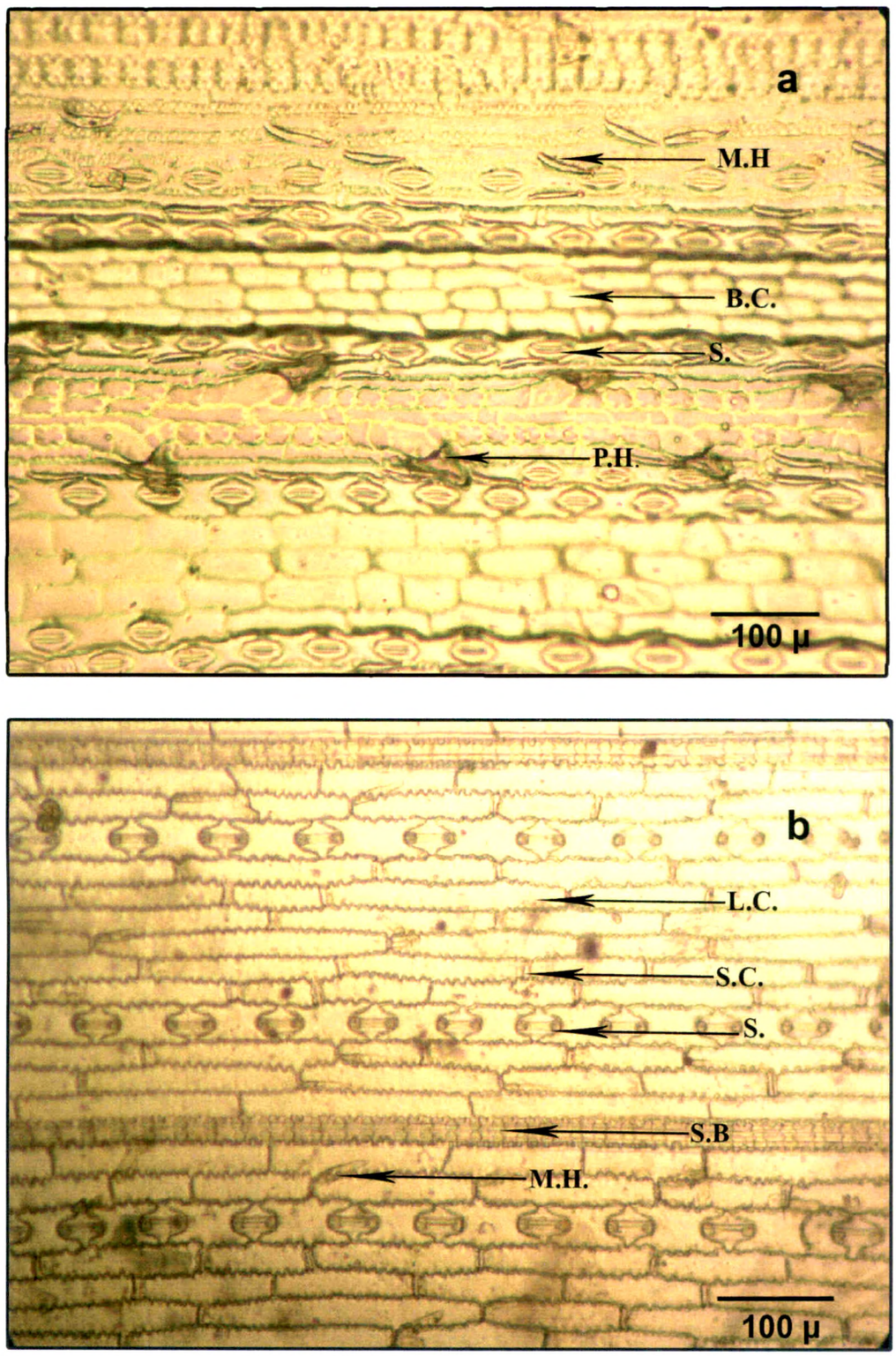
Ad.E.adaxial epidermis,Ab.E.abaxial epidermis, B.C.bulliform cell,Ch.chlorenchyma, I.S.inner sheath,O.S.outer sheath,Scl.Sclerenchyma.

only in possessing wide sclerenchymatous girder on adaxial side and narrow on abaxial side. Small alternating lateral vascular bundles similar to large vascular bundles but differs in having few bundle sheath cells and no metaxylem. All vascular bundles are of basic type. **(Fig.3.A and B, Plate-II a, b,)**

T.S.of. Culm:

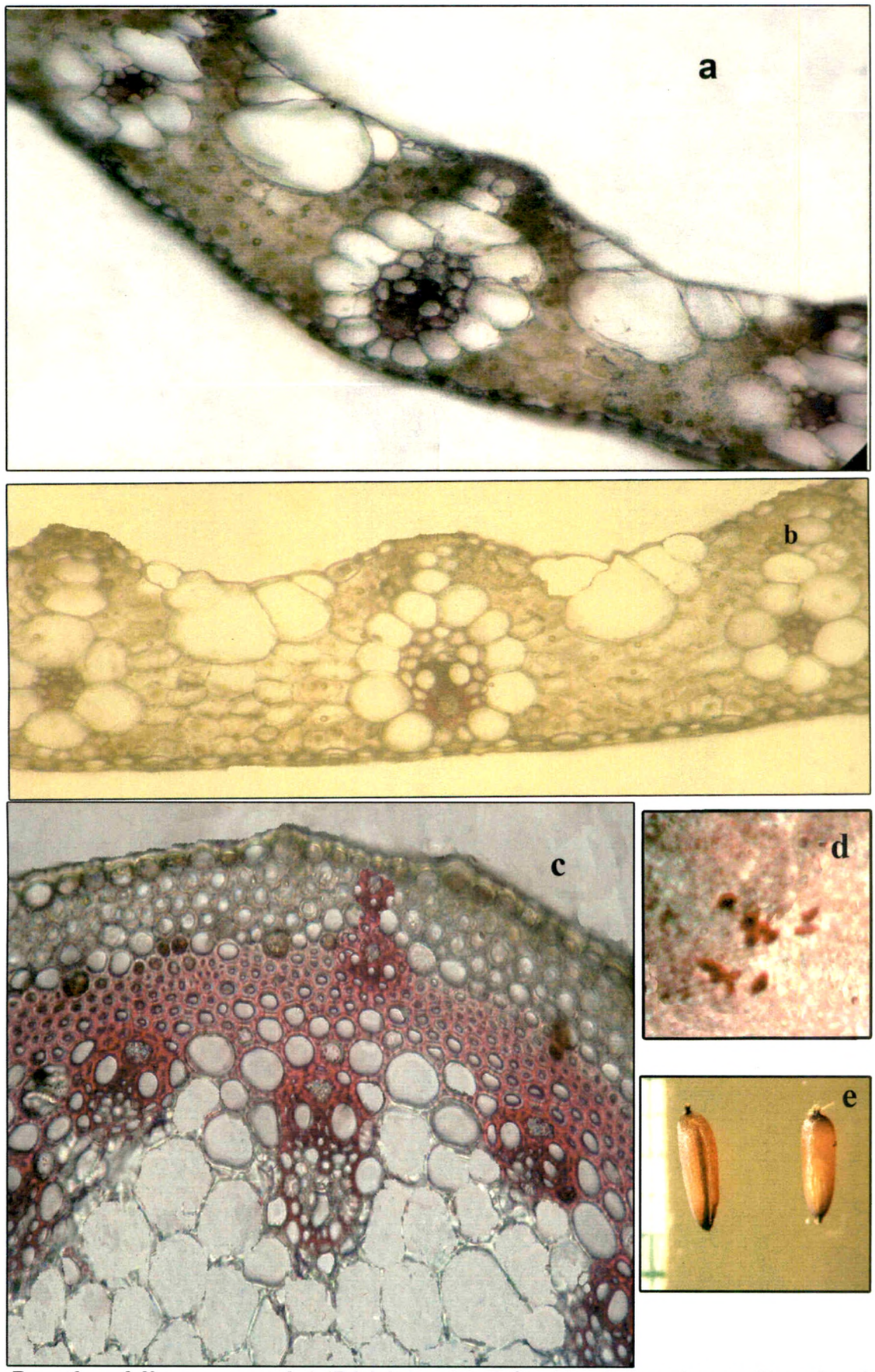
It is more or less circular in outline. Epidermis is made up of oval shaped cells of unequal size covered with thick cuticle on outer surface. The epidermis is followed by 3-4 layers of chlorenchyma with larger cells towards inner side.Chlorenchyma is followed by 4-6 layers of thick walled sclerenchyma.Vascular bundle mostly peripheral. Outermost small vascular bundles with sclerenchymatous girder up to the epidermis. Larger vascular bundle with distinct metaxylem.Vascular bundles embedded in sclerenchymatous zone is of basic type surrounding the pith. Pith is made up of large parenchymatous angular cells. **(Plate-II c)**

PLATE - I



Danthonidium gammiei (Bhide) C. E. Hubb.: a) Adaxial surface of leaf ,**b)** Abaxial surface of leaf showing epidermal feature: Long cell (L.C.), Microhairs (M.H.),Prickel hair (P.H.), Short cell (S.C.),Stomata (S).Silica bodies(S.B.).

PLATE- II



Danthonidium gammiei (Bhide) : **a)**A.T.S.of leaf showing solitary keel bundle,b)A.T.S.of leaf with small and large lateral vascular bundle-showing adaxial girder,**c)** A.T.S.of stem.showing epidermis followed by chlorenchymatous region,**d).**Plate showing chromosome number n=10,**e).**Caryoposis showing linear hilum.

Hubbardia heptaneuron Bor

Hubbardia heptaneuron Bor in Kew Bull. 1950: 385. 1951 & Grass. Bur. Cey. Ind. Pak. 572. 1960; Moulik, Grass. Bam. India 2: 537. 1997; Yadav & Sardesai, Fl. Kolh. Dist. 583. 2002; Potdar *et al.* in Janarth. & Narsim. (eds.) Proc. Pl. Div. Hum. Wel. Cons. 317. 2003. **(Fig.4.).**

Annual. Culms delicate, creeping below, rooting at lower nodes, 2.5-15 cm long, nodes glabrous. Leaf sheath shorter than the internodes, terete, 3-4 mm long, glabrous, hirsute near collar, ligule absent. Leaf blade narrowly elliptic to oblong-elliptical, 0.5-3 x 0.3-0.8 cm, thin, delicate, membranous, translucent, 7-14 nerved, hirsute on both surfaces with tuberculate hairs, scaberulus on the margins, acute. Inflorescence an axillary panicle, terminating leafy branches. Spikelets all alike, 2-flowered, without awns, terete, or abaxially flattened, disarticulating above the glumes, elliptic-lanceolate, 2-2.5 x 0.3-0.4 mm, rachilla without an extension. Lower glume thinly membranous, 2-2.3 x 0.2-0.3 mm, 5- or usually 7-nerved, 2-keeled, keels hirsute with tubercle based hairs about the middle, blunt at apex. Upper glume thinly membranous, elliptic-lanceolate, 2-2.3 x 0.2-0.3 mm, 5-nerved, 2-keeled, keels hirsute with tubercle based hairs about the middle, blunt at apex. Lower lemma hyaline, glabrous or rarely with tubercle based hairs, lanceolate, 1.6-2.7 x 0.4-0.5 mm, 7-9-nerved, glabrous, acute. Upper lemma hyaline, ovate-lanceolate, 1.6-2.7 x 0.4-0.5 mm, 7-9-nerved, glabrous, acute. Paleas absent. Lodicules 2, cuneate, glabrous, 0.3-0.4 mm long. Stamens 3, anthers 0.5-0.6 mm long. Styles 2, 0.6-0.8 mm long, stigmas 1.5-2.2 mm long, plumose, caryopsis 0.5 mm in length, mature dark brown colour narrowly oval ,narrowed at both ends. Germinating seed produces knob like radicular growth which possess bunch of unicellular hairs helping in attachment seed to vertical rocks.

Fl. & Frts.: August-September.

Chromosome number: n = 10

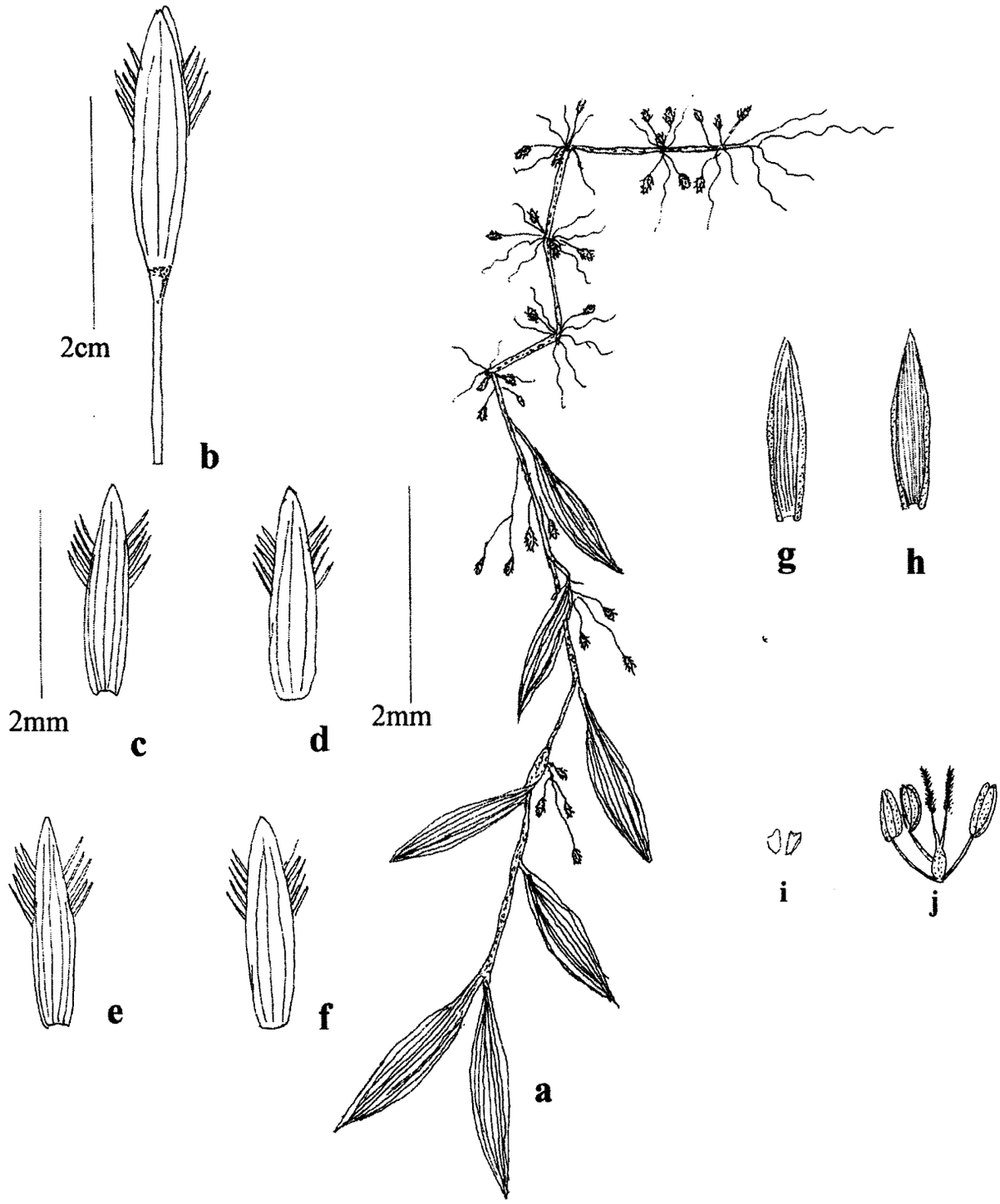


Fig.4:Hubbardia heptaneuron Bor.a. Habit,**b.** Spikelet, **c.** Adaxial view of lower glume, **d.** Abaxial view of lower glume, **e.** Adaxial view of upper glume,**f.** Abaxial view of upper glume, **g.** Lower lemma,**h.** Upper lemma, **i.** Lodicules, **j.** Stamens and Pistil.

Adaxial epidermis:

Adaxial epidermis shows distinction between intercostal and costal region. Intercostal region consists of usually 3-4 layers of cells termed as epidermal cells. Epidermal cells are of more or less similar and vertically elongated. Costal region consists of 4-5 rows of long and short cells. The long cells with straight walls. Silica bodies are present only on middle row of costal zone and square to rectangular in outline with sides usually concave.Macrohairs are present along with swollen bases and restricted to veins only. Stomata are infrequently present. **(fig.5.A), (Plate-III).**

Abaxial Epidermis

Abaxial epidermis also shows distinction between intercostal and costal region. Intercostal region consists of 8-9 rows of vertically elongated epidermal cells which are some what wavy in outline and are of unequal size. There are usually two rows of stomata in intercostal zone. Stomata are with low dome shaped subsidiary cells. Long macrohairs are with swollen bases are present abundantly both above and between costal regions. Microhairs are present only in intercostal region which are two celled of which distal cell is tapering. Costal region consists of 2-3 rows of long and short cells. Long cells are with straight walls. Silica bodies of short cells are square to rectangular in outline. **(fig.5.B). (Plate-III).**

T.S.of lamina:

T.S.of lamina shows single layered upper epidermis made up of square to rectangular cells. Epidermis is followed by only two layers of mesophyll cells. The row adjacent to adaxial epidermis forming a compact layer of oval cells somewhat resembling to palisade layer. The layer adjacent to abaxial epidermis consists of loosely arranged oval cells with low number of chloroplast. Abaxial epidermis is made up of large barrel shaped cells. The continuity of layer is broken by stomata at some places. The leaf consists of usually seven vascular bundles of more or less similar size structure. Each vascular bundle has outer bundle sheath made up of large radialy elongated cells extending to adaxial epidermis by colourless cells and single layer of sclerenchyma is present on abaxial side mainly in middle bundle. Inner bundle sheath is made up of small polygonal cells. Vascular bundles are

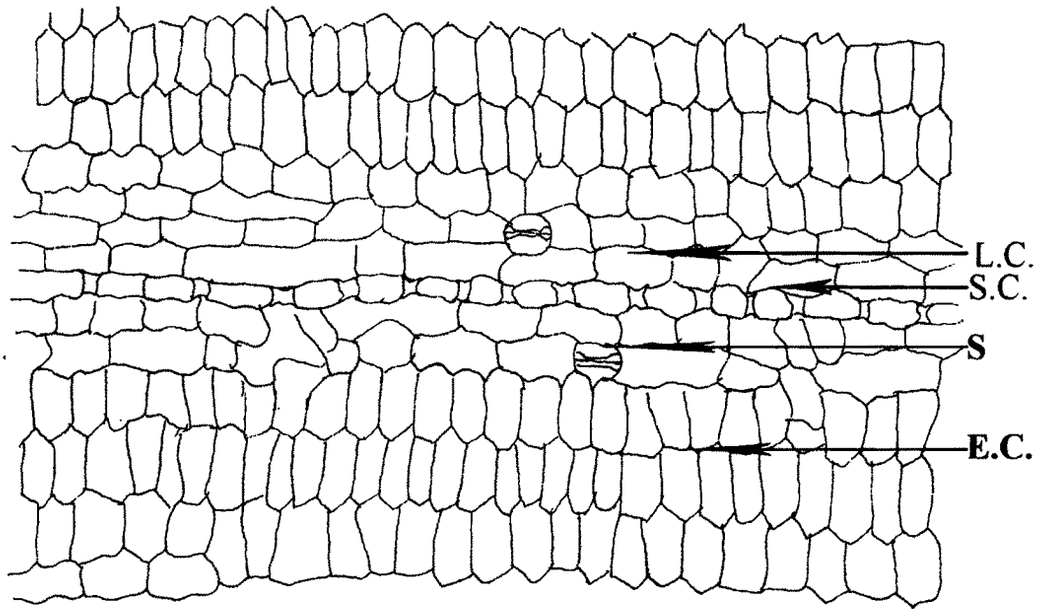


fig: 5.A. Adaxial leaf epidermis of ***Hubbardia heptaneuron*** Bor. leaf x 200

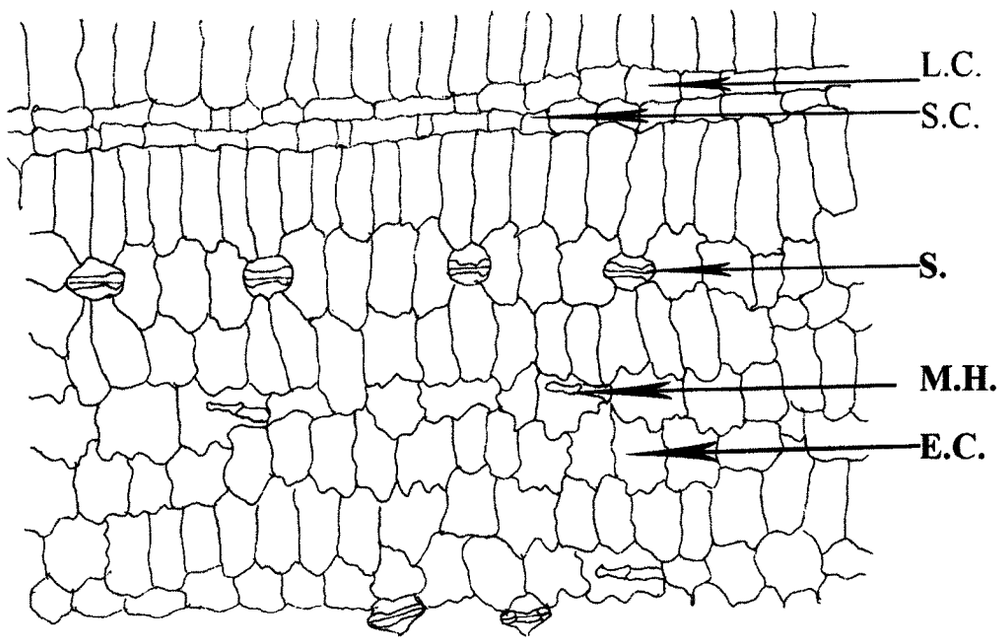


fig.5.B. Abaxial leaf epidermis of ***Hubbardia heptaneuron*** Bor leaf x 200

Epidermal cell(E.C.).Longcell (L.C.), Microhair (M.H.), Shortcell(S.C.), Stomata (S).

