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Foliar Epidermal Characteristics of Some Grass Species in Gbele Resource Reserve, Upper West Region, Ghana

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Abstract:

The study presents investigations into the leaf epidermal characteristics of sampled grass species in Gbele Resource Reserve to determine variations or similarities in terms of the presence of anatomical features among the grass species. The scraping method was used to study both the adaxial and abaxial epidermis of grass species. Pictorial illustrations of the epidermis of all the grasses studied were presented with their anatomical features. The study revealed variations and similarities among some of the grass species. The adaxial and abaxial epidermis of Andropogon gayanus, Rottboelia cochinchinensis, Imperata cylindrica, Hyparrhenia rufa, Elucine indica, Hyperthelia dissoluta and Brachiaria lata were clearly distinguished into coastal and intercoastal zones. The coastal zones were generally narrower while the intercoastal zones were broader. These zones were however not recorded in Setaria pallide-fusca. Rows of small round papillae were found in both short and long cells in the adaxial and abaxial epidermis of only Andropogon gayanus. Solitary or no stomata were seen in the adaxial epidermis of Andropogon gayanus, Rottboellia cochinchinensis, Hyparrhenia rufa and Digitaria horizontalis. However, numerous stomata were observed in the abaxial epidermis of all the grass species. A mixture of high domed to triangular shaped subsidiary cells of the stomata was observed in Elucine Indica and Brachiaria lata. Low domed subsidiary cells were recorded in Andropogon gayanus, Setaria pallide-fusca and Sporobolus pyramidalis. Leaf epidermal studies have become an essential tool in providing information of taxonomic importance. It affords us the opportunity to classify and identify grasses into their various tribes and genus of the family poaceae.

Keywords: *Epidermal, foliar, phytogenetic, anatomical, genera.*

1. Introduction

Grasses which belong to the family poaceae formerly known as graminae consist of approximately 10,000 species and 785 genera (Yanis *et al.*, 2010; The plant list, 2010; Hilu, 2006). The grass family is one of the largest of all plant families. Poeceae is the fifth most species rich flowering plant family (Tim, 1999). It ranged among the top five families of flowering plants in terms of the number of species, but they are clearly the most abundant and important family of the earth's flora (Campbell, 2014).

Grasses are distributed worldwide and exhibited great variations in size and shape. The family has more individual plants and a wider environmental range than does any other family, occupying the geographic limits of vegetation in polar regions and on mountain tops, enduring extremes of cold, sunlight heat and drought, while dominating various landscapes worldwide (Tom Van Devender *et al.*, 2013; Ogie -Odia *et al.*,2010). They are adapted to a wide range of habitats from alpine to warm tropical savannah regions where there is plenty of sunlight, moisture and warmth (Bryan and Alfonso, 2011).

No plant family comes close to poeceae in its importance to world agriculture. Many species of range and pasture grasses in addition to grains are used for livestock forage and feed. The economic importance of grasses lies in their role as an important food source. Up to 76% of the world's agricultural land is given to crop grasses and more than 50% of the world's calories come from grasses, particularly cereals. At least 300 grass species are known to harvest in the wild as cereals and about 35 are or have been domesticated (Campbell, 2014; Tim, 1999). The grass family is of particular interest to humans. Most people on earth rely on grasses including rice, wheat and maize for a major portion of their diet. Domestic animals are raised on diets partly or wholly of grasses. In addition, grasses form an important part of the urban and suburban landscape in much of the world (Kellogg, 2001).

The leaf epidermis is generally considered an important aspect for classification and delimitation of grass species and genera and for sorting out the evolutionary and phytogenetic problems associated with the family poaceae (Jones, 1986, cited by Chaudhari *et al.*, 2014: Uka *et al.*, 2014). Leaf epidermal studies have proved to be very important in providing information of taxonomic importance. The study and identification of leaf epidermal characters afford us the opportunity to classify and identify grasses into their various tribes and genus and thus adds to our knowledge on the biosystematics of grass species (Ogie-Odia *et al.*, 2010). Different parameters

of epidermal anatomy such as long cells, pickle hairs, micro hairs and nature of stomata are helpful in the identification of species at the tribal and subfamily level (Chaudhari *et al.*, 2014). Several studies have been conducted in other areas on tribes and genera belonging to the family poaceae using leaf epidermal technique. The aim of this study therefore is to examine the anatomical features on the epidermis of grass species in the study area for purposes of identification and classification in the family poaceae.

1.1. The Study Area

Gbele Resource Reserve is the northern most wildlife protected area in Ghana closest to Burkina Faso. It is situated in the upper West Region of Ghana and covers a total area of 565km square. It is located at ($10^o22^{'}$) and ($10^o44^{'}$) N and (2^o $03^{'}$) and ($2^o17^{'}$) W. (Wildlife Division, 2009; Ghana National Parks, 2007). The reserve serves as a trans-boundary migratory route for elephants and other mammals to and from the Nazinga Game Ranch in Burkina Faso. The reserve was established in 1975 purposely to conserve the undisturbed Guinea savannah ecosystem and the large population of the roan antelope in the area. Gbele receives an annual rainfall of 1000mm. The annual temperature ranges between $21C^0$ to $32C^0$ with minimum and maximum reaching $18C^0$ in December/January and $40C^0$ in March/April. Guinea savannah ecosystem is the most common vegetation type at Gbele. The vegetation is dominated by woody species which included; *Adansonia digitatata*, *Afzelia africana*, *Anogeissus leiocarpus*, *Parkia biglobosa*, *Pterocarcapus erinaceus*), *Vitellaria paradoxa*, *Daniellia oliveri*, *Acacia* and *Ficus spp*, *Khaya senegalensis.* Grass cover is dominated by *Andropogon gayanus*, *Pennisetum polystachion*, *Eragrostis tenella*, *Hyparrhenia involucrata*, *Hyperthelia dissoluta*, *Digitaria horizontalis and Paspalum orbiculare*). Common herbivores at Gbele included; hartebeest (*Alcelaphus buselaphus*), bushbuck (*Tragelaphus scriptus*) waterbuck (*Kobus ellipsiprymnus*) Roan antelope (*Hippotragus equinus*) and warthog (Phacochoerus).

2. Materials and Methods

A 1m x 1m quadrat was systematically laid at 200m interval along transect lines to sample grass species in the area. Grass species were identified at the Herbarium of the University for Development Studies in Tamale.

Mature but fresh leaves of grasses were cut into smaller pieces ($1–2cm^2$). They were first boiled in water for five minutes to restore to their normal shape. The side which is not needed (Adaxial or abaxial) is damaged by scraping with a safety razor blade to facilitate the penetration of bleaching solutions in order to obtain fast removal of chlorophyll (Ogie–Odia *et al.*, 2010; Raole and Desai, 2009).

