Trichome Morphology of *Durio Zibethinus* L.

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Abstract

Knowledge regarding taxonomy such as plant species trichome morphology has developed significantly in recent years, which deals with the classification of an organism according to its similarity and variance. It offers vitally important knowledge for most plant classification systems, such as Durian varieties. The Durian is one of Malaysia's famous and sought after fruits. Therefore, this taxonomic study will serve as a complementary tool to the *D. zibethinus* variation assessment. Hence, this research was aimed at scrutinizing the trichome morphology variation of *D. zibethinus*. Samples of *D. zibethinus* leaves were collected from Jelebu, Negeri Sembilan and Jabatan Pertanian Bukit Goh, Kuantan, Pahang and kept as herbarium vouchers. Observation on trichome morphology was carried out by using a light microscope. The analysis revealed variations of trichome morphology in terms of its presence, morphological characteristics and trichome types. On the upper and lower surfaces of the *D. zibethinus* leaves, non-glandular trichome (lepidote trichome, stellate trichome, and simple trichome) is densely covered. Glandular trichome does not present in all accessions. To sum up, trichome morphology may be used in *D. zibethinus* identification process.

Keyword: *Durio zibethinus,* leaf morphology, trichome.

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Introduction

Durio zibethinus L. (Malvaceae) or durian is commonly referred to as King of Fruit in countries in Southeast Asia such as Malaysia, Indonesia and Thailand. *D. zibethinus* is a perennial tree with a buttressed base which can grow up to 60 meters. The leaves vary with acuminate apex with an elliptic, oblong or lanceolate leaf shape. The leaves on the upper surface are entirely green and glossy; on the other hand, the lower surface is brown owing to it is densely covered by several trichomes layers. *D. zibethinus* has cauliferous inflorescences growing in clusters of 3-10 flowers, and each comes with five petals. Bat and moth pollinate *D. zibethinus* flowers, and thorny fruits take at least 100 days to mature, ripe and becoming edible. Ripe fruits produce a pungent smell and distinctive taste [1-5].

D. zibethinus species identification is made exclusively on the basis of their flower and fruit morphologies. As *D. zibethinus* trees are regarded as the seasonal that yield fruit once or twice a year, this circumstance may confuse the farmers and researchers when it comes to identifying the plants which do not bear fruits. Numerous taxonomic research on the vegetative structures of *D. zibethinus* has been published such as Husin et al. [6] and DOA [7] for the identification and classification of *D. zibethinus* varieties. Previous research done by Salma [8] has reported that *D. zibethinus* possessed the significant presence of trichome morphology that could be used to identify and classify *D. zibethinus.*

Trichome variations are one of the micromorphological features that could be used as a significant key in identification and classification of plant samples from various aspects such as type, presence and density. Trichomes are epidermal cell appendages of several form, structure, and function. Trichome's most prominent role is to protect the plant from herbivores, heat and sunlight and to control the temperature of the leaves and water loss [1]. This study could add invaluable additional information in the area of *D. zibethinus* botany that could benefit future researchers. The purpose of this study was to observe and characterize the trichome morphology of *Durio zibethinus*.

Materials and Methods

The samples were obtained in Jelebu, Negeri Sembilan and Pusat Pertanian Bukit Goh, Kuantan, Pahang. Five and six accessions from Jelebu, and Pusat Pertanian Bukit Goh, respectively were processed as herbarium vouchers. Two duplicates of the herbarium voucher are processed for each sample. The samples were appropriately organised in the newspaper and ensured that all the leaves part were displayed and clear. The samples were placed between layers of the newspaper and the board before they were pressed with wood presser. The samples were oven dried at 55°C for two weeks. The samples were mounted on the herbarium sheet after drying. Upper and lower sides of the leaves were clearly displayed. The samples were knitted by using a needle and a soft cotton rope. The herbarium was then housed in the Herbarium room of Department of Plant Science, Kulliyyah of Science, IIUM Kuantan.

From the third branch onwards, healthy and perfect mature leaves were selected for trichome morphology observation. Cellophane tape was placed randomly on upper and lower leaf surfaces, apex, lamina and leaf base. Next, the tape was placed on the glass slide. The samples were photographed and examined under a camera-connected Leica ICC50 HD light microscope regarding their trichome morphology. Eventually, the presence of trichome was

recorded and the images were displayed using Leica LAS EZ software on a computer. The observation was repeated until good quality images were obtained.

