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A Study on Stomatal Complex of Certain Epiphytic Orchids

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Abstract
In the present study stomatal complexes of nine species of epiphytic orchids were studied. All the leaf of selected orchids are leathery in texure, Hypostomatic condition is predominant, The minimum stomatal index was recorded in Oberonia santapaul 3.83, whereas maximum is in Polystachea flavascence 17.45. Highest stomatal frequency was found in Eria mysorensis 12238.32 and least stomatal frequency is recorded in Gastrochilus acaulis 2725.53 In the present study three major types of stomata,such as paracytic,anomocytic and anisocytic type of stomata were recorded.

INTRODUCTION

Orchids, the most beautiful flowers in god's creation, comprise a unique group of plants. Orchids one of the most fascinating creations of nature, are also one of the most widely distributed groups of flowering plants on this earth. Orchids are found in almost every type of habitat ranging in condition from arctic to tropical. Orchids may be found in growing submerged or subterranean to several meters above the ground level in air,as epiphytes on tall trees or as lithophytes on rocks boulders and stones.

Orchidaceae being one of the largest families of flowering plants with both terrestrial and epiphytic members. Taxonomically, they represent the most highly evolved family among monocotyledons with 600-800 genera and 25,000-35,000 species (Arbitti, *et.al*., 1979).In India this family is represented by about 152 genera and 1300 species (Rao, 1979). In karnataka this family is represented by about 203 species and 59 genera (Krishnaswamy *et.al*., 2004a)

Stomata is the structure through which gaseous exchange takes place between intercellular spaces of the sub epidermal cells and the atmosphere. usually this stomata situated on the skin like epidermis. Plants may exert control over their gas exchange rates by varying stomatal density. In new leaves uptake of CO_2 is much, because of more number of stomata per unit area (stomata density). These stomata are also involved in loss of water in the form of vopour and these stomata are especially abundant in the lower epidermis of the leaf.

The epidermal cells that abut upon the guard cells are distinct from the other cells in the epidermis are referred to as subsidiary cells. Based on type of subsidiary cells stomata are classified in to Anomocytic, Anisocytic, Paracytic, and Diacytic. Rubina abid *et.al*. (2007). The number of stomata per unit area is sometime reflective of the environment of the plant. Stomatal size, shape and orientation pattern of the stomatal guard cells, with other epidermal cells is of immense taxonomic importance.

MATERIALS AND METHODS

The present investigation deals with 11 species of epiphytic orchids belonging to 7 genera Viz *Polystachea.flavascence, Eria mysorensis, Trias* *stocksii, Vanda tassaleta, Vanda testasea, Xenikophyton smeeanum, Gastrochilus acaulis, Oberonia bruniana, Oberonia santapaul*

Isolation of leaf epidermal layers

In the present study stomatal complex was studied by peeling method of leaves,mature leaves were used to study the dermal characters the methods suggested for orchids by (Williams 1975).

Staining, mounting and observation of leaf surfaces on microscope

A portion of each macerated cuticle was taken for microscopic studies.It was stained in 1% aqueous solution of saffranin for about 3 -5 min. Excess stain was rinsed off with clean water. The stained cuticle was mounted in DPX. Observations were made on the microscope to determine, stomatal complex types and their frequencies, stomatal size, and stomatal index. All observations were recorded. The size of the guard cell as well as aperture can be measured under light microscope with micrometer and prepared slides are also observed in Trinocular Microscope, and photography was taken in camera under both 10 x and 45x magnification

Determination of frequency of stomatal complex types

Using 10 fields of view at 10X and 40X objective as quadrats, the number of subsidiary cells per stoma was noted to determine the types of stomatal complex present in each specimen. Frequency of each stomatal complex type was expressed as % occurrence of each stomatal complex type based on all occurrences of stomatal complex types (Carr and Carr, 1990); (Obiremi and Oladele, 2001). Terminology used for stomatal complex types followed those of Dilcher(1974) , (Metcalfe and Chalk 1988).and (Saadu *et.al.*, 2009)

Determination of stomatal index

Stomatal index (SI) was determined as follows:

