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THE TAXONOMIC STUDY OF TRICHOME MORPHOLOGY IN SELECTED ASTERACEAE SPECIES OF PAHANG, MALAYSIA

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ABSTRACT

A comparative study of foliar trichomes for selected Asteraceae collected in Pahang was observed. The selected species were *Ageratum conyzoides* L., *Tridax procumbens* L., *Eclipta prostrata* (L.) L., *Sphagneticola trilobata* (L.) Pruski, *Emilia sonchifolia* (L.) DC. and *Youngia japonica* (L.) DC. The objective of this study is to document various trichomes among selected Asteraceae species in Pahang. Trichomes are known as one of the micromorphological characteristics that can be investigated for the assisting identification of Asteraceae. The trichomes were examined under a light microscope and Scanning Electron Microscopy (SEM). The trichomes in this study were classified into eight types. The diagnostic characteristics in *Ageratum conyzoides* consist of glandular trichomes while the non-glandular trichomes are mostly shown in *Tridax procumbens. Tridax procumbens* showed four diagnostic characteristics which are simple multicellular trichome (coned shape), simple multicellular trichome (long, pointed-end), simple multicellular trichome (long, tapered-end), and stellate trichome. This study proved that data from plant anatomy can be used as supporting data for plant classification in Asteraceae.

Key words: Asteraceae, diagnostic characters, leaf micromorphology, medicinal plants, trichome

INTRODUCTION

Asteraceae or previously known as Compositae is the largest family among flowering plant families. The majority of Asteraceae exist as herbaceous, shrubs and trees that grow randomly in South and North America, or other countries except in Antarctica (Smith & Richardson, 2011). Asteraceae is classified under the order of Asterales (Simpson, 2006) in APG I until the latest APG system. In traditional medicine practices, several Asteraceae species have been tested to heal wounds such as *Artemisia*, *Ageratum*, *Eclipta*, *Vernonia,* and *Tridax* (Suntar, 2014).

Identification of plants can be conducted via flowers or leaves. Asteraceae is the flowering angiosperm plant that is mainly identified and described with floral morphology. However, the incomplete specimen may cause wrong interpretation or identification. Leaf anatomical characteristics such as the type of trichomes can be used as a supporting analysis to help in the identification and classification of species in Asteraceae. Thus, the alternative way of identifying a species could be done on the leaf surface by observing the type of trichome. In this present study, trichomes of selected Asteraceae in Pahang were studied via light microscope and Scanning Electron Microscopy (SEM). The objective of the study is to observe various types of trichomes in selected different genera and species in Asteraceae. At the end of this study, these data can be used as supportive data for the identification and classification of the Asteraceae family.

MATERIALS AND METHODS

Materials

This study uses a descriptive method by describing the type of trichome. The material to name the types of trichomes was an identification book (Simpson, 2006). Three replicates of fresh leave of *Ageratum conyzoides* L., *Tridax procumbens* L., *Eclipta prostrata* (L.) L., *Sphagneticola trilobata* (L.) Pruski, *Emilia sonchifolia* (L.) DC. and *Youngia japonica* (L.) DC. were collected from several open areas in Pahang (as in Table 1). For the first replicate, the sample was dried in the oven and mounted as voucher specimens on a mounting board. Later, the voucher specimens were deposited at International Islamic University Malaysia (IIUM) Herbarium for future reference. Other samples were fixed in 3:1 AA Solutions (70% Alcohol: 30% Acetic Acid) (Johansen, 1940). Later, the samples were sectioned at petiole, midribs, leaf lamina, and marginal in a range of thickness (15-40 µm) by using sliding microtome and followed by staining using Safranin and Alcian blue. After several steps of dehydration, the slides were mounted

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in Euparal and the images were captured using a video (3CCD) camera attached to a Leitz Diaplan microscope using Cell^B software. Another sample was peeled to get a thin, clear surface and immersed in Jeffrey's solution. The leaves were washed with distilled water and a drop of Safranin was added and observed under the light microscope. For SEM methods, small pieces of leaves were cut and affixed to aluminum stubs with double-sided adhesive tape and coated with gold. The samples were examined under a SEM. The process is repeated for the second and third replicate to get a consistent result.

