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Trichomes Characterization of Ornamental Plants *Begonia* spp (Begoniaceae)

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Abstract. The presence of sharp needle-shaped hairs on the leaf surface of the ornamental begonia plants is recognized as a trichome that has not been widely studied. This research aimed to determine the characteristics of trichomes of Begonia's leaves in Ambon. The plant material used was the Begonia species that was explored in Ambon and private collections. Identification of plant species, scientific and trade names was carried out by comparison of the sample plants' characteristics with online data and references. Trichome observations were carried out using the whole mount method with 400x magnification using the Optilab camera of the Olympus microscope. Trichome's shape and type were described based on the obtained pictures, while number and length were the average of 10 fields of view, from 3 replications, and displayed as mean ± standard deviation (mean ± SD). The 21 Begonia species were collected, and their trichome was characterized. In general, the Begonia's trichome consists of structure like base, median or body and tip, uniseriate and multiseriate types, needle or cone shape, and glandular or non glandular. The average length of trichomes range from 29.80-233.47 µm. Based on these results, it can be concluded that the trichomes on the leaves of Begonia ornamental plants in Ambon City have variations in type, shape, number and size. This result is expected to be new information or references for those who interest in developing Begonia species, especially in classifying begonias based on their trichomes characteristics.

Keywords: Trichomes characteristics; exotic plants; *Begonia* spp.

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INTRODUCTION

Begonia spp. (Begoniaceae) belongs to flowering plants (Liu et al., 2020), is one of the tropical plants that grows wild in wet forests, damp places, humus soil, as well as slightly shaded places, at an altitude up to 2.400m above sea level (Janson et al., 2021). It was the largest genus of Angiosperms (Permata & Susandarini, 2022), highest morphological diversity (Semarayani & Rahayu, 2021), and recently around 2052 species have been discovered (Moonlight et al. 2018). The most striking features of the Begonia genera are the asymmetric leaf trait, which can be easily distinguished from other plant species (Janson et al., 2021; Permata & Susandarini, 2022).

In Southeast Asia, there were 521 species that have been identified and are widely spread across several countries (Hughes et al., 2020). Indonesia has the highest diversity of Begonia in Southeast Asia and is the center of Begonia diversity in the world (Effendi et al., 2020), with the number of which exceeds 500 types (Janson et al., 2021). This number excludes introduced types such as exotic types, which are currently growing rapidly because of their utilization as an ornamental plant and widely cultivated.

Begonias are grouped into natural and exotic Begonias. Natural begonia is native to Indonesia and derived from the exploration of forests in Indonesia. They have a simple habitus, simple leaf shape and color, grow wild in damp habitats, and are sometimes associated with shrubby forests. Unlike natural begonias, exotic begonias are not native to Indonesia. These begonias greatly vary in shape, color, pattern, and size of leaves and flowers, because they are the result of crossing. Some exotic begonias in Indonesia have also been introduced from overseas, and are currently found

easily and widely traded in ornamental plant nurseries (Siregar et al., 2018). High diversity of Begonia species was caused by the existence of hybridization, polyploidization, and the wide adaptability of Begonia to various environmental conditions (Sang & Kiew, 2018).

In Ambon City, Maluku Province, the ornamental plant Begonia has received quite a lot of attention because of its variation of leaf shapes and colors. They could be found in people's houses, as well as ornamental plant sales centres in Ambon. Apart from the various colors and shapes of the leaves, one of the striking characteristics of Begonia is the hairy surface of the leaves, especially when touched. These fine hairs have been recognized as trichomes (Wardhani, 2015)

Trichomes are a protrusions modified appendages, hair-like organs derived from a proliferation of epidermal cells then undergo cell division, differentiation, and growth to produce tissues that extend from the surface of the epidermis, unicellular or multicellular, and then develop into a shape resembling short, smooth feathers, or some are long with pointed and sharp tips like needles, visible in almost all outermost parts of the plant body, especially stems and leaves and be the first when touched by humans and animal (Agustin & Susanti, 2022; Han et al., 2022; Hernandez & Park, 2022; Anam, 2021; Wang et al., 2021). This structure allows trichomes to function as plant protection by repelling toxins and providing a barrier, inhibiting the feeding process of predators or pathogens (Han et al., 2022), constitute the first line of plant defense, reducing leaf temperature by reducing the evaporation process, particularly when plants are facing water deficiency (Latifa et al., 2024), increases light reflectance, prevents drying out, and reduces friction on the leaves (Kaur et al., 2021), and storage of secondary metabolites (Astiti, 2021).

