

## STOMATAL STUDIES OF SELECTED EPIPHYTIC ORCHIDS

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### Abstract

In the present investigation, different epiphytic orchids such as *Rhynchosstylis retusa*, *Arachnis flos- aeris*, *Acampe praemorsa* and *Dendrobium aphyllum* were studied for different stomatal types. Stomata is a pore found in the epidermis of leaves used to control gas exchange. The pore is bordered by a pair of specialized parenchyma cells known as guard cells that regulate the size of the stomatal opening. And, also in this study the stomatal index of four selected orchids were calculated. The stomatal index of the leaf is the ratio of the number of stomata to the total number of stomata and epidermal cells. Stomatal types and stomatal index are different in different species. This will help us to identify the plant species. Low stomatal index helps to survive orchid plants in different environmental conditions for conserving water. Thus, the present study helps to find out different types of stomata and stomatal index of different orchids such as *Rhynchosstylis retusa*, *Arachnis flos- aeris*, *Acampe praemorsa* and *Dendrobium aphyllum*.

**Keywords:** Stomatal index, Epiphyte, Endophyte, Guard cell, Subsidiary cell, Anomocytic stomata

### Introduction

Orchids have a long history traceable back to the ancient Greeks. Their earliest mention appeared in book 'Enquiry into plants' written by Theophrastus(370- 285 B.C.) who referred to a group of plants having paired testiculate tubers as Orchis (Singh, 2001). Lindley did extensive work on documentation of orchids in different continents and in 1826 proposed a classification scheme by dividing orchid family into 8 tribes; he is therefore known as 'Father of Orchidology'. Epiphytic orchids which grow on other plants in tree canopies are especially susceptible to dehydration because their roots are on bare branches or in leaf litter rather than actual soil. In response to water stress and nutrient acquisition, aerial roots of epiphytic orchids have developed a specialized spongy multilayered epidermis of velamen. The velamen is extremely porous and formed from epidermis, then water can enter into the cortex.

Different types of stomata are also seen in different orchids. Stomata is a pore found in epidermis of leaves used to control gas exchange.

The pore is bordered by a pair of specialized parenchyma cells called guard cells. The guard cells are kidney shaped in dicotyledons but dumb bell shaped in the members of monocotyledons. The epidermal cells surrounding guard cells are specialized and called subsidiary cells or accessory cells which give support in the movement of guard cells (Vishal T. Aparadh, 2012). Stomata are found in the epidermis and cuticle layer of leaves, which provide the primary route for water vapour transfer when they are open (Hopkins, 1995). Water loss and uptake are mediated by the guard cells, which can activate stomata closure if they sense water stress (Taiz and Zeiger, 1991). The process of stomata closure is one of the very important protective processes to prevent severe water stress. This defence helps to prevent tissue desiccation before leaves reach low water levels (Fitter and Hay, 1987). Stomata have been classified by Metcalfe and Chalk in 1950, as anomocytic, anisocytic, paracytic and diacytic type. The anomocytic stomata is perigenous in origin and anisocytic and paracytic stomata are mesogenous in origin. Various modes of stomatal development

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occur in different organs of the same plant. The present study is an attempt to identify the stomatal type and stomatal index of selected epiphytic orchids in Kerala.

### Materials and methods

#### Plant material

In the present study leaves of different epiphytic orchids such as *Rhynchostylis retusa*, *Arachnis flos-aeris*, *Acampe praemorsa* and *Dendrobium aphyllum* were collected randomly from different regions in Kerala were used in stomatal studies.

#### Systematic position

Kingdom : Plantae

Division : Phanerogamae

Class : Monocotyledonae

Series : Microspermae

Family : Orchidaceae

#### Stomatal studies

In the present study stomatal complex were studied by peeling method of leaves, mature leaves were used to study the dermal characters the methods suggested for orchids by (Williams, 1975). Isolate both upper and lower epidermal layers of leaves of orchids. For detailed studies epidermal peelings were taken from the lower and upper surface, and stained with 1% aqueous saffranine for about 3-5 min. Excess stain was rinsed off with clean water. Care was taken to avoid the presence of any mesophyll tissue other parts with the peelings. The stained sections were mounted on a slide in glycerine. Observations were made on the microscope to determine stomatal index. Average number of stomata per field of the microscope was estimated from the three different fields and recorded. The stomata can be viewed under light microscope and photography was taken in camera under 40X magni-

fication. Using three fields of view at 10X objective, the number of stomatal cells and epidermal cells present in each field were noted. Then calculate the stomatal index using following formula;-