SI = S/E+S X 100

Table-1

Sl. No	Name of Orchid	Leaf surface	Type of stomata	Size of guard cell	Size of aperture	Stomatal index	Stomatal frequency
1	*Polystachea flavascence*	Hypo stomatic	Anomocytic	740.91	280.23	17.45	10357.04
2	*Eria mysorensis*	Hypo stomatic	Paracytic	700.87	265.74	11.34	12238.32
3	*Trias stocksii*	Hypo stomatic	Paracytic	1980.95	663.88	9.74	3815.74
4	*Vanda tassaleta*	Hypo stomatic	Anisocytic	1397.86	406.86	10.89	4633.40
5	*Vanda testasea*	Amphi stomatic	Anisocytic	794.27	177.00	5.66	6541.28
6	*Xenikophyton smeeanum*	Hypo stomatic	Paracytic	1837.29	379.54	9.26	4633.3
7	*Gastrochilus acaulis*	Hypo stomatic	Paracytic	1575.00	590.93	6.56	2725.53
8	*Oberonia bruniana*	Hypo stomatic	Anisocytic	676.70	211.57	6.72	4088.30
9	*Oberonia santapaul*	Hypo stomatic	Paracytic	625.95	153.27	3.83	3270.63

Where: SI = Stomatal index

S = Number of stomatal per square millimeter

E = Number of ordinary epidermal cells per square millimeter.

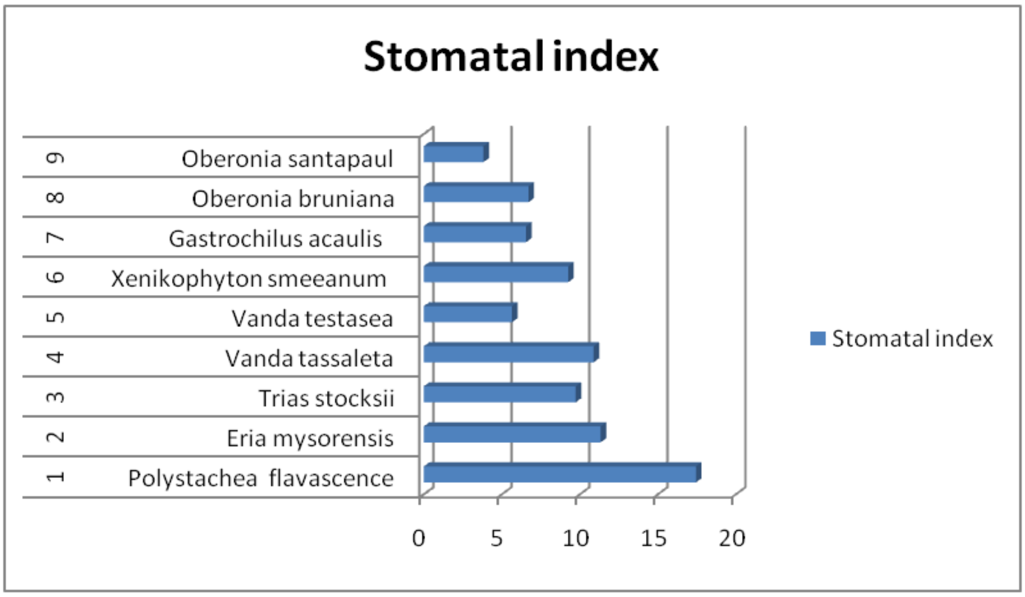
Determination of stomatal size

The mean stomatal size or area of a species was determined by measuring length and breadth using a micrometer of a sample of 10 stomata using eye-piece micrometer