Identification of certain plant families can be done by investigating their trichome characteristics (Sholehah et al., 2022) through several physical properties including structure, shape, type, size, number and density (Latifa et al., 2024). Recent studies regarding the anatomical properties of Begonia have been reported by (Suffan, 2020) for five Begonia species from nurseries in Bogor, Indonesia, (Rjosk et al., 2022) on four species of Begonia from Germany, and (Lailaty & Efendi, 2023) on *Begonia* spp. Section Platycentrum-Sphenanthera Group from Java and Sumatera, Indonesia.

Information about the anatomical characteristics of Begonia can be useful for taxonomical purposes, such as recognition and grouping of plants (Anam, 2021), and as a learning resource that provides valuable insights into plant development, defense mechanisms, and the ability to adapt to the environment (Kabir et al., 2024). Nowadays, studies of trichomes on Begonia ornamental plants, particularly in Ambon, Maluku Province, have never been carried out and reported. Hence, this research aims to reveal the characteristics of trichomes on the leaves of ornamental plants, Begonia spp, in Ambon. This research presents new findings of Begonia's trichomes characteristics, especially in Ambon. Hence, this result could be new knowledge and references for those who study Biology, such as students, teachers, and biologists. As well as for instance, and taxonomist who is interested in developing Begonia species, this information can be useful in studying or classifying begonias based on their trichome characteristics.

METHODS

Identification of plant species. The plant material used in this research was an ornamental Begonia plant, which was obtained by exploration, including the collection of plant material from ornamental plant nurseries in Ambon City and private collections. Identification of plant species, Latin name, and trade name was carried out by comparing the characteristics of sample plants with species that have been published, which were accessed online on the websites (https://www.dreamstime.com/photos-images/ begonia.html), http://www.plantsoftheworld online.org/ and (https://www.shutterstock. com/id/search/begonia).

Trichomes observation was conducted by collecting the three oldest leaves at the bottom of each plant (assuming that the old leaves had complete organ development, including the trichomes). The three leaves are three replicates. On each leaf blade, one piece was made with 1 x 1 cm in size. The leaf piece was then soaked in 70% alcohol. Preparations for observing trichomes were carried out using the whole mount method (Rahangmetan, et al., 2021). After being soaked, the leaf pieces were then taken out from the alcohol and transferred into a fixative solution, consisting of a mixture of 4% formaldehyde, 70% alcohol, and glacial acetic acid (90:5:5). The fixation process was carried out for three days. After the fixation, the fixative was removed and replaced with 5% NaOH solution for two days.

The next step was the remove the NaOH and replace it with 10% of commercial bleach solution until the leaf pieces become clear.

The next step was staining with 1% of Safranin in 70% of alcohol for one minute, then washed with 70% of alcohol. The leaf piece was then placed on a glass object that had been dripped with glycerin, covered with a cover glass, and observed under the microscope. Observations were made on the upper surface (adaxial side) of the leaf piece with 400x magnification using an Optilab camera of an Olympus light microscope (CX23) connected to the computer. Variables observed include type, number, and length of trichomes. Trichomes length was measured by using the measure feature of the Image Ruster® Software. Trichomes number and length were measured at 10 fields of view from three leaves of each plant.

Data analysis was conducted descriptively towards trichome anatomical data, including the shape and type of trichomes, and described based on the obtained figure, while the data on the length of trichomes was the average of 10 fields of view, from three replications, and displayed as mean ± standard deviation (mean ± SD).

RESULTS AND DISCUSSION

A total of 21 species of Begonia ornamental plants were used in this research, which were obtained from ornamental plant sales centres in Ambon and also private collections (Figure 1). In general, all of the Begonia species show variation in shape with asymmetrical leaf blades, which is the main characteristic of the Begoniaceae family. The leaves surface was rough and sharp, while the leaf blade and leaf stalk were varied in color and length.

