Characteristics of Leaves Anatomy of Some *Syzigium* (Myrtaceae)

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ABSTRACT
In identifying a plant species, anatomical characteristics of vegetative organs such as leaves are needed to complete taxonomic data and increasing group understanding within a taxa. The aimed of this research to determine the cross-sectional characteristics of leaves and stomata characteristics of three plants of *Syzygium*. The plants were *Syzygium aromaticum* (L.) Merr. & Perry, *Syzygium malaccense* (L.) Merr. & Perry, and *Syzygium polyanthum* (Wight.) Walp. The results of this study indicate that of the three plants have the secretory cavities that produce oil glands, was found anomocytic stomata type on *S.aromaticum* (L.) Merr. & Perry and *S. malaccense* (L.) Merr. & Perri, while *S. polyanthum* (Wight.) Walp. has a parasitic stomata type. This shows that the stomata type does not indicate taxonomic value for this genera. Spread of stomata is only found at the abaxial surface of the leaf (hypostomatic). The length of stomata in the *S. aromaticum* (L.) Merr. & Perry was 60.20 ± 6.99 μm2, in *S. malaccense* (L.) Merr. & Perry was 108.29 ± 21.17 μm2, and *S. polyanthum* (Wight.) Walp. was 53.17 ± 9.32 μm2.
Keywords: *stomata type, S. aromaticum, S. malaccense, S. polyanthum, hypostomatic*

1. INTRODUCTION

Indonesia is one of the countries with the greatest biodiversity in the world (megabiodiversity countries) along with Brazil and Zaire (RD Congo). Biodiversity includes plants and animals that are spread throughout Indonesia. Indonesia ranks fourth in the world for plant species diversity, which has around 38,000 species. The diversity of plant species is illustrated in forests that are spread throughout Indonesia [12]. One of the diversity of plants is the genus *Syzygium* (Eugenia) which belongs to the family Myrtaceae. This genus has 700-800 species, including *Syzygium aromaticum* (L.) Merr. & Perry, *Syzygium malaccense* (L.) Merr. & Perry, and *Syzygium polyanthum* (Wight.) Walp. [14]

In studying the diversity of living things, taxonomy is needed [15]. Anatomical structure can be used as an initial data source that can be used in plant taxonomy. Anatomy of the vegetative organ is usually used more as a taxonomic feature compared to the anatomy of the reproductive organs. Vegetative anatomy usually comes from leaves, stems and roots [17]. In leaf organs, to identify a type of plant, epidermal characteristics are needed to complete taxonomic data, so that it will increase the understanding of groups in a taxa [9]. In general, leaves consist of the same anatomical structure, such as the epidermis, stomata, mesophyll, and beam transport [4]. In identifying a plant species, epidermal characteristics are needed to complete taxonomic data, so as to increase understanding of groups within a taxa [9].

To identify the anatomical structure characteristics of a plant such as epidermal tissue is to make microscopic observations. One of the derivatives of epidermal tissue is stomata. Stomata types can be used as indicators of scientific taxonomic similarity. Dasti [7] states that some researchers have recognized and reported on the importance of epidermal characteristics in identifying plant species such as stomata types. According to Mulyani [16], basically the type of stomata found in plant species with other species varies, even in the same family even though different types of stomata can occur. But it can also occur in one family was found the same type of stomata, for example in Malvaceae and Rubiaceae.

The most important stomata characteristic is its type which can be distinguished based on the number and location of neighboring cells, such as anomocytic, anisocytic, parasitic, diacitic and actinositic types [22]. The distribution of stomata is another characteristic, where in land plants stomata are generally found on the underside of the leaf (hypostomastic). But in some stomata plants are located on the upper surface of the leaf (epistomastic), and some stomata plants are located on the top surface (adaxial) and bottom of the leaf (abaxial). This type of leaf is called an amphistomastic [20]. In addition to the characteristics of epidermal tissue, the presence of other tissue can also be used as a way to identify from a plant, such as the presence of secretory tissue.

