



Morphological Diversity of Double Petal Telang (*Clitoria ternatea* L.) in Several Flower Colors

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ABSTRACT

Telang is a plant that grows wild and is cultivated by the people of Indonesia. Telang flowers originate from Ternate Island, Maluku, Indonesia. The most widely used part of Telang, especially in food coloring, is the flower, where Telang flowers can produce a blue color. This study aims to assess the diversity of four types of double-petal Telang flowers based on plant morphology. This study used a Non-Factorial Randomized Group Design (RAK) with treatments in 4 colors of double-petal Telang flowers. The number of replications required was 5 replications, so there were 20 experimental blocks, each experimental block was planted with 3 plants, the number of samples taken from each experimental block was 2 plants and 3 flower samples were taken from each plant. Morphological observations were made directly in the field; the morphological characters observed included varieties and generative. For each color 10 plants were selected. The results of this study show that some types of Telang showed good growth, such as plant height, and then, for the generative period, no significant difference was produced between the types of Telang. Some of the morphology of leaves and flowers have visible similarities. This study's conclusion is based on observing vegetative, generative, and morphological characters of several types of Telang. The observations found that in the vegetative period, some Telang tended to grow fast, but the purple and blue Telang had the highest plant height. Then, in the generative period, the average observation of several types of Telang was not significantly different. The morphology of Telang itself also still has similarities, such as leaf morphology and Telang flowers.

Keywords: *Flower color, Phenotypic diversity, Plant Telang*

1. INTRODUCTION

The Telang flower is extensively grown by the community due to its numerous health benefits. These include its use as a natural coloring agent for soft drinks (Unawahi et al., 2022), its antibacterial properties (Rizkawati et al., 2023), its role as a natural antioxidant (Handito et al., 2022), and its consumption as a natural drink commonly referred to as Telang tea. While the blue Telang flower, classified as a single-petal, is the most popular and widely cultivated variety, there are also double-petal Telang plants. However, the double-petal Telang information is not as widely disseminated among the public.

The Telang plant, scientifically known as *Clitoria ternatea*, is a tropical plant recognized for its vibrant blue flowers and significance in traditional medicine and natural dye production. Hailing from Southeast Asia, this plant exhibits a remarkable ability to thrive in diverse environmental settings. Telang thrives in warm climates with well-drained, fertile soil and can be spotted in regions ranging from lowlands to moderate elevations (Azam-Ali & Squire, 2002). Its range spans Asia, Africa, Australia, the Americas, various parts of Europe and the Pacific islands. This extensive distribution underscores the potential of the butterfly pea plant in numerous agricultural and medicinal contexts, underscoring its importance for further exploration into its applications and cultivation under varying environmental conditions (Barik et al., 2007)..

The term "morphology" in the field of linguistics is derived from the Greek words "morphe" meaning "form" and "logos" meaning "study" or "science". Morphology is the branch of linguistics that focuses on the structure and formation of words in a language. It examines the internal structure of words, including their roots, prefixes, and suffixes, to understand how words are

formed and convey meaning (Widiya et al., 2019).

Telang flower (*Clitoria ternatea* L) is classified under the leguminosae family, as Aziza et al. (2021) indicated. This plant thrives in tropical and subtropical regions. Double petals on Telang flower plants, which exhibit variations in the keel and wings, serve as a distinguishing feature used to analyze relationships within populations. Double-petal flowers possess distinct characteristics compared to single-petal Telang flowers. Single-petal flowers typically showcase papilionaceous (butterfly-shaped) flowers with Diadelphous stamens, whereas double-petal flowers lack papilionaceous flowers and instead have 10 free stamens. The genetic variation responsible for the difference between double-petaled and single-petaled Telang flowers is attributed to dominant gene mutations. Nevertheless, double-petal plants are known for their reduced pollen fertility and challenges in pod formation.