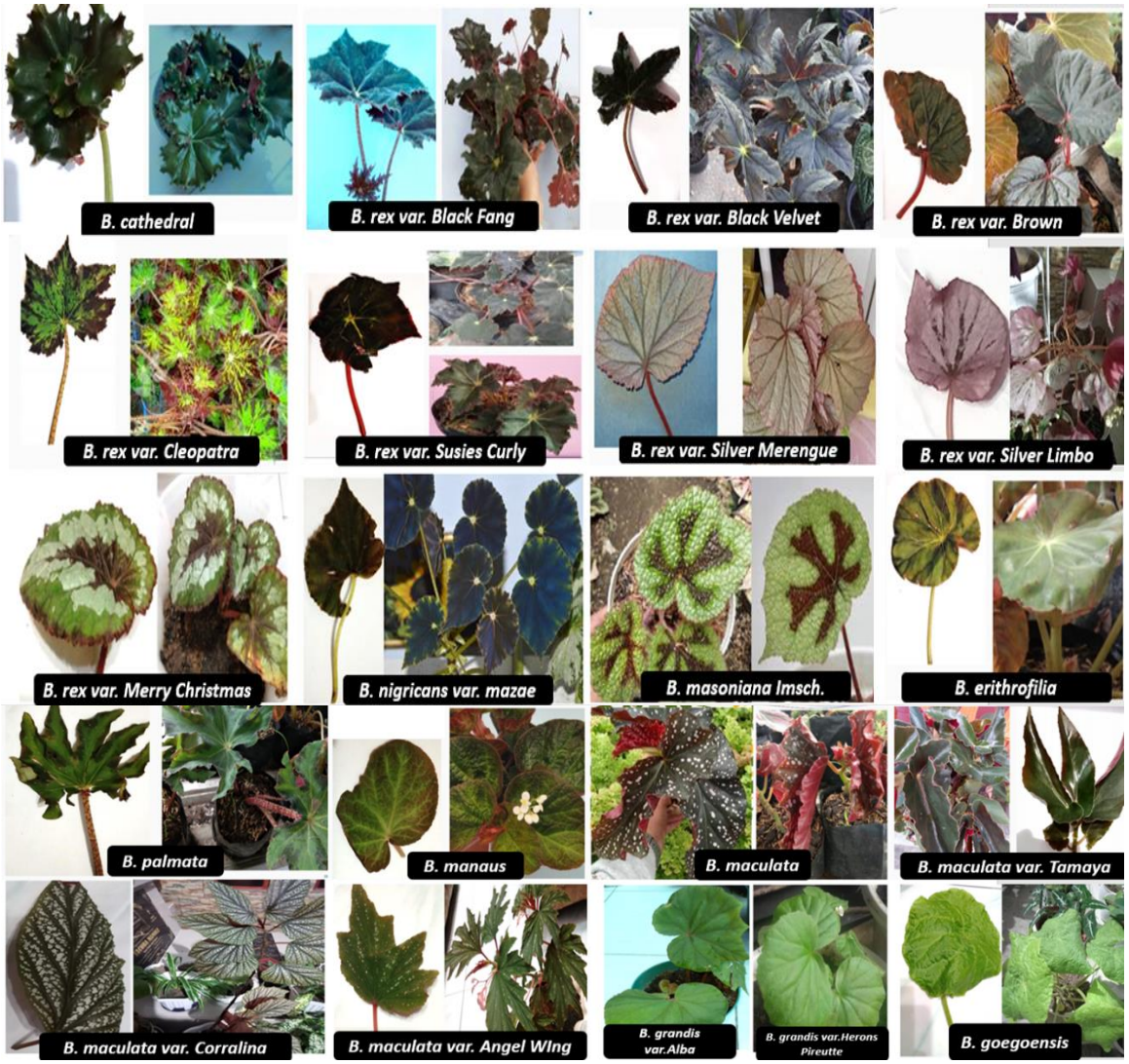

Figure 1. Leaf Morphological Variation of *Begonia* spp. in Ambon (Author Documentation)

Table 1. Morphological description of leaves of *Begonia* spp in Ambon (Author Documentation)