The epidermal peels were then soaked in household bleach (5% sodium hypochlorite solution) for 30 - 60 minutes depending on the plant species till nearly colourless. The peels were washed in water, stained with 1% safranine solution for 10 minutes and cleared in 50% ethanol. Each peel was then washed in water and mounted in a drop of distilled water on a 76mm x 26 mm slide covered with a 22mmx22mm coverslip. Slides were then studied thoroughly using a Labomed CXL Digital Microscope under low and high power objective lenses of 40X and 100X magnifications as recommended by (Metcalfe, 60; Raole and Desai (2009). Photomicrographs of the epidermal features were taken from the slides with a Labomed Digital camera (3.0 mega pixels) fitted onto the microscope. Images and drawings from literature sources were used to aid the study of the specimens. Terminologies for the epidermal morphology such as stomata prickle hairs, long cells, short cells and micro-hairs were that of (Metcalfe, 60: Ogie -Odia *et al.*, 2010).

3. Results

The list of the grass species studied is presented in table 1 whilst the descriptions of the leaf epidermal characteristics are presented in Table 2; the epidermal keys are also presented whilst the epidermal slides are illustrated in Figures 1a to 10b.

Scientific Name	**Common Name**	**Family Name**
Andropogon gayanus (Kunth)	Northern gamba grass	Poaceae
Rottboelia cochinchinensis (Lour)	Itch grass	Poaceae
Imperata cylindrica (Anderss)	Spear grass	Poaceae
Hyparrhenia rufa (Stapf)	Thatch grass	Poaceae
Setaria pallide- fusca (Schum)	Cat tail grass	Poaceae
Pennisetum polystachion (Linn)	Feathery grass	Poaceae
Digitaria horizontalis (Willd)	Crab grass	Poaceae
Brachiaria lata (Schumach)	Signal grass	Poaceae
Elucine Indica (Gaertn)	Bull grass	poaceae
Sporobuolus pyramidalis(P.Beauv)	Giant rat tail	Poaceae

Table 1: List of Grass Species Studied

3.1. Andropogon Gayanus Kunth.

3.1.1. Adaxial Surface
Clearly distinguished into coastal and intercoastal zones. Long cells are numerous and rectangularly shaped and are elongated. Anticlinal walls vary from slightly sinuous to straight. Solitary short cells are present in the intercoastal zones. A row of small round papillae are present on the long cells. Intercostal hooked Prickle- hairs are found in the intercoastal zones. Infrequent bi-cellular micro-hairs with distal cell tapering towards the apex are present in the intercoastal zones. Subsidiary cells of the stomata are high-domed shaped.

3.1.2. Abaxial Surface
Clearly separated into coastal and intercoastal zones. Long cells are rectangularly shaped with straight anticlinal walls. Fewer solitary short cells are found in rows of two or more cells. Numerous bi-cellular micro-hairs with distal cell tapering towards the apex are spread over cell surfaces. Rows of small round papillae are present in short and long cells. Subsidiary cells of the stomata are low-domed shaped. Pickle-hairs are unseen.

3.2. Rottboelia Cochinchinensis (Lour) Clayton

3.2.1. Adaxial Surface
Conspicuously distinguished into coastal and intercoastal zones. Long cells are rectangular and elongated with sinuous anticlinal walls. Prickle-hairs in row of dumb-bell-shaped silica bodies. Stomata are infrequent with low-domed shaped subsidiary cells. A row of coastal silica bodies ranging from dumb-bell-shaped to saddle-shaped occur in the coastal zones.

3.2.2. Abaxial Surface
Clearly distinguished into coastal and intercoastal zones. Long cells are rectangular and elongated with sinuous anticlinal walls. Numerous stomata are found across cell surface with triangular subsidiary cell shape. Fewer bi-cellular micro-hairs with hemispherical distal cell shape are present. Saddled-shaped silica-bodies are present in the coastal zones. No papillae present on long cells. Numerous solitary short cells are found in the intercoastal zones.

3.3. Imperata Cylindrica (Anderss)

3.3.1. Adaxial Surface
Clearly separated into coastal and intercoastal zones. Numerous stomata with high-domed subsidiary cells are present. Long cells rectangular, numerous and elongated with near straight anticlinal cell walls. Few bicellular micro-hairs with distal cell tapering towards apex are seen. Papillae not seen on long cells. Pickle- hairs are absent. Various solitary short cells are found in intercoastal zone.

3.3.2. Abaxial Surface
Distinguished into coastal and intercoastal zones. Long cells are rectangular and elongated with near straight anticlinal cell wall. Subsidiary cell of the stomata are high domed-shaped. Rows of saddled-shaped costal silica bodies occur along the coastal zones. Infrequent bicellular micro-hairs with distal cell tapering towards apex occur within the intercoastal zone. Papillae not found on long cells. Prickle-hairs were unseen.

3.4. Hyparrhenia Rufa Stapf

3.4.1. Adaxial
Clearly separated into coastal and intercoastal zones. Long cells are rectangular in shape with straight anticlinal walls. A bundle of costal silica bodies ranging from kidney-shaped to tall and narrow body shaped occur in the coastal zones. Numerous prickles hairs ranging from angular to intercostals hook are present in the intercoastal zone. Papillae not found on long cells. Stomata are conspicuously absent.

3.4.2. Abaxial Surface
Distinguished clearly into coastal and intercoastal zones. Numerous stomata with high and low–dumb shaped subsidiary cells are present. Long cells are rectangular and elongated with sinuous anticlinal walls. Row of costal silica bodies of different kinds rangingfrom dumb- bell-shaped to cross-shaped occur within the coastal zone. Prickle-hairs in row of dumb–bell-shaped silica bodies are found in the coastal zone. No papillae present on long cells.

3.5. Setaria Pallide- Fusca (Schum)

3.5.1. Adaxial Surface
Long cells are rectangular and extremely elongated with straight anticlinal walls. Infrequent number of stomata with low-domed subsidiary cell occur. No papillae occur on surfaces of long cells. Few bi-cellular micro-hairs with distal cell tapering towards apex occurr within the intercoastal zone.
3.5.2. Abaxial Surface
Infrequent numbers of stomata with low-domed subsidiary cells are present. Long cells are rectangular and elongated with straight and smooth anticlinal walls. Fewer bi-cellular micro-hairs with distal cell tapering towards apex in the intercoastal zone. No papillae found on surfaces of long cells. Prickle-hairs are conspicuously absent.

3.6. Pennisetum Polystachion (Linn)

3.6.1. Adaxial Surface
Distinguished clearly into coastal and intercoastal zones. Long cells are triangular and elongated in shape with sinuous anticlinal walls. Fewer number of stomata with triangular subsidiary cell shape are present. A row of angular prickle-hairs occur in the coastal zone. Infrequent numbers of bi-cellular micro-hairs are found in the intercoastal zone. No papillae are found on long cells.