RESULTS A ND DISCUSSION

Stomatal Index

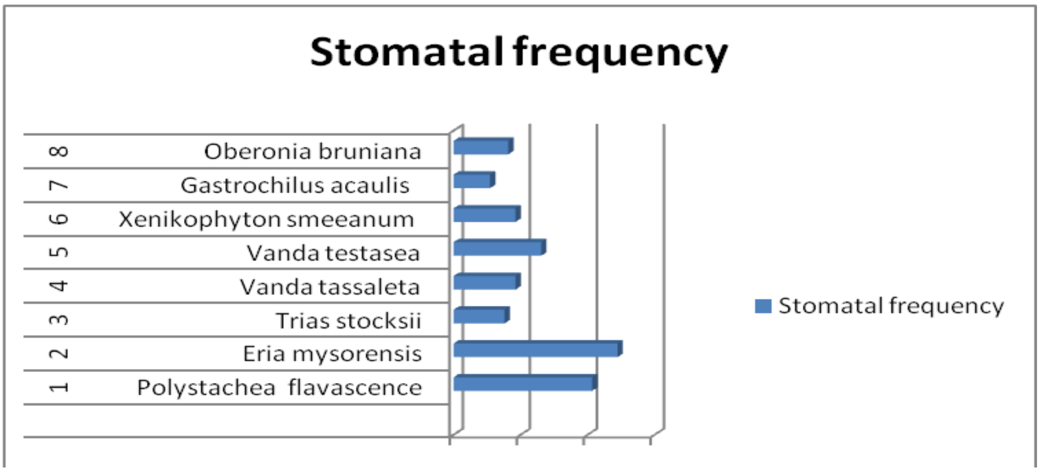
In the present Investigation reveals that among 09 Species stomatal index ranges from 3.83 to 17.45 the minimum stomatal index was recorded in *Oberonia santapaul* 3.83 where as maximum is in *Polystachea flavascence* 17.45. Next to the *Polystachea flavascence*, *Vanda tassaleta* shows maximum stomatal index 10.89. (Graph-1)



Graph-1

Stomatal Frequency

Among the 9 orchids *Sps* the highest stomatal frequency was found in *Eria mysorensis* 12238.32 followed by *Polystachea flavascence* 10357.04 , *Vanda testasea* 6541.28, *Xenikophyton smeeanum* 6541.28, *Vanda tassaleta* 4633.40 and least frequency is recorded in *Gastrochilus acaulis* 2725.53 (Graph 2)



Graph-2

In the present study reveals the presence of three major types of stomata, such as paracytic,anomocytic,and anisocytic type.

Previously these were also reported in number of monocots (Cheadle, 1953).Stebins and Khush(1961)suggested that anomocytic type is limited only to the orders closely related to liliales. Most of the species shows hypostomatic condition. Only one species shows amphistomatic condition.. most of these plants are adopted for epiphytic habitats, In order to avoid water loss from the epidermis hypostomatic condition is predominant. The two important proceses viz., photosynthesis and transpiration are influenced by stomatal frequency (Imamdar *et.al.*, 1991).The stomatal frequency in ventral surface has been found higher than dorsal surface (Col and Dobrenz, 1971).

Earlier (Dressler and Dodson 1960)noted a strong association of leathery leaves with epiphytic habit and suggested their independent origin from the membranous ones, along several evolutionary lines in orchids.

Hypostomatic condition is predominant in order to adjust with the epiphytic habitat and to conserve the water.Stomatal frequency also varies from plant to plant depending on habitat.From the graph-1 and graph-2 it is evident that there is a direct relationship between stomatal index and stomatal frequency.