No.	Scientific and trade names of Begonia	Description
1.	*B. cathedral* (*curly Begonia)*	The upper leaves surface is dark green, while the lower surface is reddish. The leaves edges are wavy (curly). The surface is hairy. Leaf stalks are smooth and 10-15 cm in length
2.	*B. rex* var. *Black Fang* (star Begonia/ *black fang* begonia*)*	The upper surface of leaves is dark brown, and the lower surface is reddish. The shape of the leaf blade resembles a star, and the edge of the leaf is pointed. The surface of the leaves is rough and sharp. Leaf stalks are reddish, coarsely hairy, and sharp; 10-15 cm in length
3.	*B. rex* var. *Black Velvet* (star Begonia/ *black velvet Begonia*)	The upper surface of leaves is dark brown, and the lower surface is light brown. Leaf's blade shape is fingerlike, with tapered leaf tips. The surface of the leaves is hairy, rough, and sharp. Petioles are brown and hairy, with 10-15 cm in length
4.	*B. rex* var. Brown (Brown Begonia)	The color of the upper leaf surface is dark brown, while the lower surface is reddish. The shape of the leaf blade is asymmetrical, and the leaf edge is tapered. The surface of the leaves is hairy and sharp. Hairy leaf stalks with a reddish tint, Leaf stalk length between 10 and 15 cm.
5.	*B. rex* var. *Cleopatra* (Star Begonia/*Batik* Begonia)	The color of the upper surface of the leaves is a mixture of green and brown at the edges and brown spots in the middle of the leaf blade, the color of the lower surface of the leaves is green. The shape of the leaf blade is finger-shaped, and the leaf edge is grooved. The leaf surface is hairy. The leaf stalks are green with red spots, and hairy; Length 10-15 cm.
6.	*B. rex* var. *Susies Curly* (Begonia *black mamba*)	The color of the leaves upper surface is green, while the lower surface is reddish. The shape of the leaf blade is rounded, and the edge of the leaf is grooved. The surface of the leaves is hairy, rough, and sharp. The petiole is hairy, with a reddish color, and its length was 10-15 cm.
7.	*B. rex* var. *Silver Merengue* (Begonia silver)	The upper surface of the leaves is silver with a slight red tinge, and the lower is red. The shape of the leaf blade is asymmetrical, pinnate, and the leaf edge is serrated. The surface of the leaves is hairy, sharp, and rough. The leaf stalks are hairy, and red; 10-15 cm in length
8.	*B. rex* var. *Silver Limbo* (Begonia silver)	The upper surface of the leaves is silver with green on the leaf veins, the color of the lower surface of the leaves is red. The shape of the leaf blade is asymmetrical oval, the leaf edge is serrated. The surface of the leaves is hairy, sharp and rough. Petiole hairy, red; 10-15 cm long.
9.	*B. rex* var. *Merry Christmas* (Begonia christmas)	The upper surface of the leaves has 3 colors, green at the edges, and white in the middle, while the deepest part of the leaves is brown. The lower surface of the leaves is brown. The shape of the leaf blade is pinnate, and the leaf edge is serrated. The surface of the leaves is hairy and sharp. Petioles are red; length 5 cm.
10.	*B. nigricans* var. *Mazae* (Begonia mazae)	The color of the upper surface of the leaves is blackish brown with a few green spots on the sides, hairy, and sharp. The color of the lower surface is blackish brown. Leaf shape is asymmetrical oval, leaves edges are grooved. Leaf stalks are green and hairy and 10-15 cm long.
11.	*B. masoniana* Imsch. (*Finger-like Begonia /Begonia tapak macan/Begonia karpet*)	The color of the upper surface of the leaves is green with several brown grooves like fingers, so it is also called Finger Begonia, with finger tips like tiger paws, it is called Tiger Tread Begonia. The color of the lower surface of the leaves is green. The shape of the leaves is asymmetrical, oval with a pointed tip, and serrated leaf edges. The surface of the leaves is hairy, rough, and sharp. Hairy leaf stalks with a reddish tint; 10-15 cm long.
12.	*B. erithrofilia* (*Begonia mangkok*/Begonia *Beef Steak*)	The upper surface of leaves is green, and the lower is reddish. The leaf blade is rounded, and the edge is grooved. The leaf surface is hairy, with green leaf stalks and 10-15 cm in length.
13.	*B. palmata* (*Begonia jari-jari*)	The color of the upper surface of the leaves is green, and the color of the lower surface of the leaves is reddish. The shape of the leaf blade is rounded, and the edge of the leaf is grooved. The hairy surface of the leaves. Leaf stalks are green, hairy; 10-15 cm long.
14.	*B. manaus* (*Begonia daun kecil*)	The upper surface of leaves is green, and the lower is reddish. Leaf blade is ovally asymmetrical, the edge is grooved. Leaf surface is hairy, and sharp with green leaf stalks and 10-15 cm in length.
15.	*B. maculata* (*Begonia polkadot*)	The color of the upper surface of the leaves is green, and the color of the lower surface of the leaves is reddish. The shape of the leaves is asymmetrical, oval, and the edges of the leaves are grooved. The surface of the leaves is hairy and sharp. Leaf stalks are green, hairy; 10-15 cm long.
16.	*B. maculata* var. *Tamaya* (*Begonia polkadot polos*)	The color of the upper surface of the leaves is green, and the color of the lower surface of the leaves is reddish. The shape of the leaf blade is asymmetrical, pinnate, and the leaf edge is grooved. The surface of the leaves is hairy and smooth. Leaf stalk length is about 10-15 cm, hairy and red in color