The Telang flowers' morphological characteristics can serve as a valuable tool in assessing the diversity and interrelationships of plants during the initial stages of breeding. Phenotype refers to the observable traits resulting from genetic factors, environmental conditions, and the interactions between genetics and the environment. The observed phenotype of a plant can be categorized into two types: quantitative traits, which can be measured, and qualitative traits, which cannot be measured. In the case of double-petal Telang flowers, there are four distinct colors: white, purple, blue, and light blue. Given the presence of these four colors, examining the variations in Telang plant morphology based on flower color becomes necessary. To establish genetic relationships, it is essential to conduct genetic similarity tests within and between populations. However, it is important to acknowledge that this research may have limitations due to

environmental influences (Maskromo et al., 2016). This study aims to investigate the diversity of the four types of double-petal Telang flowers based on plant morphology.

2. MATERIAL AND METHODS

The study was conducted in Simpang Mangga Bawah, Rantauprapat, North Sumatra, with geographical coordinates of approximately 2.0864361° North Latitude and 99.8467171° East Longitude, spanning from January to March 2024. Butterfly pea plants with varying flower colors, such as white, light blue, blue, and purple, were utilized as materials in this investigation. A non-factorial randomized block design (RAK)

was employed, with treatments consisting of different colors of double petal Telang flowers T1 (purple), T2 (white), T3 (light blue), T4 (blue), and a total of 5 replications resulting in 20 experimental units. Parameters assessed in this study encompassed plant height, flower weight, flower length, flower width, number of petals, and the morphology of various Telang plant types, leaf shape, leaf color, flower shape, and flower color.

Observational data was tested statistically using ANOVA (analysis of variance). If there are significant differences in the observed characters, they will be tested further using Duncan's multiple range test (DMRT) at the 5% level.

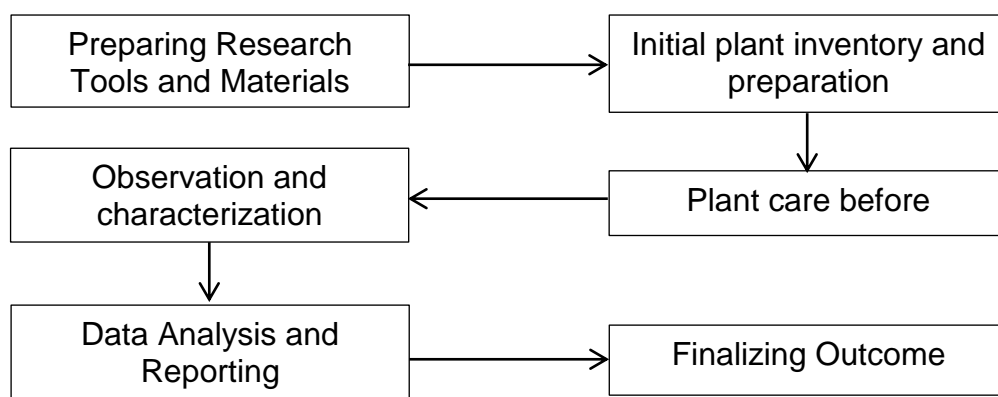


Figure 1. Research flow diagram

3. RESULT AND DISCUSSION

3.1 Morphology of Telang Plants

According to Zahara (2022), the study's findings indicate that Telang leaves are compound leaves arranged in pairs, pinnate in structure, oblong in shape, hairy on the lower surface, and green in color, with elongated stems. In the purple Telang (T1), the leaves are dark green with a high-intensity dark leaf color. These leaves have a rounded tip and an oval-lanceolate or nearly circular shape. Conversely, in the white butterfly pea (T2), the leaves display a bright light green color with a high intensity of bright leaf color. The leaves in this variety have rounded tips and an oval shape. In the light blue Telang (T3), the green leaf

color is typically bright with a light-intensity of leaf color. The leaves have a tip that is sharp but tends to be blunt, and the shape of the leaf is oval. On the other hand, in the blue Telang (T4), the leaves are dark green with a high-intensity of dark leaf color. These leaves have a blunt tip and an imperfectly round shape. The leaf morphology of various Telang plant types is illustrated in Figure 2 & 3.

Leaf growth starts from the tip of the leaf stalk. The leaves of the Telang plant are pinnately bony. It is called pinnate because the leaves have one central vein. Each stalk of the butterfly pea plant has an average of 5 leaves. The characteristic of Telang leaves is that

they have a glabrous upper surface and a hairy underside.



