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RESEARCH ARTICLE

TAXONOMIC IMPORTANCE OF ANTICLINAL WALLS AND STOMATA PATTERNING IN SOME *MELASTOMA* L. SPECIES FROM FRASER HILL

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ABSTRACT

The epidermal characteristics of five selected *Melastoma* L. species in Fraser Hill, Pahang that belongs to Melastomataceae family had been investigated. These five species namely *M. muticum* Ridl., *M. decemfidum* Roxb., *M. perakense* Ridl., *M. sanguineum* x *malabathricum* and *M. malabathricum* var. *normale*. The objective of this study is to determine whether epidermal characteristics in *Melastoma* could be taxonomic value in systematic and diagnostic investigations. Methods of the investigation involved epidermal peel and scanning electron microscopy. Results obtained revealed that the presence of hypostomatic stomata and guard cells pairs were elliptic in shaped for all species studied. Apart, the pattern of anticlinal walls on adaxial and abaxial surfaces was straight to wavy for all species studied except for wavy to sinuous anticlinal walls on abaxial surface of *M. sanguineum* x *malabathricum*. Furthermore, two types of stomata were observed among species studied such as anomocytic and diacytic stomata. Results showed that diacytic type was only present in *M. sanguineum* x *malabathricum* therefore could be a criterion to diagnose the species. Lastly, this present study was also reported on the presence of two types of guard cell pairs such as raised or slightly raised and sunken guard cell pairs. In conclusion, the present study revealed that the anticlinal walls and stomata patterning possess as taxonomic importance in identification and classification of *Melastoma* either at genus or species level.

KEYWORDS

Melastoma, anticlinal walls, stomata, taxonomic importance.

1. INTRODUCTION

Melastomataceae is one of the largest families in flowering plants which distributed in tropical and sub-tropical regions around the world (Ong and Yong, 2007). This family has been also distributed throughout the wet tropics in montane to lowland areas, savannas and disturbed vegetation (Heywood, 2007). On the other hand, the genus *Melastoma* (Melastomataceae) occurs throughout South-east Asia and extends to India, South China, Japan, Northern Australia and Oceania which commonly found in rainforests and along the roads (Meyer, 2001). It is also reported that the distribution of *Melastoma* can be occurred in the open areas in primary and secondary forests (Tan et al., 2010).

The genus of *Melastoma* consists of various flower colors that vary from violet to purple, pinkish purple to mauve, pink and white colors (Nirmal et al., 2013). However, it has stated that *Melastoma* are mostly composed of purple or pinkish purple flowers while those with mauve or pink flowers commonly distributed in the highland areas. In addition, *Melastoma* are comprised of medicinal values that later possibly utilized in pharmaceuticals field. In last two decades, the pharmaceutical industries are more focusing on the medicinal plants because of the increased in awareness and interest of public and scientific community on the

medicinal plants usage (Nirmal et al., 2013). For instance, the leaves and roots of *M. decemfidum* have been utilized to treat diarrhea, dysentery, gastric ulcers, epilepsy and rheumatism (Lohezic-le et al., 2002). Besides, the floral tissues of *M. decemfidum* are also used to inhibit cancer cell line of human breast cancer (Susanti et al., 2007).

The identification and classification of *Melastoma* seems to be very difficult because of the closed similarity in morphological parts between the species in the same genus. The identification and classification process are more problematic when there is lack or no reproductive parts obtained from the field sampling. Additionally, the previous study on *Melastoma* species especially in Peninsular Malaysia is very sporadic reported. That is the reason why the anatomy and micromorphology tools are been used especially to treat the systematic position of this plants. In other words, leaf anatomy and micromorphology is considered as one of the important taxonomic tools that been used for the identification and classification of the plants. Therefore, it was the aim of the present study to investigate the taxonomic significance of anticlinal walls and stomata patterning in the identification and classification of *Melastoma* either at species or genus level.

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2. MATERIALS AND METHODS

Fresh leaves sample of five selected *Melastoma* species which are *M. muticum*, *M. decemfidum*, *M. perakense*, *M. sanguineum x malabathricum* and *M. malabathricum* var. *normale* were collected from Fraser Hill, Pahang. Specimens obtained from the field sampling were dried, curated, identified and deposited at Herbarium of International Islamic University of Malaysia, Kuantan, Pahang. Fresh leaves sample were fixed in 3: 1 AA Solutions (70% Alcohol: 30% Acetic Acid) (Johansen, 1940). The methods of anatomical epidermis study involved epidermal peeling. The epidermal peels were prepared using Jeffrey's solution and stained with Safranin. Slides were mounted in Euparal after dehydration process. Slides were dried in oven at 60 °C for one week. Anatomical images were captured by using LEICA ICC50 HD camera attached to light microscope with the aided of LAS EZ Software. For micromorphology study, scanning electron microscopy (SEM) method was applied. The specimens were taken from dried sample of herbarium in which 1cm² lamina portion of leaf samples were cut and mounted on mounting holder. The specimens were then coated with gold by using sputter-coated machine. The observation of micromorphological characteristics were done under Scanning Electron Microscope Zeiss Model Evo 50.