PHOTOGRAPHS

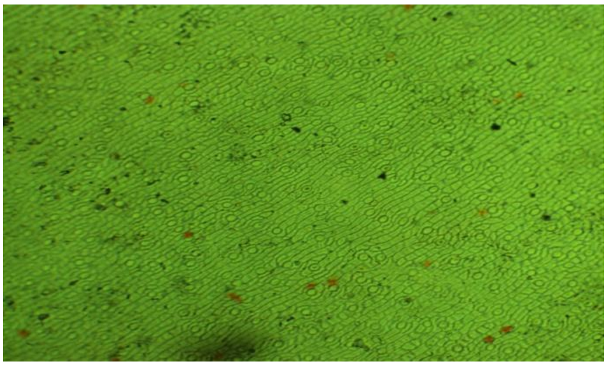


Plate-1

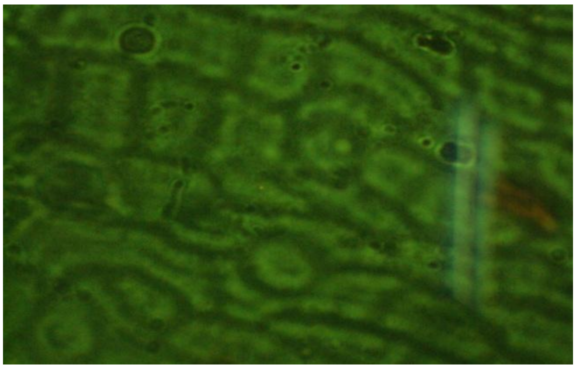


Plate-2

Plate-3

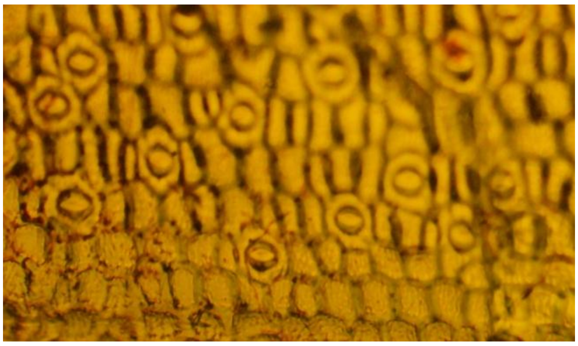


Plate-4

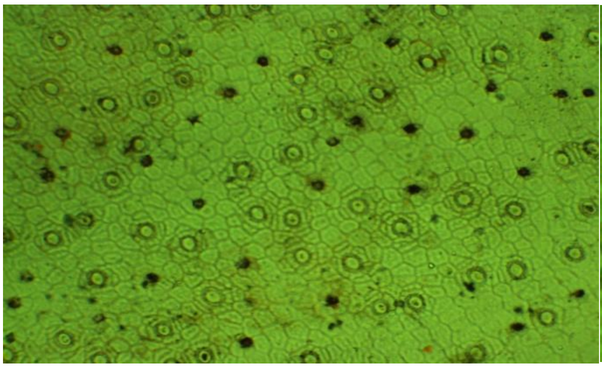
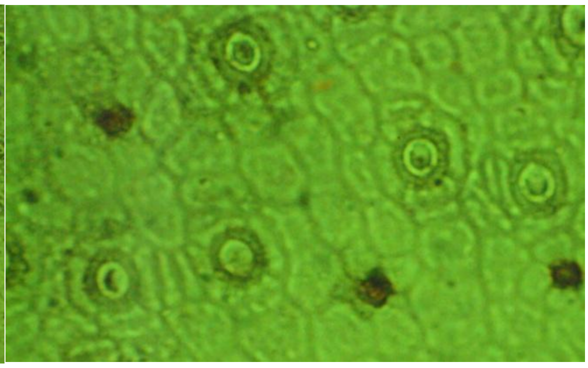


Plate-5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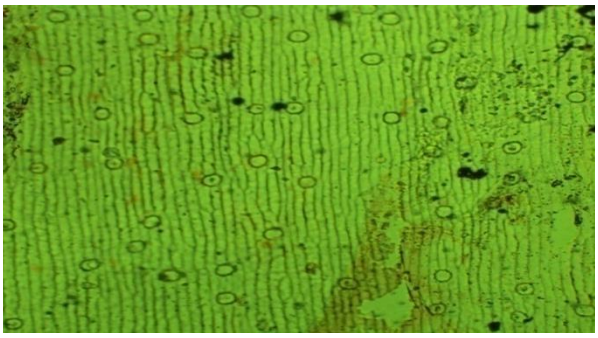


Plate-7

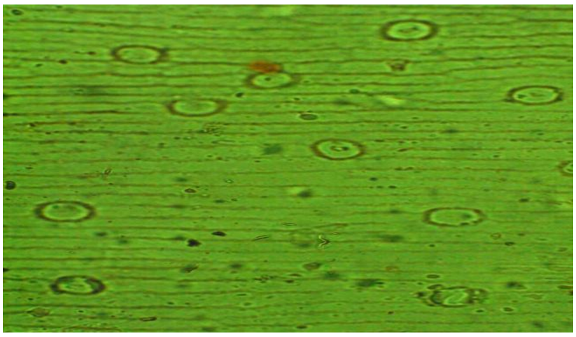
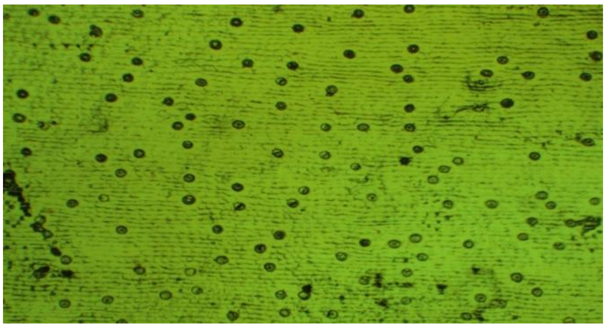


