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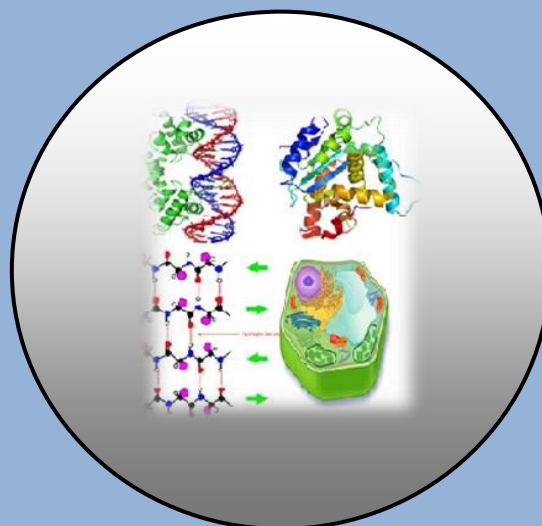
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Existence and Morphology Characteristics of Tunjuk Langit Fern (*Helminthostachys zeylanica* Hook.) in Bali

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ABSTRACT

This study focused on the existence and morphological characteristics of the sporophyte (Sporophyll and trophophyll) tunjuk langit fern (Helminthostachys zeylanica) in Bali. The study was conducted using exploration method in some areas of rain forest, forest plantations in Bali at an altitude of 300-1,100 m above sea level (asl). The study was conducted in December 2014 to April 2015. The point coordinates of the location of the discovery of H. zeylanica specimens recorded and descriptions of habitat and morphologic character. The identification is done by comparing the specimen sample with a description H. zeylanica which refers to the LIPI, (1979), Heyne, K. (1987), Croft, J. (1999b) and Meddleton, D. (2015). Plants specimens collected for the manufacture of herbarium. The results showed that the Helminthostachys zeylanica can be found in the plantation areas of cocoa (Theobroma cacao), clove (Syzygium aromaticum) and mangosteen (Mangostana sp.) at an altitude of 352-360 m asl. in the Kikian village, Selemadeg sub-district of Tabanan- Bali. Grown in soil with high humidity and rich in organic matter. Existence of this species in the habitat is very rare. Is an annual plant, grow well in the rainy season. Habitus is a herb plants, sterile frond part (trophophyll) and fertile (Sporophyll) is different. Trophophyll composed palmatus, tripartite. Sporophyll shaped spice like with tightly attached sporangium, green color (when young) to yellow/brown (when mature). Sporophyll appears above from the base of the leaves tripartite trophophyll. Rhizome is stiff short, creeping in soil bearing the numerous fleshy roots.

Keywords: *Helminthostachys zeylanica, Habitat Grows and Morphological Characteristics.*

INTRODUCTION

Helminthostachy zeylanica (Synonyms *H.dulcis*) is one of the ferns of the family Ophioglossaceae (class Polypodiopsida). Fern of these families have different morphological forms of the other fern in the same class. Frond of the fern is different between sterile leaves (trophophyll) and fertile leaves (sporophyll). Partfertile (sporophyll: contains sporangium) shaped like a spice. Part of sterile frond shaped palmatus (LIPI, 1979; Croft, J.1999a). In Indonesia *H. zeylanica* known as the tunjuk langit, in some areas known as varied name, including: pakupacarbumi (South Sumatra), tapakjalak/jajalakan (Sunda/West Java), Pakis Kaler, manonor pakuurang (Java) and bute-bute (Makasar/South Sulawesi). These plants widely used for traditional medicine. Rhizomeas a medicinal ingredient for dysentery, salesma, pulmonary tuberculosis at an early stage, the leaves are dried and smoked to treat nosebleeds, young leave scan be used vegetable. The old stalk can be used materials crafts (Fitrya et al., 2010; Heyne, K. 1987). Geographically spread of fern *Helminthostachys* sp. Is in the wet forests of Cambodia, India, the Himalayas, Japan, Laos, the Philippines, Sri Lanka, Thailand, Vietnam, Australia and the Pacific islands. In Indonesia, these plant are found in wet forest/rain forest in Java, Sumatra, Kalimantan and Sulawesi (Heyne, 1987; Kholik et al., 2011; Fitrya et al., 2010). From the research about diversity of fern in Baliby Adjie, B. & Lestari W.S. (2011), existence of the fern *Helminthostachys zeylanica* has not been reported. The species of fern from *Ophioglossaceae* groups that have been reported only *Ophioglossum pendulum* and *Ophioglossum pendunculolum*. Status of the existence of *H. zeylanica* in Indonesia is not yet known with certainty. Although, Joshi, B. (2011) and South China Botanical Garden, (2015) stated that the existence status of this species in China and India has been categorized as an endangered species because of exploitation and habitat destruction. Given the existence of *Helminthostachys zeylanica* in Bali have not been reported, although some forested areas of wet/rainforest in Bali has the potential for growth of this plant. Therefore, this study focused on the exploration of presence and morphology characteristic of the *H. zeylanica* in Bali.