3. RESULTS AND DISCUSSION

In this present study, the study of epidermal surfaces revealed a number of important anatomical and micromorphological characteristics which exhibit interspecific variations that are significance for the identification of *Melastoma*. To be noticed, the anticlinal walls are mostly reported to be sinuous in leaf blade of dicotyledons compared to be elongated in many of monocotyledons (Fahn, 1967). Additionally, plants are also distinguished by various types of epidermal cells since the epidermis varied in shape, size and arrangement. The value of sinuous wall is actually helps to increase the tensile strength of the epidermis (Korn, 1976). The present study based upon the anticlinal walls and stomata patterning hereby are reported to be useful in taxa delineation of *Melastoma*.

Findings from this study revealed that two types of anticlinal walls occurred among *Melastoma* species. All species showed the patterns of straight to wavy anticlinal walls for both abaxial and adaxial surfaces except for *M. sanguineum x malabathricum*. The abaxial surface of this species showed wavy to sinuous anticlinal walls which possibly considered as a diagnostic character for the species. Finding of this study hence supports the previous research on the variation of anticlinal walls in the identification of plant species especially at the coastal area (Nurul-Aini et al., 2019). Figure 1 below shows the two patterns of anticlinal walls in some of *Melastoma* species.

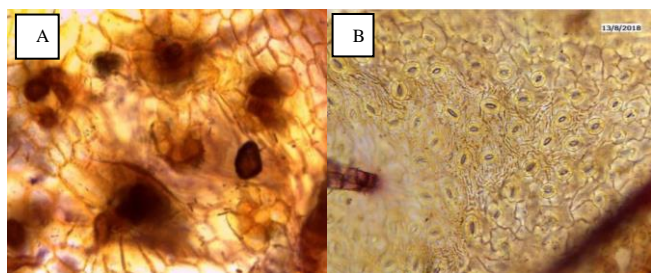


Figure 1: The patterns of anticlinal walls. A) Straight to wavy anticlinal walls in *M. muticum*. B) Sinuous to wavy anticlinal walls in *M. sanguineum x malabathricum*. Scale: A & B) 50 µm

Furthermore, the stomata are usually found on the aerials parts of plants especially on leaves, stems and rhizomes. The stomata might also be found on petals, stamina filaments, carpels and seeds but usually they are non-functional (Fahn, 1967). To be noticed, the presence of stomata on both sides of leaves is known as amphistomatic whereas hypostomatic stomata occurred if they present on lower side of leaves only. The stomata is actually plays a key role of water movement and gaseous exchange in plants (Cutler, 1978). Besides, the stomata arrangement has also been reported to be differed between monocotyledons and dicotyledons plants. The stomata are parallel arranged in monocots while irregularly arranged for dicots (Fahn, 1967). This present study thereby reported on the presence of hypostomatic stomata in all selected *Melastoma* species hence could be a character to characterize the genus.

To be noted, stomata may also vary in their types and shapes. The character of stomata types has been reported to be used in distinguishing Coniferales (Fahn, 1967). Previous study has discovered on four main types of stomata in dicotyledons based on the basis arrangement of

subsidiary cells which are; anomocytic, anisocytic, paracytic and diacytic types (Metcalf and Chalk, 1950) The anomocytic type is referred to the guard cells that surrounded with certain number of subsidiary cells which do not differ in shape and size from other epidermal cells. Meanwhile, diacytic type is referred to the stomata that surrounded by two subsidiary cells at which the common wall is at right angle to the longitudinal axis of the stomata (Fahn, 1967). To be added, the parameter of stomata types has also been applied in the identification and classification of selected taxa in Acanthaceae (Noor-Syaheera et al., 2015).

Findings from this study therefore revealed that two types of stomata are been observed among five selected *Melastoma* species. All the species studied show the anomocytic stomata except for *M. sanguineum x malabathricum* which shows diacytic type of stomata. Hence, this character might be used to diagnose the species. Figure 2 below shows the presence of anomocytic (Figure 2A) and diacytic (Figure 2B) stomata in selected *Melastoma* species.