By calculating the length of the attachment between the fimbriates from the center of the trichome to the separation of the attachment, the webbing percentage of trichome was defined using the following formulation:

$$\text{Webbing Percentage} = \frac{Length\ of\ Attached\ Fimbriates}{Total\ Length\ Fimbriate} \times 100\%$$

Results and Discussion

Results

The identification and classification of trichome morphology corresponded to the previous research conducted by Salma [8], Liu et al. [9], and Metcalfe [10] as shown in Figure 1 below. Throughout Table 1, the presence of trichomes on the upper and lower leave surfaces was summarized. Selected images of trichome types are as shown in Figure 2-4. *D. zibethinus* exhibited three main types of non-glandular trichomes, based on the observation: lepidote trichome, stellate trichome, and simple trichome. There are no glandular trichomes.

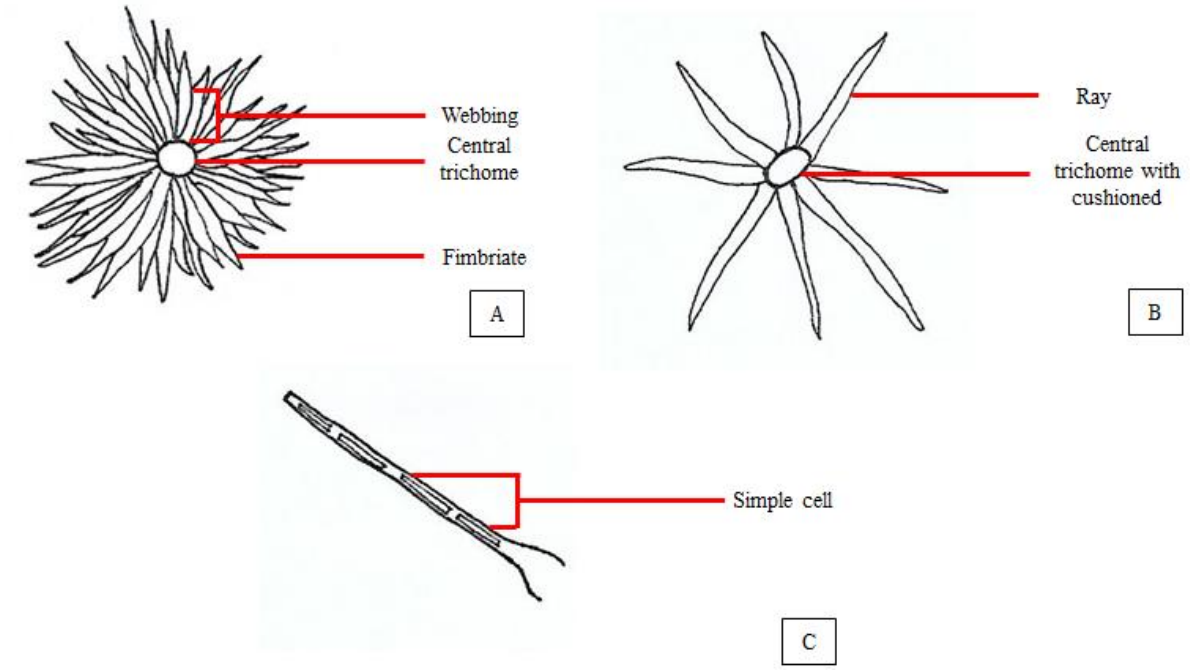

Figure 1: Characterizaton of trichome morphology of D. zibethinus. (A) Lepidote trichome; (B) Stellate trichome; (C) Simple trichome.

Type I. Lepidote trichome (Figure 2A-2C). This trichome morphology resembles appressed-stellate but has radii that are bound by webbing to form shield-like scales. Three subtypes were identified from the observation. Subtype Ia, Lepidote (Figure 2A) has at least 80-100 per cent webbing. Subtype Ib, dentate-lepidote (Figure 2B) has 50-80 per cent webbing and appears like the hybrid of lepidote trichome and stellate trichome. Subtype Ic, stellate-

lepidote (Figure 2C) has 30-50 per cent webbing, which looks more like stellate trichome [9,10].