MATERIAL AND METHODS

This research was conducted by the exploration method that is focused on rainforest land/wet forest. Which explored area is 4 forest area and plantation habitat namely in Pupuan, Selemadeg, Bedugul and Kintamani with altitude from 300 m to 1.200 m above sea level (Figure 1). The study was conducted in December 2014 and March 2015. The discovery location of tunjuk langit fern (*H. zeylanica*) recorded in geography coordinates, temperature, air humidity, altitude and growth habitat descriptions. The specimens of the *H. zeylanica* were found to be described morphological characters; habitus, leaf morphology/frond, morphology trophophyll (sterile leaves), morphology sporophyll (the part containing the sporangium). The identification was done by comparing the specimen sample with a descriptions ferns *H. zeylanica* which refers to LIPI (1979), Heyne K. (1987) and Jim Croft (1999b). Plants Specimen collected for the manufacture of herbarium. Making the barium refers to Frank and Perkins (2015). The selected specimens are part of the plant has grown that indicate the presence of leaves and sporangiumor complete all parts if possible. Herbarium material collected labeled (name of plants, plant origin, name of collector, collection date, short description).

Furthermore, neatly arrange in news print and oven dried at a temperature of 30°C for 4x 24 hours. Specimens that have been dry prepared on paper "mounting paper" and specimen data is placed on the right bottom of the paper (Figure 2). The herbarium is stored in the Laboratory of Plant Taxonomy Department of Biology, Udayana University.



Figure 1. Explored area and discovery location of tunjuk langit fern.



Figure 2. Herbarium specimen of tunjuk langit fern (*Helminthostachys zeylanica*).

RESULTS AND DISCUSSION

Discovery Location of Tunjuk Langit Fern (*Helminthostachys zeylanica*).

Helminthostachys sp. found only in one location, from four potential sites was explored. Location discovery this species is in crops plantation forest at Kikian village, Selemadeg district, Tabanan regency of Bali (Figure 1). The coordinates of the discovery of this plant is 8° 26' 55.84" S; 115° 02' 10.22" E and 8° 26' 55.09" S; 115° 02' 11.22" E, at an altitude of 352-360 m above sea level. Temperatures range from 25-30 °C and humidity between 60-90%. Population of this fern on the discovery location is extremely rare, founded only 6-10 individual at location point in the Kikian village. The existence of this fern in Bali has not been reported before (Adjie B. & Lestari, 2011). The existence of these fern in nature elusive, due to growth requires environmental factors specific (LIPI, 1979).

Manna *et al.* (2013) stated that *Helminthostachys zeylanica* very sensitive to differences in environmental factors makes including temperature, humidity, wind velocity and water availability. In Indonesia, this fern found is generally limited to some areas in Sumatra, Java and Sulawesi (Heyne, 1987; Kholik *et al.*, 2011; Fitrya *et al.*, 2010). In India and China, this species have been rare category "endangered status" due to exploitation for medicinal products (Joshi, B.2011).

Habitat of Tunjuk Langit Fern (*Helminthostachys zeylanica*)

This plant grows in shady conditions under canopy of the tree in plantations forest. Grows as a bush associated with other species of fern among *Pteris* sp., *Tectaria* sp. and *Lygodium cyrcinatum* and also associated with some grass among *Axonophus* sp., *Digitaria* sp. and *Oplismenus burmani* (Figure 3).