3.6.2. Abaxial Surface
Clearly separated into coastal and intercoastal zones. Subsidiary cells of the stomata are triangular in shape. Long cells are elongated and rectangular in shape with no papillae occurring on them. Anticlinal wall of the long cells are slightly sinuous. Few bi-cellular micro-hairs occur in the intercoastal zone.

3.7. Digitaria Horizontalis (Willd)

3.7.1. Adaxial Surface
Clearly distinguished into coastal and intercoastal zones. Long cells are triangular and elongated in shape with slightly straight anticlinal walls. No papillae found on surfaces of long cells. Row of angular pickle- hairs on leaf margin were found on the coastal zone. Frequent numbers of costal silica bodies of dumb-bell-shaped occur within the coastal zone. No micro-hairs and stomata present in the intercoastal zone.

3.7.2. Abaxial Surface
Separated clearly in coastal and intercoastal zones. Frequent numbers of stomata occur in the intercoastal zone with low and high domed subsidiary cells. Long cells are rectangular and elongated with slightly sinuous anticlinal walls. Rows of angular prickle-hairs and dumb-bell-shaped silica bodies occur in the coastal zone. Numerous short cells are present in the intercoastal zone. Papillae not found on long cells.

3.8. Brachiaria Lata (Schumach)

3.8.1. Adaxial Surface
Distinguished into coastal and intercoastal zones. Subsidiary cells of the stomata are in high domed shape. Long cells are rectangular and elongated in shape with straight anticlinal walls. No papillae found on long cells. Row of dumb-bell-shaped silica bodies is present in the coastal zone. No prickle-hairs found in either coastal or intercoastal zones.

3.8.2. Abaxial Surface
Clearly separated into coastal and intercoastal zones. Long cells found in the intercoastal zone are rectangular and elongated with straight anticlinal walls. No papillae found on surfaces of long cells. Solitary short cells are found in the intercoastal zone. Frequent number of stomata with subsidiary cells varying from high domed to triangular shaped. Row of dumb-bell-shaped silica bodies are found in the coastal zone.

3.9. Elucine Indica (Gaertn)

3.9.1. Adaxial Surface
Clearly separated into coastal and intercoastal zones with the intercoastal zone been broader than the coastal zone. Long cells are rectangular in shape. No papillae found on surfaces of long cells. Anticlinal walls of the long cells are straight. Subsidiary cells of the stomata are triangular in shape. No papillae found on long cells. Fewer prickle- hairs are found on the intercoastal zone. Silica bodies not found on the coastal zone. Micro-hairs not found on the intercoastal zones.

3.9.2. Abaxial Surface

Separated into coastal and intercoastal zones with the intercoastal zone wider than the coastal zone. Subsidiary cells of the stomata varied from high domed to triangular shape. Long cells are rectangular and elongated with anticlinal cell walls near straight. No papillae found on long cells. Solitary prickle-hairs are found within the intercoastal zone. Micro-hairs not found on the intrercoastal zone.

3.10. Sporobuolus Pyramidalis (P.Beauv)

3.10.1. Adaxial Surface

Distinguished clearly into coastal and intercoastal zones. Long cells are rectangular and elongated with straight anticlinal cell walls. No papillae present on long cells. Numerous prickle-hairs found on the intercoastal zone. Micro-hairs not present on the intercoastal zone. Solitary low-domed subsidiary cells of stomata occur on the intercoastal zone.

3.10.2. Abaxial Surface

Clearly separated into coastal and intercoastal zones with the intercoastal zone been broader than the coastal zone. Long cells are rectangular and elongated with no papillae found on them. Numerous stomata with low-domed subsidiary cells occur within the intercoastal zone. No prickle-hairs and micro-hairs found on the intercoastal zone. Numerous long cells are found on the intercoastal zone.

Species	**Surface**	**C/IC**	**LC**	**SC**	**ST**	**MH**	**PH**	**SI**	**P**	**SSC**
Andropogon gayanus	AD	C	+	+	+	+	+	_	+	LDS
	AB	IC	+	+	+	+	_	_	+	LDS
Rottboelia cochinchinensis	AD	IC	+	+	+	+	+	+	_	LDS
	AB	IC	+	+	+	+	_	+	_	TRS
Imperata cylindrica	AD	C	+	+	+	+	_	+	_	HDS
	AB	C	+	+	+	+	_	+	_	HDS
Hyparrhenia rufa	AD	IC	+	+	_	_	+	+	_	_
	AB	C	+	_	+	_	+	+	_	TRS
Setaria pallide- fusca	AD	_	+	_	+	+	_	_	_	LDS
	AB	_	+	_	+	+	_	_	_	LDS
Pennisetum polystachion	AD	C	+	_	+	+	+	+	_	TRS
	AB	C	+	+	+	+	+	_	_	TRS
Digitaria horizontalis	AD	C	+	_	_	_	_	_	_	_
	AB	IC	+	_	+	+	_	+	_	H/LDS
Brachiaria lata	AD	IC	+	_	+	_	_	+	_	HDS
	AB	C	+	+	+	_	_	+	_	TR/HDS
Elucine indica	AD	IC	+	+	+	_	+	_	_	TR/HDS
	AB	IC	+	+	+	_	+	_	_	TR/HDS
Sporobuolus pyramidalis	AD	C	+	+	+	_	+	_	_	LDS
	AB	IC	+	+	+	_	_	_	_	LDS

Table 2: Summary of Leaf Epidermal Features of the Grass Species Studied

→ Legends for Table 2 and Figures 1a – 10b

AD = Adaxial surface
AB =Abaxial surface
LC = Long cells
SC = Short cells
ST = Stomata
+ = Present
MH = Micro – hairs
PH = Prickle- hairs
SI = Silica-bodies
P = Papillae
SSC = Subsidiary cells
- = Absent
LDS = Low dome-shaped
HDS = High dome- shaped
TRS =Triangular- shaped
IC = Intercostal zone
C = Costal zone