17.	*B. maculata* var. *Corralina* (*Begonia coralina*)	The upper surface of the leaves is dark green, with thick white spots. The lower surface of the leaves is red. The shape of the leaf blade is pinnate, and the leaf edge is serrated. The surface of the leaves is rough. The leaf stalks are green, hairy, and about 5 cm long.
18.	*B. maculata* var. *Angel Wing* (*Begonia anting*)	The upper surface of the leaves is dark green, with thick white spots. The lower surface of the leaves is red. The shape of the leaf blade is finger-shaped, and the leaf edge is serrated. The surface of the leaves is rough, the petioles are red, hairy; length 5 cm.
19.	*B. grandis* var. *Alba* (Green Begonia)	The upper and lower surfaces of the leaves are green, the color of the leaf veins is reddish, the shape of the leaf blade is asymmetrical and pinnate, and the edges of the leaves are grooved. The surface of the leaves is hairy and sharp. Petiole is red and hairy,leaf stalks is about 10-15 cm.
20.	*B. grandis* var. *Herons Piroutte* (green Begonia)	The color of the upper and lower surfaces of the leaves is green, the color of the leaf veins is green, the shape of the leaf blade is asymmetrical pinnate, and the edges of the leaves are grooved. The surface of the leaves is hairy and sharp. The petiole is red and hairy, with 10-15 cm in length.
21.	*B. goegoensis* (Green begonia)	The upper and lower surfaces of the leaves are green, and the color of the leaf veins is green. The shape of the leaf blade is rounded, and the edge of the leaf is serrated. The surface of the leaves is hairy, sharp, and rough. Leaf stalks are green, hairy; 10-15 cm long.

The results of trichomes characterization of 21 Begonia plants species show that the structure was not quite different. In general, the structure of trichomes of Begonia ornamental plant in this study was multicellular trichomes (consisting of more than one cell) which were divided into two types, namely uniseriate and multiseriate types. This is in line with the statement which was proposed by Simpson (2019) that multicellular trichome comprises two types i.e uniseriate and multiseriate. Uniseriate type if there is only one vertical row, while if there is more than one row vertically cells are arranged, could be defined as multiseriate type. Trichome structure consists of the base, median or body, and tip (Figure 2). The base part is large and borders the epidermis on the surface of the leaf. Trichomes are embedded in the epidermal cells (Kabir et al., 2024). The middle to the tip is conical, with the number of cells decreasing from base to tip, allowing the appearance of a cone-like shape. The shape of the tip is different, some are thorn needle-shaped or slender hairs and some are hook-like (Figure 3). Multiseriate trichomes are multicellular epidermal hairs with more than one vertical row of cells with a thick basal part and gradually tend to be more conical towards the tip. They can be glandular or non-glandular. The number of cells at the tip is one or two cells. All trichomes of the Begonia ornamental plant in this study were non-glandular type, so there is no secret that could be produced (Table 2).

