Original Article

Systematic Significance of the Foliar Trichomes in Selected *Melastoma* L. Species from Fraser Hill, Pahang

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Abstract

Background: The foliar trichomes of five selected *Melastoma* L. species in Fraser Hill, Pahang, that belongs to *Melastomataceae* family had been studied. These five species namely *Melastoma muticum* Ridl., *Melastoma decemfidum* Roxb., *Melastoma perakense* Ridl., *Melastoma sanguineum* x *malabathricum*, and *Melastoma malabathricum* var. *normale*. **Aims and Objectives:** This study aims to investigate the systematic significance of foliar trichomes in the identification and classification of *Melastoma* species. **Materials and Methods:** Methods of investigation involved cross-section using sliding microtomes on petiole and midrib, epidermal peel, and leaf clearing and observation under a light microscope. **Result:** The investigation showed that the genus of *Melastoma* seems to have a great variation of foliar trichomes. This present study has reported nonglandular trichomes in all species studied. However, six types of trichomes were discovered which serve as distinct variations of taxonomic values, such as simple multiseriate (short, pointed end), simple multiseriate (long, pointed end), simple multiseriate (short, hooked end), simple multiseriate (long, hooked end), strigose–setose, and scales trichomes. Surprisingly, the presence of simple multiseriate (long, hooked end) trichome only in *M. muticum* could be a criterion to diagnose the species. **Conclusion:** In conclusion, the present study revealed that the foliar trichomes possess as systematic significance in the identification and classification of *Melastoma* either at genus or species level.

Keywords: Foliar trichomes, *Melastoma*, systematic significance

Introduction

According to Angiosperm Phylogeny Group IV, the genus of *Melastoma* is classified under *Melastomataceae* family that belongs to *Myrtales* order. *Melastomataceae* is a large pantropical family which consists of about 170 genera and at least 4550 species.[1] These species consist of trees, shrubs, herbs, lianas, and epiphytes. Besides, it has reported that *Melastomataceae* are distributed in tropical regions, especially in South America.[2] This family is found throughout the wet tropics, especially in montane to lowland forests, disturbed vegetation, and savannas.[3]

The previous research on taxonomic studies of *Melastomataceae* found that there is some conflicting evidence regarding the division of its families. However, the traditional studies classified *Melastomataceae* into three subfamilies which are *Astronioideae*, *Memecyloideae*, and *Melastomatoideae*.[1] Later on, Heywood[3] reported on the division of *Melastomataceae* into two subfamilies which are *Kibessioideae* and *Melastomatoideae*. Wong[4] characterized the *Melastoma* leaves by certain characteristics such as opposite arrangement, petiolate, ovate, elliptic, or lanceolate (rarely linear) leaves shaped. The leaf venation composed of two to four acrodromous secondary veins and five to six merous flowers with isomorphic or anisomorphic stamens and typically consists of dehiscent fruit berries but may also consists of indehiscent berries or dry capsules. In addition, Wong[5] mentioned that the hypanthium indumentum is one of the reliable characteristics to diagnose the group and species.

The *Melastomataceae* has gained the world attention due to their biochemical composition and the isolation of secondary metabolites.[6] Therefore, the taxonomic studies regarding potent plant family including *Melastomataceae*, especially *Melastoma* species, are useful for the pharmaceutical

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part. Unfortunately, the identification and classification of *Melastoma* seem to have problems when there are incomplete data, especially for the reproductive parts. Sometimes, taxonomists get confused on the morphological similarities among the *Melastoma* species. Apart, the previous report on *Melastoma* species, especially in Pahang, is very scanty. Hence, leaf anatomy is considered as a medium to classify the plants and serve as systematic value when its characteristics are interpreted carefully. Therefore, the aim of the present study was to investigate the systematic significance of foliar trichomes in the identification and classification of *Melastoma* species.

Materials and Methods

Fresh leave samples of five selected *Melastoma* species which are *Melastoma muticum*, *Melastoma decemfidum*, *Melastoma perakense*, *Melastoma sanguineum* x *malabathricum*, and *Melastoma malabathricum* var. *normale* were collected from Fraser Hill, Pahang. Specimens obtained from the field sampling were dried, curated, identified, and deposited at the Herbarium of International Islamic University of Malaysia, Kuantan, Pahang. Fresh leave samples were fixed in 3:1 AA solutions (70% alcohol: 30% acetic acid).[7] The methods of foliar studies involved cross-section using sliding microtome, epidermal peeling, and leaf clearing. Part of petioles and midribs was sectioned in a range of thickness (30–40 µm) using sliding microtomes and stained with Safranin and Alcian blue. The epidermal peels were prepared using Jeffrey's solution and stained with Safranin. Slides were mounted in Euparal after dehydration process. The leaf clearing method was prepared using Basic Fuchsin's solution. Slides were then mounted in *Canada balsam* after dehydration process. All slides were dried in oven at 60°C for 1 week. Anatomical images were captured using LEICA ICC50 HD camera (Leica Microsystems (SEA) Pte Ltd. (All Microscopy) 12 Teban Gardens Crescent Singapore, 608924 Singapore) attached to a light microscope with the aided of LAS EZ Software (Leica Microsystems (SEA) Pte Ltd. (All Microscopy) 12 Teban Gardens Crescent Singapore, 608924 Singapore).

