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# Morpho-Anatomical Structure and DNA Extract of Sun and Shade Leaves of Jute (*Corchorus capsularis L.)*

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**Abstract:** A study on the comparison of morpho-anatomical structure and DNA extract of sun and shade leaves of jute (*Corchorus capsularis* L.) was done. Morphological structure of exposed the *Corchorus capsularis* are taller, leaves are lighter, thicker, bigger and broader than shaded. Anatomical form of exposed jute have many stomata on the leaf, two layered palisade and compact spongy layer of leaf lamina, compact cells of the mesophyll of midrib, compact parenchyma cells of the cortex of the stem, and larger vacuole in the pith of the stem. While shaded jute has less stomata on the leaf, one layered palisade and loosely arranged cells in the spongy layer of leaf lamina, loosely arranged cells of the mesophyll of midrib, loosely arranged parenchyma cells of the cortex of the stem, and small vacuole in the pith of the stem. In terms of DNA extract, exposed leaves of jute (*Corchorus capsularis* L.) has more DNA extract than that of the shaded leaves. Thus, morpho-anatomical structure and DNA extract of exposed and shaded jute (Corchorus capsularis L.) differ.

**Keywords:** Jute, DNA Extract, Stomata, Mesophyll, Parenchyma, Palisade, Morpho-Anatomical Structure

## 1. Introduction

Light is one of the most important environmental factors, acting on plants not only as the sole source of energy, but also as the source of external information, affecting their growth and development. Shade leaves exhibit a number of traits that makes them quite distinct from leaves that are exposed to full sunlight. In the sun leaves significantly higher rates of photosynthesis, photorespiration and dark respiration, and also photosynthetic $CO_2$ fixation capacity, photosynthetic productivity, and saturating, adaptation and compensating irradiances were found. Specific leaf mass, mean leaf area, stomata density and size as well as the chlorophyll content per unit dry mass were also significantly different in both types of the leaves. Higher photosynthetic efficiency in the shade leaves allows them a better utilization of the lower irradiance for carbon dioxide uptake (Masarovicová, E. and L. štefančík. 1990).

Saluyot (*Corchoruscapsularis L.*), also known as jute, is a green leafy vegetable that is rich in calcium, phosphorus, iron and potassium. It has also been determined that 100 grams of saluyot contains an ample amount of Vitamin A, thiamine, riboflavin, ascorbic acid, and is also rich in fiber. With these facts alone, we can appreciate the benefits that can be derived from eating and incorporating saluyot in one's diet. This vegetable also assures safety of intake even for pregnant mothers. Unlike other plants with medicinal benefits like makabuhay, it is safe to be eaten even by those which are medically considered to be in a weak state. Saluyot can be found basically everywhere. From warm, tropical countries like the Philippines to tropical deserts and wet forest zones, saluyot is abundant. It does not require much attention and care, and thus, thrives without cultivation the whole year round (Philippine Herbal Medicine, 2010).

Thus, a study that would give information on the differences of morpho-anatomical structure of plants exposed under the sunlight or/and in shaded areas will be conducted. This would also answer the differences in the data gathered on DNA extraction of the same plants. Furthermore, this simple and practical study would be useful to biology teachers, for instruction, especially in discovering DNA fragments of plants

Objectives of the Study

This study is intended to compare the morpho-anatomical structure and DNA extract of sun and shade leaves of jute (*Corchorus capsularis L.)*. Specifically it aimed to:

1. Compare the morphology and anatomy of sun and shade jute (Corchorus capsularis L.) plant.

a) Plant height
b) Leaf
c) Stem

2. Compare the amount of chlorophyll DNA extracted from sun and shade leaf.

# 2. Methodology

### *2.1. Collection of Materials*

Sun and shade jute (*Corchorus capsularis L.)* leaves was collected from Doroluman, Arakan, Cotabato. From this leaves, free hand sectioning and extraction was done. A section was used for anatomical data and extracts for Modified Plant DNA Kitchen extraction.

### *2.2. Free Hand Sections*

Free hand sectioning was done on the leaves of sun and shade jute (*Corchorus capsularis L.).*

### *2.3. Modified Plant DNA Kitchen Extraction*

One half (1/2) cup of jute leaves was pounded using clean mortar and pestle. About 100 ml of the extract was obtained (source of DNA) by squeezing the pounded jute leaves using clean cheesecloth (cacha). Then, about 1/8 tsp (less than 1 ml) table salt and 1 cup (200 ml) cold distilled water was added to the extract. It was stirred until completely mixed. The mixture was poured into a measuring cup with 2 tablespoon (30 ml.) liquid detergent. It was mixed by swirling the mixture. The mixture was set aside for 5 to 10 minutes (or longer). The mixture was poured into a test tube about 1/3 full. A pinch of meat tenderizer was added and stirred gently. Test tube was tilted and rubbing alcohol (preferable ethyl alcohol) was poured slowly down the side until the same amount of alcohol and tissue mixture was poured. Wooden stick or hook was used to collect DNA strand (Whitish) in the alcohol layer (SEP 2010).