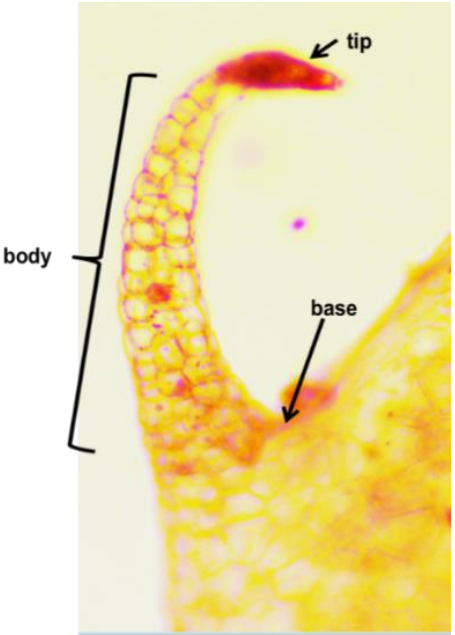

Figure 2. Trichome structure of ornamental plant *Begonia* spp (Author Documentation Olympus CX23, 400xMag.)

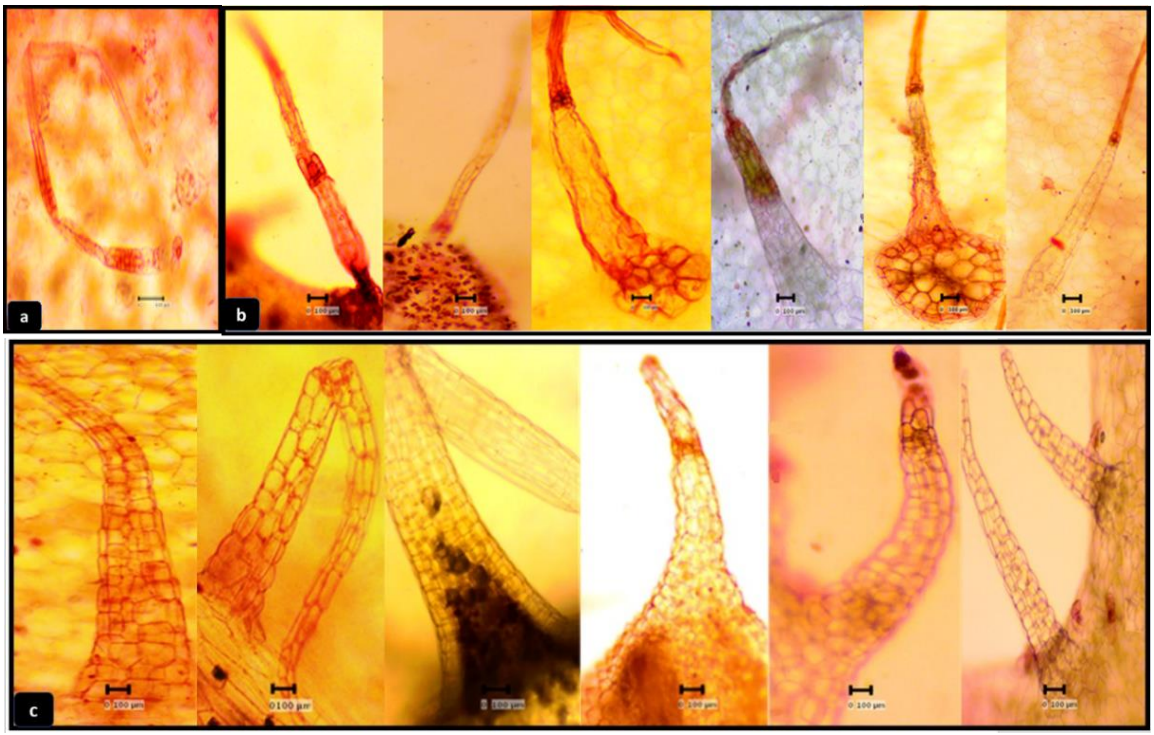

Figure 3. Variation of trichomes type and shape of the exotic plant *Begonia* spp in Ambon. (a) Uniseriate from base to tip, hairy shape, (b) multiseriate from base to median, uniseriate at the tip, needle-like tip and (c) multiseriate from base to tip, hook-like shape. (Author documentation by Olympus CX23, 400xMag.)