4. Leaf Epidermal Figures of the Grass Species Studied

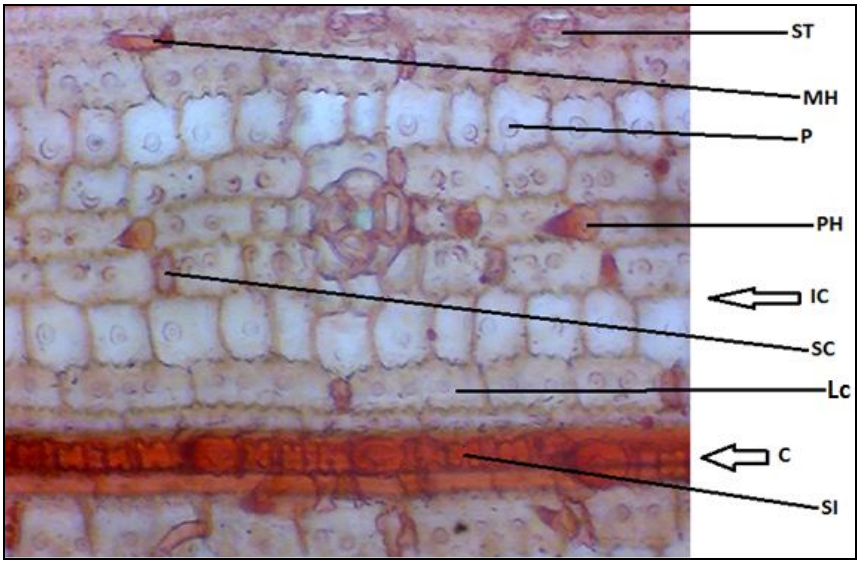

Figure 1a: Adaxial epidermis of Andropo

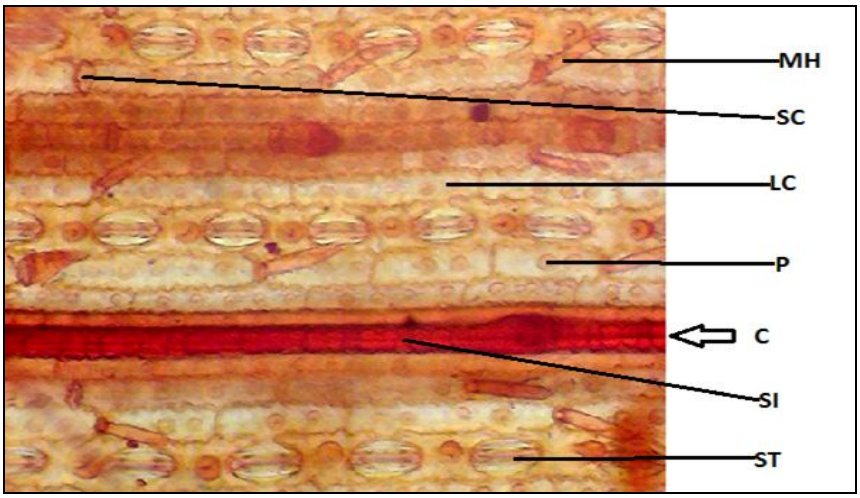

Figure 1b: Abaxial epidermis of Andropogon gayanus

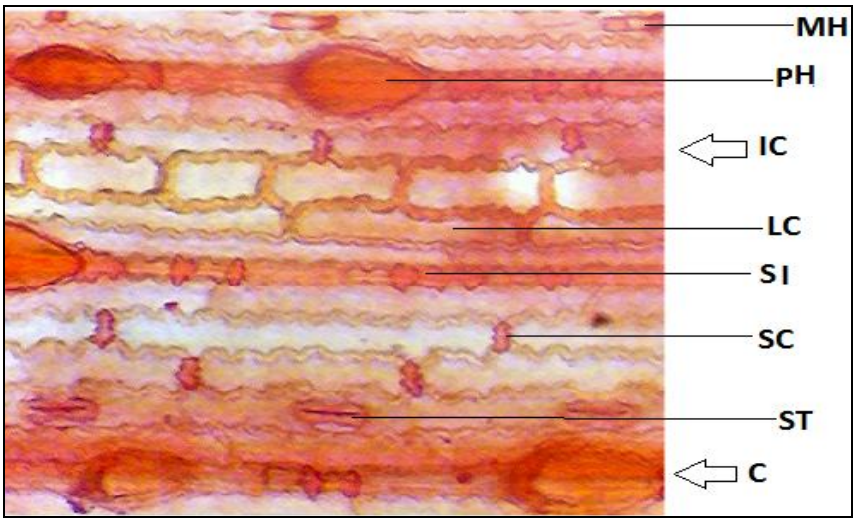

Figure 2a: Adaxial epidermis of Rottboelia cochinchinensis

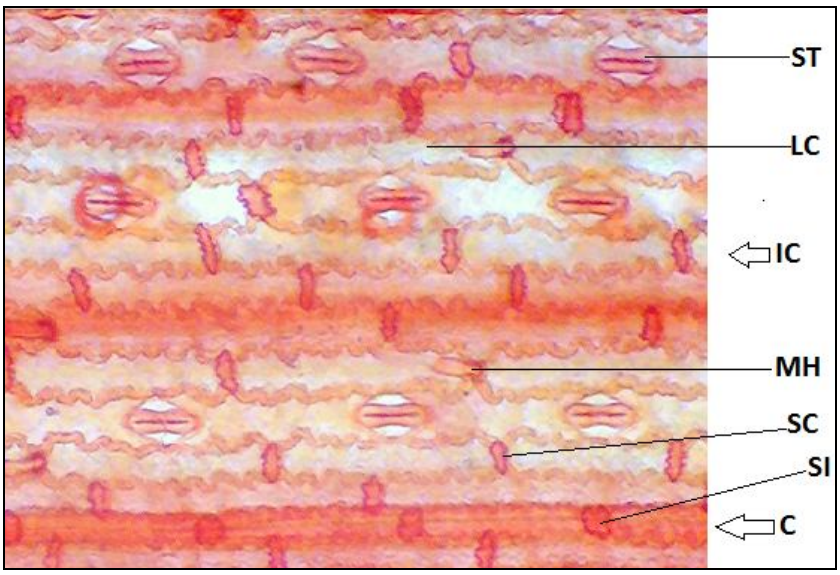

Figure 2b: Abaxial epidermis of Rottboelia cochinchinensis

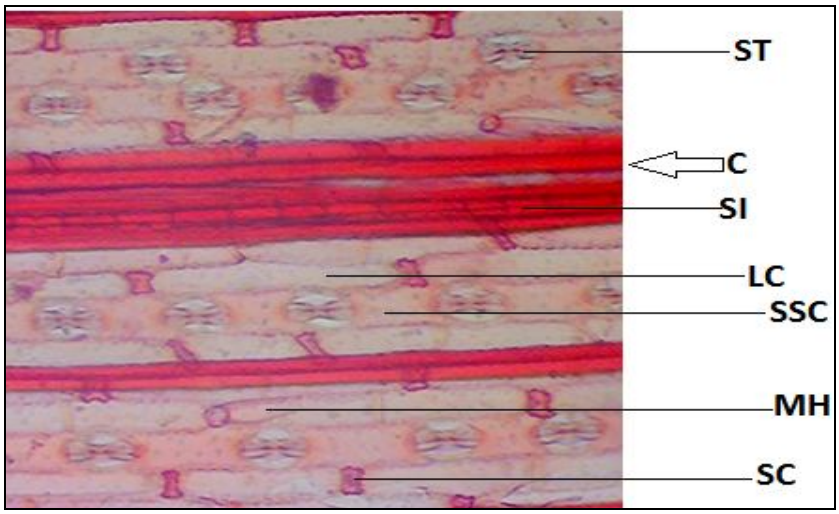

Figure 3a: Adaxial epidermis of Imperata cylindrical

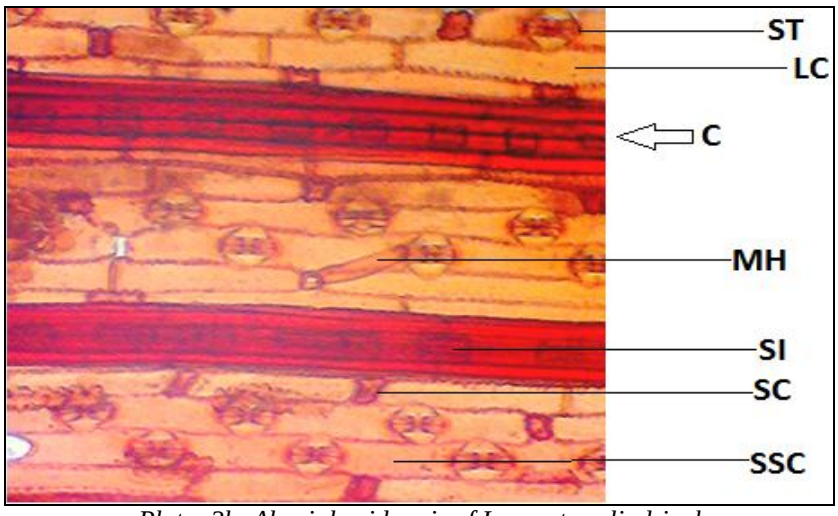

Plate: 3b: Abaxial epidermis of Imperata cylindrical

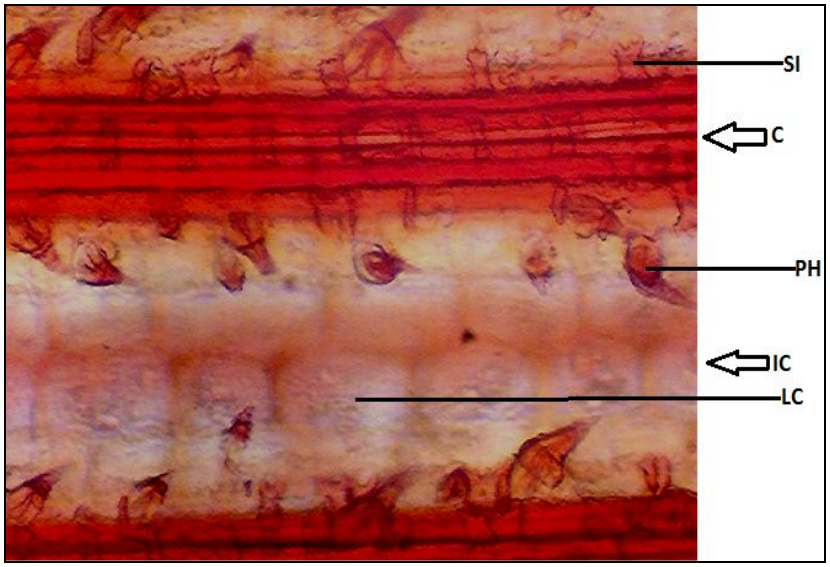

Figure 4a: Adaxial epidermis of Hyparrhenia Rufa

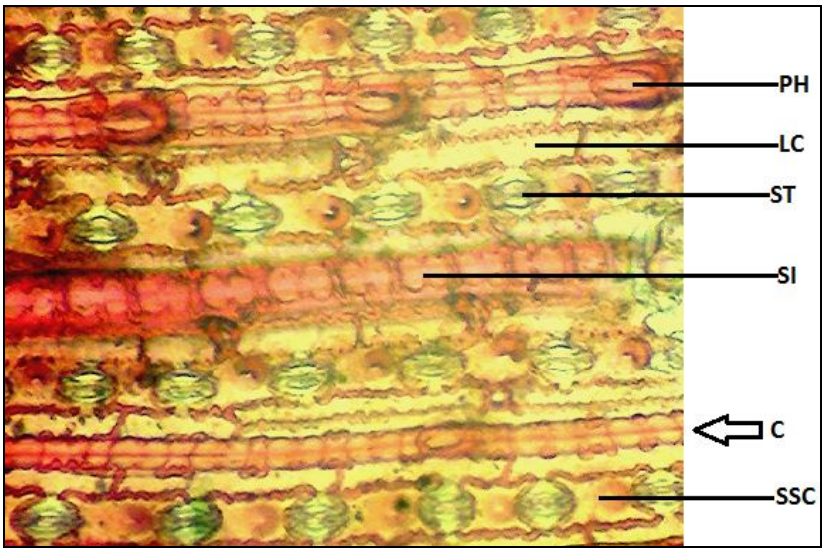

Figure 4b: Abaxial epidermis of Hyparrhenia rufa

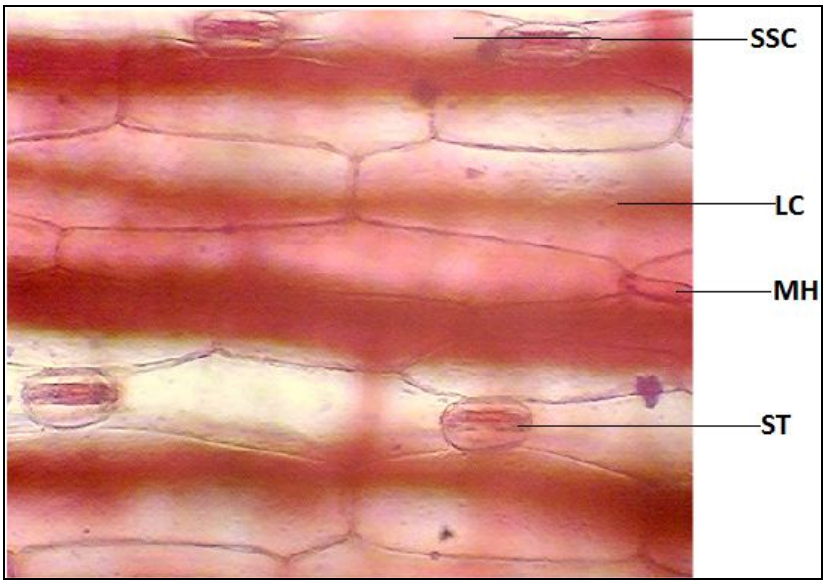

Figure 5a: Adaxial epidermis of Setaria pallide- fusca

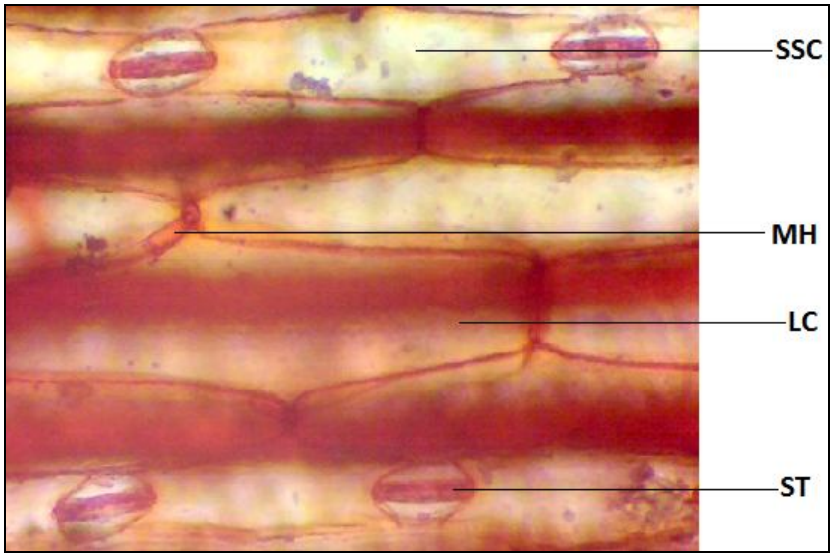

Figure 5b: Abaxial epidermis of Setaria pallide- fusca

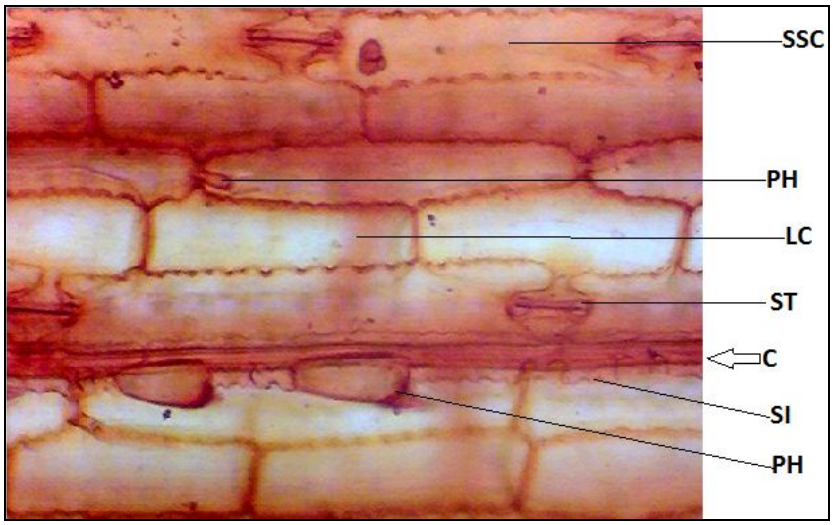

Figure 6a: Adaxial epidermis of Pennisetum polystachion

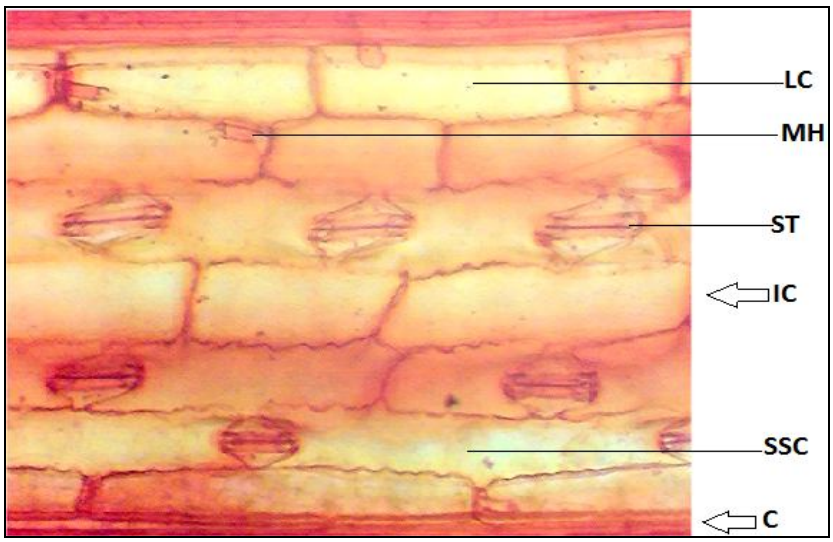

Figure 6b: Abaxial epidermis of Pennisetum polystachion

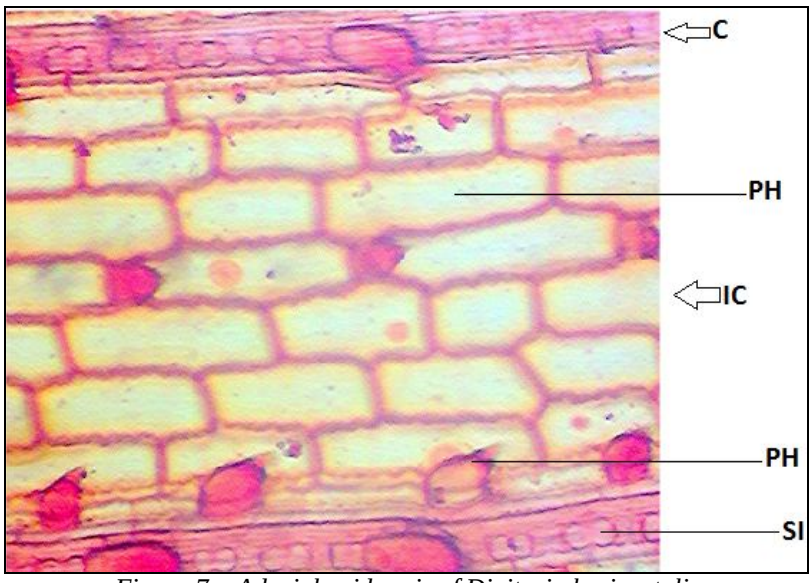

Figure 7a: Adaxial epidermis of Digitaria horizontalis

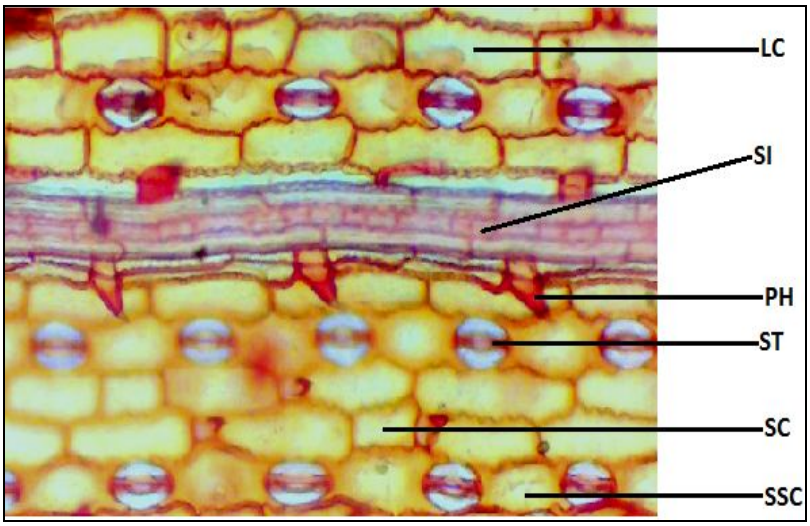

Figure 7b: Abaxial surface of Digitaria horizontalis

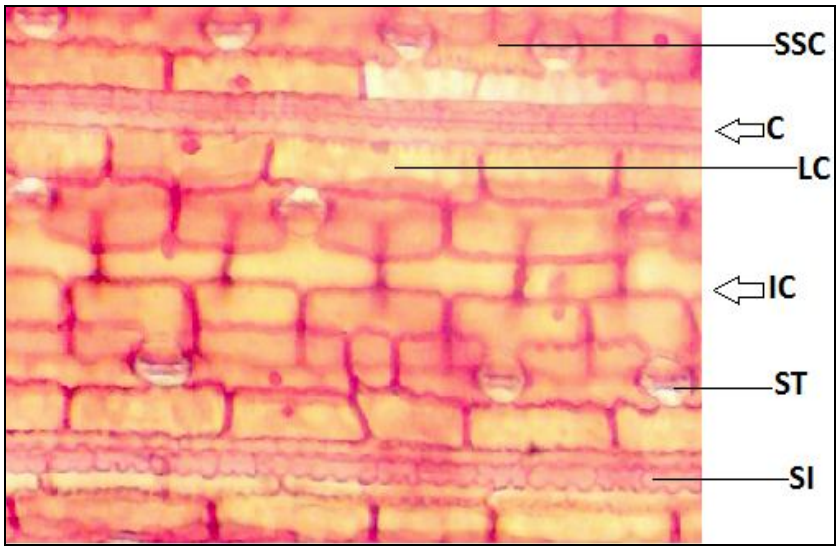

Figure 8a: Adaxial epidermis of Brachiaria lata

