



STOMATAL STUDIES OF EPIPHYTIC ORCHIDS

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ABSTRACT

Leaf anatomy was investigated in six epiphytic orchids under Orchidaceae family. Five species of orchids such as *Acampe praemorsa*, *Aerides ringens*, *Bulbophyllum sterile*, *Dendrobium aphyllum* and *Oberonia brachyphylla* were studied. Anomocytic stomata were recorded and stomatal index ranges from 7.69% to 28.6%. The minimal stomatal index was recorded in *Dendrobium aphyllum* (7.69%) where as maximal is in *Acampe praemorsa* (28.66%). The number of stomata in a definite area of leaf varies from plant to plant. Low value of stomatal index is an adaptation of orchid plants to survive in different climatic conditions by conserving water. A detailed study is needed to reveal these differences in stomatal density.

KEYWORDS: STOMATA, ORCHIDACEAE, ANOMOCYTIC, STOMATAL INDEX

INTRODUCTION

Orchid's horticultural and commercial values, as well as ethanobotanical uses (in medicine or food), support livelihood of people in different parts of the world are well documented. Habitat of the orchids varies from terricolous, corticolous as well as saxicolous and some of these also possess lignicolous habitat. However, over harvesting and habitat destruction has driven many species in the wild towards extinction (Chen *et al*, 2012). Nearly 70% species are epiphytic (Zotz, 2001) and are distributed mainly in tropical and subtropical climates. Several orchids are used in several ayurvedic formulations for their rejuvenating and restorative properties (Hoffman *et al*, 2011).

Stomata are the structure through which gaseous exchange takes place between intercellular spaces of subepidermal cells and the atmosphere. Plants may exert control over their gas exchange rates by varying stomatal density. These stomata are also involved in loss of water in the form of vapour and these stomata are especially abundant in the lower epidermis of the leaf. Stomata have been classified (Metcalf and Chalk, 1950) into anomocytic, anisocytic, paracytic and diacytic type.

MATERIALS AND METHODS

In the present study different epiphytic orchids such as *Acampe praemorsa*, *Aerides ringens*, *Bulbophyllum sterile*, *Dendrobium aphyllum* and *Oberonia brachyphylla* were collected from Central Travancore region which are used in stomatal studies.

Systematic position

Kingdom : Plantae
Division : Phanerogamae
Class : Monocotyledonae
Series : Microspermae
Family : Orchidaceae

Stomatal Preparation through peeling method

In the present study from mature leaves peelings were taken to study epidermal characteristics (Williams, 1975). A portion of the peel was taken, stained in 1% aqueous solution of saffranin and mounted in glycerine. Slides were viewed under 10x magnification of light microscope and noted the number of stomata, epidermal cells, type of stomata and also photographs were taken. Average number of stomata per field of the microscope was estimated from three different fields and recorded.

Determination of Stomatal Index

Using 3 fields of view at 10X objective, the number of stomatal cells and epidermal cells present in each field were noted.

Stomatal Index, $SI = S/E+S \times 100$

S = No. of stomatal cells

E = No. of ordinary epidermal cells.

RESULTS

The present investigation reveals that among 5 species of epiphytic orchids tested, anomocytic stomata were recorded (Plates 1-5) and stomatal index ranges from 7.69% to 28.6%. *Bulbophyllum sterile* (23.58%), *Dendrobium aphyllum* (7.69%), *Oberonia brachyphylla* (26.19%), *Aerides ringens* (13.44%), *Acampe praemorsa* (28.66%) (Table: 1). The minimal stomatal index was recorded in *Dendrobium aphyllum* (7.69%) where as maximal is in *Acampe praemorsa* (28.66%).

DISCUSSION

The present study was undertaken to elaborate the stomatal studies of Orchidaceae family. Five species of orchids such as *Acampe praemorsa*, *Aerides ringens*, *Bulbophyllum sterile*, *Dendrobium aphyllum* and *Oberonia brachyphylla* were used in stomatal studies. They share same common features of stomatal characters regarding the type of stomata and their distribution. Stomata were often confined to the lower surface and anomocytic stomata were identified. But stomatal density differs between the orchid species and ranges from 7.69% to 28.6%. Hypostomatic condition is predominant in order to adjust with the epiphytic habitat and to conserve the water. Mulgaonkar (2005) studied the dermal anatomy of some terricolous orchids from Sahyadri (Western Ghats).

The exchange of gases especially water vapour and CO₂ between the interior of the leaf and the atmosphere is controlled by the stomata (Buckley, 2005). Stomatal distribution, size, density, morphology and behavior are closely associated with plant transpiration (Willmer and Fricker, 1996). Larger stomata are slower to close and have a greater potential for hydraulic dysfunction under conditions of drought (Aasamaa *et al.*, 2001).