# 3. Results and Discussion

### *3.1. Morphological Difference*

Figure 1 and table 1 present the morphological differences of jute (*Corchorus capsularis L.)* exposed to the sunlight and shaded. Table 1 shows the morphological differences of jute (*Corchorus capsularis L.)* exposed to the sunlight and shaded. It was observed that exposed jute (*Corchorus capsularis L.)*are taller than shaded with a mean plant height of 130.3 cm and 96.2 cm, respectively. In terms of its leaf size, exposed leaf of jute (*Corchorus capsularis L.)* is bigger, with the mean length of 8.09 cm, than shaded leaf with the mean length of 6.55 cm. Width of the jute (*Corchorus capsularis L.)* leaf in exposed and shaded also differ with the mean width of 4.14 cm and 5.47 cm, respectively.

***Table 1.*** *Morphological differences of jute (Corchoruscapsularis L.) exposed the sunlight and shaded.*

| Characters | Exposed | Shaded |
|---|---|---|
| Plant height (cm) | 130.3 | 96.2 |
| Leaf size | | |
| Length | 8.09 | 6.55 |
| Width | 4.14 | 5.47 |

Figure 1 shows the leaves of jute (*Corchorus capsularis L.)* exposed to the sunlight and shaded. Leaves exposed to the sunlight are lighter and thicker than leaves in the shaded.

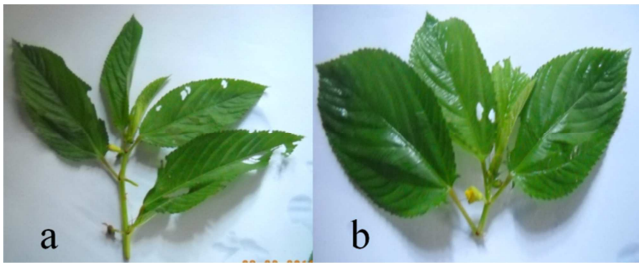


***Figure 1.*** *Leaves of jute (Corchorus capsularis L.) exposed (a) to the sunlight and shaded (b).*

Results observed in figure 1 and table 1 was supported by Holley (2009). He stated that aside from the effect of light through photosynthesis, light influences the growth of individual organs or of the entire plant in less direct ways. The most striking effect can be seen between a plant grown in normal light and the same kind of plant grown in total darkness. The leaves of plant grown in sunny fail to expand, and both leaves and stem, lacking chlorophyll, are pale yellow. Such a plant is said to be *etiolated.* Plants grown in shade, on the other hand, instead of darkness show a different response. Moderate shading tends to reduce transpiration more than it does photosynthesis. Hence, shaded plants may be have larger leaves because the water supply within the growing tissues is better. With heavier shading, photosynthesis is reduced to an even greater degree and small, weak plants result. Moreover, Hanson (1917 In: Lambers et al., 1998) stated that the increased thickness in sunny leaf is largely due to the formation of longer palisade cells in the mesophyll and, in species that have this capacity, the development of multiple palisade layers in sun leaves. In addition, according to Adamson et al. (1991 In: Paiva et al., 2003), leaf development of *Tradescantia albiflora* was seriously influenced by the light. Leaves produced under high luminosity were reduced in size, thicker and presented a low chlorophyll content than leaves produced in moderate shade. Also, in full sunlight, *T. albiflora* presented the ability reduce its light-harvesting potential, which is a feature of most shade plants. In contrast, study of Buisson and Lee (1993 In: Paiva et al., 2003) with *Carica papaya*, showed that the leaves of plants kept under shade conditions were thinner and with reduced specific leaf mass in comparison to those kept under sunny conditions.

### *3.2. Anatomical Differences*

Figures 1 to 5 and table 2 presents the anatomical

differences of jute (*Corchorus capsularis L.)* leaves and stems exposed to the sunlight and shaded. Figure 2 shows the stomata in the epidermal peel of jute (*Corchorus capsularis L.)* exposed and shaded leaf. It is shown in the figure that there are many stomata in the exposed leaf than in the shaded. This is supported by the data in table 2.