widely separated and connected by radial row of chlorenchymatous cells. Each vascular bundle is of basic type. **(Fig.6.A.and B), (Plate-IV).**

T.S. of Culm:

Culm is Plano convex in outline. Epidermis is made up of oval to circular cells covered with thin cuticle. Epidermis is followed by layer of two large parenchymatous cells with intercellular spaces forming hypodermis. Hypodermis is followed by sclerenchymatous zone embedding about 6 vascular bundles in a ring. Each vascular bundle consists of two metaxylem, protoxylem and phloem surrounded by sclerenchymatous sheath. The pith is large with parenchymatous cells containing starch grains and intercellular spaces. **(Plate-IV).**

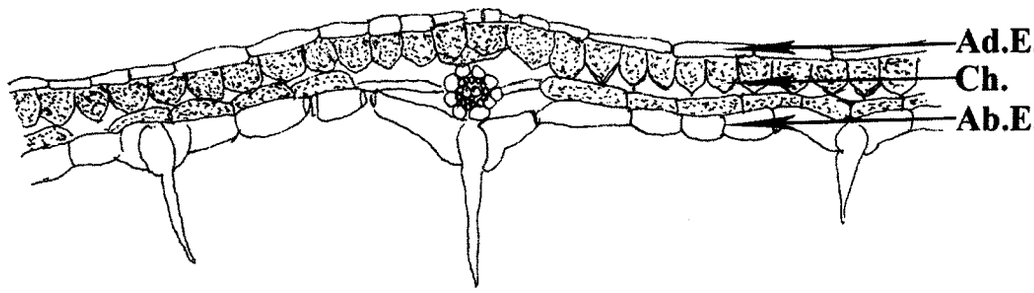


fig: 6.A. T.S.of leaf showing layer of mesophyll cells of ***Hubbardia heptaneuron*** Bor. leaf x 250

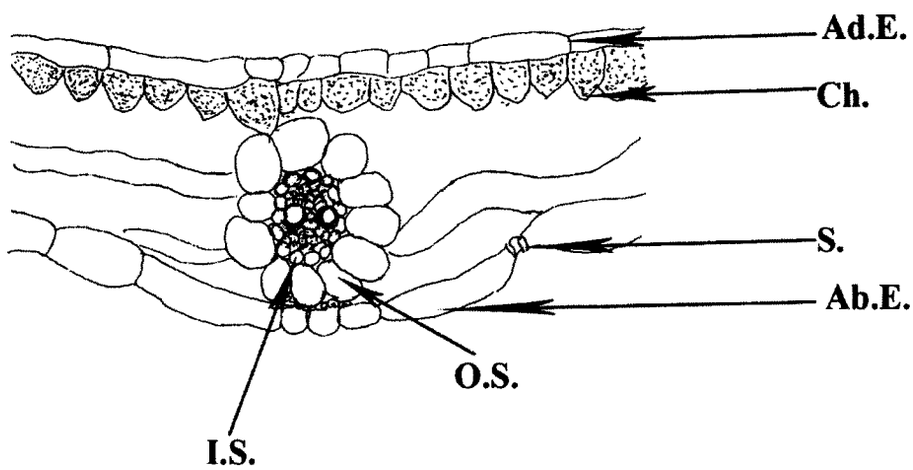
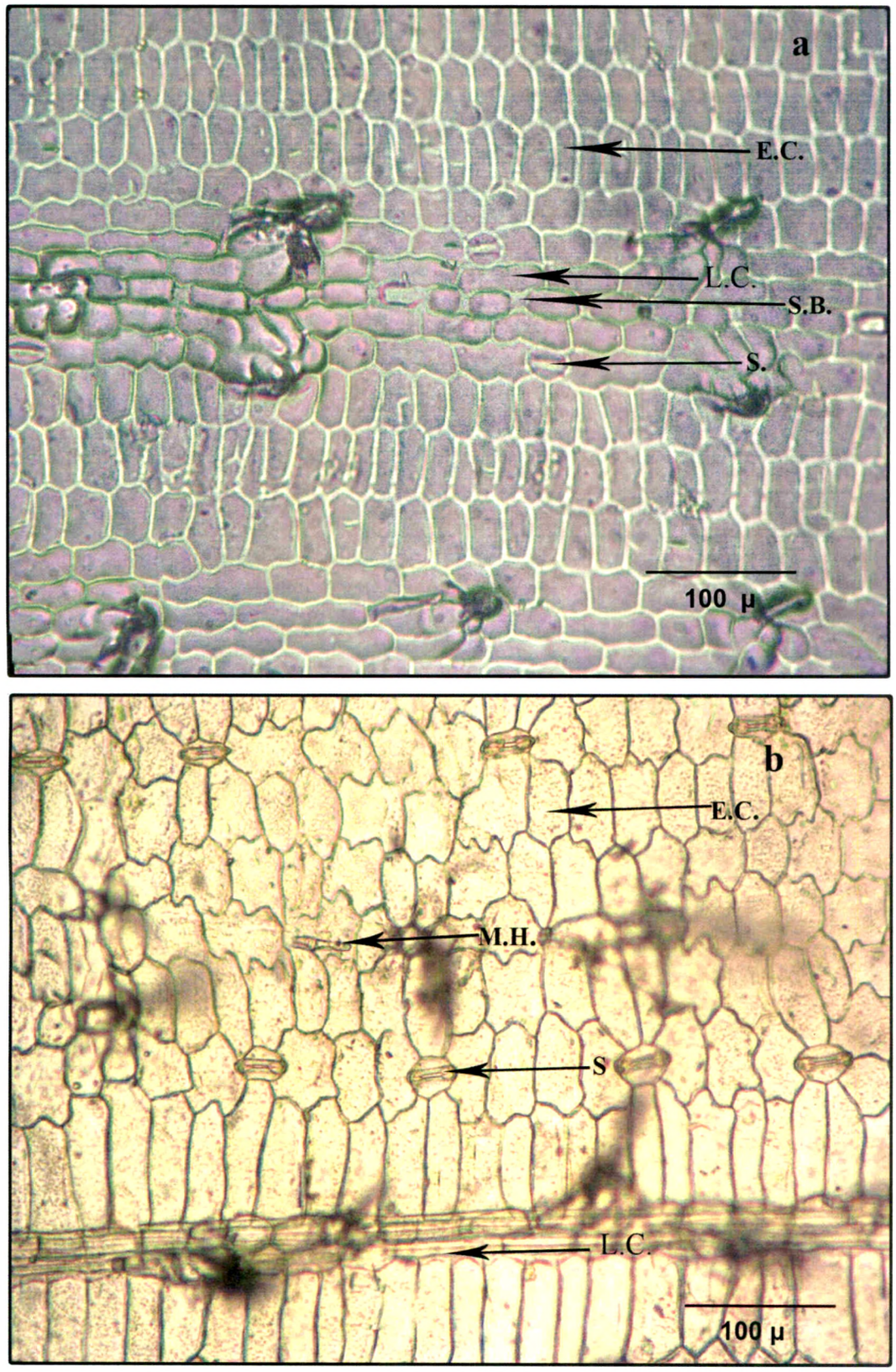


fig: 6.B. Enlarge vascular bundle showing parenchymatous sheath in ***Hubbardia heptaneuron*** Bor. leaf x 250

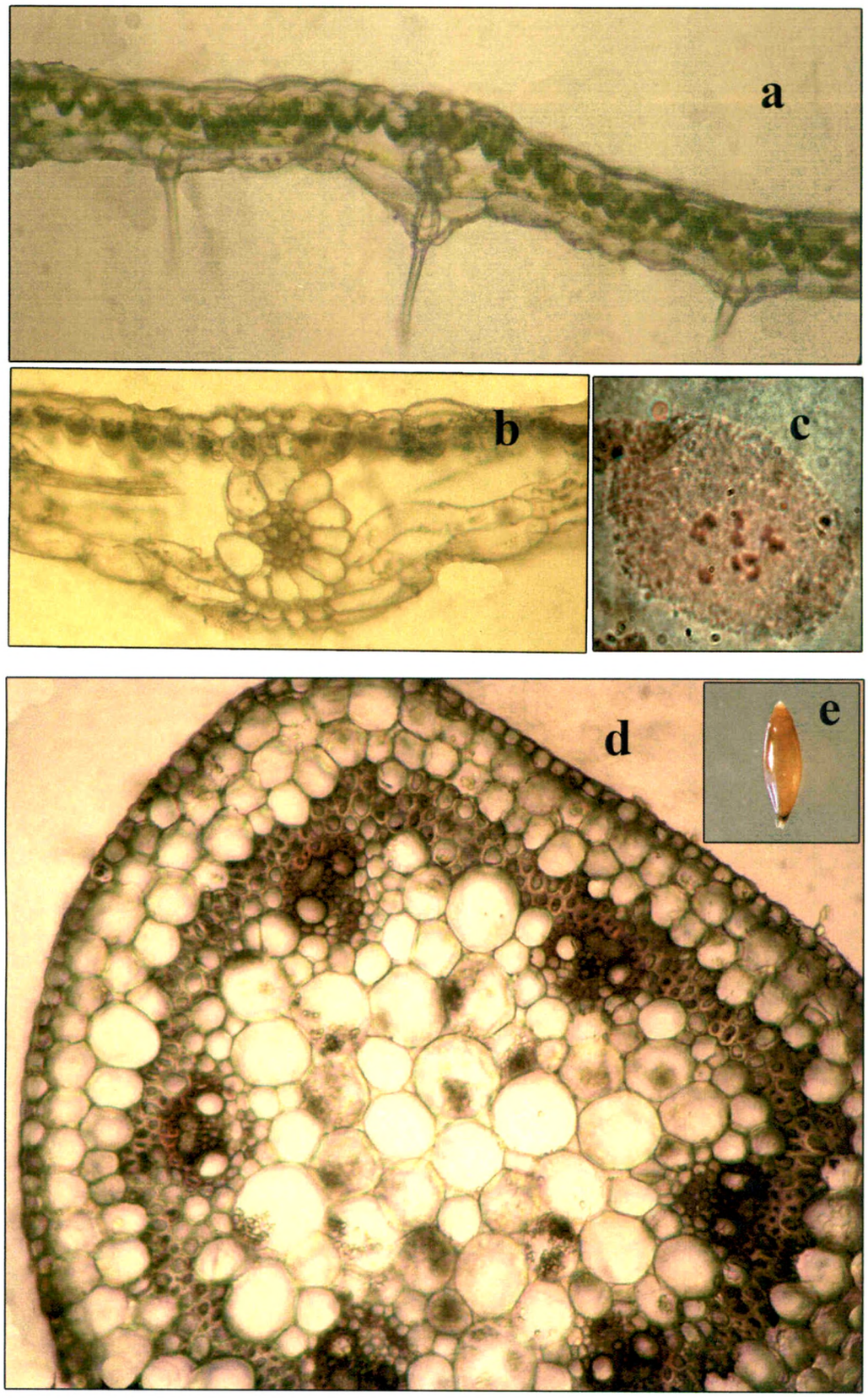
Ad.E. adaxial epidermis,Ab.E.abaxial epidermis,Ch.chlorenchyma, I.S. inner bundle sheath,O.S. outer bundle-sheath, Scl.sclerenchyma,S.Stomata.

PLATE -III



Hubbardia heptaneuron Bor.a. Adaxial surface of leaf., **b.** Abaxial surface of leaf showing epidermal features:Epidermal cell (E.C.),Long cell (L.C.), Microhairs (M.H.),Silica body (S.B.),Stomata (S).

PLATE-IV



Hubbardia heptaneuron Bor. a.T.S.of lamina showing two layers of chlorenchyma cells.**b.**Vascular bundle with single parenchymatous sheath,**c.** Chrmosomes n=10,**d.**T.S.of.stem showing vascular bundle embedded in single sclerenchymatous ring,**e.**Caryopsis.

Indopoa paupercula (Stapf) Bor

Indopoa paupercula (Stapf) Bor in Kew Bull 13: 225. 1958 & Bor, Grass. Bur. Cey. Ind. Pak. 522. 1960; Laxmi. in Sharma *et al.* (eds.), Fl. Maharashtra, Monocot. 506. 1996; *Tripogon pauperculus* Stapf in Hook. Ic. Pl. t. 2442. 1896; Hook. f. Fl. Brit. Ind. 7: 285. 1896; Blatt. & McC. Bombay Grass. 266. 1935; Bor, Grass. Bur. Cey. Ind. Pak. 522. 1960. **(Fig.7.)**

Annual. Culms terete, 5-15 cm tall, erect glabrous, nodes glabrous. Leaf sheath compressed, 1-4 cm long, glabrous, ligule membranous, 0.6-0.8 mm long. Leaf blade linear, involute, setaceous, 2-8 cm long, glabrous, apex acuminate. Raceme spiciform, 3-10 cm long, erect or recurved towards apex, rachis triquetrous, glabrous. Spikelets 3-10, 7-11 mm long (excluding awns), distant, 2-5 flowered. Lower glume membranous, narrowly ovate-oblong, 3.4-3.8 x 0.6-0.8 mm, glabrous, 1-keeled on dorsal side, 1-nerved, asymmetrical, apex acuminate. Upper glume membranous, narrowly ovate, 6-7 x 0.6-0.8 mm, 1-keeled, 1-nerved, apex acuminate. Lower lemma membranous, linear ovate, 5-6.5 x 0.8-1 mm (excluding awn), bearded at the base, apex deeply 2 lobed, lobes capillary, median awn in the cleft, geniculate, 10-13 mm long, minutely scaberulus. Palea hyaline, narrowly elliptic-ovate, 4.2-4.5 x 0.7-0.8 mm, 2-keeled, keels ciliolate, 2-nerved, apex acute. Lodicules 2. Stamens 3, anthers 0.4 mm long. Fruit small to medium sized 3-4.5 mm long, mature dark brown colour isodiametric; biconvex, very slender and needle like with an apical glabrous, emarginated, fleshy appendages, hilum punctiform. Embryo small, about one fifth of grain length.

Fl. & Frts.: August to October.

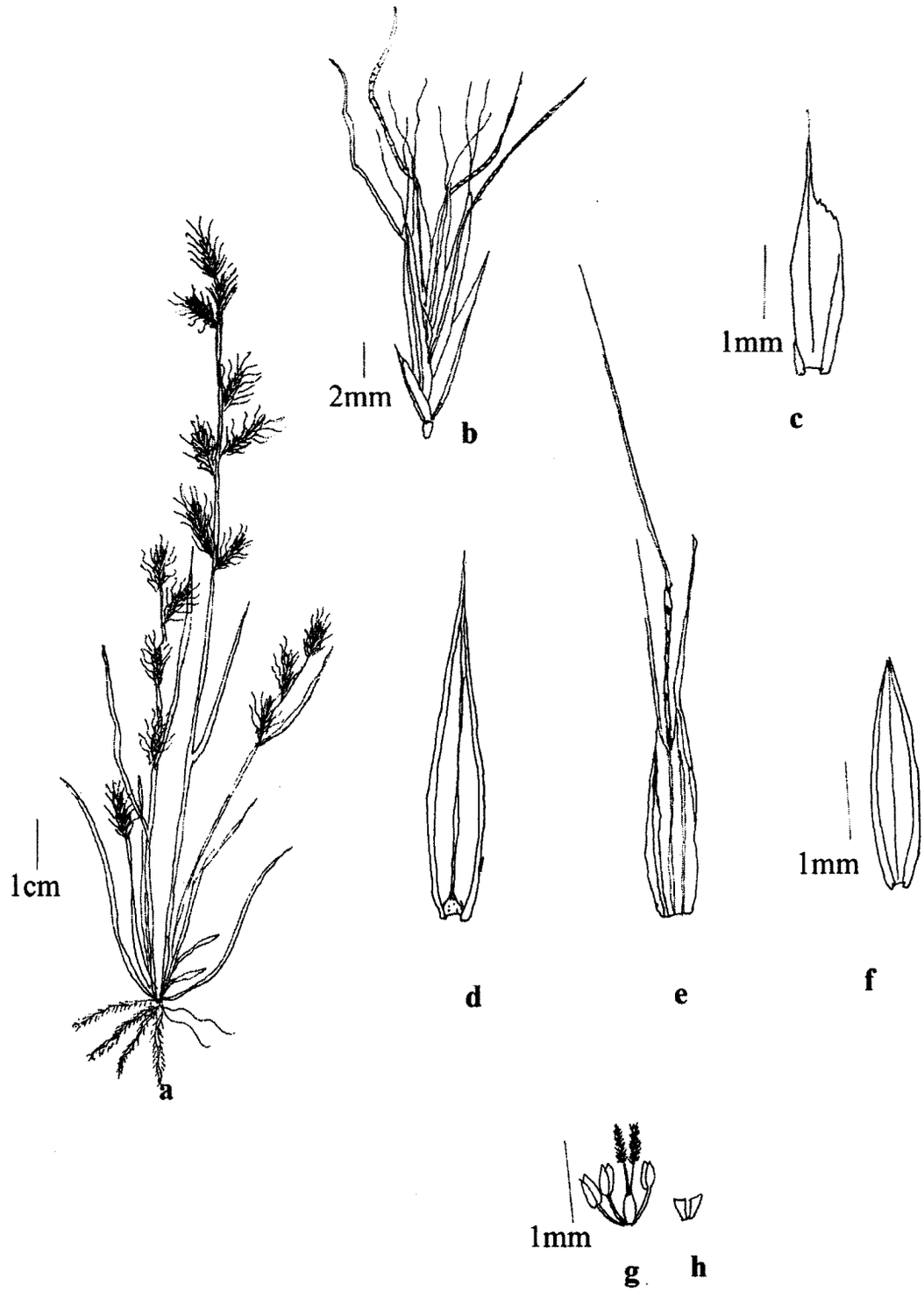


fig.7. Indopoa paupercula (Stapf) Bor a. Habit,**b.**Spikelet,**c.** Lower glume, **d.** Upper glume,**e.** Lemma, **f.** Palea, **g.** Stamens & Pistil, **h.** Lodicules.

Abaxial epidermis:

Abaxial epidermis well distinct into costal and intercostals regions.Intercostal region is made up of 3-4 rows of long cells with sinuous walls. Each alternate intercostals zone contains a row of stomata. Stomata with triangular subsidiary cells. Unicellular rounded microhairs are of Sporobolous type, frequently present in intercostal region. Costal region consists of single row of short cell with thick and sinuous wall. Silica bodies are saddle shaped.