Stomatal Index,  $SI = \frac{S}{E+S} \times 100$

S = Number of stomatal cells

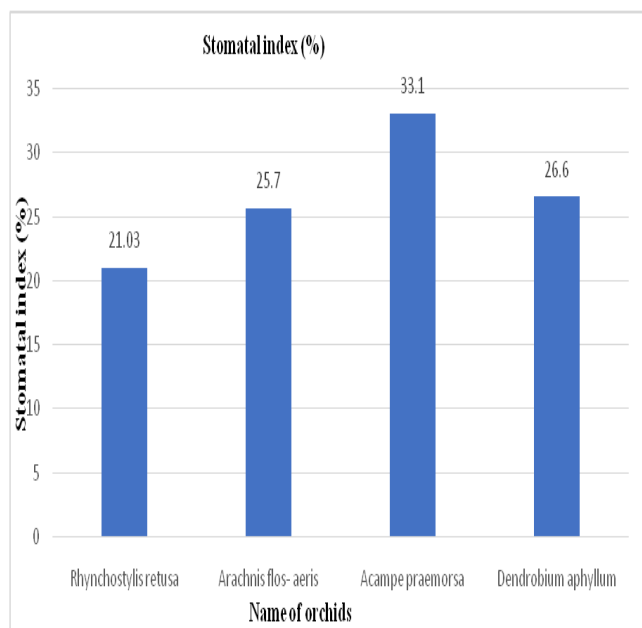
E = Number of ordinary epidermal cells

#### Results and discussion

In the present investigation of 'Stomatal studies of selected epiphytic orchids', the different epiphytic orchids such as *Rhynchostylis retusa*, *Arachnis flos-aeris*, *Acampe praemorsa* and *Dendrobium aphyllum* were studied for stomatal characterization of leaves. In the present investigation reveals that among four species of epiphytic orchids, anomocytic stomata were recorded in *Rhynchostylis retusa* (figure 2), *Arachnis flos-aeris* (figure 3), *Acampe praemorsa* (figure 4) and *Dendrobium aphyllum* (figure 5). Anomocytic stomata have guard cells that are surrounded by cells that have the same size, shape and arrangements as the rest of the epidermal cells. The stomatal index ranges from 21.03% to 33.1%. *Rhynchostylis retusa* with 21.03%, *Arachnis flos-aeris* with 25.7%, *Acampe praemorsa* with 33.1% and *Dendrobium aphyllum* with 26.6% (Table:1). The maximal stomatal index was recorded in *Acampe praemorsa* whereas minimal stomatal index is in *Rhynchostylis retusa* (figure 1). The number of stomata in leaf varies from plant to plant. Low value of stomatal index is an adaptation of orchid plants to survive in different climatic conditions for conserving water.

**Table 1.** Stomatal index of orchids under study

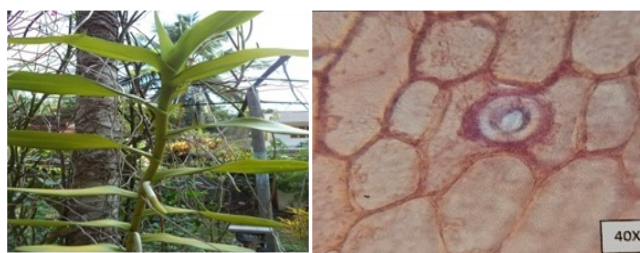
Serial No.	Plant Materials	Number of stomatal cells	Number of epidermal cells	Stomatal index (%)
1	<i>Rhynchostylis retusa</i>	23.6	88.6	21.03
2	<i>Arachnis flos-aeris</i>	27.6	80	25.7
3	<i>Acampe praemorsa</i>	33.3	67.3	33.1
4	<i>Dendrobium aphyllum</i>	56.3	155.3	26.6



**Figure 1.** Percentage of Stomatal index



**Figure 2.** Stomatal types in *Rhynchosstylis retusa*



**Figure 3.** Stomatal types in *Arachnis flos-aeris*



**Figure 4.** Stomatal types in *Acampe praemorsa*



**Figure 5.** Stomatal types in *Dendrobium aphyllum*

### Conclusion

The present study was undertaken to identify the stomatal types and stomatal index of epiphytic orchids such as *Rhynchosstylis retusa*, *Arachnis flos-aeris*, *Acampe praemorsa* and *Dendrobium aphyllum*. Stomatal density differs between the orchid species and ranges from 21.03% to 33.1%. Hypostomatic condition was predominant in order to adjust with the epiphytic habitat and to conserve the water. 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 the stomatal attributes such as length, width and density among different orchid species and its habitats. These variations could help in accurate species identification.

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