Plate-8

Plate-1 & *2* *P.flavascence (under10x & 45x)* **Plate-3 & 4** *E, mysorensis (under10x & 45x)*, **Plate-5 & 6** *T, stocksii (under10x & 45x),* **Plate-7 & 8** *V,tassaleta (under10x & 45x)*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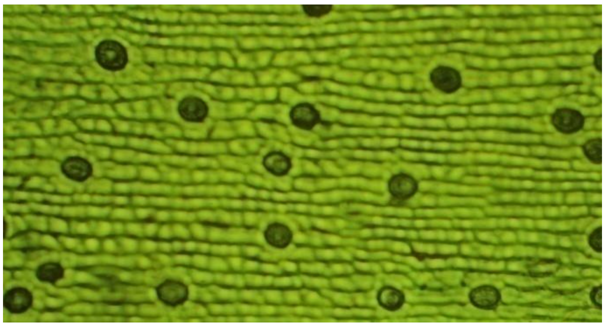


Plate-10

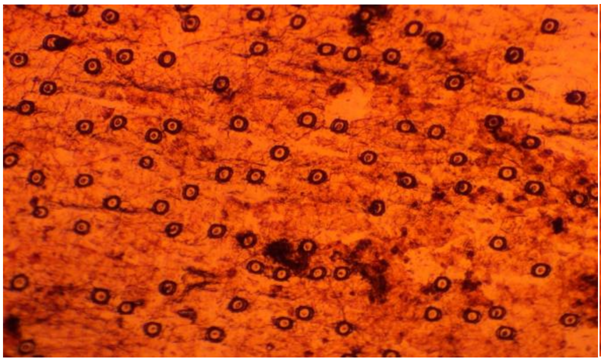
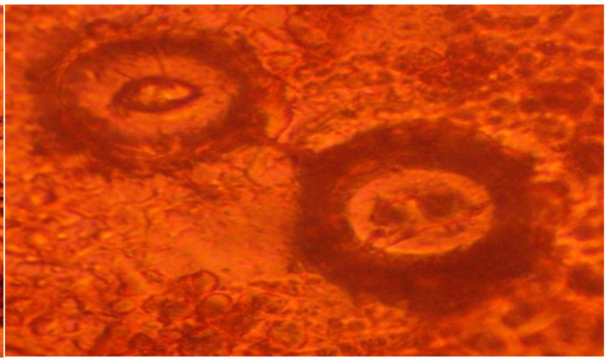


Plate-11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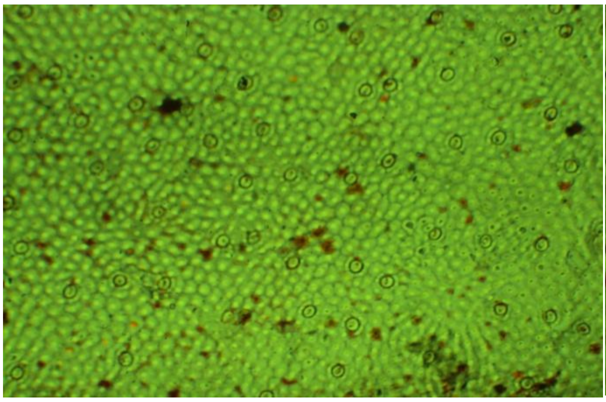

