



Click here and write your Article Category

## Leaf Morphology of Brazilian Spinach (*Alternanthera sissoo*) as a Backyard Vegetable

Hikma Ellya<sup>a\*</sup>, Nurlaila<sup>a</sup>, Nukhak Nufita sari<sup>a</sup>, Rila Rahma Apriani<sup>a</sup>, Ronny Mulyawan<sup>a</sup>, Bakti nur Ismuhajarah<sup>b</sup>

<sup>a</sup> Department of Agroecotechnology, Agricultural Faculty, Lambung Mangkurat University, Banjarbaru, 70714, Indonesia

<sup>b</sup> Department of Agronomy, Agricultural Faculty, Lambung Mangkurat University, Banjarbaru, 70714, Indonesia

### ARTICLE INFORMATION

#### Article history:

Received 05 February 2021

Revised: 20 March 2021

Available online: 1 April 2021

#### Keywords:

backyard, botanical, Brazilian spinach

#### Correspondence:

Phone: +62 813 5112 7671

E-mail: hikma.ellya@ulm.ac.id

### A B S T R A C T

The utilization of backyard gardens to fulfil family food by the Indonesian people needs to be developed, along with fulfilling nutrition during the Covid-19 pandemic. One of the plants that have the potential to grown is Brazilian spinach (*Alternanthera sissoo*). References on the morphology of Brazilian spinach are still limited, so it is necessary to observe the plant organs. This study aims to determine the leaf morphology of Brazilian spinach as vegetables in backyard gardens. Morphological observations of this spinach leaves were carried out visually at the Integrated Laboratory of the Agroecotechnology Department, Faculty of Agriculture, Lambung Mangkurat University, in August 2020. The results showed that Brazilian spinach has a herbaceous with a simple leaf in a deltoide shape (*deltoideus*). It has tapered leaf tips (*acuminatus*); acuminate leaf base (*acuminatus*); wavy leaf margin (*repandus*); and simple palmate leaf venation (*palminervis*). The arrangement of its leaves is *folia decussate*, that is, in each nod has two leaves that emerge opposite each other.

@2021

## INTRODUCTION

Plant introduction is an essential part of an agricultural expansion to widening the plant's beneficiary to capacious society across the world (Suryadi *et al.*, 2004; Pyšek, *et al.*, 2004). The spread of coffee beans and potatoes to the whole world is a successful example of plant introduction.

Recently, a kind of vegetable widely known as Brazilian Spinach (*Alternanthera sissoo*) is being imported and introduced to some Southeast Asian countries, such as Malaysia and Indonesia exactly. We can find the hype of this type of vegetable on social media, on Instagram, and on various Indonesian e-commerce such as Tokopedia, Bukalapak, Shopee, etc. There we can find easily high

demand for this Brazilian spinach from the buyers that most home garden lovers. The determination of plant commodities on home gardens, especially in urban areas, is very noteworthy. In addition to fulfilling family food and nutrition, the commodities planted also meet aesthetic values so that they look beautiful when planted around the residence. One of the plants that can fulfill food and has aesthetics value is Brazilian spinach (Toensmeier, 2007; Tregenza, 2016). Brazilian spinach leaves are part of the plant that can be consumed and have a beautiful shape.

In this covid-19 pandemic period, the demand for Brazilian spinach is getting high on the market. It is because they have more time to stay at home (Thesiwati, 2020). Unfortunately, this hype of Brazilian spinach introduction in Indonesia has not fulfilled with enough scientific

knowledge about this type of aesthetic vegetable. Nor we couldn't find enough source or reference that talks about Brazilian spinach agronomically on the internet. The articles are rare to find, but the knowledge about the plant introduced is very fundamental. The research needs to conduct to help home garden lovers to know more about Brazilian spinach if they decide to grow the plant in their backyard. So, further study is needed.

Plant morphology is important in order develop cultivation technique, biodiversity conservation, functional plant, and plant recognition (Aptoula & Yanikoglu, 2013; Balao, *et al.*, 2011; Santos, *et al.*, 2012). Leaf morphological approach is one of the study should be conducted to further understanding. So, this study aims to determine the leaf morphology of Brazilian spinach as a backyard vegetable.

## METHOD

Brazilian spinach leaf samples had taken from the house yard in Sungai Sipai Village, Sungai Sipai District, Banjar Regency, South Kalimantan. Sampling had taken on the petiole, then put it in Styrofoam that was sprinkled with water to keep the leaf sample fresh. Morphological observations of these spinach leaves had carried out visually at the Integrated Laboratory of the Agroecotechnology Department, Faculty of Agriculture, Lambung Mangkurat University, in August 2020. Observation parameters include leaf parts, leaf shape, leaf base, leaf tip, leaf margin, leaf venation, and leaf arrangement.