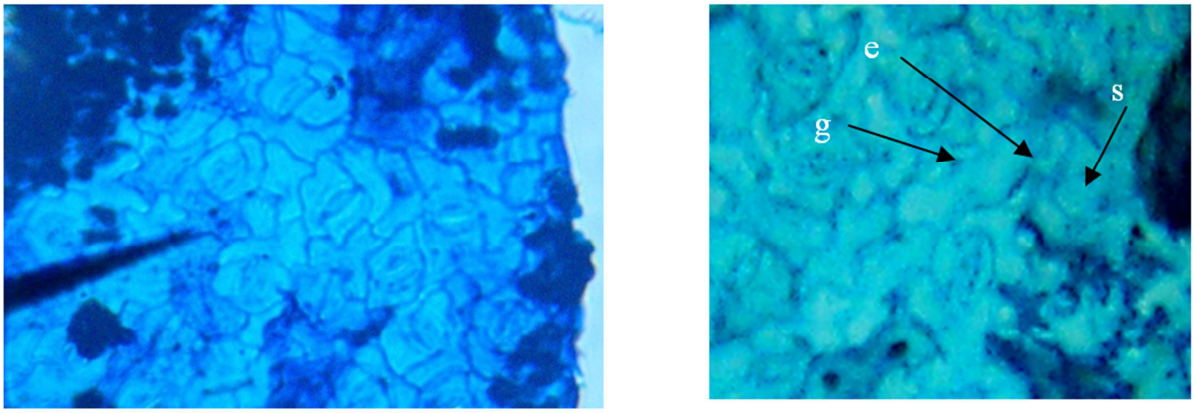


***Figure 2.*** *Stomata in the epidermal peel of jute (Corchoruscapsularis L.) leaf in exposed (a) to the sunlight and shaded (b). Ec – epidermal cells, gc – guard cell, sp – stomatal pore.400x.*

Table 2 presents the number of stomata in the epidermal peel of jute (*Corchoruscapsularis L.)* exposed and shaded leaf. The table shows that there are 22 stomata in the exposed leaf as viewed under the high power objective of the compound microscope and 10 stomata in the shaded leaf of jute (*Corchorus capsularis L.)*.

***Table 2.*** *Number of stomata in the epidermal peel of (Corchorus capsularis L.) exposed and shaded leaf.*

| Characters | Exposed | Shaded |
|---|---|---|
| Number of stomata | 22 | 10 |

Figure 3 shows the cross section of exposed and shaded lamina of jute (*Corchorus capsularis L.)* leaves. It shown in the figure that the palisade layer of the mesophyll cells in exposed leaf is 2 layered while shaded leaf has 1 layer of palisade cells. Also, cells in the spongy layer of exposed leaves of jute are compact while cells of the spongy layer of shaded leaf are loosely arranged.

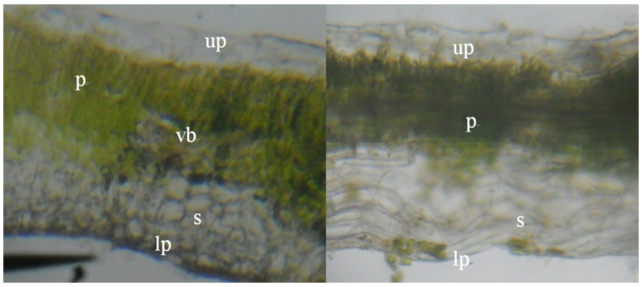


***Figure 3.*** *Cross section of jute lamina exposed (a) to the sunlight and shaded (b). up – upper epidermis, lp – lower epidermis, p – palisade layer, s – spongy layer, vb – vascular bundles.400x.*

Figure 4 shows the cross section of exposed and shaded midrib of jute (*Corchorus capsularis L.)* leaves. It shown in the figure that the mesophyll cells of exposed leaf is compact than that of the shaded leaf.