Table 2. Trichomes type and shape of ornamental Begonia in Ambon

Species	Trichome types	Trichomes shape
B. cathedral (Begonia *curly*)	Uniseriate	Hairy
B. rex var. *Black Fang*	Multiseriate at the base and median, uniseriate at the tip	Hairy shape, sharp tip like a needle,
B. rex var. *Black Velvet*	Multiseraite at the base and median, uniseriate at the tip	Hairy shape, tip shape like a hook
B. masoniana Imsch	Multiseriate from base to tip	Hairy shape, tip shape like a hook
B. rex Brown	Multiaseriate at the base and median, multiseriate from base to the tip, or uniseriate at the tip	Hairy shape, sharp tip like a needle sometimes hooked
B. rex var. *Cleopatra*	Multiaseriate at the base and median, multiseriate from base to the tip, or uniseriate at the tip	Hairy shape, sharp tip like a needle sometimes hooked
B. erithrofilia	Multiaseriate from base to median, multiseriate from base to the tip, or uniseriate at the tip	Hairy shape, sharp tip like a needle sometimes hooked
B. rex var. *Susies Curly*	Multiaseriate at the base and median, multiseriate from base to the tip, or uniseriate at the tip	Hairy shape, tip shape like a hook
B. nigricans var. *Mazae*		
B. palmata (Begonia jari-jari)	Multiseriate from base to tip	Hairy shape, sharp tip like a needle sometimes hooked
B. mannaus		
B. maculata	Multiaseriate from base to the tip	Hairy shape, tip shape like a hook
B. maculata var. *Tamaya*		
B. grandis var. *Alba*	Multiaseriate from base to the tip	Hairy shape, sharp tip like a needle sometimes and blunt
B. grandis var. *Herons Piroutte*	Multiseriate from base to the tip, Multiseriate at the *base*, and median, uniseraite at the tip	Hairy, sometimes like a needle

Species	Trichome types	Trichomes shape
B. rex var. *Silver Merengue*	Multiseriate from base to the tip	Hairy shape, tip shape like a hook
B. geogeoensis	Multiseriate from base to the tip	Hairy shape, tip shape like a hook
B. maculata var. *Corralina*		
B. rex var. *Silver Limbo*	Multiseriate from base to tip	Hairy shape, tip shape like a hook
Begonia maculata var. *Angel Wing*	Multiseriate from base to median, uniseriate at the tip	Hairy shape, tip shape like a hook
Begonia rex var. *Merry Christmas*	Multiseriate from base to tip, multiseriate at the base to median and uniseriate at the tip	Hairy shape, tip shape like a hook

Generally, trichomes of the same plant species tend to be similar in their structure, but in this research, trichomes type of Begonia was vary in types and shapes. One of the Begonia species may consist of two types of trichomes namely uniseriate and multiseriate. According to (Wang et al., 2021) that there are multiple interactions that can affect and regulate plant trichomes development including a complex molecular network, phytohormones, and environmental factors. (Kabir et al., 2024) explain that trichomes develop from precursor cells in the protoderm layer of the developing leaf primordia. The epidermal cells surrounding the trichomes continue to divide while the initial trichomes then separate from the epidermis. After the trichomes exit the mitotic cycle, they undergo endoreduplication four times. In the first stage of endoreduplication, the polarity of the trichome cells changes, and protrusions begin to appear on the surface. The formation of mature trichomes occurs in the fourth stage of endoreduplication where the trichome cells undergo expansion.

Based on their shape, the trichomes shape of Begonia plants resemble simple hairs like needles, with sharp, blunt or hooked tips. Multiseriate trichomes, sometimes multiseriate from base to tip or only at the base and body, the characteristics are wide at the base, pointed at the tip, straight or curved (hooked), with different numbers of cells at the basal (base), median and tip. At the basal part, there can be 7 to 15 cells, and it decreases towards the tip, leading only 1 cell at the tip. Uniseriate trichomes consist of only one cell from the basal to the tip. Apart from variations in shape and type, trichomes of Begonia also show variations in number and length. The average number of trichomes of the Begonia ornamental plants ranges from 1.0 – 1.63µm per field of view, while the average length of trichomes ranges from 40.97 – 233.47 µm (Table 3).

On the leaf surface, the number of trichomes can vary depending on the plant species and environmental factors. In some cases, when trichomes are fully developed, their number on the leaf remains relatively constant, however, in other cases, the number of trichomes can decrease during their expansion and development in response to external environmental conditions such as light, temperature, and humidity, or hormonal factors such as gibberellins, cytokinins, jasmonic acid, and stress responses. These specific factors and mechanisms can vary among different plant species (Kabir et al., 2024).