2. MATERIALS AND METHODS

This research will be carried out in February 2019 to March 2019 at the Botany Laboratory of the Department of Biology, Faculty of Mathematics and Natural Sciences, Padang State University. The leaves observed from

Syzygium, that are *S. aromaticum* (L.) Merr. & Perry, *S. malaccense* (L.) Merr. & Perry, and *S. polyanthum* (Wight.) Walp.
First transverse slices are made from the three plant leaves observed, then an epidermal incision is made on both leaf surfaces (adaxial and abaxial). The incision results are soaked in 96% alcohol for approximately 5 minutes to dissolve chlorophyll in the leaf mesophyll. Then the incision is rinsed using aquades and placed on the slide after being covered with cover glass, observations were made using the Zeiss Primo Star microscope at a magnification of 10 x 40. The observed stomata were then measured in length and width in microns (µm), then determined the size of the stomata or stomata size (SS) with the formula of Franco [2] as follows:

SS= L x B x K
L: Length
B: width
K: Franco's constant (0.79)

3. RESULT AND DISCUSSION

3.1 Structure of Leaves

In Figure 1. can be seen that all three plants of the genus *Syzygium* have a secretion cavity that can produce an essential oil in the form of essential oils. Oil ginger is one of the characteristics of the Myrtaceae family. The gland of the oil can come out of the secretion cavity if it is sliced against the leaf organs, so it is also called internal secretion. The secretion cavity is found under the epidermal tissue, both adaxial and abaxial. The Myrtaceae family is known to have leaf organs with oil glands produced by secretory tissue [20]. Observation of Defaveri [6] on *Eegenia rotundifolia* (Myrtaceae) also shows the secretion cavity in the leaves of these plants. Cardoso [3] also observed several leaves of plants from the Myrtaceae family, all of which showed the secretion cavity.

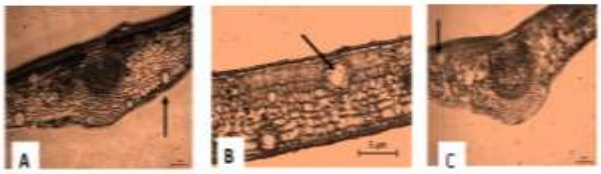

Figure 1. Leaf cross section, A). *S. aromaticum* (L.) Merr. & Perry, B). *S. malaccense* (L.) Merr. & Perry and C). *S. polyanthum* (Wight.) Walp. The arrows indicate the secretory cavities that produces oil glands.

Based on the number and arrangement of accessory cells, stomata on the leaves of *S. aromaticum* (L.) Merr. & Perry and *S. malaccense* (L.) Merr. & Perry has the same type, the anomocytic type. According to Esau [8], anomocytic stomata type is a type of stomata whose cell cover is accompanied by a number of accessory cells whose shape and size cannot be distinguished from other epidermal cells. Anomocytic stomata types are also found in some plants such as *Citrullus lanatus* and *Cucurbita pepo* [13], Rindyastuti and Lia [18] also found anomositic stomata types in several other plants namely *Calophyllum inophyllum*, *Schleichera oleosa*, *Draconto-melon dao*, and *Madhuca longifolia*.

3.2 Stomata Characteristics

Table 2. Types, Spread and Size of Stomata from *S. aromaticum* (L.) Merr. & Perry, *S. malaccense* (L.) Merr. & Perry and *S. polyanthum* (Wight.) Walp.