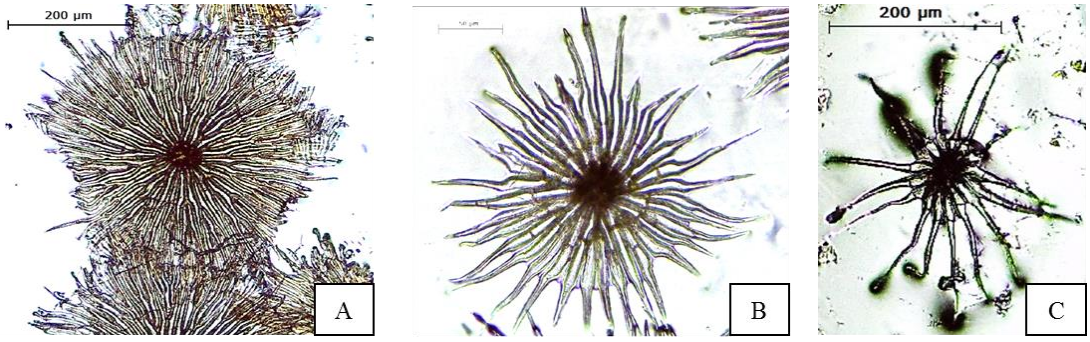

Figure 2: (A) Lepidote trichome (lepidote-subentire) (Ia); (B) Lepidote trichome (dentate-lepidote) (Ib); (C) Lepidote trichome (stellate-lepidote) (Ic).

Type II. Stellate trichome (Figure 3A-3D). It is characterized from its star-shaped form in one plane that is usually flattened onto the lamina. From this study, this trichome can be divided into four subtypes which are; Subtype IIa, Cushioned (Figure 3A) is sessile with more than five rays with a central cushion. Subtype IIb, Flat (Figure 3B) is sessile with more than five rays without a central cushion. Subtype IIc, four-armed (Figure 3C) is sessile, four rays with central cushion. Subtype IId, three-armed (Figure 3D) is sessile, three rays without central cushion [8,10].

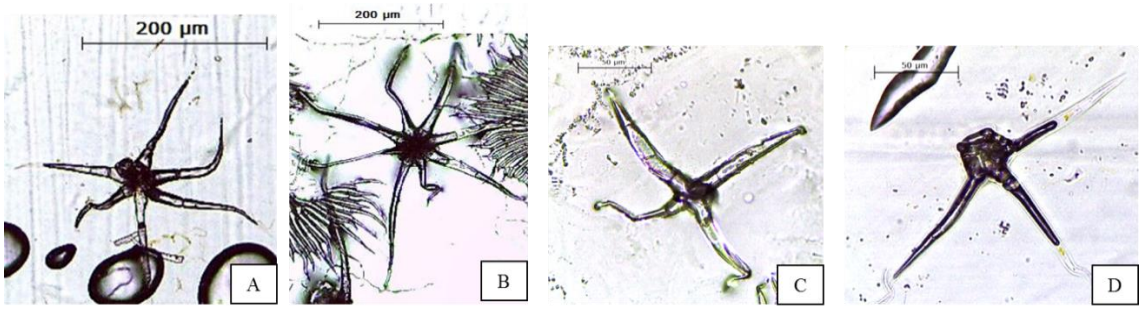

Figure 3: (A) Stellate trichome (cushioned) (IIa); (B) Stellate trichome (flat)(IIb); (C) Stellate trichome (four-armed) (IIc); (D) Stellate trichome (three-armed) (IId).

Type III. Simple trichome (Figure 4A and 4B). Two subtypes were observed. Both types have long tip-tapered trichome. Subtype IIIa is unicellular (Figure 4A), and Subtype IIIb is multicellular (Figure 4B).

Figure 4: (A) Simple trichome (unicellular) (IIIa); (B) Simple trichome (multicellular) (IIIb).

Only *Chanee* has the presence of trichome as per upper-leaf surface observation. As for the lower leaf surface, lepidote trichome, stellate trichome (flat), and stellate trichome (four-armed) were found to have all accessions. Only the DJ2 sample did not have stellate trichomes (cushioned). Stellate trichome (three-armed) only presented in *Chanee, Hajjah Hasmah,* MDUR88 and *Musang King.* Simple trichome (unicellular) was absent in DJ3 and MDUR88, while simple trichome (multicellular) only presented in *Sultan, Chanee, Tok Litok,* MDUR88 and *Musang King.*

Table 1: Presence of trichome on the upper and lower leaf surface of D. zibethinus.