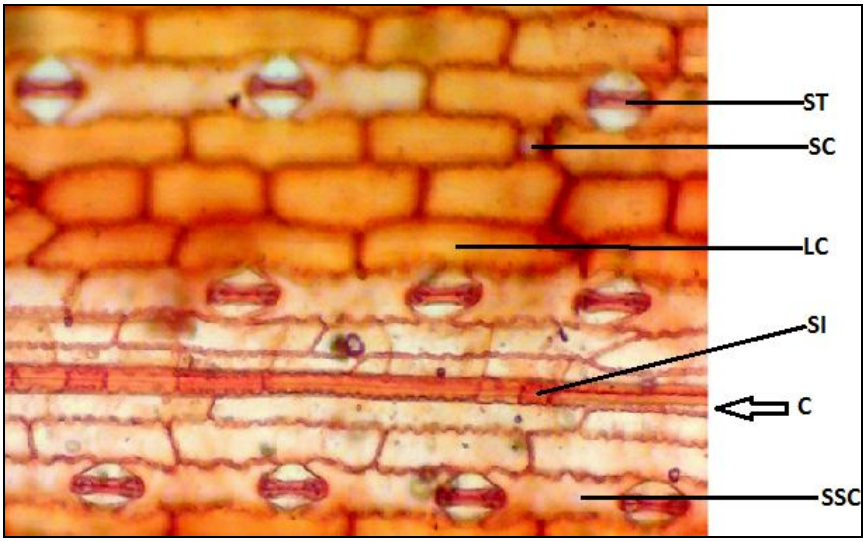

Figure 8b: Abaxial epidermis of Brachiaria lata

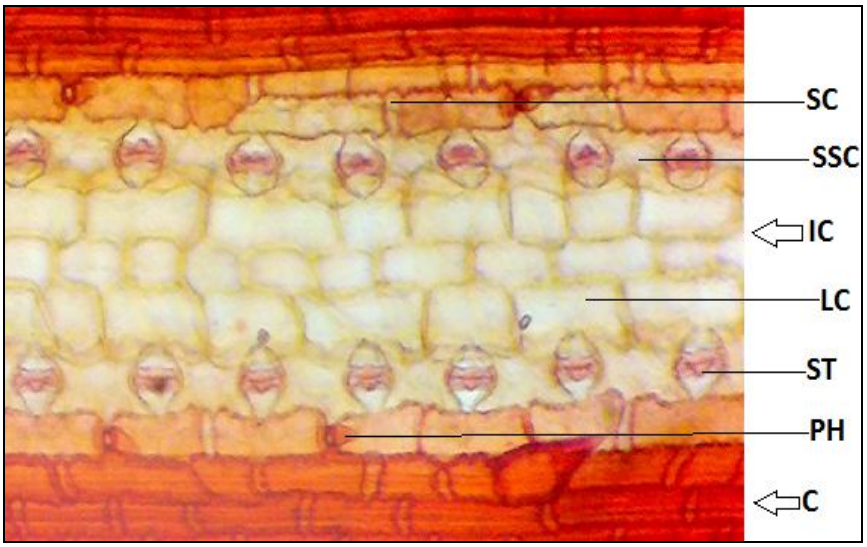

Figure 9a: Adaxial epidermis of Elucine indica

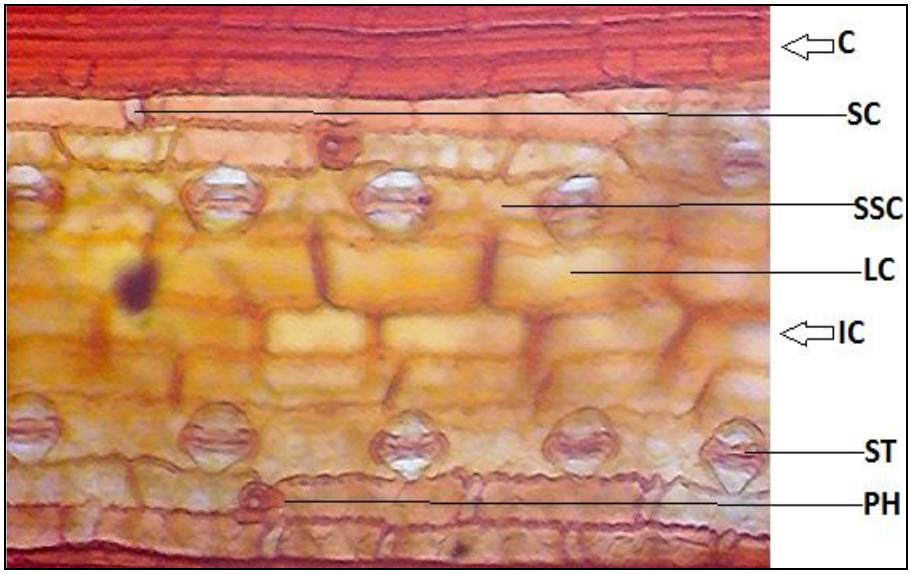

Figure 9b: Abaxial epidermis of Elucine Indica

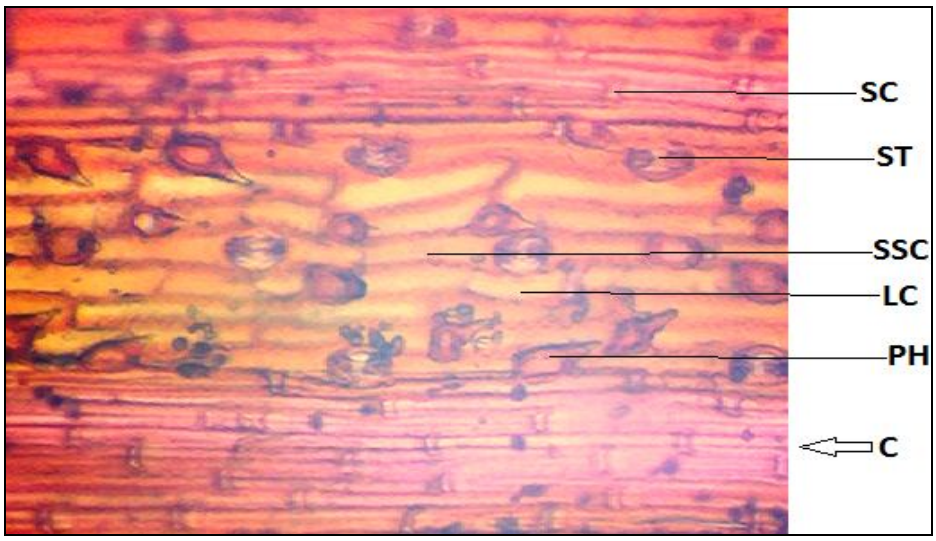

Figure 10a: Adaxial epidermis of Sporobuolus pyramidalis

Figure 10b: Abaxial surface of Sporobolus pyramidalis

5. Discussion

The leaf epidermis of the various grass species studied exhibited a wide variety of anatomical characteristics which could be helpful in the identification and classification of grasses into tribes, families and subfamilies. Chaudhari *et al*., 2014; Ogie-Odia *et al.*, 2010; Abayomi and Ojuolape (2009) pointed out that the leaf epidermal characteristics of grass species exhibit anatomical features such as stomata, long cells, short cells, prickle-hairs, macro-hairs and micro-hairs which varied considerably in size and shape according to species. In the present study, the shape of the subsidiary cells of the stomata of *Elucine indica, Brachiaria lata, Pennisetum polystachion* varied from low-domed to triangular-shape. Costal silica bodies ranging from saddled-shaped to dumb-bell-shaped were observed in the coastal zones of *Rottboelia cochinchinensis, Pennisetum polystachion, Hyparrhenia rufa* and *Hyperthelia dissoluta.