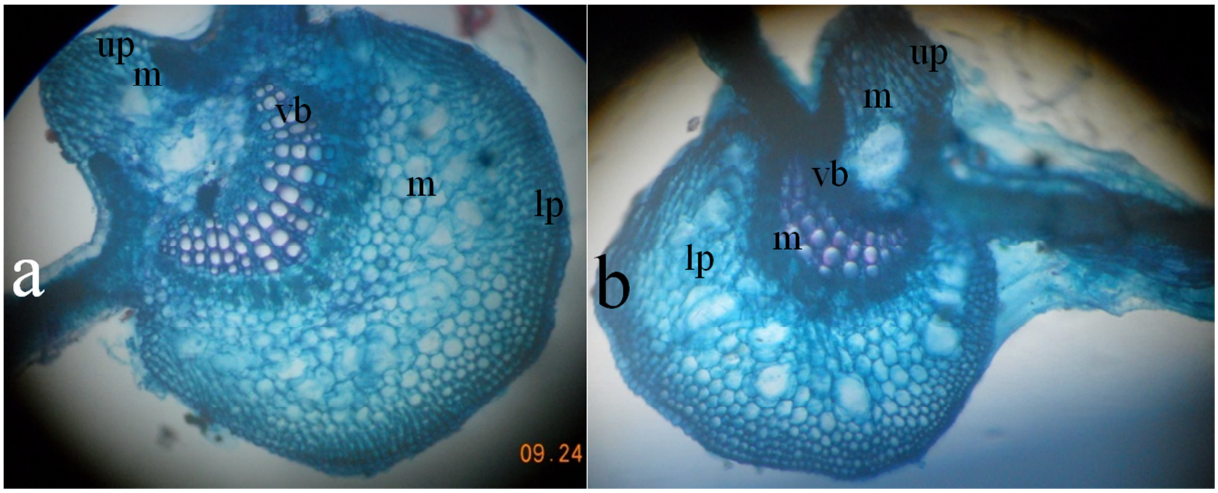


***Figure 4.*** *Cross section of exposed (a) and shaded (b) midrib of jute (Corchorus capsularis L.) leaves. up – upper epidermis, lp – lower epidermis, m – mesophyll, vb – vascular bundles.400x.*

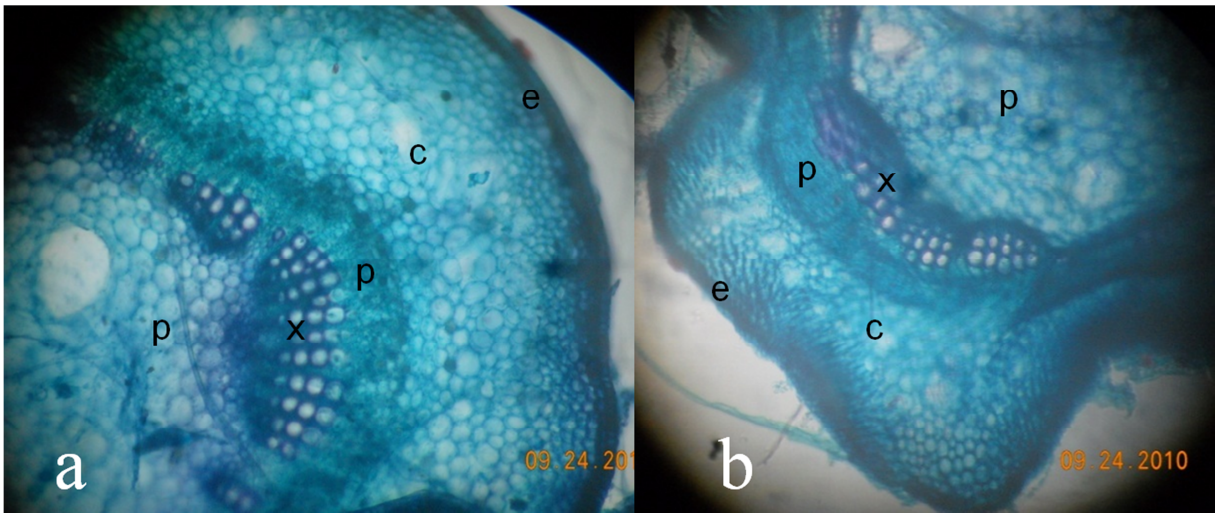


***Figure 5.*** *Cross section of exposed (a) and shaded (b) stem of jute (Corchoruscapsularis L.) showing collateral vascular bundle.e –epidermis, c – cortex, p – phloem,, x – xylem, p – pith.400x.*

Figure 5 shows the cross section of exposed and shaded stem of jute (*Corchorus capsularis L.)*. It is shown in the figure that the cells of the cortex is compact in exposed than in the shaded plant. In addition, large vacuole is found in the pith of exposed while small vacuole in the shaded.

The result in figure 2 and 5 and table 2 is in accordance with Morais et.al. 2004 findings that leaves under dense shade presented a mesophyll with smaller volume but with large intercellular spaces; and epidermis with thicker cells and smaller stomata amount. Also, Lambers, et al. (1998) reported that there are fewer chloroplasts per unit area in shade leaves as compared with sun leaves due to the reduced thickness of mesophyll. Furthermore, leaves exposed to high light intensities, generally present an increase in the number of cell layers in palisade parenchyma, and consequently in mesophyll thickness (Kubínová 1991 In:Paiva, E. A. S., et al., 2003).