Results and Discussion

This present study revealed that *Melastoma* species composed of great variation of foliar trichomes. It has been found that the distribution of trichomes can be observed both on adaxial and abaxial surfaces. In addition, on the investigation of the foliar trichomes on five selected *Melastoma* species, six types of nonglandular trichomes were identified, hence supported by the previous research that had been done on some *Melastoma* species of Peninsular Malaysia.[8] For convenience and easy reference, Table 1 shows the illustration of six types of trichomes found in all species studied.

A group researchers stated that trichomes are the extensions of epidermal cells, which normally divided to form files of cells and comprised of various functions.[9] Trichomes have been important to protect plants from the insects and herbivores either through passive or active ways. The passive protection refers to simply hindering access to plants whereas active protection involved the toxin secretion.[9] Besides, trichomes classified as epidermal appendages and claimed with its significant value is well known in taxonomic studies.[10] On top of that, some of the plant families can be easily recognized by the occurrence of these particular types of hairs. Apart, the taxonomic significant of trichomes has also reported by researchers which also stressed on the important of hair structures in the classification of plant genus and species.[11]

Findings from this research showed that two types of trichomes have been identified in all species studied. The trichomes include simple multiseriate (short, pointed end) trichome (Type 1) and strigose–setose trichome (Type 5). This research hence supported by the previous research which reported on the presence of setose and simple multiseriate trichomes on the epidermis of the midrib in *M. decemfidum* and *M. malabathricum*.[12] Therefore, these characteristics may be used in characterizing this genus.

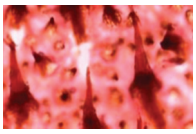
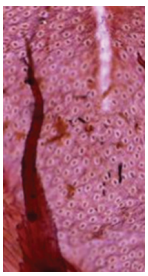
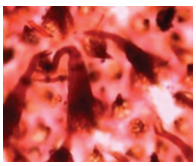
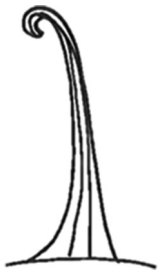
Apart, the types of trichomes can also be used in the identification and classification of plants. Bieras and Sajo[13] previously used the types of trichomes in the identification and classification of woody plants in Brazilian Savanna. Even in the identification and classification of selected taxa of *Acanthaceae*, Nurul-Aini *et al.* also mentioned the significant taxonomic value based on types of trichomes, especially to resolve the taxonomic conflicts of the species.[14] For convenience, a summary of trichomes types based upon five selected *Melastoma* species is presented in Table 2.

This present study thereby revealed that simple multiseriate (short, hooked end) trichome (Type 3) only could be examined in *M. muticum* and *M. perakense* whereas scales trichome (Type 6) only could be observed in *M. perakense* and *M. sanguineum* x *malabathricum.* These characteristics hence have been useful and considered as taxonomic values to identify and classify the species. In addition, Cutler mentioned that the various types of trichomes existed can perform as diagnostic value at species level and sometimes also at genus level.[15] Findings from this investigation of foliar trichomes therefore reported the presence of simple multiseriate (long, hooked end) trichome (Type 4) only in *M. muticum.* Therefore, this characteristic can be a good diagnostic value to diagnose the species.

Conclusion

Results of this investigation on foliar trichomes revealed an interesting characteristic that is considered to have taxonomic and diagnostic values. Findings from this study showed that all nonglandular trichomes present in all selected *Melastoma* species from Fraser Hill, Pahang. Two types of trichomes were identified in all species studied such as simple multiseriate (short, pointed end) and strigose–setose trichomes which might be the characteristic to recognize the genus. Besides, it is noticed that simple multiseriate (short, hooked

Table 1: Type of trichomes found in all species studied

Type of trichomes	Details	Illustrations	Pictures
Type 1	Simple multiseriate trichome (short, pointed end)		
Type 2	Simple multiseriate trichome (long, pointed end)		
Type 3	Simple multiseriate trichome (short, hooked end)		
Type 4	Simple multiseriate trichome (long, hooked end)		
Type 5	Strigose–setose trichome		
Type 6	Scales trichome		

end) trichome only can be examined in *M. muticum* and *M. perakense* whereas scales trichome only can be observed in *M. perakense* and *M. sanguineum* x *malabathricum.* In addition, the presence of simple multiseriate (long, hooked end) trichome only in *M. muticum* could serve as a diagnostic characteristic for the species. In conclusion, the results from the present study showed that the foliar trichomes of *Melastoma* species have taxonomic significance which can be used in the identification and classification of *Melastoma* either at genus or species level, especially for species in Fraser Hill, Pahang.

Table 2: Type of trichomes found in all species studied

Species	Types					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Melastoma muticum	+	+	+	+	+	-
Melastoma decemfidum	+	+		-	+	-
Melastoma perakense	+	+	+	-	+	+
Melastoma sanguineum × *malabathricum*	+	-	-	-	+	+
Melastoma malabathricum var. normale	+	+	-	-	+	-

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Conflicts of interest

There are no conflicts of interest.

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