One of the most striking features of *Begonia* is the asymmetric shape of their leaves, there are also hairs on the surface of the stems and leaves. However, based on Tables 2 and 3, it turns out that there are types of Begonia species whose trichomes cannot be found, namely *B. nigricans* var. *Mazae, B. manaus, B. maculata* var. *Tamaya,* and *B. maculata* var. *Corralina*. These types of Begonia have different leaf morphology with a smooth leaf surface. Whereas Begonia with trichomes, the length was around 29.80µm (*B. cathedral*) to 233.47µm (*B. rex* var. *Black Velvet*). According to (Nawrath & Hachez, 2021), trichomes are hair-shaped epidermal derivatives found in plant organs such as roots, stems, leaves, flowers and fruit. Trichomes perform various protective functions through the synthesis, storage and secretion of certain toxic secondary metabolite compounds, thus protecting plants from herbiphores, pathogens, or from biotic and abiotic stresses (Watts and Kariyat 2021). Trichome morphology and density also affect several aspects of plant physiology and ecology by mediating interactions between plant and their environment. *In Arabidopsis plants attacked by herbivores, trichome densities can increase up to 500%, whereas plants without such attacks typically have around 20–40% of trichome densities (Kabir et al., 2024).*

Table 3. Average of trichomes number, and length of the ornamental plant *Begonia* spp. in Ambon

No.	Species	Average Number of Trichomes/field of view	Average Length of Trichomes (µm)
1.	*B. cathedral* (*Begonia curly*)	1.05 ± 0.24	29.80 ± 11.54
2.	*B. rex* var. *Black Fang*	1.3 ± 0.39	198.75±84.95
3.	*B. rex* var. *Black Velvet*	1.5 ± 0.36	233.47±17.67
4.	*B. masoniana* Imsch	1.3 ± 0.18	77.35 ± 9.62
5.	*B. rex Brown*	1.1 ± 0.20	48.28 ± 22.03
6.	*B. rex* var. *Cleopatra*	1.32 ± 0.33	67.65 ± 25.23
7.	*B. erithrofilia*	1.0 ± 0.32	54.02 ± 6.05
8.	*B. rex* var. *Susies Curly*	1.1 ± 0.06	46.70 ± 2.92
9.	*B. nigricans* var. *Mazae*	-	-
10.	*B. palmata* (*Begonia jari-jari*)	1.07 ± 0.09	47.71±7.75
11.	*B. mannaus*	-	-
12.	*B. maculata*	1.53 ± 0.34	73.03 ± 10.39
13.	*B. maculata* var. *Tamaya*	-	-
14.	*B. grandis* var. *Alba*	1.24 ± 0.49	40.97 ± 7.89
15.	*B. grandis* var. *Herons Piroutte*	1.12 ± 0.12	62.80 ± 16.75
16.	*B. rex* var. *Silver Merengue*	1.63 ± 0.38	66.26 ± 8.09
17.	*B. geogeoensis*	1.14 ± 0.12	78.60 ± 4.39
18.	*B. maculata* var. *Corralina*	-	-
19.	*B. rex* var. *Silver Limbo*	1.36 ± 0.27	36.66 ±5.25
20.	*B. maculata* var. *Angel Wing*	1. 2 ± 0.33	69.17±11.03
21.	*B. rex* var. *Merry Christmas*	1.52 ± 0.29	64.92 ± 9.77

Research on the anatomical structure of trichomes, especially from Begonia species, has not been widely studied and is not well documented. Therefore, this study is the only recent result regarding the trichomes structure of Begonia, especially in Ambon city. Hence, this study is expected to be a source of reference and enrich the knowledge of students and teachers in studying trichomes in biology lessons both in schools and universities. In addition, for taxonomists and those who want to develop further about Begonia, the results of this study can also be a reference, especially in classifying Begonia specifically based on the trichomes characteristics.

CONCLUSION

It can be concluded that the trichomes structure of the Begonia ornamental plant consists of 3 parts, namely the base, body and tip. The types of trichomes on begonia ornamental plants are multicellular trichomes which are divided into uniseriate and multiseriate and all of them are non-glandular. The average number of trichomes is one, with the length ranging from 29.80µm to 233.47µm. Further investigation can be conducted including the ability of plant to adapt to specific climates, growing media, fertilization, irrigation, cultivation, and as well as adaptation to pathogens, whereas all of these variables must be related to the presence of trichomes in begonia plants, and expected to increase economic value of Begonia as an ornamental plants.

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