RESULTS

The result from this study can be grouped into eight types of trichomes as follows (as in Table 2):

(1) Peltate glandular trichome. These trichomes are found on *Ageratum conyzoides* and *Sphagneticola trilobata*.
(2) Capitate glandular trichome (multicellular with short stalk, unicellular head). These trichomes are found on *Ageratum conyzoides, Sphagneticola trilobata, Emilia sonchifolia,* and *Youngia japonica.*
(3) Capitate glandular trichome (multicellular with a long stalk, unicellular head). These trichomes are found on *Ageratum conyzoides* and *Emilia sonchifolia.*
(4) Simple multicellular trichome (coned-shape). These trichomes are coned-shaped with more than two cells and have broad-based. Found on *Tridax procumbens.*
(5) Simple multicellular trichome (long, pointed-end). These trichomes have more than two cells, long with sharp-pointed on the apex. Found on *Tridax procumbens.*
(6) Simple multicellular trichome (long, tapered-end). These trichomes have more than two cells, are short in length, have a broad base, and become smaller towards the apex with a tapered end. Found on *Ageratum conyzoides, Tridax procumbens,* and *Sphagneticola trilobata.*
(7) Simple multicellular trichome (long, pointed-end, echinate ornamentation). These trichomes have more than two cells with echinate ornamentation and a pointed end on the apex. Found on *Eclipta prostrata* and *Sphagneticola trilobata.*
(8) Stellate trichome. Structure as 'star-shaped'. Found on *Tridax procumbens.*

Table 1. Details of sample collection

Specimen	Voucher Specimen	Collectors	Date of Collection	Localities
Ageratum conyzoides	ARZS 01	Zainab Sholehah A. R.	10 November 2019	Glasshouse & Nursery Complex, IIUM Kuantan, Pahang
Tridax procumbens	ARZS 02	Zainab Sholehah A. R.	28 November 2019	Kulliyyah of Science, IIUM Kuantan
Eclipta prostrata	ARZS 03	Zainab Sholehah A. R.	1 December 2019	Taman Teruntum, Kuantan, Pahang
Sphagneticola trilobata	ARZS 04	Zainab Sholehah A. R.	1 December 2019	Bukit Pelindung, Kuantan, Pahang
Emilia sonchifolia	ARZS 05	Zainab Sholehah A. R.	28 December 2019	Masjid Sultan Haji Ahmad Shah, IIUM Kuantan, Pahang
Youngia japonica	ARZS 06	Zainab Sholehah A. R.	29 December 2019	Taman Gelora, Kuantan, Pahang

Table 2. Summary of various trichomes in selected Asteraceae of Pahang

Type No.	1	2	3	4	5	6	7	8
A. conyzoides	/	/	/			/		
T. procumbens				/	/	/		/
E. prostrata							/	
S. trilobata	/	/					/	
E. sonchifolia		/	/					
Y. japonica		/						

DISCUSSION

Trichome is commonly seen as hair that has distinct functions and structures (Wina *et al*., 2020). According to Hardin (1979), the morphological characteristics of trichomes have played an important role in plant systematics, especially of a particular group at generic and specific levels. The result of this study showed that glandular and non-glandular trichomes are present on the abaxial and the adaxial leaf epidermal surface. Metcalfe and Chalk (1950) also stated that the anatomical variation of Asteraceae is usually observed by the structure of the leave such as trichome characteristics. Ramayya (1962) believed that the pattern of trichomes shows almost similar patterns that can be considered mutually related. A variety pattern of trichomes functions as evidence of the interrelationship among species of Asteraceae.

From this study, there are eight types of trichomes that have been recorded in six species studied. The summary of the types of trichomes of all species studied is shown in Table 1. Results showed three types of glandular trichomes which are peltate glandular trichome (Figure 1a), capitate glandular (multicellular, short stalk, unicellular head) (Figure 1b), and capitate glandular trichome (multicellular, long stalk, unicellular head) (Figure 1c). In this recent study, capitate glandular trichome (multicellular, long stalk, unicellular head) (Figure 1c) was found on the adaxial of *Emilia sonchifolia* and this finding was different from Ndukwu and Agbagwa (2006) since they did not find any trichomes on *Emilia sonchifolia*.