In addition, the difference in the number of stomata in exposed and shaded leaves is due to the need of reactants in photosynthesis. One of the reactants of photosynthesis is carbon dioxide which enters into the stomata. Since exposed leaf has more chloroplast due to the thickness of its palisade layer, then it needs carbon dioxide, thus more stomata are found in the exposed than in the shaded.

### *3.3. DNA Extract*

Figure 6 shows the DNA extract of exposed and shaded jute (*Corchorus capsularis L.)* leaves. It is observed that exposed leaves of jute (*Corchorus capsularis L.)* has more DNA extract than that of the shaded leaves.

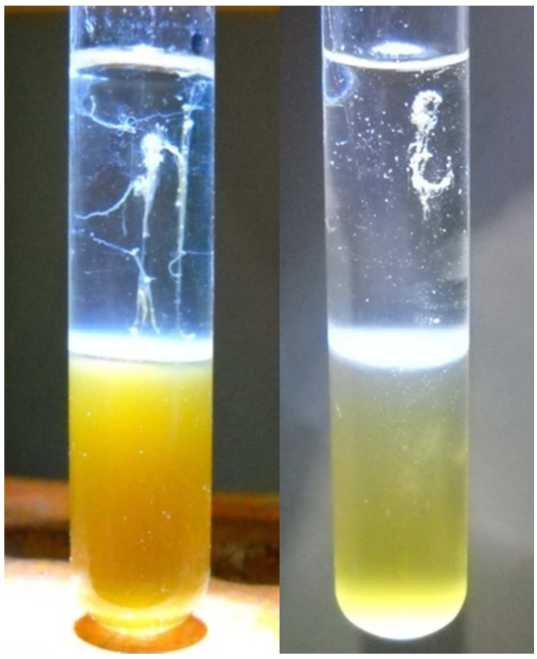

***Figure 6.*** *Chlorophyll DNA extract of exposed (a) and shaded (b) jute (Corchoruscapsularis L.) leaves.*

Exposed leaf to sunlight has thicker leaves which provide space for more chloroplast per unit leaf area and higher values of net photosynthesis (Morais et.al, 2004). Thus more DNA extract is being obtained through the modified plant DNA kitchen extraction. In addition, Lambers et al. (1998) reported that the ultrastructure of the chloroplasts of sun and shade leaves showed distinct differences. Shade chloroplasts have a smaller volume of stroma, where the Calvin-cycle enzymes are located but larger grana, which contain the major part of the chlorophyll. Such differences are found both between plants grown under different light conditions and between un and shade leaves on a single plant, a well as when comparing chloroplast from the upper and lower side of one, relatively thick, leaf of Scheffleraarboricola.

In contrast Adamson et al. (1991 In: Paiva, E. A. S., et al., 2003) stated that leaves produced under high luminosity were reduced in size, thicker and presented low chlorophyll content than leaves produced in moderate shade. Also, in full sunlight, *T. albiflora* presented the ability reduce its light-harvesting potential, which is a feature of most shade plants.

# 4. Conclusion

A study on the comparison of morpho-anatomical structure and DNA extract of sun and shade leaves of jute (*Corchorus capsularis L.)* revealed the following result for morphological differences: Exposed jute (*Corchorus capsularis L.)* are taller than shaded with a mean plant height of 130.3 cm and 96.2 cm, respectively. Leaf length of exposed jute (*Corchorus capsularis L.)* is bigger, with the mean of 8.09 cm, than shaded with the mean length of 6.55 cm. Leaf width of exposed jute (*Corchorus capsularis L.)* and shaded differ with the mean of 4.14 cm and 5.47 cm, respectively. Leaves exposed to the sunlight are lighter and thicker than leaves that are in the shaded.

Anatomical differences of jute (*Corchorus capsularis L.)* leaves and stems exposed to the sunlight and shaded are the following: Many stomata are observed in the exposed leaf than in the shaded with 22 and 10 stomata, respectively. Palisade layer of the mesophyll in exposed leaf is 2 layered while shaded leaf has only 1 layer. Cells in the spongy layer of exposed leaves are compact while in shaded leaf it is loosely arranged. Cells of the mesophyll of exposed midrib is compact than that of the shaded leaf. Parenchyma cells of the cortex of the stem is compact in exposed than in the shaded plant. In addition, large vacuole is found in the pith of exposed while small vacuole in the shaded.

DNA extract of jute (*Corchorus capsularis L.)* leaves in exposed to the sunlight and shaded differ. Exposed leaves of jute (*Corchorus capsularis L.)* has more DNA extract than that of the shaded leaves

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