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Research Article

Stomatal responses to environmental variation among *Duranta erecta L.*

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Abstract: Stomata are pores found in the epidermis of leaf that allow for consequently water loss through transpiration, pores are bound by specialized cells, called guard cells. Abnormalities present in the stomata such as contiguous stomata, twin stomata are of great importance to the global-water cycle and plant's ability to respond to environmental variation. Elevation of atmospheric carbon di-oxide concentration often results in lower stomatal density. Inspection of the distribution of stomata in leaves growing in environment with different levels of available water gives clues for the role of stomata in plant adaptation. The plant environment is continuously changing, and stomatal apertures are perceived by the guard cells. They adapt to local and global changes on all timescales from minute to millennia.

Keywords: Contiguous stomata, environmental variation, adaptation.

Introduction

Studies of stomata have been a classical understanding of the botanical sciences; the history of such research is discussed in detail in one of the papers in the volume (Meidner)[1]. Abnormalities such as persistent stomatal cells, single guard cells, degeneration of guard cells, cytoplasmic connections, contiguous stomata, twin stomata, one and a half contiguous stomata, notching of guard cells and division of guard cells are seen. Based on previous studies, it is well known to the scientific community that stomata are the key experimental tool to investigate plant response to environmental changes[2,3] (Hetherington and Woodward, 2003; Macfarlane et al., 2004). Stomata play an important role in plant innate immunity[4]. Abnormal stomatal patterning or "stomatal cluster" as it is known, has been reported successively in certain species of the family Begoniaceae (*Begonia cavaleriei* L.), Crassulaceae (*Sedum lineare* and *S. aizoon*), Sonneratiaceae (*Sonneratia alba* J. Smith), and Moraceae (Some species of Ficus)[5]. Two types of stomatal clusters have found among plants: type A clusters have 2 (or more) stomata placed in direct contact (without intervening epidermal cells between neighboring guard cells), such as: *Alysicarpus procumbens* Schindl from Papilionaceae [6], Sonneratiaceae, *Ginkgo biloba*[7] and Annonaceae [8]. While type B clusters are formed by groups of stomata that do not contact with each other (they are separated by the subsidiary cells). Those plants are Crassulaceae (S. lineare) [9], *Himantandra parvifolia* Bak [10]. These two types of clusters are still not well classified: the term "stomatal cluster" has been used for both types in many studies[11].

Duranta erecta L. belongs to family Verbenaceae also known as 'golden dewdrop'. Leaf colour green, arrangement whorled, simple type, serrate leaf margin, ovate Leaf venation and 2 to 4 inches leaf blade length. The flowers are mauve, blue or white, and are grouped together. They develop into a round orange berry, about 1cm across, which hang in loose drooping bunches from the ends of the branches.

Material and Methods

Fresh leaves of *Duranta erecta* L. used for the study were collected near the campus of University Department of Botany, Ranchi University, Ranchi and taxonomically identified by from the local Flora (Haines, 1924)[12]. They were washed in tap water and immersed in water to facilitate peeling. Peeling was done by means of sharp razor blade at the abaxial and adaxial surfaces of the leaves. The were then stained for a few seconds with Safranin and mounted on slides. The slides were observed under OLYMPUS CH 20i microscope. Frequency count per unit area was also made from the slides. Photomicrographs of relevant features with attached camera. Stomatal Index (S.I) was calculated using the formula below.

$$S.I = S / E + S * 100$$

Where, S = number of stomata
E = number of epidermal cells per unit area

Stomatal clusters density (SCD) was also measured. In order to measure the size of the stomata, which involves the length and breadth of the guard cell apparatus. The measurements were made with an ocular micrometer, carefully valued by comparison with a stage micrometer. As in the case of the

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countings, ten measurements were made upon material practically taken at random from the plant, and the figures in the table represent the mean of these.

Result

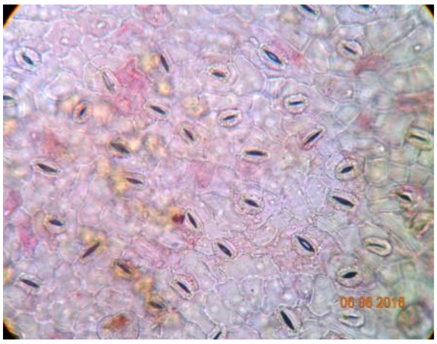
Stomatal clusters are abnormal patterning in the leaves of *Duranta repens*. The stomata would probably be impaired due to guard cell extrusion in large stomatal clusters. Table 1 shows the no of stomata, no. of epidermal cells, and stomatal cluster density. Stomatal clusters, little marks on the leaves gives us new clues to uncover the truth about the adaptation of *Duranta repens* to the ever- challenging environment and ecologically.

Discussion

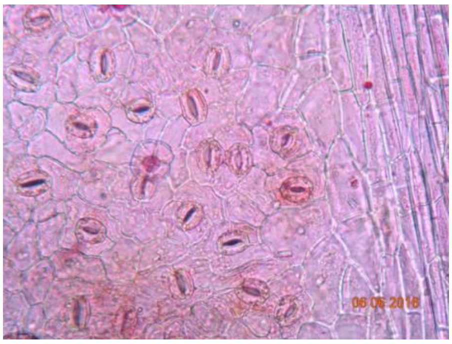
Inspection of the distribution of stomata in leaves growing in the environments with different levels of available gives us clues for the role of stomata in plant adaptation. Tang and his col- leges reported a positive relationship between cluster size and multiple epidermis, which is a typical drought adaptation trait in *Begonia peltatifolia* [13]. Stomata clustering and poly contiguous stomata clustering were observed in the leaf epidermis of A. reticulate and I. tataricum. Stomatal clustering," an abnormal stomatal patterning that is formed by two or more stomata in the leaf epidermis, has been reported in more than 60 species of terrestrial plants.[14] The stomata abnormalities include the stomata with one or two single guard cells were observed in *N. pseudonarcissus* and the degenerated guard cells in *A. reticulate* and *N. pseudonarcissus*. Stomata clustering and poly contiguous stomata clustering were observed in the leaf epidermis of A. reticulate and I. tataricum, two contiguous stomata in I. langport, laterally poly juxtaposed contiguous stomata clustering in the leaf epidermis of A. cepa and laterally two and three contiguous stomata in *N. pseudonarcissus*.[15]

Table I: Stomata of *Duranta erecta* L. (Ventral view)

No. of readings	Number of stomata (Apex. Middle, Base)	Number of epidermal cells (Apex. Middle, Base)	Stomatal Index (S.I)	Stomatal clustering
1.	35	164	17	2
2.	37	161	19	4
3.	32	155	17	4
4.	37	161	19	2
5.	37	158	19	3
6.	34	158	17	3
7.	33	161	17	4
8.	31	157	16	2
9.	33	157	17	2
10.	32	160	17	4



Stomata of *Duranta erecta* L. (Ventral view)



Stomatal cluster in *Duuranta erecta* L.

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