Five types of non-glandular trichomes have been recorded in this study which are simple multicellular trichome (coned-shape) (Figure 1d), simple multicellular trichome (long, pointed-end) (Figure 1e), simple multicellular trichome (long, tapered-end) (Figure 1f), simple multicellular trichome (long, pointed-end, echinate ornamentation) (Figure 1g) and stellate trichome (Figure 1h). Stellate trichome only is found in *Tridax procumbens* which makes the trichome the diagnostic characteristics for the species. Kuldeep and Pathak (2013) stated that unicellular trichomes are present on the leaf surface of *Tridax procumbens*. Based on the result obtained, simple multicellular trichomes (coned-shape) and simple multicellular trichomes (long, pointed-end) exist only in *Tridax procumbens* on both the abaxial and adaxial leaf epidermis surface.

Previous research that has been done by Perveen *et al*. (2016) stated that trichomes for *Eclipta prostrata* were simple multicellular trichomes with pointed-end and round-base. Silva *et al*. (2012) also reported that the trichomes found in *Sphagneticola trilobata* were multicellular trichomes with biseriate, short stalk, and bicellular secretory heads. This recent study proves that it could add new data that are not discovered by previous authors.

This finding supports that any diagnostic characteristics that exist in a species can be used as evidence to identify the species specifically (Amirul-Aiman *et al*., 2017). This study also supports the previous research by Nurul-Aini *et al*. (2018) who enumerated the importance of morphology and type

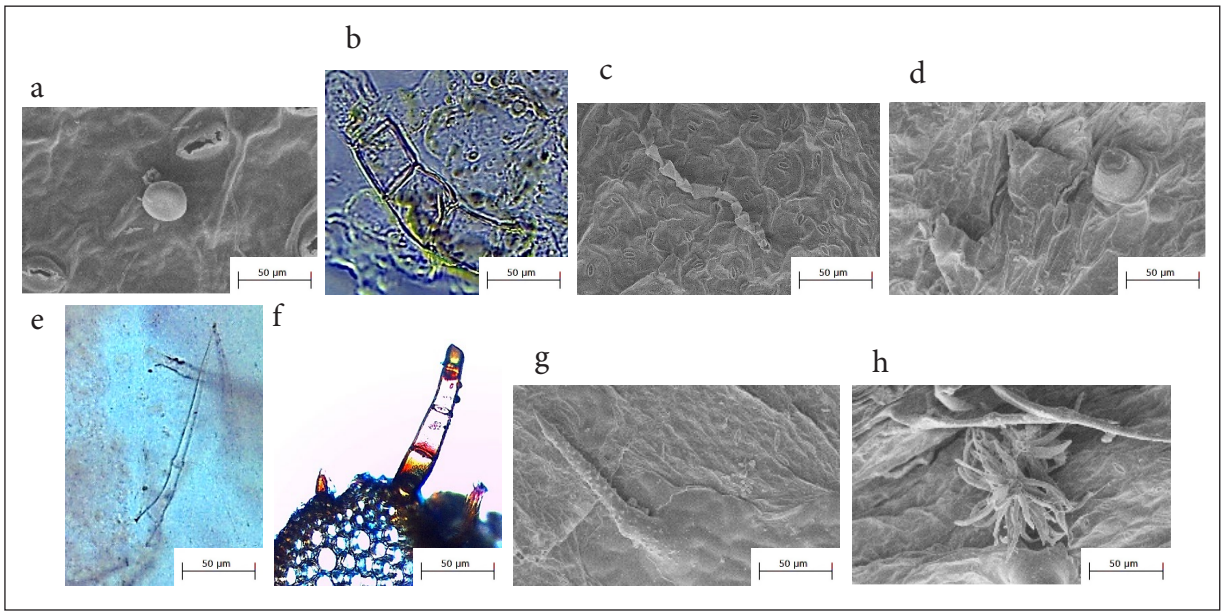

Fig. 1. Types of trichomes a) Type 1: Peltate glandular trichome, b) Type 2: Capitate glandular trichome (multicellular, short stalk, unicellular head), c) Type 3: Capitate glandular trichome (multicellular, long stalk, unicellular head), d) Type 4: Simple multicellular trichome (coned-shape), e) Type 5: Simple multicellular trichome (long, pointed-end), f) Type 6: Simple multicellular trichome (long, tapered-end), g) Type 7: Simple multicellular trichome (long, pointed-end, echinate ornamentation) and h) Type 8: Stellate trichome.

of trichome to differentiate and identify *Staurogyne* (Acanthaceae).

CONCLUSION

In conclusion, the additional information on this trichome morphology can be used as additional data in assisting the identification of species in Asteraceae. This data also could be used by pharmacologists to choose the correct plant for the correct medication in the future.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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