Attempts were made to get peeling of adaxial epidermis by scraping and nail polish method. However, due to small size of leaf and presence of numerous hairs a satisfactory peel could not be obtained. **(fig.8), (Plate-V).**

T. S. Lamina:

The leaf lamina is very narrow and in rolled. Adaxial surface has tall; closely placed ribs with some what narrowly rounded apices and separated by 'v'shaped furrows. Ridges and furrows are of unequal size. The bulliform cells between vascular bundle at the bases of furrow larger and somewhat fan shaped that on lateral side smaller and oval shaped.Macrohairs are present at apex of each adaxial rib and the bases of hair rest on adaxial sclerenchymatous girders. The macro hairs are pillose on their outer surfaces and partly ensheathed by epidermal cells. Mesophyll consists of single layer of small thin walled somewhat radially elongated one either side of vascular bundles. Midrib is not conspicuous. The median vascular bundle is of basic type. Two lateral bundles large and remaining are smaller in size. Total vascular bundles per leaf ranges from 13-15 of which one median and two lateral large and well developed. Bundle sheaths of median and lateral large vascular bundles single layered made up of large oval parenchymatous cell and have incomplete outer sheath. The xylem and phloem of these bundles is well distinguished. There are 3-4 small vascular bundles between two large vascular bundles. Small vascular bundle consists of single bundle sheaths surrounding indistinct xylem and phloem. All vascular bundles are with abaxial and adaxial girders .Adaxial girders are prominent, wide, 2-3 cells in thickness on which bases of macrohairs raised.Abaxial girder consist of row of 8-10 sclerenchyma cells interrupting the bundle sheaths. **(Fig.9.A.and B), (Plate-VI)**

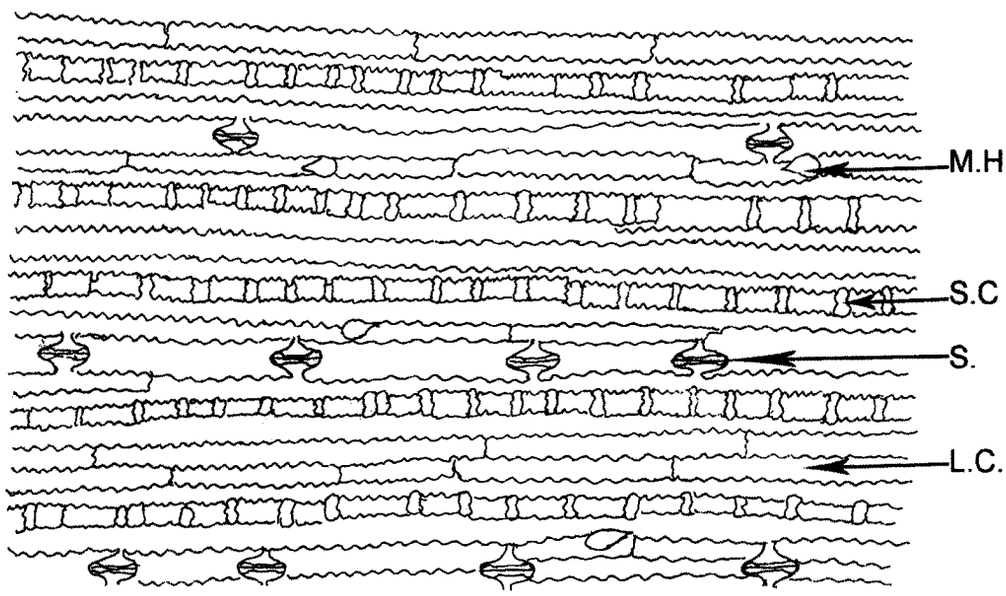


fig.8. Abaxial epidermis of ***Indopoa paupercula*** (Stapf) Bor x 200.

Long cell,(L.C.),Microhair(M.H.),Short cell (S.C.),Stomata(S).

T. S. of culm:

The culm is circular in outline. The epidermis is made up of thin walled small oval cells which get peeled of while sectioning. Epidermis followed by sclerenchymatous zone of -5 layers. The sclerenchymatous zone is followed by a ring of large vascular bundle about 7 in number.Vascualr bundles are separated from each other by large parenchymatous cells with intercellular spaces. Some rudimentary vascular bundles are found adjacent to sclerenchymatous zone in between large vascular bundle. Each vascular bundle consists of sclerenchymatous sheath, 2 metaxylem, protoxylem and phloem. It is of basic type. Central cell of the pith get crushed forming a cavity in center. **(Plate-VI).**

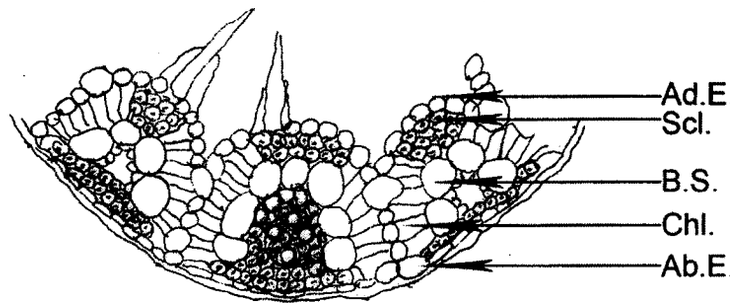


fig 9.A. T.S.of leaf passing through mid region of **Indopoa paupercula** (Stapf) Bor x250.

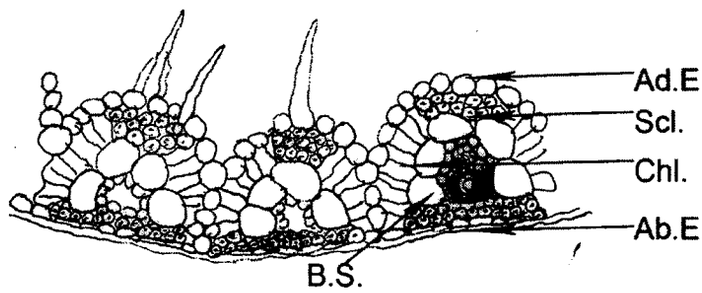
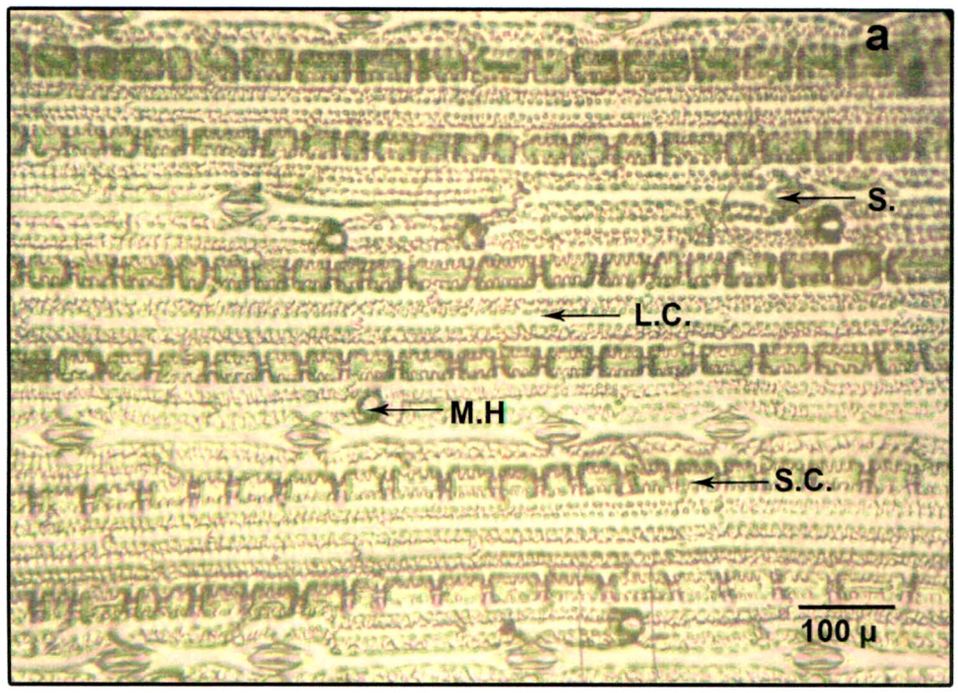
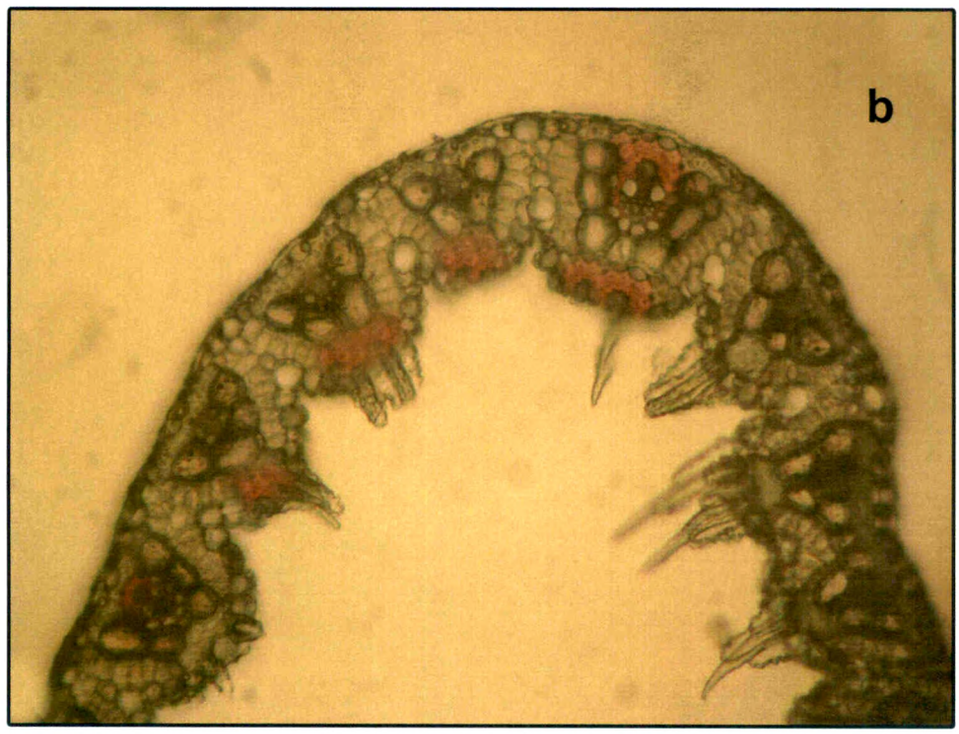


fig.9.B.T.S.of leaf showing lateral large and small vascular bundle with sclerenchymatous girder of **Indopoa paupercula** (Stapf) Bor x 250.

Adaxial epidermis (Ad.E.),Abaxial epidermis (Ab.E.),Bundle Sheath (B.S.), Chlorenchyma (Chl.),Sclerenchyma (Scl.).

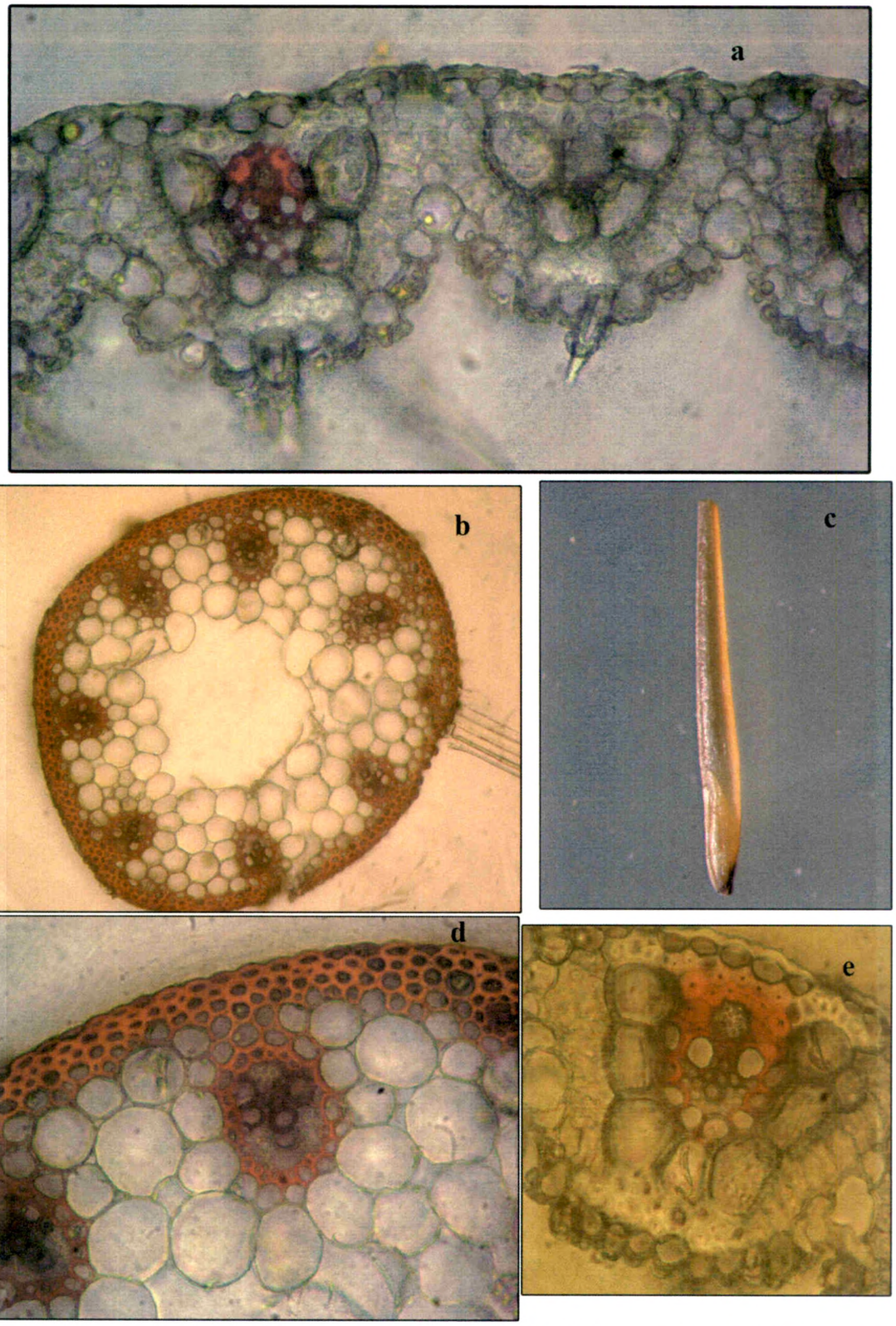
PLATE-V





Indopoa paupercula (Stapf) Bor :a. Abaxial surface of leaf showing epidermal features:stomata(S),Long cell(L.C.), Short cell(S.C.),Microhair(M.H.).**b**.T.S.of leaf showing vascular bundle with adaxial and abaxial sclerenchymatous girder.

PLATE-VI



Indopoa paupercula (Stapf) Bor :**a).**T.S.of leaf showing lateral large and small vascular bundles,**b)**T.S.of culm showing peripheral vascular bundle and peeled epidermis,**c)**.Needle shaped caryopsis,**d)**.Enlarged stem vascu -lar bundle with prominent metaxylem elements, **e)** Mid bundle of leaf with both the girders.

Pogonachne racemosa Bor

Pogonachne racemosa Bor in Kew Bull. 1949: 176. 1949 & Grass. Bur. Cey. Ind. Pak. 200. 1960; Laxmi. in Sharma *et al.* (eds.), Fl. Maharashtra, Monocot. 571. 1996; Moulik, Grass. Bam. India 1: 300. 1997. **(fig.10).**

Annual. Culms tufted, terete, 20-120 cm tall, erect or geniculately ascending, rooting at lower nodes, stilt rooted, slender to stout, simple or branched, glabrous and nodes glabrous. Leaf sheath terete, 4-15 cm long, glabrous or sparsely hairy, margins sparsely ciliate, ligule membranous, 2-3 mm long. Leaf blade flat, linear elliptic, glabrous or sparsely tubercle based hairy, margins scaberulous, apex finely acuminate. Racemes 4-7 cm long (excluding awn), more or less exerted from spathes. Joints compressed, linear, 3-5 mm long, ciliate on one margin. Spikelet solitary, pedicelled, pedicels compressed, 1.5-2 mm long, linear, ciliate on one margin. Spikelet narrowly ovate, 7-12 x 1.8-2 mm, callus densely bearded with white hairs, awned. Lower glume coriaceous, narrowly ovate-elliptic, 7-10 x 1.4-1.6 mm, glabrous or hairy, 23-25-nerved, 2-keeled at apex, keels pectinately ciliate, margins hyaline, apex hyaline, truncate. Upper glume coriaceous, narrowly ovate, 7-12 x 1.3-1.5 mm, glabrous or sparsely hairy, obscurely 3-nerved, 1-keeled, keels ciliate at apex with a tuft hair above the middle on back, margins hyaline, apex hyaline, acuminate. Lower lemma hyaline, narrowly elliptic-ovate, 7-8.5 x 0.8-1 mm, 3-nerved, apex acute. Palea hyline, narrowly ovate-oblong, 4.5-5.5 x 0.6-0.8 mm, apex acute. Upper lemma hyaline, oblong, cleft at apex into two subacute lobes, awned from sinus, awn 2.5-4.5 cm long, geniculate. Palea hyaline, ovate-oblong, 3.5-4 x 0.7-0.8 mm, apex subacute. Lodicules 2. Stamens 3, anthers 2-2.5 mm long, Caryopsis 6-7 x 1.8-2 mm, obovate to narrowly oblong-linear, dorsally compressed. Hilum slightly linear embryo present at one side of seed and nearly half as large as the fruit.

Fl. & Frts.: September to November.

Chromosome number: n= 10

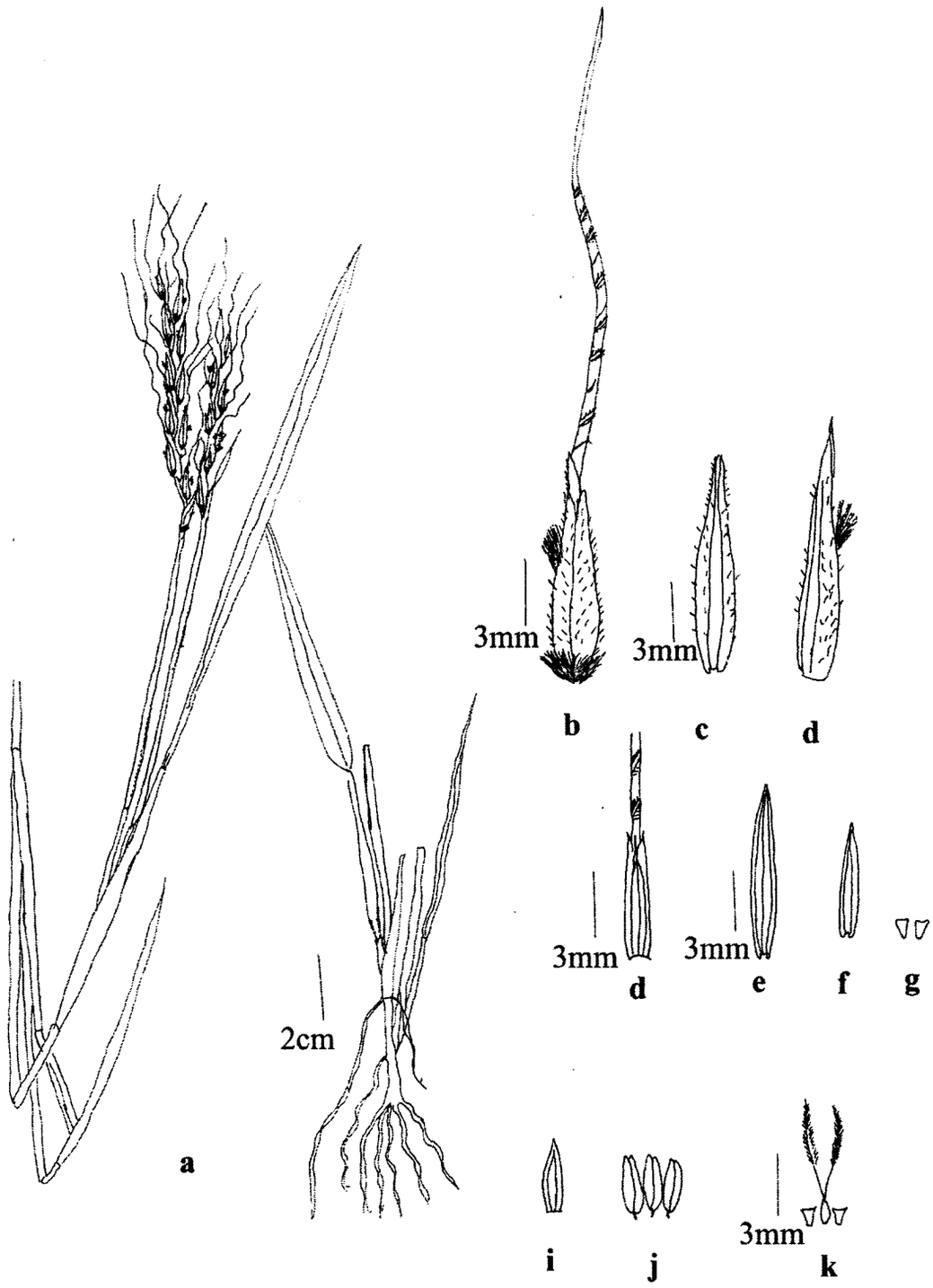


fig.10.Pogonachne racemosa Bor .a. Habit, **b.** Pedicelled spikelet, **c**. Lower glume, **d.** Upper glume,**e.** Lower lemma, **f.** Palea, **g.** Lodicules, **h.** Upper lemma, **i.** Palea, **j**. Stamens,k. Pistil & Lodicules.