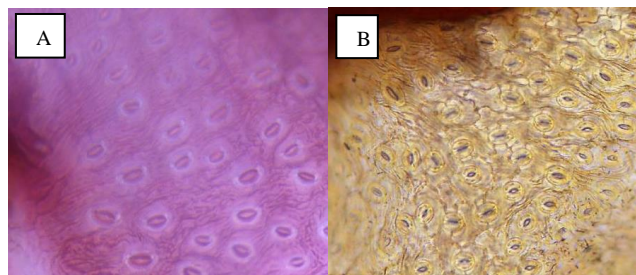


Figure 2: The types of stomata. A) Anomocytic stomata in *M. malabathricum* var. *normale*. B) Diacytic stomata in *M. sanguineum x malabathricum*. Scale: A & B) 50 µm

Not only that, the leaf micromorphological characteristics are also been useful in taxa delineation of plants. The characters of guard cell pairs of stomata could be categorized into sunken or raised relatively to the epidermal cells of the plants (Fahn, 1967). Apart, the guard cell pairs might be also differentiated by its outline shaped (Fahn, 1967). Previous study reported on the significance of guard cell pairs outline in distinguished *Parashorea* species (Noraini and Cultler, 2009). Additionally, this parameter has also been applied in the study of some *Melastoma* species from Peninsular Malaysia (Noorma-Wati et al., 2015). Thereby, this present study discovered on the presence of elliptic guard cells pairs (Figures 3A & 3B) in all selected *Melastoma* species thus supported the previous research reported on the presence of elliptic guard cells pairs in *Melastoma* species (Noorma-Wati et al., 2015).

Apart, the present micromorphology study has also discovered on the presence of raised or slightly raised and sunken stomata among the selected *Melastoma* species. The presence of raised stomata are shown in two *Melastoma* species such as *M. muticum* and *M. decemfidum* (Figure 3A) whereas slightly raised and sunken stomata observed in *M. perakense*, *M. sanguineum x malabathricum* and *M. malabathricum* var. *normale* (Figure 3B). This parameter is therefore useful to narrow down or circumscribe the *Melastoma* species.

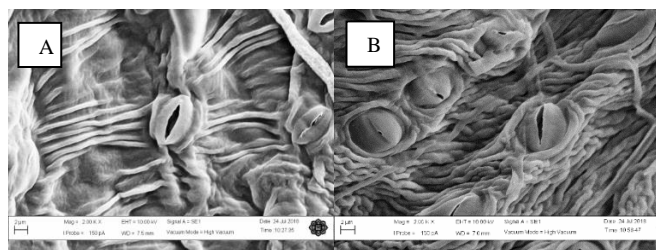


Figure 3: The patterns of stomata and guard cells pairs. A) Raised guard cells pairs in *M. decemfidum*. B) Slightly raised and sunken guard cells pairs in *M. perakense*. Scale: A & B) 2 µm

4. CONCLUSION

Results of the study reveal a number of interesting features with some characters that possibly considered as taxonomic importance and diagnostic values. The leaf anatomical and micromorphological evidence can be used for identifying certain species in *Melastoma* from Fraser Hill, Pahang. Findings from this study thereby showed the presence of hypostomatic stomata with elliptic guard cells pairs in all species studied.

Therefore, the characters could serve as taxonomic value to characterize the genus. Apart, straight to wavy anticlinal walls are present in both abaxial and adaxial surfaces of all species studied except for abaxial surface in *M. sanguineum* x *malabathricum* which shows wavy to sinuous anticlinal walls thus considered as a good diagnostic value for the species. Furthermore, all species studied show anomocytic type of stomata except in *M. sanguineum* x *malabathricum* which occurred as in diacytic type. Therefore, it could be another character that can be used to diagnose the species. Not only that, this present study was also reported on the presence of two types of guard cell pairs such as raised or slightly raised and sunken guard cell pairs. Raised guard cells pairs could be observed in *M. muticum* and *M. decemfidum* while slightly raised and sunken guard cells pairs observed in *M. perakense*, *M. sanguineum* x *malabathricum* and *M. malabathricum* var. *normale*. Therefore, this parameter could be also used to circumscribe certain species in *Melastoma*. In conclusion, the anatomical and micromorphological characteristics based on the anticlinal walls and stomata patterning could serve as taxonomic importance in identification and classification of *Melastoma* either at species or genus level especially for species in Fraser Hill, Pahang.

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