* Chaudhari *et al*., (2014) have reported similar observations with other tribes of the family poaceae. The adaxial and abaxial surfaces of *Andropogon gayanus, Imperata cylindrical, Rottboelia cochinchinensis, Hyparrhenia rufa, Hyperthelia dissoluta, Elucine indica, Brachiaria lata* and *Sporobolus pyramidalis* were clearly distinguished into coastal and and intercoatal zones. The coastal zones were generally narrower while the intercoastal zones were broader. Earlier studies carried out by Chaudhari *et al*. (2014) have reported similar observations in other species of the family poaceae. Early studies done by Ogie *et al*., (2010); Abayomi and Ojuolape, (2009) have revealed that the anticlinal walls of the long cells of various genera and tribes of the family poaceae undulate. In this study, similar observations were made in the anticlinal walls of the long cells which are sinuous, straight to slightly straight or sinuous. A row of small round papillae were found on the long and short cells of both the adaxial and abaxial epidermis in the intercoastal zone of *Andropogon gayanus.* Abayomi and Ojuolape, (2009) have reported similar observations in other genera and tribes of the family poaceae. Furthermore, micro-hairs which were observed mainly in the intercoastal zones of both the adaxial and abaxial epidermis were generally bi-cellular in shape with distal tapering towards the apex. Metcalfe, (1960) have described similar structure of bi-cellular hairs in many grass species of the family poaceae. Raole and Desai, (2009) have reported that long cells of members of the