Adaxial epidermis:

Adaxial epidermis shows some distinction between intercostal and costal region. Intercostal region consists of about 5-6 row of long cells. Short cells are sparsely distributed. The long cells are of unequal size with sinuous wall and few of them are papillate.A single row of stomata with low dome shaped subsidiary cell are present in mid row of intercostal zone. Macrohairs are present abundantly, each with 3-4 mm in length. Microhairs are present at junction of two long cells. Costal region consists of 2-3 layers of short cell and long cells. Dumbbell shaped silica bodies are present in a row over vein. **(fig.11.A), (Plate-VII).**

Abaxial epidermis:

Abaxial epidermis shows poor distinction between intercostal and costal region except for presence dumbbell shaped silica bodies in row over the vein. The intercostal region is made up of 5-6 rows of long cells with deeply sinuous walls. The long cells are papillate. Papillae are of unequal size. A single row of stomata is present in each intercostal region. Stamatas are with triangular subsidiary cells.Microhairs are small in shape. High stomatal frequency as compared to adaxial epidermis is found on abaxial surface.

Costal region consist of layer of long and short cells. A row of dumbbell shaped silica bodies is present. **(fig.11.B), (Plate-VII).**

T. S. Lamina:

Adaxial epidermis is consisting of large bulliform cells of somewhat unequal size. Few cells of adaxial epidermis are papillate. Mesophyll is arranged in radiate manner made up of chlorenchymatous cells. The small and large lateral vascular bundles are alternate. Large lateral bundles consist of both adaxial and abaxial sclerenchyma girders, two metaxylem and phloem surrounded by single bundle sheath. Small vascular bundle consist of complete bundle sheath and undifferentiated xylem and phloem.Abaxial epidermis made up of oval prominently papillate cells interrupted by stomata.

Mid rib region is Plano convex in outline. Adaxial epidermis in middle portion made up of small barrel shaped cells which are merged into large lateral bulliform cells. Adaxial epidermis followed by single row of sclerenchyma about fifteen cells which is followed by ground tissue made up of large polygonal cells.

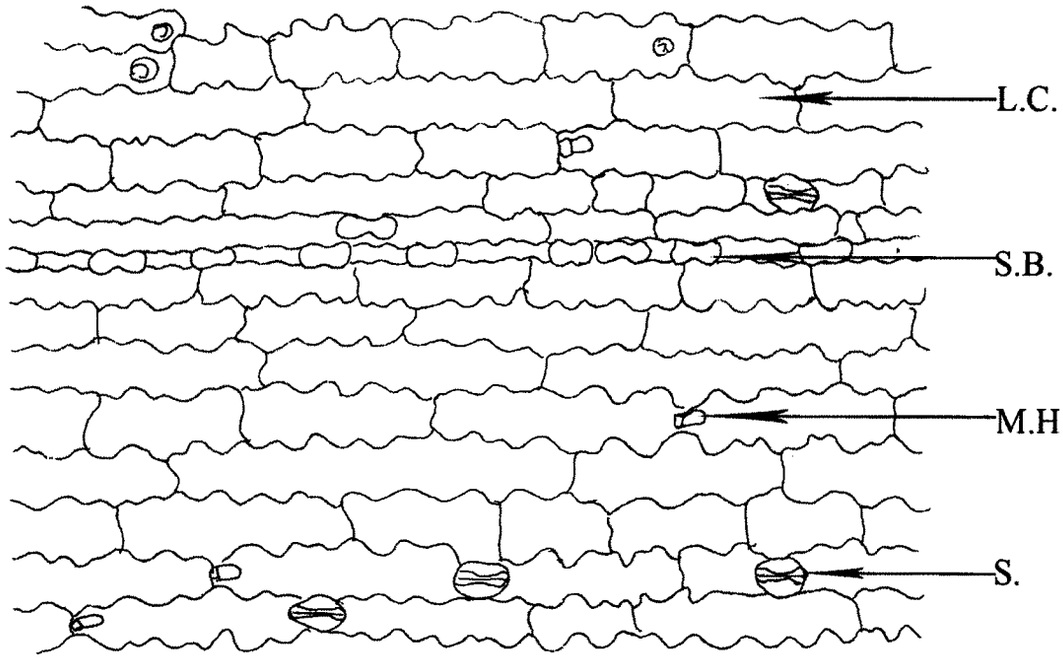


Fig.11. A. Adaxial surface of ***Pogonachne racemosa*** Bor x 200

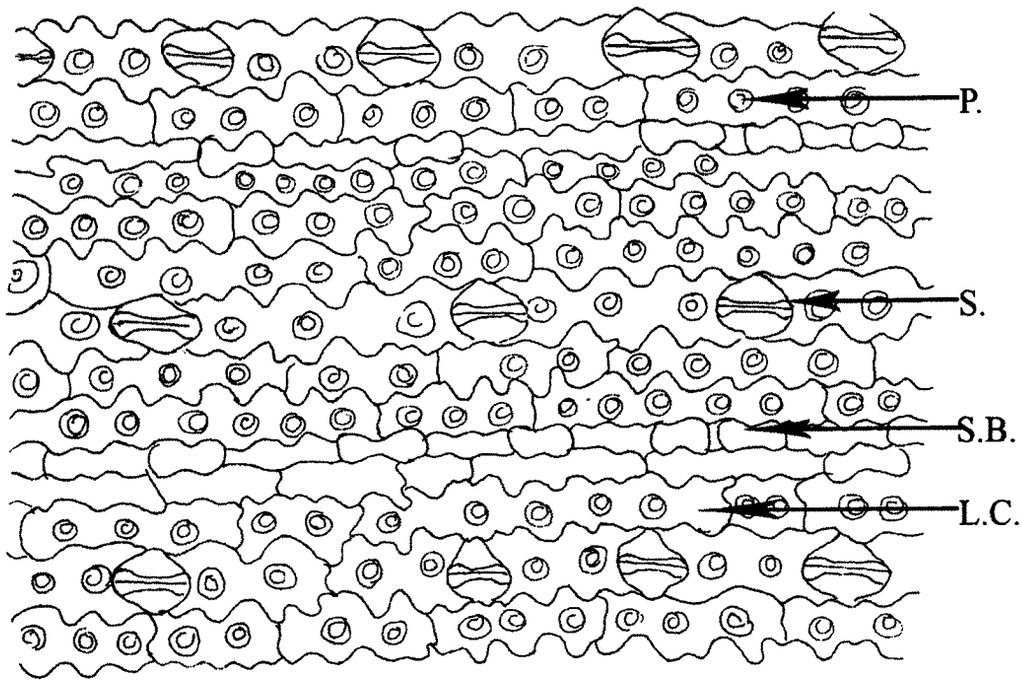


Fig.11. B.Abaxial surface of ***Pogonachne racemosa*** Bor.x 200.

Longcell(L.C.),Microhair (M.H.), Papillae(P), Stomata (S), Short cell (S.C.), Silica Bodies (S.B.).

Abaxial epidermis cells are prominently papillate. Median vascular bundle consists of two prominent metaxylem and distinct phloem surrounded by sclerenchymatous sheath and wide girder of sclerenchymatous cells. The lateral bundles of keel region consist of small and large vascular bundle. Small vascular bundles consist of parenchymatous sheath and undistinguished xylem and phloem. Larger bundles similar to smaller vascular bundles but have sclerenchymatous girders. All vascular bundles are of basic type. **(Fig.12.A and B), (Plate-VIII).**

T. S. of Culm:

Culm is more or less circular in outline. Epidermis is single layered made up of oval compactly arranged cells covered with cuticle on its outerside.Epidermis followed by 1-2 layers of sclerenchyma followed by a ground tissue made up of parenchymatous cells with large intercellular spaces. The vascular bundle are scattered in outer peripheral part of the culm. Outermost zone below epidermis consists of small vascular bundle with 2 distinct metaxylem, phloem surrounded by sclerenchyma. Inner layer vascular bundles consist of two large metaxylem, well developed phloem and lysogenous cavity surrounded by sclerenchymatous sheath. All vascular bundles are of basic type **(Plate-VIII).**

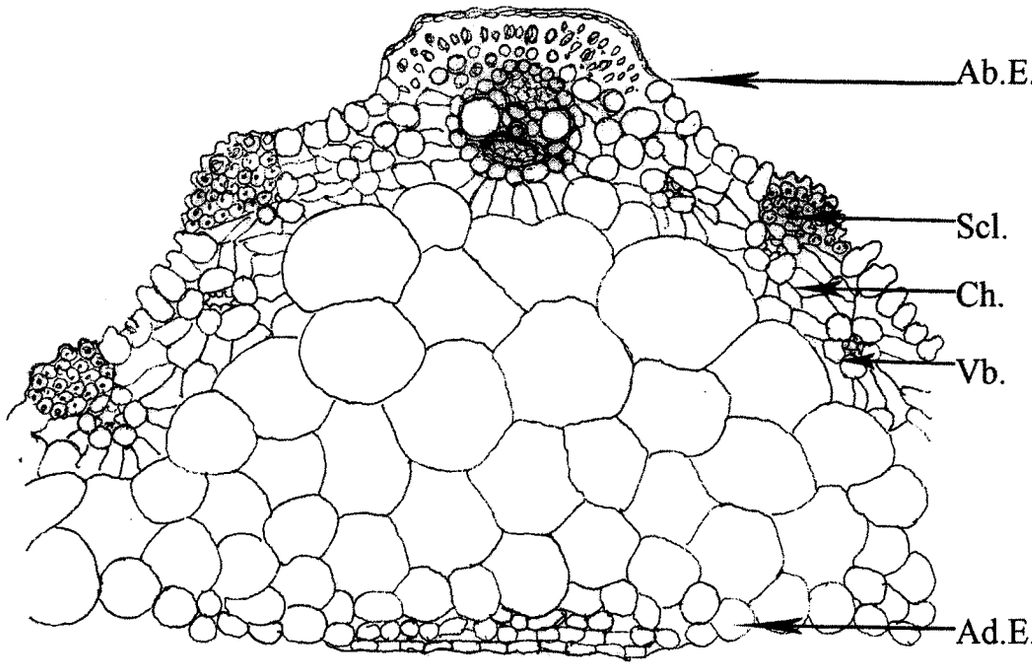


Fig.12.A.T.S.of leaf ***Pogonachne racemosa*** Bor passing through keel region x 250.

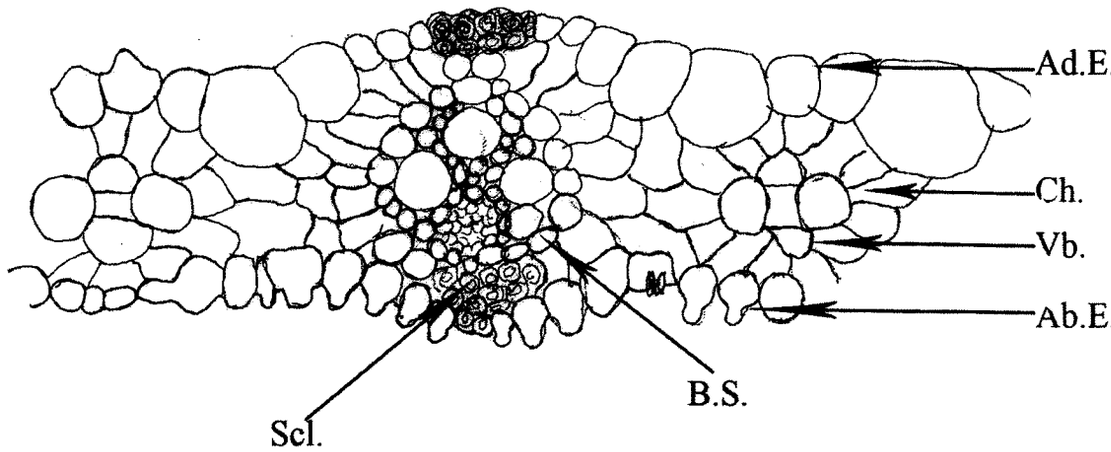
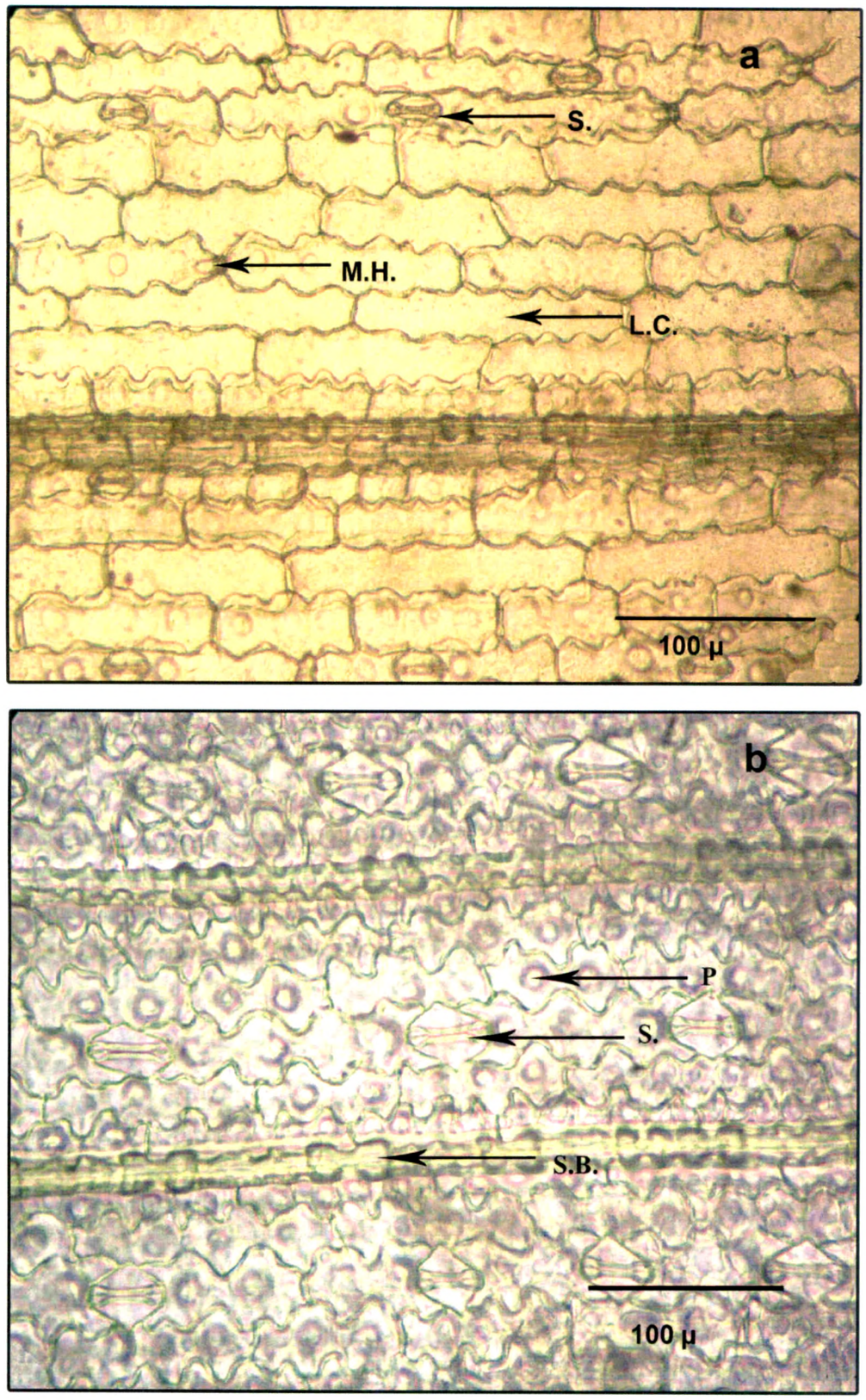


Fig.12.B.T.S.of leaf ***Pogonachne racemosa*** Bor showing lateral small and large vascular bundles x 250.

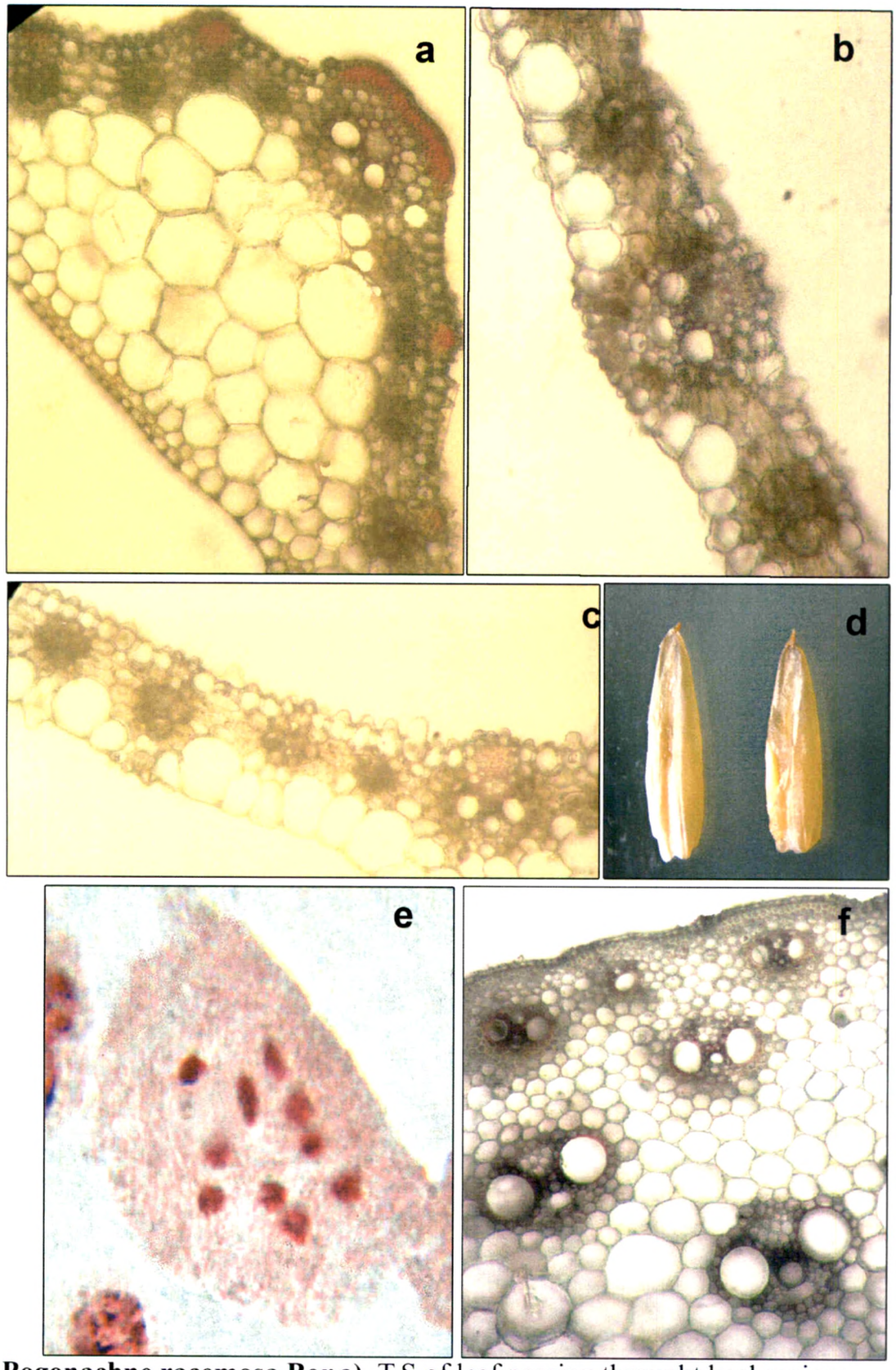
Ad.E.adaxialepidermis,Ab.E.abaxial epidermis,B.C.bulliform cells, Ch.chlorenchyma,B.S. bundle-sheath,S.stomata,Scl.sclerenchyma,Vb. vascular bundle.