Figure 2. Leaf Shape



Figure 3. Leaf Color

3.2 Morphology of Telang Plant Flowers

Telang flowers exhibit concealed stamens and pistils, showcasing diverse colors, including blue, light blue, light purple, and white. The Telang flower, on the other hand, is characterized as a single cupped monosymmetrical flower with either five or three attached petals (Zahara, 2022). For this particular investigation, purple (T1), white (T2), light blue (T3), and blue (T4) Telang flowers were utilized. Upon careful observation, it was determined that the purple butterfly

pea flowers were the smallest, while the light blue and white variants were of medium size, and the blue flowers were the largest. The flower morphology of various Telang plant types is visually depicted in Figure 4.

The characteristic of the Telang flower in this study is that it has 5 flower petals. The shape of the flower is a dichasium, or inverted umbrella child, a bordered compound flower (inflorescentia centrifuga), with two opposite branches emerging from the mother leaf stalk.



Figure 4. Telang Flower

3.3 Plant Height

The results showed that the purple butterfly pea flower (T1) was the plant with the highest average at 2 WAP of 8.10 cm and 4 WAP of 13.20 cm. In the study, the T3 Telang plant type exhibited the tallest height of 21.60 cm at 6 WAP, while the T4 Telang plant type surpassed it with a height of 37 cm at 8 WAP (Table 1). Each Telang plant type displayed distinct growth patterns in terms of plant height. Initially, T1 showed an increasing

growth rate, but growth slowed down at 6 WAP. On the other hand, T4 started with slower growth compared to other Telang types but eventually showed the highest plant height. The research site was shaded to ensure optimal light intensity, as Sobari et al. (2012) suggested that shade intensity can impact vegetative traits such as plant height. This study focused on identifying the genotype with the best plant height performance.

Table 1. The average height of Telang plants

Treatment	2WAP	4WAP	6WAP	8WAP
T1	8,10a	13,20a	21,20a	36,20a
T2	7,00ab	11,60a	20,00a	34,42a
T3	6,68ab	12,60a	21,60a	35,80a
T4	5,82b	11,40a	21,20a	37,00a

Note: Numbers in each column that are different and followed by the same letter indicate that they are not significantly different based on the 5% DMRT follow-up test.

3.4 Telang Flower Character

The characteristics of double Telang flowers that were observed included flower weight, flower length, flower width and number of petals. The analysis of variance showed that several types of Telang plants did not differ significantly in flower weight, flower length, flower width and number of petals. The results of the quantitative characters can be seen in detail in Table 2.

According to the data presented in Table 2, it is evident that the most significant weight of flowers was obtained from the blue Telang variety (T4), precisely measuring 0.77 g. This weight was not significantly different from the other Telang varieties. Similarly, the

longest flower length was observed in the Blue Telang (T4) variety, measuring 4.04 cm, which was not significantly different from the other Telang varieties. On the other hand, the widest flowers were produced by the white Telang (T2) and light blue Telang (T3) varieties, measuring 3.06 cm. These measurements were not significantly different from the purple Telang (T1) and blue Telang (T4) varieties. Furthermore, the highest number of petals was found in the purple (T1) and white (T2) sea cucumbers, measuring 4.80 cm, which was not significantly different from the light blue (T3) and blue (T4) sea cucumbers.

Table 2. Average quantitative characters of Telang plants

Treatment	Flower Weight	Flower Length	Flower Width	Total Petal
T1	0,61a	4,00a	2,88a	4,80a
T2	0,73a	4,00a	3,06a	4,80a
T3	0,76a	3,96a	3,06a	4,60a
T4	0,77a	4,04a	2,86a	4,60a

Note: Numbers in each column that are different and followed by the same letter indicate that they are not significantly different based on the 5% DMRT follow-up test.

4. CONCLUSION

The primary objective of this study is to examine the vegetative, generative, and morphological traits of various Telang species. The findings indicate that certain Telang species exhibit rapid growth during the vegetative phase, with purple and blue Telangs displaying the greatest plant height. However, no significant variations were observed among Telang species during the generative phase. Furthermore, the morphology of Telang remains consistent, particularly in leaf and flower structure.

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