## RESULTS AND DISCUSSION

*Alternanthera* is a genus in the *Amaranthaceae* family. The genus includes 80 – 200 species with the main center of diversity in South America (Iamónico & Sánchez-Del Pino, 2016). *Alternanthera sissoo* (Brazilian spinach) is one species of this genus. This species is the perfect edible groundcover for tropical polyculture systems. Brazilian spinach, originally from Brazil, is a low groundcover that roots at the nodes and spreads indefinitely. It forms a dense enough cover to suppress the germination of weeds. It prefers partial shade, actually having many fewer pest problems at 50 percent shade. The leaves are a mild cooking green (Toensmeier, 2007).

Leaves are a substantial part of plants in plant growth, especially as an organ where photosynthesis takes place. Entire leaves have leaf parts in the form of leaf midrib, petiole, and leaf blade (lamina). Brazilian spinach leaves only have petiole and leaf blade, so it classified in the incomplete leaf group (Tjitrosoepomo, 2011). It is also called petiolate the blade is attached to the stem by a stalk called a petiole (Glimm-Lacy & Kaufman, 2006). The

lamina, the most conspicuous feature of the leaf, is the relatively large, thin plate, with its upper surface usually orientated towards the sun (Ingram *et al.* 2016). Brazilian spinach is herbaceous with a simple leaf. A simple leaf has one blade, which may be broad, narrow, or needlelike. Herbaceous plants are plants that, by definition, have non-woody stems.

The results of the morphological study of Brazilian spinach leaves in leaf shape, leaf tip, leaf base, leaf margin, and leaf venation has presented in Figure 1. The arrangement of Brazilian spinach leaves has presented in Figure 2.

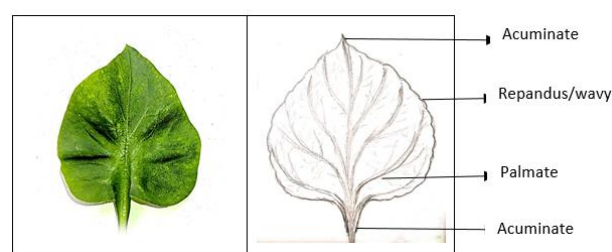


Fig. 1. Brazilian spinach leaves in leaf shape, leaf tip, leaf base, leaf margin, and leaf venation

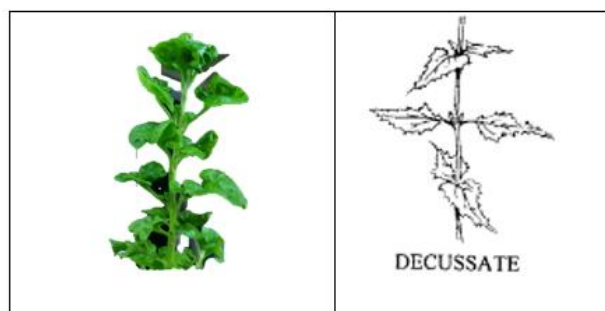


Fig. 2. The arrangement of Brazilian spinach leaves

Leaf shape is determined by looking at the shape of the leaf blade as a whole without being affected by any notches on the leaf edges (Tjitrosoepomo, 2011). When describing leaf shapes, botanists use a variety of terms often taken from Latin. These terms can be used for describing any flat shape on a plant (not only the leaf but also the stipule, sepal, petal, and others). These terms take into account the length-to-width ratio, the curving of the margin or edge, and the position of the widest point. Brazilian spinach has a deltoid leaf shape. This shape seems with the form of the Greek letter of the Delta, shaped like an equilateral triangle (Harris & Harris, 2006). Shaped like a triangle in which all sides are the same length.

In general, the leaf parts are the leaf tip (apex), the leaf base, and the leaf margin. The leaf tip is farthest from the point of attachment. Brazilian spinach has tapered leaf tips (*acuminate*). It is gradually tapering to a sharp point and

forming concave sides along the tip. The leaf base is the end of the leaf blade nearest to the point of attachment. Brazilian spinach has an acuminate leaf base. It is also called cuneate, is wedge-shaped, triangular tapering to a point at the base. The leaf margin is the edge of the leaf blade. Generally, the leaf margin is divided into integer and notched shape. Brazilian spinach is a notched leaf margin. Brazilian spinach is *repandus* leaf margin, with a slightly wavy or weakly sinuate margin. It is wavy but not so deeply furrowed (Harris & Harris, 2006).

The design and function of leaf venation are urgent to plant performance, with principal implications for the distribution and productivity of ecosystems, and applications in paleobiology, agriculture, and technology. Veins are composed of xylem and phloem cells embedded in the parenchyma, sometimes sclerenchyma, and surrounded by bundle sheath cells. The vein xylem transports water from the petiole throughout the lamina mesophyll, and the phloem transports sugars out of the leaf to the rest of the plant. Leaf venation systems vary strongly across major plant lineages, with many early groups having dichotomously branching, open systems, but reticulation evolved frequently (Sack & Scoffoni, 2013). Brazilian spinach has a simple palmate leaf with brochidodromous second-order veins.