PLATE-VII



Pogonachne racemosa Bor :a) Adaxial surface of leaf **,b)** Abaxial surface of leaf showing epidermal features Long cell (L.C.), Papillae (P),Stomata (S.),Silica body (S.B.).

PLATE- VIII



Pogonachne racemosa Bor.a). T.S.of leaf passing throught keel region showing mid large vascular bundle and small vascular bundle,**b).**T.S.of laef showing lateral large and small bundles,**c).**section showing irregular bulliform cell,**d)**Caryopsis showing linear hilum,**e)**.Plate showimg chromosome number n= 10,**f)**.T.S.of stem showing peripher vascular bundles.

Pseudodicanthium serrafalcoides (Cooke & Stapf) Bor

Pseudodicanthium serrafalcoides (Cooke & Stapf) Bor in Indian forester 66: 272. 1940; Bor, Grass. Bur. Cey. Ind. Pak. 204. 1960; Laxmi. in Sharma *et al.* (eds.), Fl. Maharashtra, Monocot. 577. 1996; Moulik, Grass. Bam. India 1: 278. 1997. *Andropogon serrafalcoides* Cooke & Stapf in Kew Bull. 1908: 456. 1908. *A. cookei* Stapf ex Woodr. in J. Bombay nat. Hist. Soc. 13: 438. 1901 nom. tautum; Cooke, Fl. Presi. Bombay 3: 506. 1958 (Repr. ed.). *Dichanthium serrafalcoides* (Cooke & Stapf) Blatt. & McC. in J. Bombay nat. Hist. Soc. 32: 426. 1928 & Bombay Grass. 95. 1935. **(fig.13)**

Annual. Culms terete, 10-70 cm tall, weak, straggling, geniculate at base, slender, branched, glabrous, nodes glabrous. Leaf sheath sub compressed, 1-5 cm long, glabrous or covered with tubercle based hairs, margins glabrous or ciliate, ligule membranous, 0.5-1 mm long. Leaf blade flat, linear to linear elliptic, 3-15 x 0.3-0.8 cm, sparsely hairy, margins scaberulous and apex finely acuminate. Racemes solitary, 2-5 cm long, peduncles capillary. Joints slender, 1.2-1.6 mm long, ciliate on one margin. Sessile spikelet ovate-elliptic, 5-8 x 2-2.3 mm, awned, callus bearded. Lower glume chartaceous, elliptic-oblong, 5-7.5 x 2-2.3 mm, margins narrowly inflexed, sparsely hairy on dorsal surface, 9-11-nerved, 2-keeled, keels winged, wings unequal, apex bifid. Upper glume narrowly ovate, membranous, 5-7 x 1.3-1.5 mm, puberulous on dorsal surface, 2-keeled, 3-nerved, apex acuminate. Lower lemma hyaline, 3.8-4.5 x 1-1.2 mm, glabrous, nerveless, apex obtuse. Palea absent. Upper lemma reduced to a hyaline base of 3-4 cm long geniculate awn, 3-nerved. Lodicules 2. Stamens 3, anthers 1.6-2 mm long. Caryopsis 2.5-3 x 1-1.2 mm, elliptic. Pedicels 2-3.5 mm long, ciliate on one margin, producing sac like cavity at apex. Pedicelled spikelet narrowly ovate, 8-11 x 2-3 mm, unawned. Lower glume subcoriaceous, narrowly ovate, 8-11 x 2-3 mm, hairy on dorsal side, 9-11-nerved, 2-keeled, keels winged, wings unequal, apex hyaline, acute. Upper glume membranous, narrowly elliptic-oblong, 5-8 x 1.3-1.6 mm, 5-nerved, puberulous, margins inflexed, keels ciliate, apex acute. Lower lemma hyaline, obovate, 4.5-5 x 0.8-1 mm, 1-nerved, apex 2-lobed. Palea absent. Upper lemma hyaline, elliptic, 5-5.5 x 1.3-1.5 mm, margins inflexed, ciliate, 3-nerved, apex obtuse, caryopsis 3-5

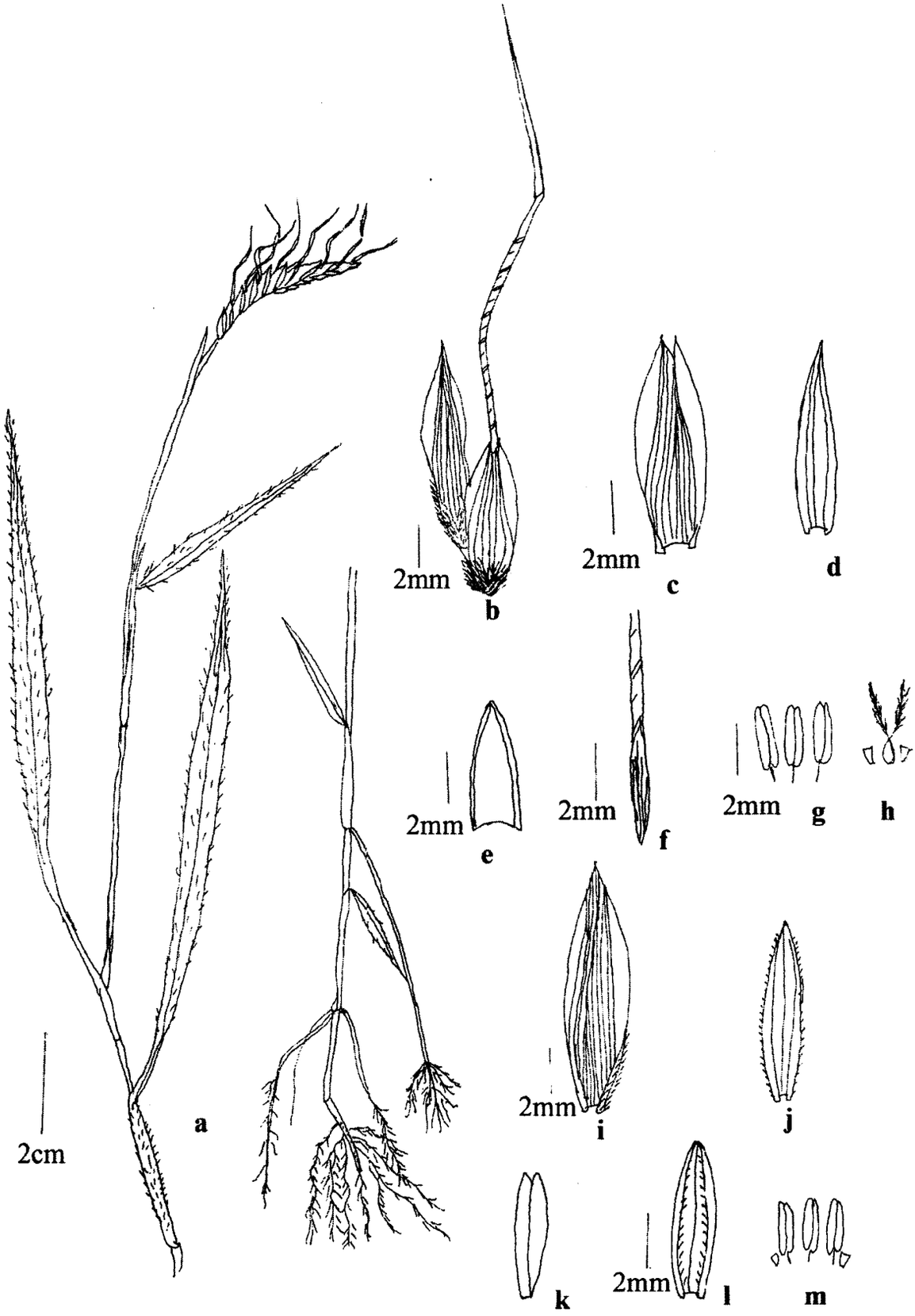


fig.13.Pseudodichanthium serrafalcoides (Cooke & Stapf) Bor a. Habit, **b.**Sessile & Pedicelled spikelet, **c–h.** Sessile spikelet: **c.** Lower glume, **d.** Upper glume, **e.** Lower lemma,**f.** Upper lemma, **g.** Stamens, **h.** Pistil & Lodicules, **i–m.** Pedicelled spikelet: **i.** Lower glume, **j.** Upper glume, **k.** Lower lemma, **l.** Upper lemma, **m.** Stamens & Lodicules.

mm,oblong to oval in shape, mature slightly yellowish in colour compressed dorsivently,hilum oval-bordered shaped , embryo present opposite to hilum.

Chromosome number: n= 10

Adaxial epidermis:

Adaxial epidermis shows clear differentiation between intercostal and costal zones. The intercostal zone is made up of 7-8 rows of long cells of unequal size with straight walls. Stomata are absent on adaxial surface. Few microhairs of panicoide type found in intercostal zone. Costal zone consists of about 3 rows of long and short cells. The cell wall of the zone with sinuous walls. Dumbbell shaped silica bodies are found in single row. Prickle hairs are found on a row containing silica bodies. The prickle hairs have pointed apex. **(fig.14.A), (Plate-IX).**

Abaxial epidermis:

Abaxial epidermis is weekly differentiated into intercostal and costal zones. Intercostal zones consist of 4-5 rows of long cells with deeply sinuous walls. The cells are prominently papillate. Papillae are of unequal size present in a row. Macrohairs are present frequently, each with 4-5 mm in length. Scattered microhairs are in intercostals zone. A single row of stomata with triangular subsidiary cell is found in each intercostal zone. Nodular shaped silica bodies are present in a single row on costal region. **(fig.14.B). (Plate-IX).**

T.S.Lamina:

Adaxial epidermis consists of large bulliform cells of somewhat unequal size. Mesophyll is arranged in radiate manner made up of chlorenchymatous cells. The small and large lateral vascular bundles are alternate. Large lateral bundles consist of two metaxylem and phloem and with incomplete bundle sheath surrounded by single bundle sheath which is interrupted adaxial and abaxial sclerenchymatous girders. Small vascular bundle consists of complete bundle sheath and undifferentiated xylem and phloem.Abaxial epidermis made up of oval prominently papillate cells interrupted by stomata.

Mid rib region is triangular in outline with abaxial region consisting of main vein. Adaxial epidermis in middle portion made up of small barrel shaped cells

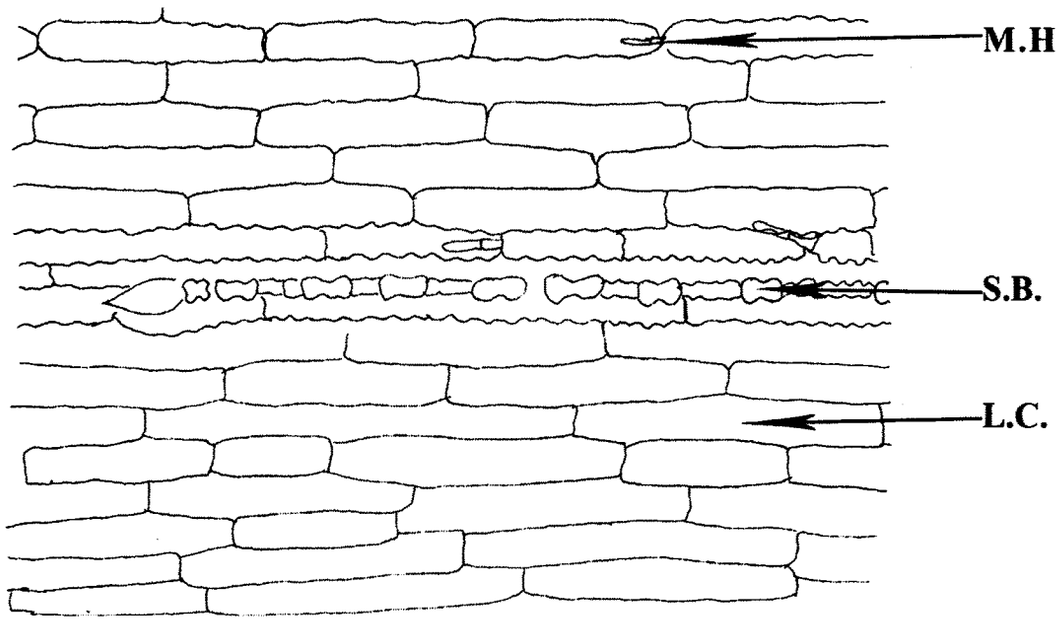


Fig.14.A.Adaxial epidermis of ***Pseudodichanthium serrafalcoides*** (Cooke & Stapf) **x 200**

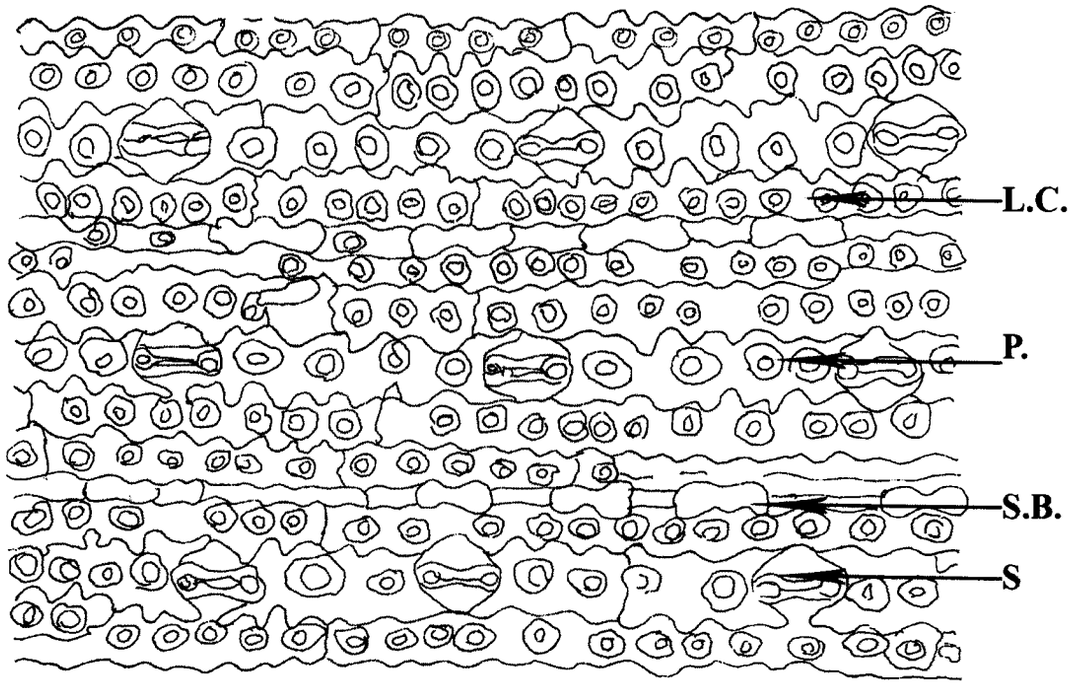


Fig.14.B.Abaxial epidermis of *Pseudodichanthium serrafalcoides* (Cooke & Stapf) **x 200**

Long cell (L.C.), Microhair (M.H.), Prickel hair (P.H.), Papillae (P), Stomata (S.),Short cell (S.C.),Silica bodies (S.B.)

which merged into large lateral bulliform cells. Adaxial epidermis followed by single row of sclerenchyma. Keel containing numerous bundles of unequal size. Median large vascular bundle and remaining 10-12 small vascular bundles. Keel ground tissue is made up of parenchymatous cells which are of unequal size. Abaxial epidermis cells are prominently papillate. Median large vascular bundle consists of two prominent metaxylem and distinct phloem surrounded by single sheath and adaxial wide girder of sclerenchymatous cells. The lateral small vascular bundles consist of parenchymatous sheath and undistinguished xylem and phloem surrounded by incomplete parenchymatous sheath. Abaxial girder is present to small vascular bundle due to which the bundle sheath interrupted. Larger bundles similar to smaller vascular bundles but have sclerenchymatous girders. All vascular bundles are of basic type. **(Fig.15.A.and B), (Plate-X).**

T.S.of Culm:

Culm is more or less circular in outline with curvature on one side. Epidermis is single layered made up of oval compactly arranged cells. Epidermis followed by 1-2 layers of sclerenchyma followed by a ground tissue made up of parenchymatous cells with large intercellular spaces. Ground tissue is gradually increasing in diameter toward the center of culm. The vascular bundle are scattered in outer peripheral part of the culm in 2-3 rows. Outermost zone below epidermis consists of small vascular bundle with 2 distinct metaxylem, phloem surrounded by sclerenchyma. Inner layer vascular bundles consist of two large metaxylem well developed phloem and lysogenous cavity surrounded by sclerenhymatous sheath. All vascular bundles are of basic type**(Plate-X).**

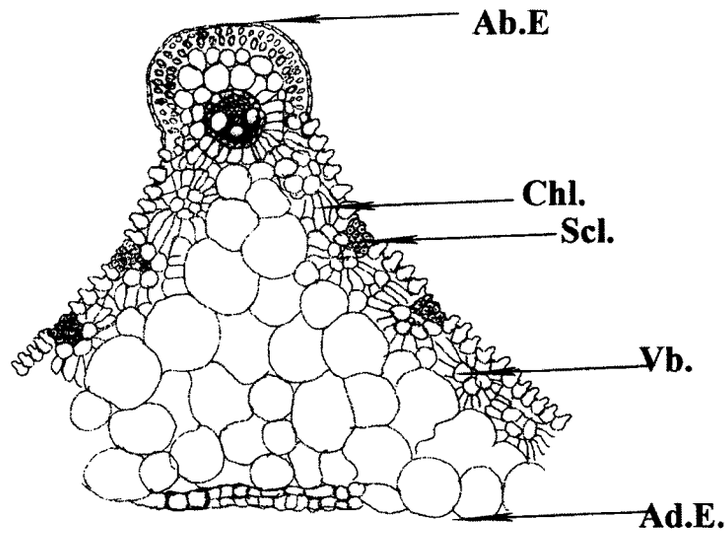


Fig.15.A.Adaxial epidermis of ***Pseudodichanthium serrafalcoides*** (Cooke & Stapf) **x 250.**

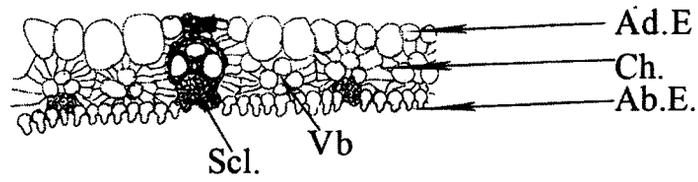
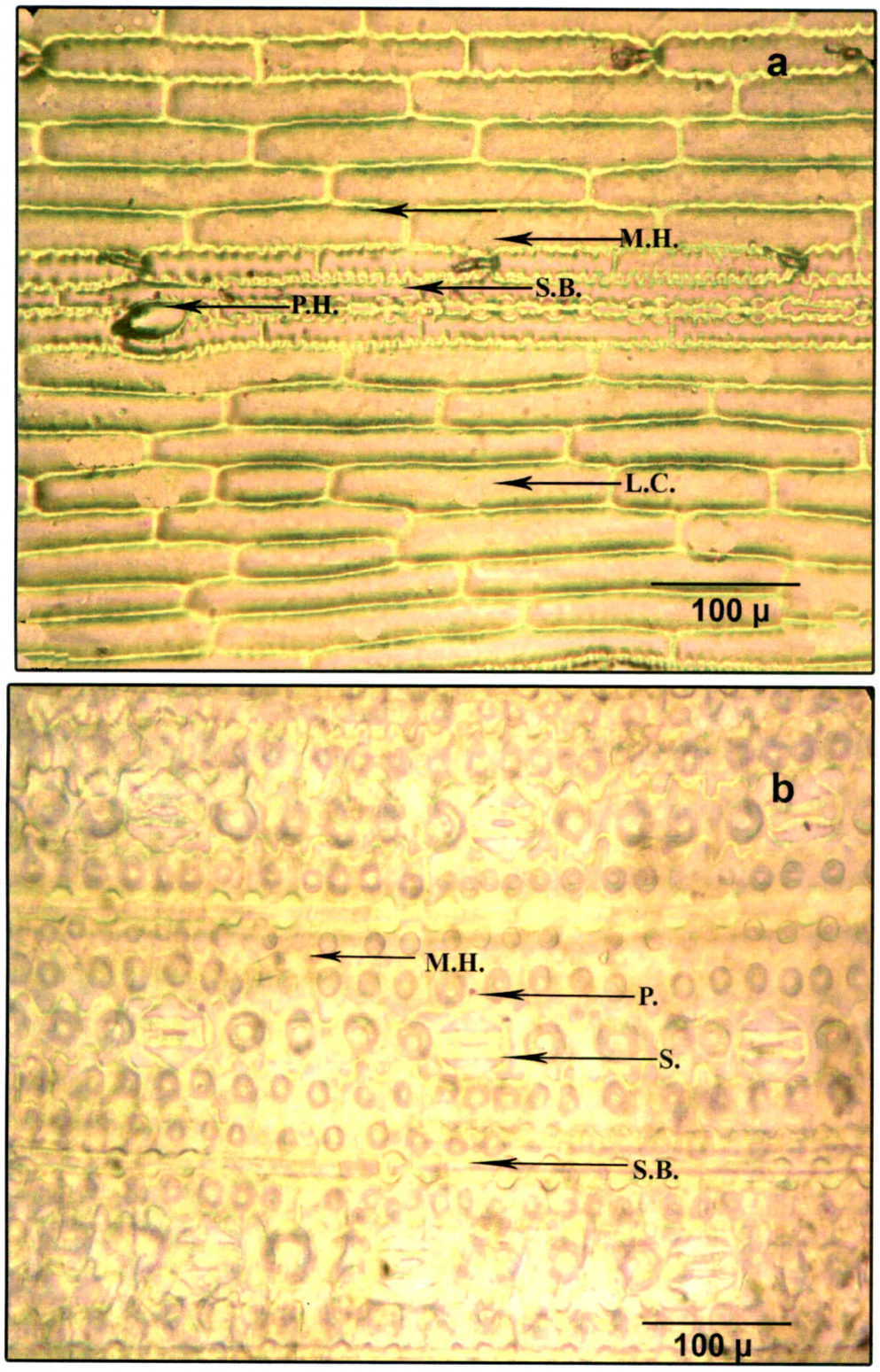