Plate-13

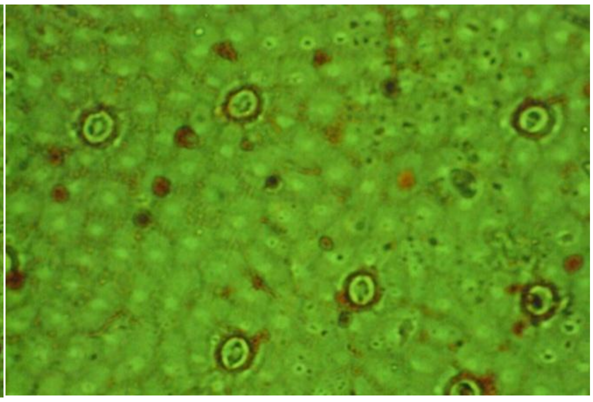

Plate-14

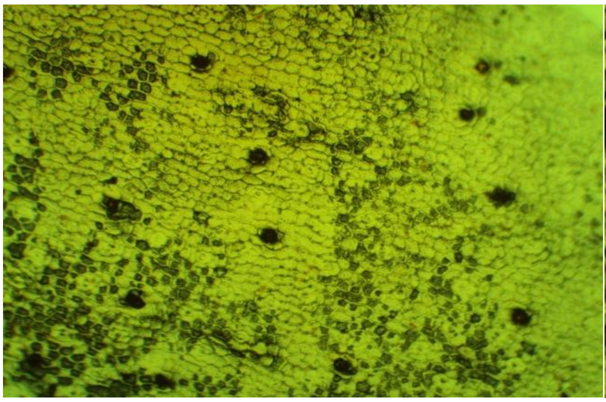

Plate-15

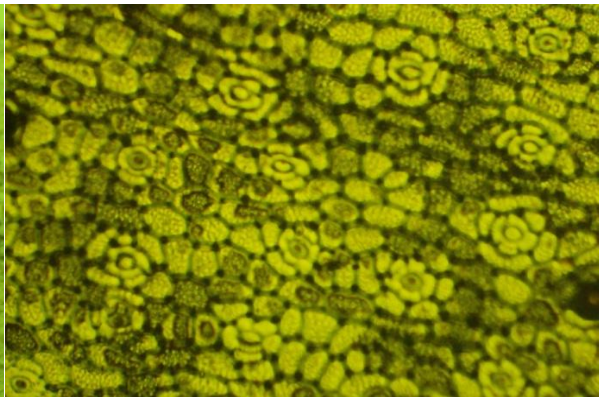

Plate-16

Plate-9 & 10 *V,testasea (under10x & 45x)* **Plate-11 & 12** *X, smeeanum (under10x & 45x)*
Plate-13 & 14 *G,acaulis (under10x & 45x),* **Plate-15 & 16** *O,bruniana (under10x & 45x)*

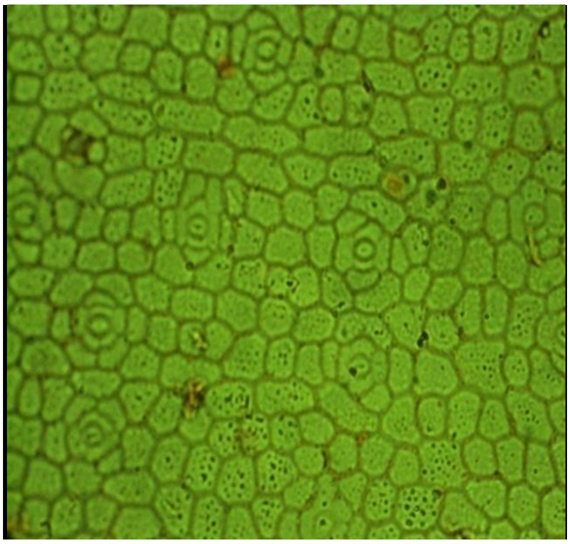

Plate-17

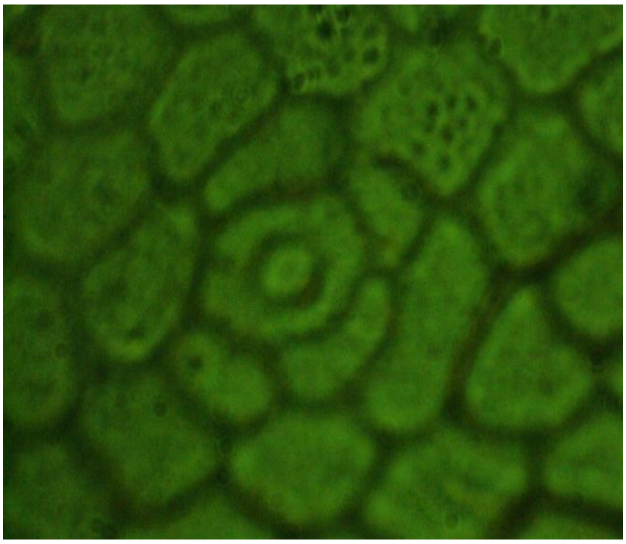

Plate-18

Plate-17& 18 *O, santapaul (under10x&45x),*

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