Accession	Area Collected	Sample	Presence of trichome									
			Upper leaf surface	Lower leaf surface								
				Type I			Type II				Type III	
				a	b	c	a	b	c	d	a	b
1	Jelebu, Negeri Sembilan	DJ1	-	√	√	√	√	√	√	-	√	-
2		DJ2	-	√	√	√	√	-	√	-	√	-
3		DJ3	-	√	√	√	√	√	√	-	-	-
4		DJ4	-	√	√	√	√	√	√	-	√	-
5		DJ5	-	√	√	√	√	√	√	-	√	-
6	Kuantan, Pahang	D24 *Sultan*	-	√	√	√	√	√	√	-	√	√
7		D123 *Chanee*	√	√	√	√	√	√	√	√	√	√
8		D168 *Hajjah Hasmah*	-	√	√	√	√	√	√	√	√	-
9		D169 *Tok Litok*	-	√	√	√	√	√	√	√	√	√
10		D190 MDUR88	-	√	√	√	√	√	√	√	-	√
11		D197 *Musang King*	-	√	√	√	√	√	√	√	√	√

* Five accessions from Jelebu is named as DJ (Durian Jelebu) while six accessions from Bukit Goh is named D, following to its registered durian accession in DOA database.

Discussion

It was proven from the result that the presence of lepidote trichome on the lower leaf surface of the leaves was typical to *D. zibethinus*. Some subtypes of stellate trichomes were also typical to flat and four-arm *D. zibethinus*. These findings were identical to research conducted by Salma [8]. Lepidote trichome and stellate trichome were not only present in *D. zibethinus*; as a matter of fact, Webster et al. [11] used the presence of these two types of trichomes in a systematic study on *Croton*.

Salma [8] has reported the presence of trichome on the upper leaf surface. This current study, however, did not discover the presence of trichome on the upper surface of the *D. zibethinus* leaves. Nevertheless, it provided new finding that *D. zibethinus* accessions from Jelebu Negeri Sembilan have the presence of stellate (three-armed) and simple (multicellular) trichome. The study also acknowledged the presence on the lower leaf surface of a simple trichome, which was not reported in the previous study [8]. Such evidence could be additional information based on trichome morphology for the identification and classification of *D. zibethinus.*

Several previous studies on the characterization of trichome morphology agreed that trichome data have been beneficial in the identification and classification of plant species. This species is not peculiar to non-glandular trichome found in *D. zibethinus*. Ilango et al. [12] and Tan et al. [13] employed trichome characterization in the identification of the *Hippophae* and *Jarandersonia* species. It was reported that the presence of stellate trichome acted as plant protection against the high temperature of the leaves, sunken stomata and dense epidermal cells. It also reduced water loss to the surrounding, thus, enhanced plant ability in severe drought condition [11].

Chanee, Tok Litok and *Musang King* collected from Kuantan, Pahang recorded to have all the trichome subtypes while *D. zibethinus* accessions from Jelebu, Negeri Sembilan might be absent of at least two or more trichome subtypes.

The effect of various sampling areas can be inferred from previous research by Talebi et al. [14] on the variations in trichome morphology. They studied trichome variants on *Salvia nemorosa* obtained from several different areas in Iran and noted that the presence of trichome showed no distinction between localities. Different habitats were speculated to have induced variability in terms of the distribution of trichome on the leaf owing to the plant's tolerance to live in that environment condition.

Conclusion

From the overall observation, there was no identical pattern regarding accessions and sampling area as far as the variations of trichomes was concerned. Nevertheless, by utilizing micromorphology characteristics, this study may act as updated information about the trichome morphology and its variability in distinguishing *D. zibethinus*. Moreover, further research on trichome must be carried out to complete *D. zibethinus* classification.

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Author Contributions

All authors contributed towards data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work.

Disclosure of Conflict of Interest

The authors have no disclosures to declare.

Compliance with Ethical Standards

The work is compliant with ethical standards.

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