Fig.15.B.Adaxial epidermis of ***Pseudodichanthium serrafalcoides***(Cooke & Stapf) **x 200**

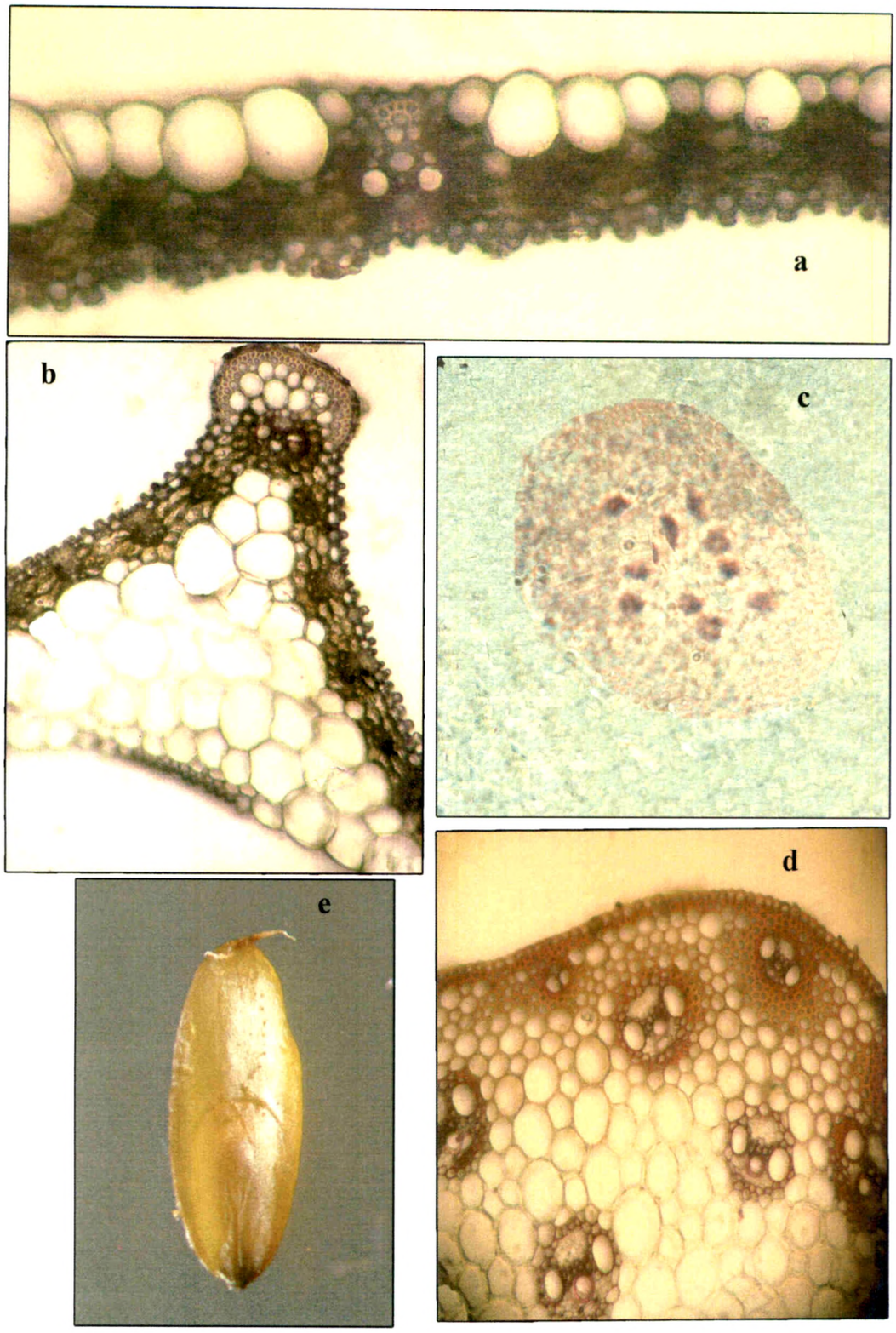
Ad.E.adaxialepidermis,Ab.E.abaxialepidermis,B.C.bulliform cells,Ch.chlor enchyma,B.S.bundle-sheath,S.stomata,Scl.sclerenchyma,Vb. vascular bundle.

PLATE-IX



Pseudodichanthium serrafalcoides (Cooke & Stapf) Bor.a. Adaxial surface of leaf **.b.**Abaxial surface of leaf showing epidermal feature: Long cell (L.C.).,Papillae(P.),Prickel hair(P.H.),Stomata (S.),Silica body (S.B.),

PLATE-X



Pseudodichanthium serrafalcoides (Cooke & Stapf) Bor: a). T.S.of leaf showing lateral large and small bundle,**b)** T.S.of leaf passing throu -ght keel bundle showing large mid vascular bundle with wide abaxial girder.**c)** Chromosome number showing n= 10,**d)** T.S.of culm showing peripheral vascular bundles.**e)** Caryopsis with oval hilum.

Trilobachne cookei (Stapf) Schenck ex Henr

Trilobachne cookei (Stapf) Schenck ex Henr. in Meded. Rijks. Herb. Leiden n. 67: 4. 1931; Bor, Grass. Bur. Cey. Ind. Pak. 268. 1960; Laxmi. in Sharma *et al.* (eds.), Fl. Maharashtra, Monocot. 625. 1996; Moulik, Grass. Bam. India 1: 177. 1997. *Polytoca cookei* Stapf in Hook. Ic. Pl. t. 2333. 1894; Hook. f. Fl. Brit. Ind. 7: 101. 1896; Cooke, Fl. Presi. Bombay 3: 518. 1958 (Repr. ed.); Blatt. & McC. Bombay Grass. 5. 1935.

Vernacular names: Dhokri, Kurisal. **(fig.16).**

Annual. Culms terete, 50-200 cm tall, erect, simple or sparingly branched, glabrous, nodes bearded. Leaf sheath terete, 5-20 cm long, hispid with stiff bulbous based hairs, ligule membranous, 0.5-1 mm long. Leaf blade broadly elliptic, 15-50 X 3-6 cm, hispid on both surfaces with bulbous based hairs, base narrowed, apex acuminate. Inflorescence 10-20 cm long, crowded in axil of upper leaves. Male spikelet binate, one shortly pedicelled and other long pedicelled. Pedicels slender, sparsely hairy. Spikelets narrowly ovate, 9-12 x 1.3-1.5 mm, pubescent, acuminate. Lower glume membranous, narrowly ovate, 9-12 x 1.3-1.5 mm, pubescent, margins inflexed, 15-nerved, apex acuminate. Upper glume membranous, narrowly ovate, 8.5-11 x 1.3-1.5 mm, pubescent, 9-11-nerved, 2-keeled, apex acute. Lower lemma hyaline, narrowly ovate, 8-9 x 1-1.2 mm, glabrous, 5-nerved, apex acute. Palea hyaline, narrowly elliptic, 7-8 x 1-1.2 mm, glabrous, 2-nerved, apex acute. Lodicules 2. Stamens 3, anthers 4-5 mm long. Upper lemma hyaline, narrowly ovate, 4.5-5.5 x 0.5-0.6 mm, glabrous, margins inflexed, 2-nerved, apex acute. Lodicules 2. Stamens 3, anthers 4-5 mm long. Female spikelet oblong, 10-12 x 3-4 mm, puberulous. Lower glume coriaceous, oblong, 10-12 x 3-4 mm, embracing upper glume, 13-15-nerved, apex 3-lobed, puberulous, lateral lobes truncate, shorter and middle lobe larger than the lateral lobes, emarginated. Upper glume coriaceous, oblong, 8-10 x 1.3-1.5 mm, 7-9-nerved, apex acuminate. Lower lemma hyaline, oblong, 7-8 x 1-1.2 mm, glabrous, margins inflexed, 7-9-nerved, apex acute. Palea hyaline, oblong, 7-8 x 1-1.2 mm, glabrous, margins inflexed, 3-nerved, apex acute. Upper lemma hyaline, linear oblong, 4.5-5.5 x 0.6-0.8 mm, nerveless, apex acute. Palea hyaline, linear ovate, 2-3 x 0.5-0.6 mm, apex acute, Grain fusiform, 3.5-4 x 1.3-1.6 mm,

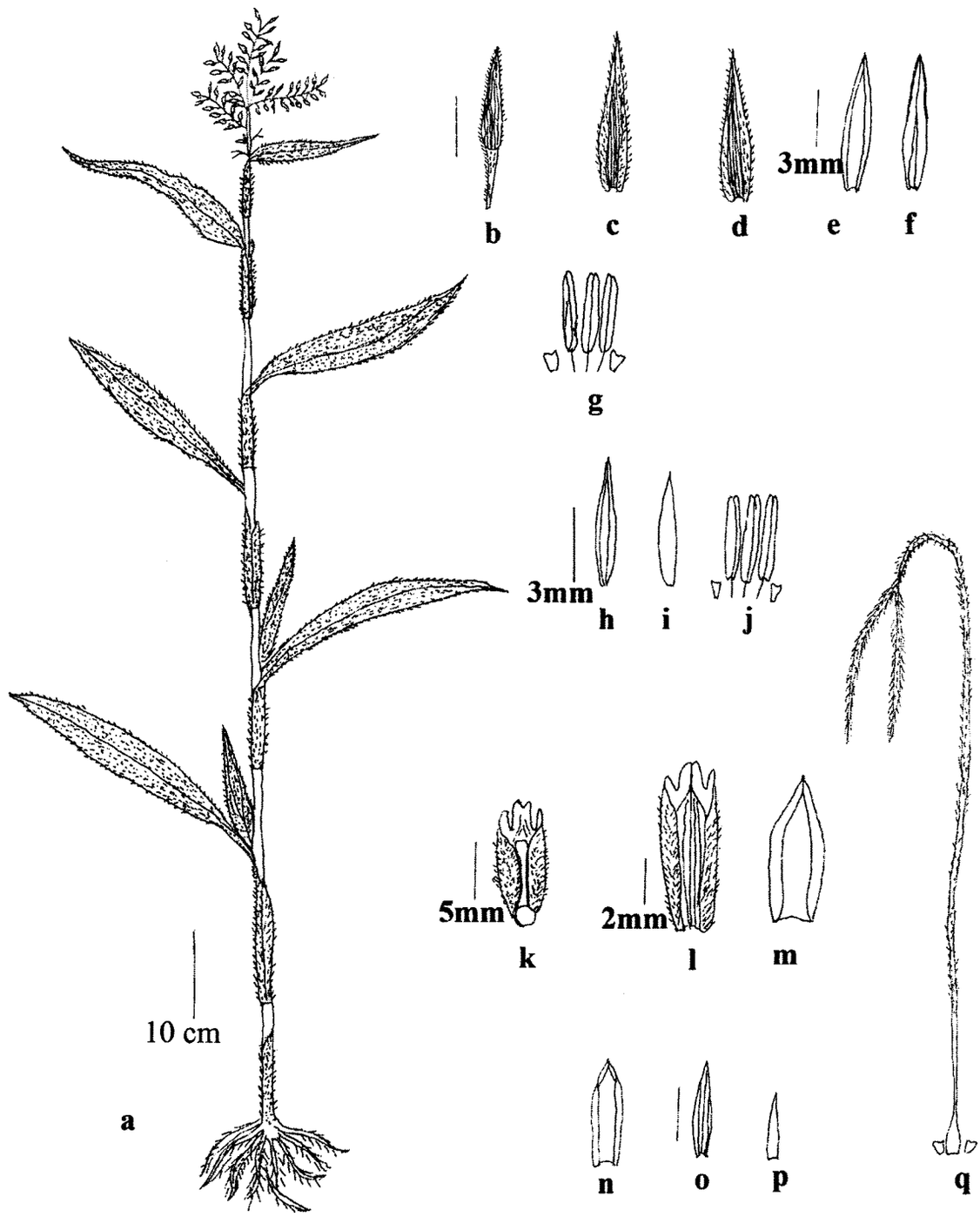


fig.16.Trilobachne cookei (Stapf) Schenck ex Henr. a. Habit,**b.** Male spikelet,**c.** Lower glume,**d.** Upper glume,**e**. Lower lemma,**f.** Palea, **g.** Stamens & Lodicules,**h.** Upper lemma, **i.** Palea, **j.** Stamens & Lodicules. **k.** Female spikelet, **l.** Lower glume,**m**. Upper glume,**n.**Lower lemma,**o.**Upperlemma,**p.** Palea,**q.**Pistil & Lodicules.

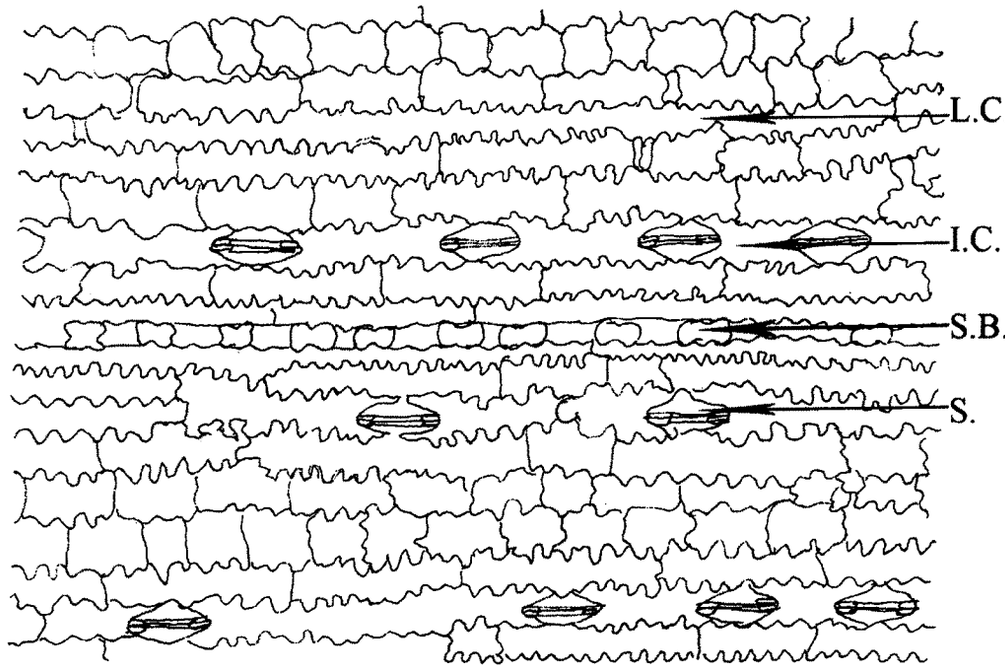


Fig. 17.A. Adaxial epidermis of ***Trilobachne cookei*** (Stapf) Schenck ex Henr.x200

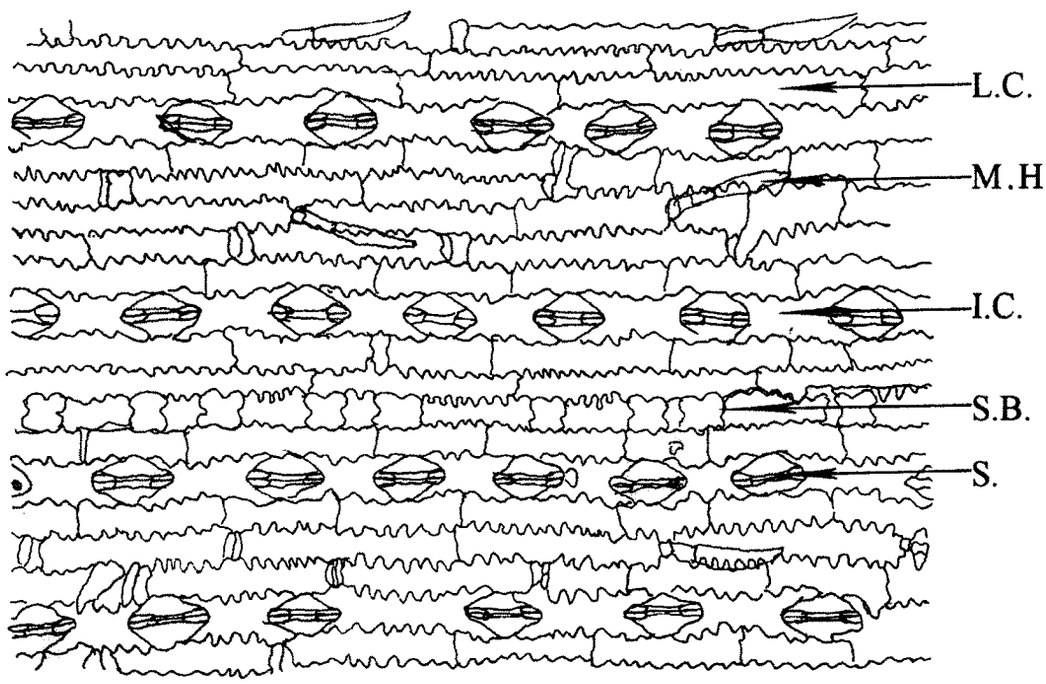


Fig.17.B .Abaxial epidermis of ***Trilobachne cookei*** (Stapf) Schenck ex Henr.x 200

Interstomatal cell.(I.C.), Long cell. (L.C.),Micro hair (M.H.),Silica body. (S.B.), Stomata.(S).

white to cream colour, slightly longitudinally grooved, compressed dorsiventrally, hilum long linear.

Fl. & Frts.: August to October.