These functions of high major VLA would benefit palmate veined relative to pinnately veined species, that is, those that have multiple first-order veins branching from the base of the leaf<sup>[8]</sup>. The hydraulic and mechanical protection provided by primary vein redundancy would be very significant in thinner and larger leaves that are not already protected. Indeed, palmate-veined species occur more commonly in temperate than in tropical floras and are more frequent in large leaves with thin laminae and low leaf mass per unit area (Sack et al. 2008; Walls, 2011).

The leaves are attached to the part of the stem is called the node. While between the nodes, there is an internode. The number of leaves attached to the node usually varies with each plant species. The various number of leaves on the node determines the difference in a leaf arrangement<sup>[3]</sup>. The arrangement of Brazilian spinach's leaves is *folia decussate* which each nod has two leaves that emerge opposite each other. Dessucate is arranged along the stem in pairs, with each pair at right angles to the pair above or below (Harris & Harris, 2006).

## CONCLUSIONS

The results showed that Brazilian spinach has a herbaceous with a simple leaf in a deltoid shape (*deltoides*). It has tapered leaf tips (*acuminatus*); acuminate leaf base (*acuminatus*); wavy leaf margin (*repandus*); and simple

palmate leaf venation (*palminervis*). The arrangement of its leaves is *folia decussate*, that is, in each nod has two leaves that emerge opposite each other.

## REFERENCES

- Aptoula, E., & Yanikoglu, B. (2013, September). Morphological features for leaf based plant recognition. In *2013 IEEE International Conference on Image Processing* (pp. 1496-1499). IEEE.
- Glimn-Lacy, J. and P.B. Kaufman. (2006). *Botany illustrated: introduction to plants, major groups, flowering plant families*. Springer Science & Business Media. New York.
- Balao, F., J. Herrera, and S. Talavera. (2011). Phenotypic consequences of polyploidy and genome size at the microevolutionary scale: a multivariate morphological approach. *New Phytologist* Vol 192(1): 256-265.
- Harris, J.G. and M.W. Harris. (2006). *Plant Identification Terminology : An Illustrated Glossary*. Spring Lake Publishing. Utah.
- Iamónico, D. and I. Sánchez-Del Pino. (2016). Taxonomic revision of the genus *Alternanthera* (Amaranthaceae) in Italy. *Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology* Vol. 150(2): 333-342.
- Ingram, D. S., D. Vince-Prue, and P.J. Gregory. (2016). *Science and The Garden : The Scientific basis of horticultural practice 3<sup>rd</sup> Edition*. Jhon Wiley & Sons. West Sussex.
- Pyšek, P., D.M. Richardson, M. Rejmanek, G.L. Webster, M. Williamson, J. Kirschner, (2004). Alien plants in checklists and flora: towards better communication between taxonomists and ecologists. *Taxon* Vol.53 (1) 131-143.
- Sack, L., E.M.Dietrich, C.M Streeter, D. Sanchez-Gomez. and N.M. Holbrook. (2008). Leaf palmate venation and vascular redundancy confer tolerance of hydraulic disruption. *Proceedings of the National Academy of Sciences, USA* Vol.105(5): 1567-1572.
- Sack, L. And C. Scoffoni. (2013). Leaf venation: structure, function, development, evolution, ecology and applications in the past, present and future. *New Phytologist* Vol.198(4): 983 – 1000.
- Santos, R. C., J. L.Pires, and R. X. Correa. (2012). Morphological characterization of leaf, flower, fruit and seed traits among Brazilian *Theobroma* L. species. *Genetic Resources and Crop Evolution*, Vol.59(3), 327-345.
- Thesiwati, A.S. 2020. Pemanfaatan Lahan Pekarangan Sebagai Pangan Lestari di Masa Covid-19. *Jurnal Pengabdian kepada Masyarakat Dewantara* Vol.3(2):25-30.
- Toensmeier, E. 2007. *Perennial Vegetables*. Chelsea Green Publishing. Vermont.
- Tregenza, R. 2016. Gardening for food and community. *Landscape Review* Vol. 16(2):86-93.
- Tjitrosoepomo, G. (2011). *Morfologi Tumbuhan Edisi .* Gadjah Mada University Press. Yogyakarta.
- Toensmeier, E. (2007). *Perennial Vegetables*. Chelsea Green Publishing. Vermont.

Walls, R.L. (2011). Angiosperm leaf vein patterns are linked to leaf functions in a global scale data set. *American Journal of Botany* Vol.98(2): 244–253.