tribe *Andropogoneae* are rectangular with slightly smooth to sinuous anticlinal walls. In the present study, the long cells were mostly rectangular, broad and elongated in shape in *Andropongon gayanus, Digitaria horizontalis, Pennisetum polystachion* except in *Sporobolus pyramidalis.* Again, there was a marked difference in the distribution of stomata between the adaxial and abaxial epidermis of all the grass species studied. Numerous numbers of stomata were seen in the abaxial epidermis while solitary or none was recorded in the adaxial epidermis in some grass species. Abayomi and Ojuolape (2009) reported similar distribution of stomata between the adaxial and abaxial epidermis in *Andropogon gayanus* and *Andropogon tectorum.* Prickle hairs ranging from angular to intercostals hook were recorded in the adaxial epidermis of *Hyparrhenia rufa, Digitaria horizontalis* and *Sporobolus pyramidalis.* Ogie-Odia *et al.*, (2010) have reported the presence of similar shape of prickle hairs in the adaxial and the abaxial epidermis of other tribes of the family poaceae.

The classification of plant species based on their morphological characteristics alone has proven to be scientifically inappropriate as some plant species do not bear flowers. Presently, grass species are still been classified based on their floral parts. This method, however poses a serious challenge to taxonomist as grasses do not produce flowers continuously throughout their lifespan. Hence a much better scientific method such as epidemiology could be used to classify grasses into tribes, families and subfamilies. Leaf epidermal studies of plants have so far proved to be taxonomically appropriate and important in identifying and classifying grass species into families and subfamilies. The study and identification of leaf epidermal characters such as silica bodies, nature of long and short cells, macro-hairs and micro-hairs, prickle hairs, type and distribution of stomata provides taxonomist with the greatest opportunity and flexibility of identifying and classifying grass species into families, subfamilies, tribes and genus.

6. Conclusion

Taxonomical studies rely hugely on numerous characters rather than a single character to determine similarities or variations among plants of the same species or those of different species. In this study, the presence of small round papillae in the long and short cells of both adaxial and abaxial epidermis of only *Andropogon gayanus* is a mark of diagnostic significance. The occurrence of similar anticlinal cell wall in *Andropogon gayanus, Rottboelia cochinchinensis, imperata cylindrica, Pennisetum polystachion, Brachiaria lata, Digitaria horizontalis,* showed that they are somewhat related. However, variations in the type of stomata and their distribution across the species could be used for the delimitation of one taxon from the other.

7. References

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