Chromosome number (n) = 10. (Sapre, A.B.1977; Venkateswarlu, J.et.al.1977)

Adaxial epidermis:

Adaxial epidermis shows some distinction between intercostal and costal region. Intercostal made up of 8-12 rows of long cells. The long cells are of unequal size with sinuous wall. Short cells are in pair and sparsely distributed. A single row of stomata with low dome shaped subsidiary cell are present on either side of costal region. Macrohairs are present abundantly, each with 0.5- 1 mm in length. Microhairs are present at junction of two long cells. Panicoide type of microhairs is present. Costal region consist of 2-3 layer of short cell and long cells. Saddle shaped silica bodies are present in a row over vein. **(fig.17.A.), (Plate-XI).**

Abaxial epidermis:

Abaxial epidermis show well distinction between intercostal and costal region. The intercostal region is made up of 12-13 rows of long cells present. Long cells are of unequal type Short cells are present in pair. Papillae are absent. Three rows of stomata with triangular subsidiary cell are present in each intercostal region. High stomatal frequency as compare to adaxial epidermis is found on abaxial surface. Macrohairs are present abundantly. Panicoide type of microhairs is present in intercostal zone. The distal cell of microhair is larger than basal cell. Costal region consists of layer of long and short cells. A row of saddle shaped silica bodies is present. **(fig.17.B.). (Plate-XI).**

T.S.Lamina:

Adaxial epidermis consists of large bulliform cells of somewhat unequal size. Few cells of adaxial epidermis are papillate. Mesophyll is of non radiate type. The small and large lateral vascular bundles are alternate. Large lateral bundles consist of both adaxial and abaxial sclerenchyma girders, two metaxylem and

phloem surrounded by single bundle sheath. Small vascular bundle consists of complete bundle sheath and undifferentiated xylem and phloem. Abaxial epidermis made up of oval cells. Mid rib region is some what circular in outline. Adaxial epidermis in middle portion made up of small barrel shaped cells which merged into large lateral bulliform cells. Adaxial epidermis followed by single row of sclerenchyma about fifteen cells which is followed by ground tissue made up of large polygonal cells. Keel region consists of large and small vascular bundle in alternate manner. Median vascular bundle consists of two prominent metaxylem and distinct phloem surrounded by sclerenchymatous sheath and wide girder of sclerenchymatous cells. The lateral bundles of keel region consist of small and large vascular bundle. Small vascular bundles consist of parenchymatous sheath and undistinguished xylem and phloem. Larger bundles similar to smaller vascular bundles but have sclerenchymatous girders. All vascular bundles are of basic type **(fig.18.), (Plate-XII).**

T. S. of Culm:

Culm is more or less circular in outline. Epidermis is single layered made up of oval compactly arranged cells covered with cuticle. Epidermis followed by 1-2 layers of sclerenchyma followed by a ground tissue made up of parenchymatous cells with large intercellular spaces. The vascular bundle are scattered in outer peripheral part of the culm. Outermost zone below epidermis consists of small vascular bundle with 2 distinct metaxylem, phloem surrounded by sclerenchyma. All vascular bundles are of basic type i.e. consists of two large metaxylem well developed phloem and lysogenous cavity surrounded by sclerenchymatous sheath. **(Plate-XII).**

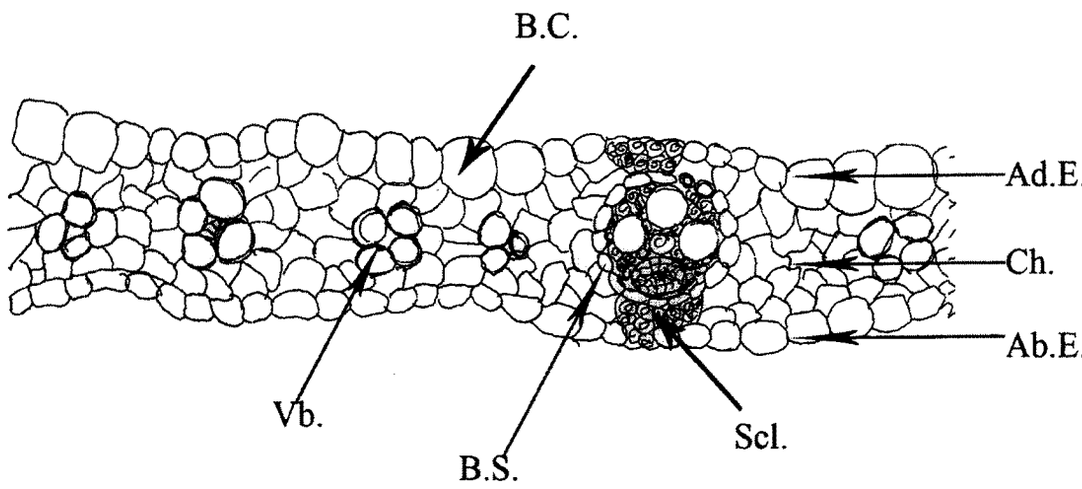
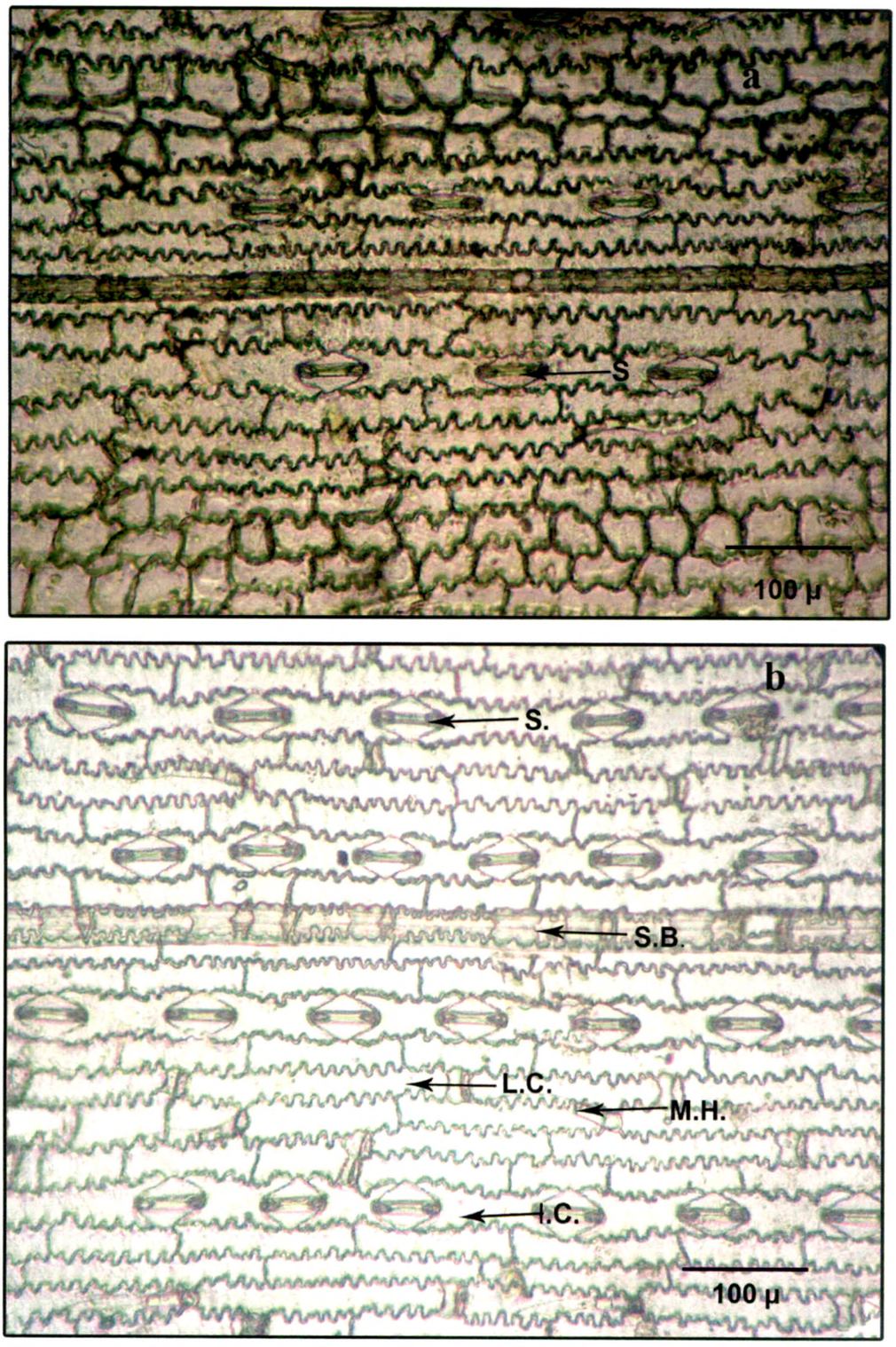


Fig.18.T.S.of leaf **Trilobachne cookei (Stapf) Schenck ex Henr.** showing lateral small and large vascular bundles x 250.

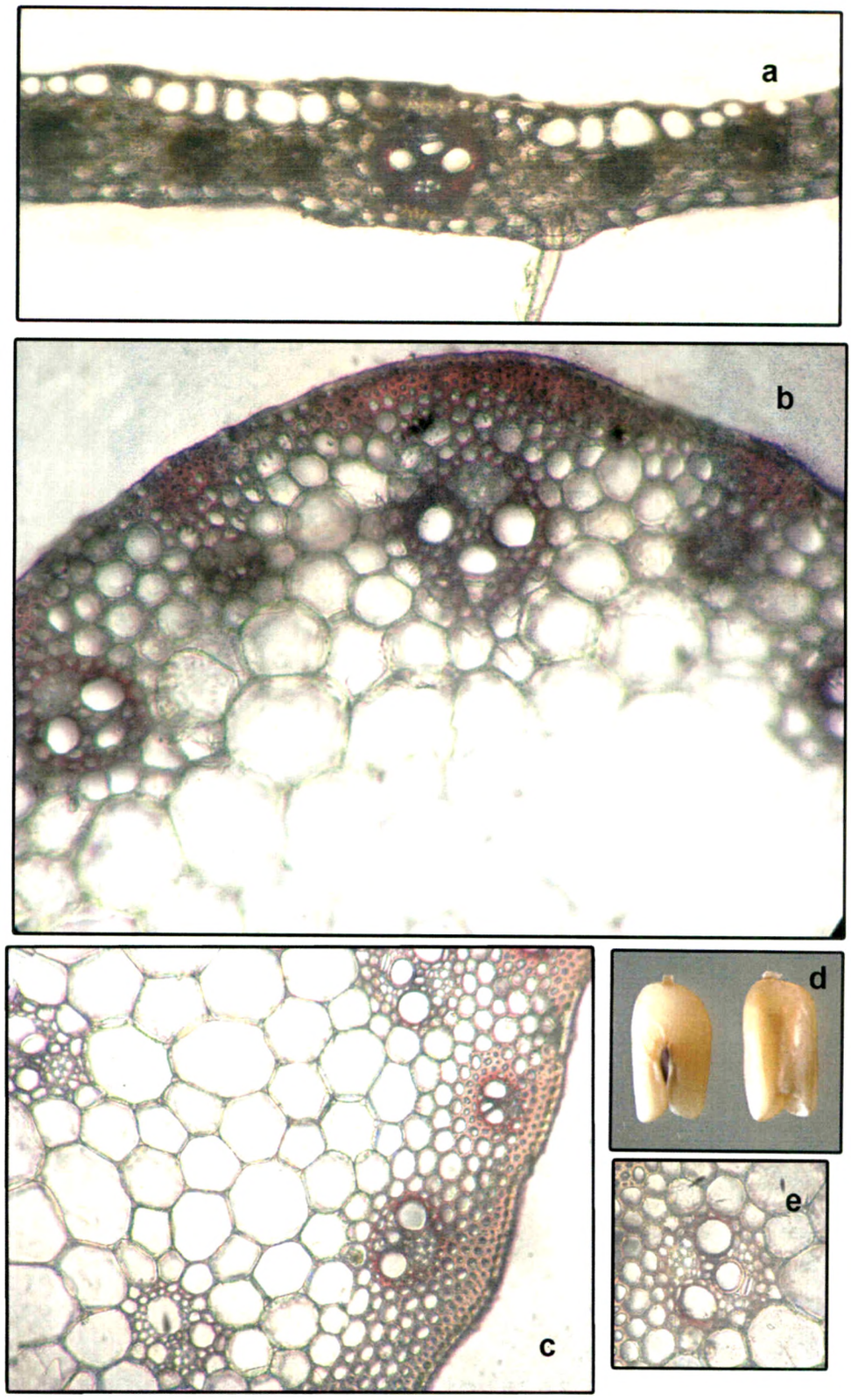
Ad.E.adaxialepidermis,Ab.E.abaxial epidermis, B.C.bulliform cells, Ch.chlorenchyma, B.S. bundle-sheath, S.stomata, Scl.sclerenchyma, Vb. vascular bundle.

PLATE -XI



Trilobachne cookei (Stapf) Schenck ex Henr.a.Adaxial epidermis of leaf ,b.Abaxial surface of leaf showing epidermal feature :Bulliform cell (B.C.), Interstomatal cell (I.C.),Long cell (L.C.), Micro hair (M.H.),Short cell (S.C.),Stomata (S.),Silica body (S.B.),

PLATE-XII



Trilobachne cookei (Stapf) Schenck ex Henr. a). T.S.of leaf showing lateral large and small vascular bundle,**b).** T.S.of leaf passing throught keel region showing mid large vascular bundle and small vascular bundle, **c).**T.S.of stem showing peripheral vascular bundle.**d).** Carypopsis, **e).** Enlarge vascular bundle of stem with prominent metaxylem element.

Triplopogon ramosissimus (Hack) Bor

Triplopogon ramosissimus (Hack) Bor in Kew Bull. 1954: 501. 1954 & Grass. Bur. Cey. Ind. Pak. 255. 1960; Laxmi. in Sharma *et al.* (eds.), Fl. Maharashtra, Monocot. 625. 1996; Moulik, Grass. Bam. India 1: 302. 1997. *Ischaemum ramosissimum* Hack in DC. Monogr. Phan. 6: 249. 1889; Hook. f. Fl. Brit. Ind. 7: 137. 1896. *I. spathiflorum* Hook. f. *op. cit.* 138; Cooke, Fl. Presi. Bombay 3: 481. 1958 (Repr. ed.). *Sehima spathiflorum* (Hook. f.) Blatt. & McC. in J. Bombay Nat. Hist. Soc. 32: 23. 1927 & Bombay Grass. 20. 1935. **(fig.19.)**

Annual. Culms tufted, terete, 50-130 cm tall, erect, branched, glabrous, stilt rooted, nodes glabrous or hairy. Leaf sheath 7-15 cm long, glabrous, ligule membranous. Leaf blade flat, linear elliptic, 10-50 x 1-2 cm, glabrous or minutely hairy, apex finely acuminate. Racemes 4-5 cm long, more or less exerted from spathes, glabrous. Joints compressed 4-4.5 mm long, ciliate on one margin. Sessile spikelet narrowly elliptic-ovate, 5-6.5 x 1.3-1.5 mm, awned, callus short, bearded. Lower glume coriaceous, narrowly ovate-elliptic, 5-6.5 x 1.3-1.5 mm, silky hairy on back at middle, with slit like groove, obscurely nerved, margins incurved, apex truncate. Upper glume coriaceous, narrowly ovate-oblong, 5-6 x 1-1.2 mm, 1-keeled, keels ciliate above the middle, 6-9-nerved, margins sparsely ciliate, apex acute. Lower lemma hyaline, narrowly elliptic, 5-5.5 x 0.7-0.8 mm, glabrous, margins inflexed, ciliate, 3-nerved, apex acute. Palea narrowly oblong, 4-4.2 x 0.5-0.6 mm, glabrous, 2-nerved, 2-toothed. Lodicules 2. Stamens 3, anthers 3-3.5 mm long. Upper lemma hyaline, narrowly ovate, 4-4.8 x 0.5-0.6 mm, cleft at apex into 2 acute lobes, awned from sinus, awn 2.5-3.8 cm long, geniculate. Palea hyaline, 3.5-3.7 x 0.5-0.7 mm, margins inflexed, glabrous, nerveless, obtuse at apex. Lodicules 2. Stamens 3, anthers 3-4 mm long. Pistil 3-4 mm long. Pedicelled spikelet narrowly to linear ovate, 8-9.5 x 1.3-1.5 mm, puberulous, acuminate, unawned. Lower glume subcoriaceous, narrowly to linear ovate, 8-9 x 1.2-1.3 mm, puberulous, margins inflexed, 15-17-nerved, apex acuminate. Upper glume membranous, narrowly ovate, 5.6-6.5 x 0.8-1 mm, margins inflexed, 3-5 nerved, apex acuminate. Lower lemma hyaline, narrowly ovate, 5-6.5 x 0.6-0.8 mm, 3-nerved, apex muticous. Palea hyaline, narrowly ovate, 4.5-5 x 0.5-0.7 mm, apex acute. Lodicules 2. Stamens 3, anthers 2-2.3 x 0.1-0.2 mm. Upper lemma hyaline, narrowly ovate, 5-5.2 x 0.5-0.6

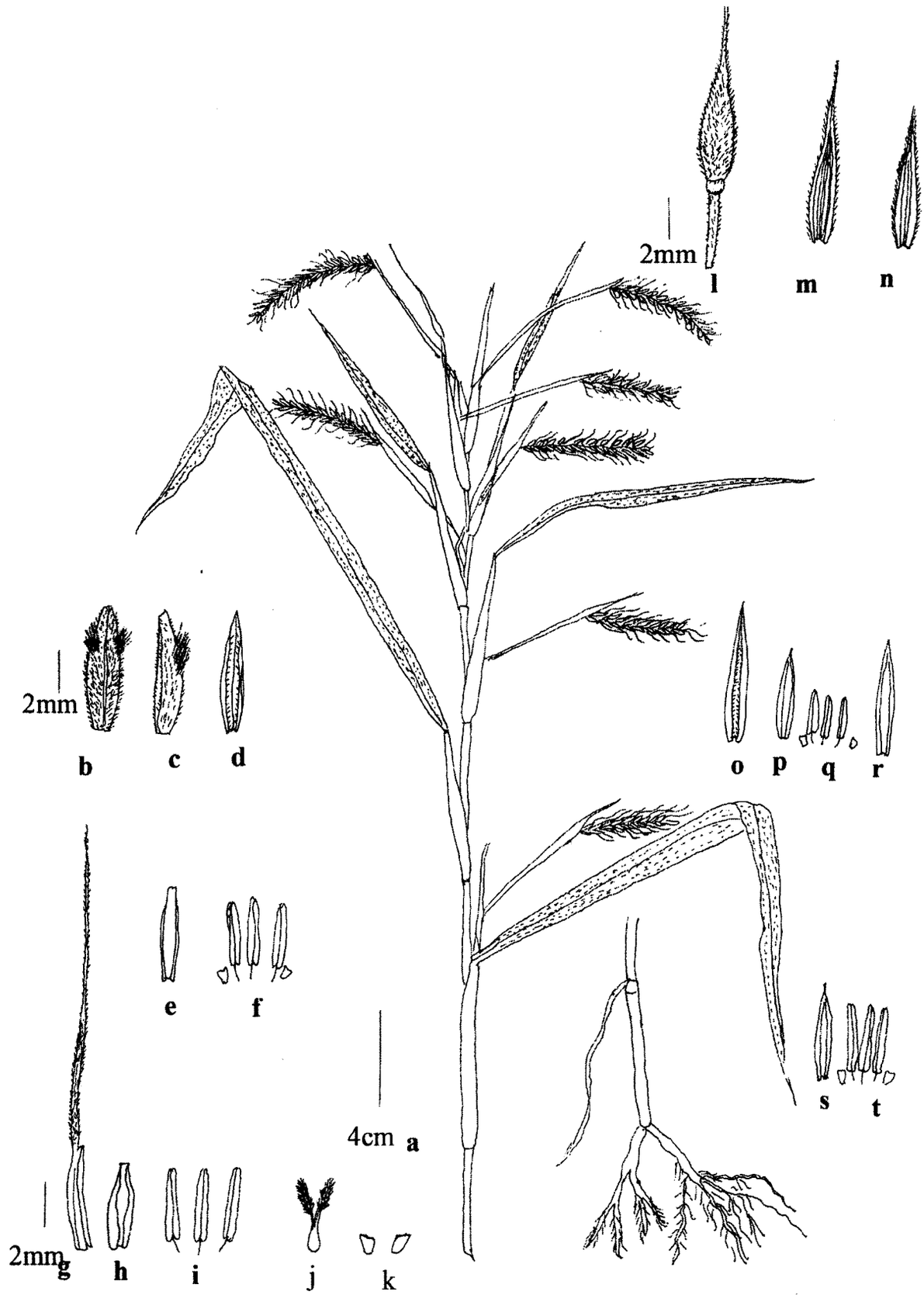


Fig.19.Triplopogon ramosissimus (Hack.) Bor. a. Habit,**b- k** Sessile spikelet: **b.** Lower glume–Ventral view,**c.** Lower glume–Lateral view; **d.** Lower lemma, **e.** Palea, **f.** Stamens & Lodicules ,**g** Upper lemma, **h.** Palea,**i.** Stamens, **j.** Pistil, **k.** Lodicules, **l–t.** Pedicelled spikelet: **l.** Pedicelled spikelet,**m.** Lower glume, **n.** Upper glume, **o.**Lower lemma, **p.** Palea,**q.** Stamens & Lodicules, **r.** Upper lemma, **s.** Palea,**t.**Stamens &lodicules.

mm, glabrous, margins inflexed, 3-nerved, apex acute. Palea hyaline, narrowly elliptic, 3-4 x 0.5-0.6 mm, apex acute. Lodicules 2. Stamens 3, anthers 3-3.5 mm long. Caryopsis with adherent pericarp; oblong; laterally compressed; sulcate on hilar side; 3.5 mm long. Embryo 0.5 time's length of caryopsis. Hilum punctiform.