CONCLUSION

Stomata are the structure through which gaseous exchange takes place between intercellular spaces of sub epidermal cells and the atmosphere. Plants may exert control over their gas exchange rates by varying stomatal density. The number of stomata in a definite area of leaf varies from plant to plant. Low value of stomatal index is an adaptation of orchid plants to survive in different climatic conditions by conserving water. A detailed study is needed to reveal these differences in stomatal density.

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Table 1. Stomatal Index of the tested orchids

Sl.No	Name of Orchid	No. of stomatal cells	No. of Epidermal cell	Stomatal Index
1	<i>Bulbophyllum sterile</i>	5.66	18.3	23.58%
2	<i>Dendrobium aphyllum</i>	4	48	7.69%
3	<i>Oberonia brachyphylla</i>	11	31	26.19%
4	<i>Aerides ringens</i>	4.66	30	13.44%
5	<i>Acampe praemorsa</i>	5.66	23	28.66%

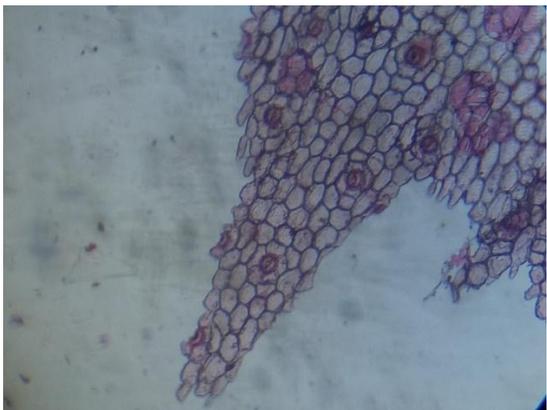


Plate 1: *Bulbophyllum sterile*

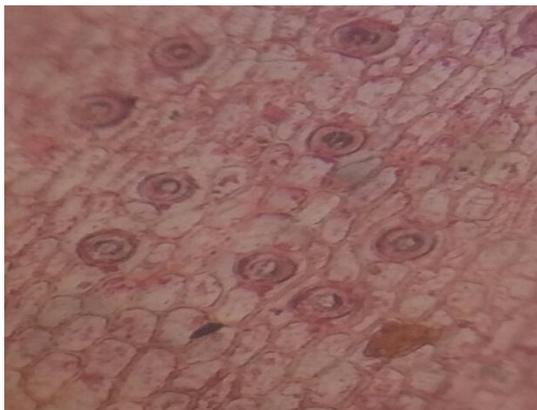


Plate 2: *Dendrobium aphyllum*

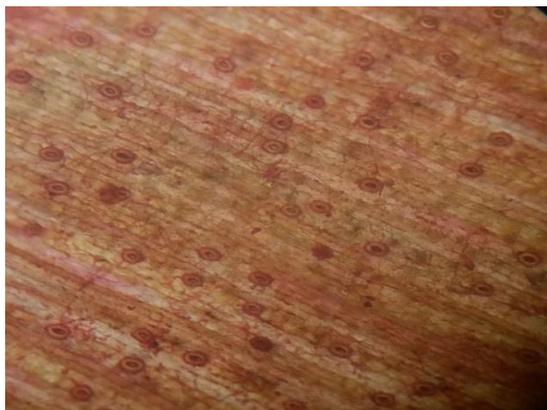


Plate 3: *Oberonia brachyphylla*

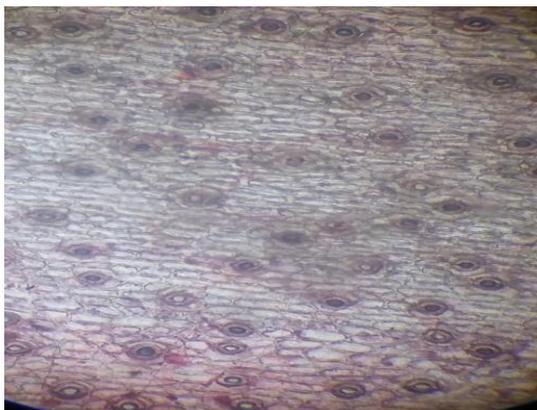


Plate 4: *Aerides ringens*

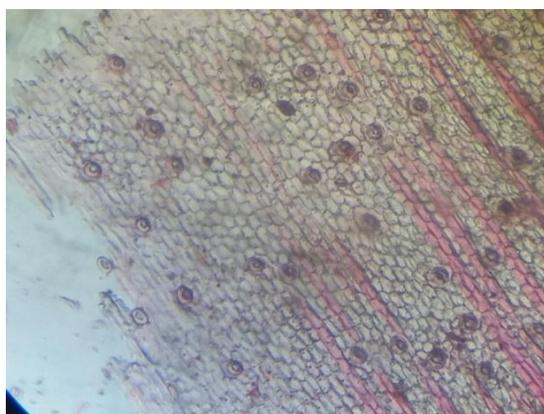


Plate 5: *Acampe praemorsa*