Plants	Type of stomata	Spread of stomata	Size of stomata (µm2)
S. aromaticum (L.) Merr. & Perry	Anomositik	Abaksial	60,20 ± 6,99
S. malaccense (L.) Merr. & Perry	Anomositik	Abaksial	108,29 ± 21,17
S. polyanthum (Wight.) Walp.	Parasitik	Abaksial	53,17 ± 9,32

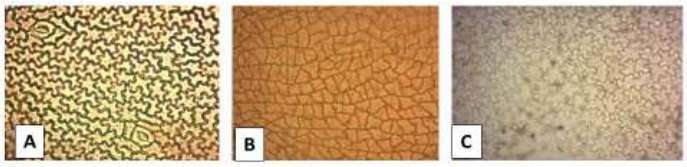

Figure 2. Adaxial surface of A). *S. aromaticum* (L.) Merr. & Perry, B*). S. malaccense* (L.) Merr. & Perry and C). *S. polyanthum* (Wight.) Walp

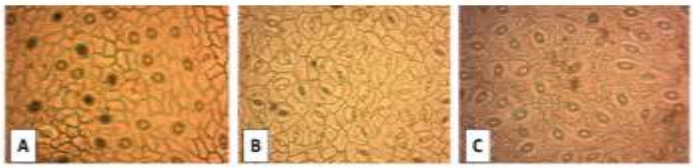

Figure 3. Abaxial surface of A). *S. aromaticum* (L.) Merr. & Perry, B). *S. malaccense* (L.) Merr. & Perry and C). *S. polyanthum* (Wight.) Walp.

S. polyanthum (Wight.) Walp. has a stomata type that is different from the two previous plants, namely the parasitic type. Esau [8] states that the parasitic stomata type has a closing cell that is accompanied by accessory cells which are located parallel to the stomata axis. This shows that three plants of this *Syzygium* have two stomata type, namely anomocytic and parasitic. In their research, Rindyastuti and Lia [18] also observed stomata in one of the plants of the *Syzygium* namely *S. cumini* which has anisocytic stomata type. Thus, in *Syzygium* found three different types of stomata, namely *S. aromaticum* (L.) Merr. & Perry and *S. malaccense* (L.) Merr. & Perry with anomositic stomata type, *S. polyanthum* (Wight.) Walp. with parasitic stomata type, and *S. cumini* with anisocytic stomata type.

Although belonging to the same genera, plants can have different types of stomata. This was also found by Abdulrahman *et al*. [1] in his research on the types of stomata in several plants of *Dioscorea*. In this study he found that there were four different types of stomata in six plants observed. In fact, three types of plants of which have more than one type of stomata each. Damayanti *et al.* [5] also found two different types of stomata in the five species of *Nepenthes* he observed.

In leaves, stomata are present on both leaf surfaces or only on one surface, usually on the lower surface [22]. Spread of stomata on *S. aromaticum* (L.) Merr. & Perry, *S. malaccense* (L.) Merr. & Perry, and *S. polyanthum* (Wight.) Walp. only in the lower leaf (abaxial) epidermis. According to Setjo *et al*. [19] the spread of stomata found only in the epidermis of the lower leaves alone is named hypostomatic. Most plants that live on land do have a spread of hypostomatic stomata. Spread of hypostomatic stomata was also found in seven of eight *Hoya* species observed by Hakim *et al.* [10], while the other one has an amphisomatic stomata spread. In research conducted by Rindyastuti and Lia [18] on ten woody plants and it was found that the ten plants had hypostomatic stomata spread.

Based on the measurement of stomata on these three plants, it can be seen that the plants that have the smallest stomata size are *S. polyanthum* (Wight.) Walp. While plants that have the largest stomata size are *S. malaccense* (L.) Merr. & Perry. Haryanti [11] found that stomatal pore widening was related to plant transpiration in adapting to their environment. In hot regions, stomata should reduce their width to reduce water evaporation, whereas in stagnant areas the stomata are more open.

4. CONCLUSION

Based on the results of the study, it can be concluded that leaf anatomy of *S. aromaticum* (L.) Merr. & Perry, *S. malaccense* (L.) Merr. & Perry *S. polyanthum* (Wight.) Walp. have the secretory cavities that produce oil glands. There are two types of stomata, that are anomocytic and parasitic, present on the abaxial surface (hypostomatic leaves).

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