Fl. & Frts.: September to October.

Chromosome number: n= 10. (Joshi, A.B.et.al.1959)

Adaxial epidermis:

Adaxial epidermis shows some distinction between intercostal and costal region. Intercostal region consists of about 5-6 row of long cells. Short cells are sparsely distributed. The long cells are of unequal size with sinuous wall and few of them are papillate.A single row of stomata with low dome shaped subsidiary cell are present in mid row of intercostal zone. Macrohairs are present abundantly, each with 3-4 mm in length. Microhairs are present at junction of two long cells. Costal region consist of 2-3 layer of short cell and long cells. Dumbbell shaped silica bodies are present in a row over vein. **(fig.20.A.), (Plate-XIII).**

Abaxial epidermis:

Abaxial epidermis show poor distinction between intercostal and costal region except for presence dumbbell shaped silica bodies in row over the vein. The intercostal region is made up of 5-6 rows of long cells with deeply sinuous walls. The long cells are papillate. Papillaes are of unequal size and oblique. Intercostal papillae overarching the stomata A single row of stomata is present in each intercostal region. Stamatas are with triangular subsidiary cells. Microhairs are small in shape. High stomatal frequency as compare to adaxial epidermis is found on abaxial surface.

Costal region consist of layer of long and short cells. A row of dumbbell shaped silica bodies is present. **(fig.20.B.), (Plate-XIII).**

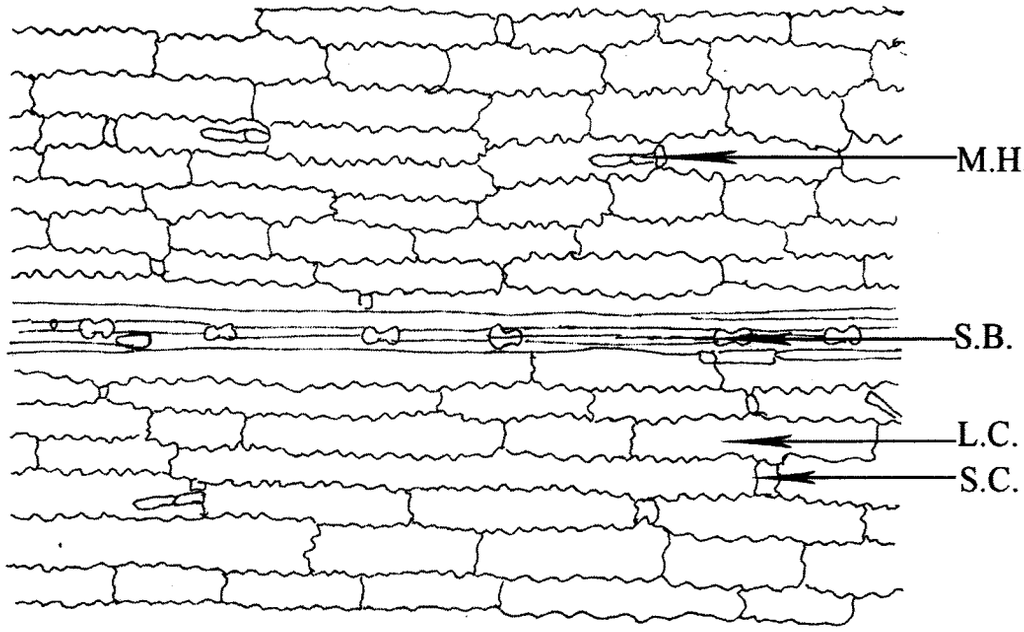


Fig. 20.A. Adaxial leaf epidermis of ***Triplopogon ramosissimus*** (Hack.) Bor. X 200.

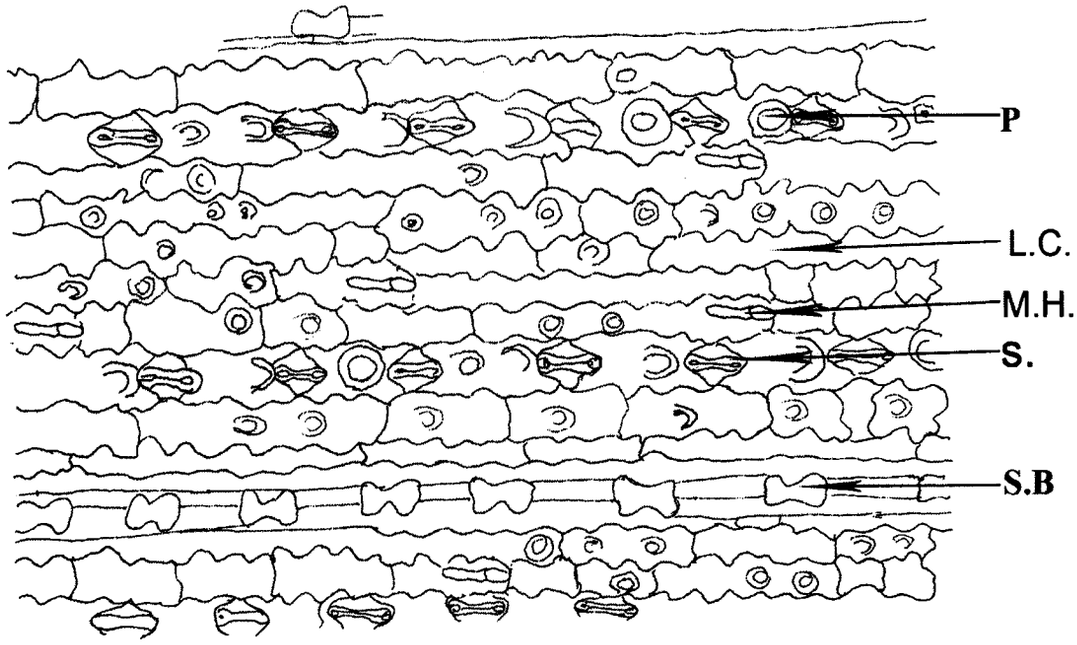


Fig.20.B.Abaxial leaf epidermis of ***Triplopogon ramosissimus*** (Hack.) Bor. x 200

Longcell(L.C.),Microhair (M.H.), Papillae(P),Prickel hair (P.H.),Stomata (S),Short cell (S.C.),Silica Bodies (S.B.).

T.S of .Lamina:

Adaxial epidermis consists of large bulliform cells of somewhat unequal size. Few cells of adaxial epidermis are papillate. Mesophyll is arranged in radiate manner made up of chlorenchymatous cells. The small and large lateral vascular bundles are alternate. Large lateral bundles consist of both adaxial and abaxial sclerenchyma girders, two metaxylem and phloem surrounded by single bundle sheath. Small vascular bundle consist of complete bundle sheath and undifferentiated xylem and phloem.Abaxial epidermis made up of oval prominently papillate cells interrupted by stomata.

Mid rib region is planoconvex in outline. Adaxial epidermis in middle portion made up of small barrel shaped cells which are merged into large lateral bulliform cells. Adaxial epidermis followed by single row of sclerenchyma about fifteen cells which is followed by ground tissue made up of large polygonal cells. Abaxial epidermis cells are prominently papillate. Median vascular bundle consists of two prominent metaxylem and distinct phloem surrounded by sclerenchymatous sheath and wide girder of sclerenchymatous cells. The lateral bundles of keel region consist of small and large vascular bundle. Small vascular bundles consist of parenchymatous sheath and undistinguished xylem and phloem. Larger bundles similar to smaller vascular bundles but have sclerenchymatous girders. All vascular bundles are of basic type. **(Fig.21.A and B.), (Plate-XIV).**

T. S. of Culm:

Culm is more or less circular in outline. Epidermis is single layered made up of oval compactly arranged cells covered with cuticle on it's outerside.Epidermis followed by 1-2 layers of sclerenchyma followed by a ground tissue made up of parenchymatous cells with large intercellular spaces. The vascular bundle are scattered in outer peripheral part of the culm. Outermost zone below epidermis consists of small vascular bundle with 2 distinct metaxylem, phloem surrounded by sclerenchyma. Inner layer vascular bundles consist of two large metaxylem well developed phloem and lysogenous cavity surrounded by sclerenchymatous sheath. All vascular bundles are of basic type. **(Plate-XIV).**

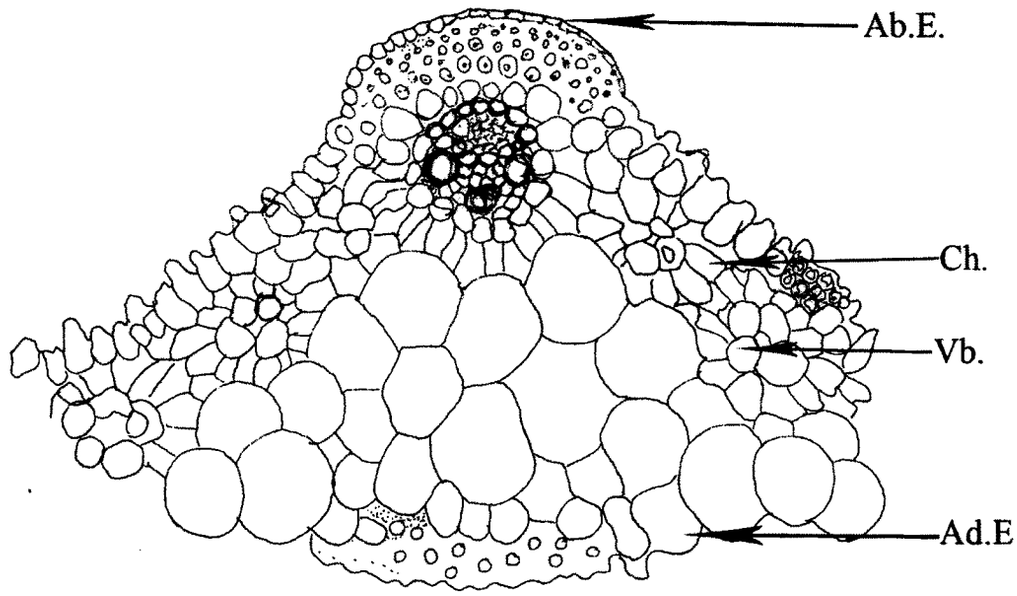


Fig.21.A.T.S.of leaf passing through keel region ***Triplopogon ramosissimus*** (Hack) Bor .x 250.

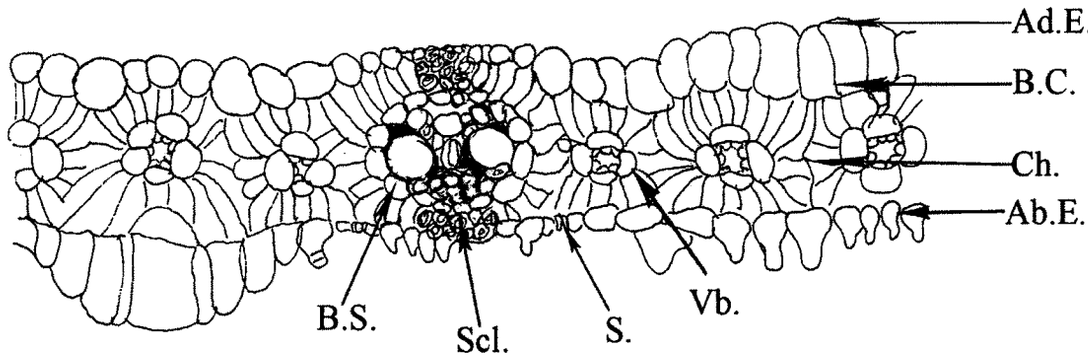
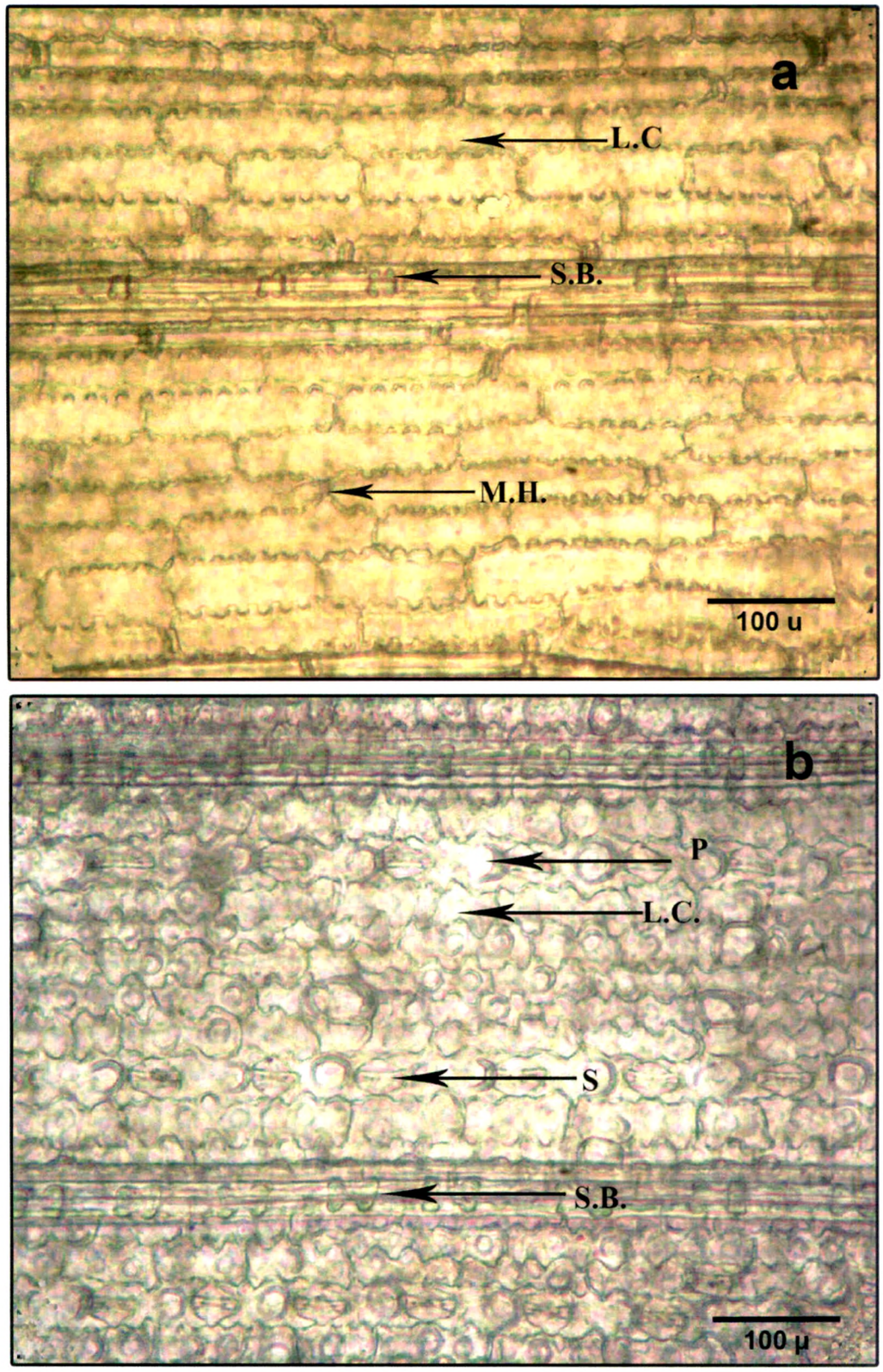


Fig.21.B.T.S.of leaf ***Triplopogon ramosissimus*** (Hack) Bor showing lateral small and large vascular bundles x 250.

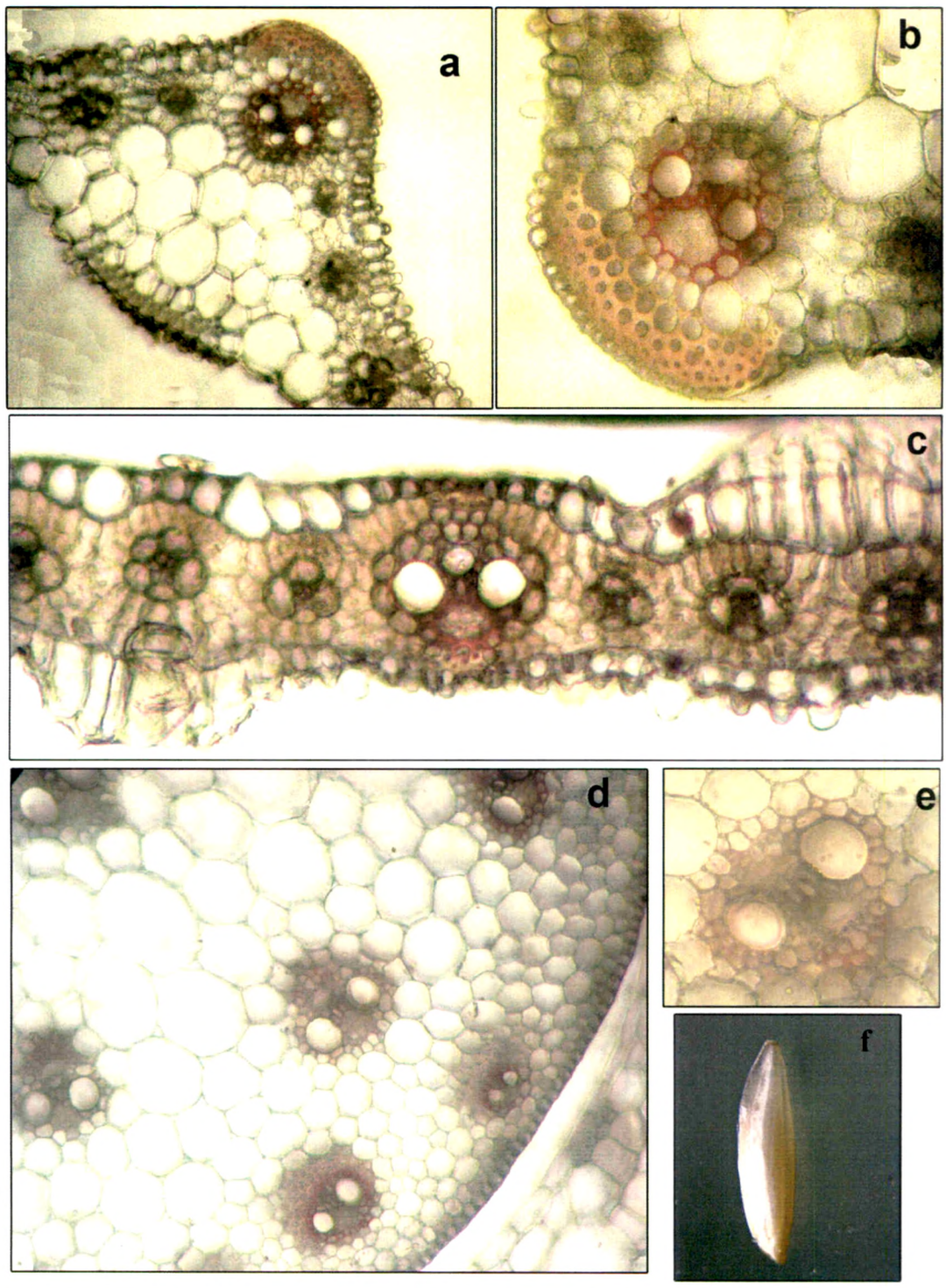
Ad.E.adaxialepidermis,Ab.E.abaxial epidermis,B.C.bulliform cells,Ch.chlorenchyma, B.S. bundle-sheath,S.stomata,Scl.sclerenchyma,Vb. vascular bundle.

PLATE-XIII



Triplopogon ramosissimus (Hack.) Bor. a. Adaxial epidermis of leaf.,b.Abaxial epidermis of leaf showing epidermal feature: Long cell (L.C.), Microhairs (M.H.),Prickel hair (P.H.),Papillae(P),Short cell (S.C.),Stomata (S).Silica bodies(S.B.).

PLATE-XIV



Triplopogon ramosissimus (Hack) Bor .**a).**T.S.of leaf passing throught keel showing large median and several small vascular bundle, **b).**Enlarge mid vascular bundle,**c).**T.S.of.leaf.showing large and small lateral bundles i.e.basic type,**d).**T.S.of.stem showing peripheral vascular bundles. **e)**.Enlarge single stem vascular bundle,**f.** Caryposis.