This plant grows in areas with high humidity, soil rich in humus and organic matter. Able to grow in under the shade of some trees, those were cacao (*Theobroma cacao*), durian (*Duriozibethinus*), clove (*Syzigium aromaticum*), coconut (*Cocos nucifera*) and mangosteen (*Mangostana* sp.). Manna *et al.* (2013) found that this fern grows under the shade of a tree or associating with them *Barringtonia acutangula*, *Antidesma acidum*, in the Barringtonia forest Himalayas. Joshi B. (2011) also found that *H. zeylanica* is grown in association with trees including *Tectona grandis*, *Eucalyptus hybrid*, *Acacia catechu*, *Dalbergiasisso* and *Albizzia procera* in the wet forests of the Himalayas. *H. zeylanica* an annual plant grows well in the wet season from December to reach maturity sporangium on March /April. When the dry season, the rhizome and spore dormancy in the soil. Kholiket *al.* (2011) suggest that *H. zeylanica* fern grows in moist secondary forest and also in industrial forest plantations (HTI) at a altitude of 60-250 m above sea level in East Kalimantan. Joshi B. (2011) also stated that this species of fern grows well in moist forest areas, organic rich soil at an altitude of 235-275 m above sea level places in the Himalayas.



Figure 3. Habitat of tunjuk langit fern (*Helminthostachys zeylanica*) in Kikian village, Selemadeg district, Tabanan Regency, Bali)

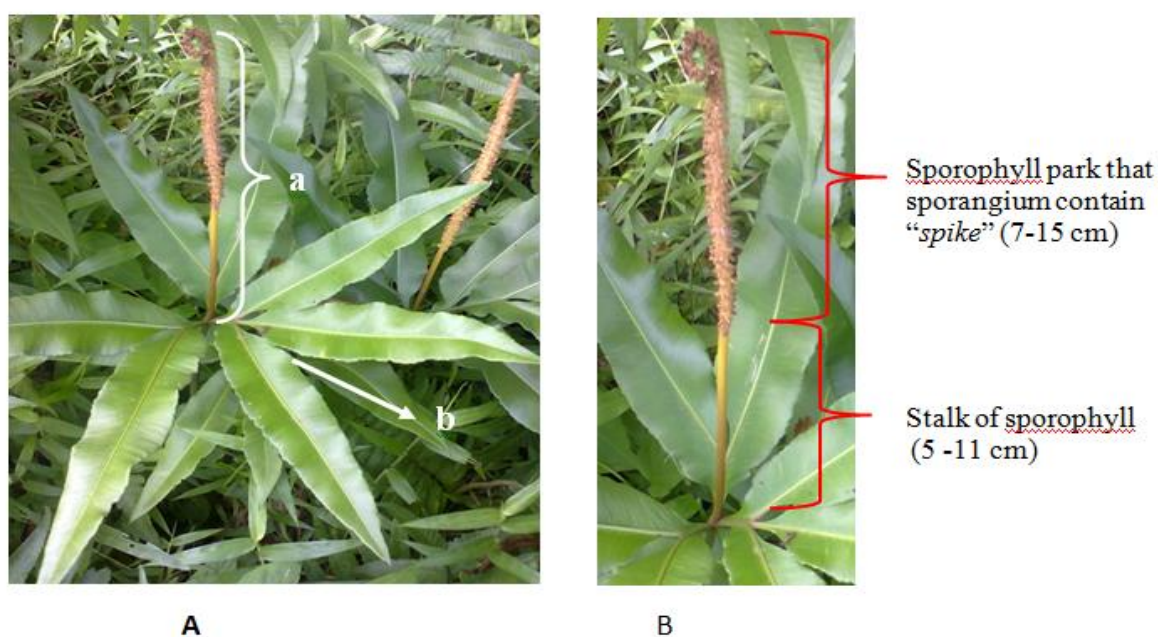
(A: plantations forest; B: associated tunjut langit fern with some other underground plants).

Morphological characteristics

This fern is a terrestrial plant, habitus is small herb (herbaceous), plant height of about 30-68 cm from the base of frond ground until the end of the sporangium. The frond of this plant differentiated between the sterile and fertile part. Part of sterile frond (trophophyll) composed palmatus, divided into 3 parts leaf (tripartite), each with a terminal lobe and one or two pairs of lateral lobes are sessile. Lobes shape oblong to oblong-lanceulatus, the edges acutus at the tip (apex), cuneatus and somewhat decurent in the basal, pinnate leaf veins. Rhizomes form (part of the stem) short stiff, creeping, brown colour and propagates below ground level, with fleshy roots coming out of the rhizome. Rhizome diameter size between 8-11 mm (Figure 4).



Figure 4. Frond morphology of tunjuk langit (*Helminthostachys zeylanica*).
(A: habitus of tunjuk langit in the habitat; B: part of rhizome, trophophyll and sporangium; C: part of rhizome)



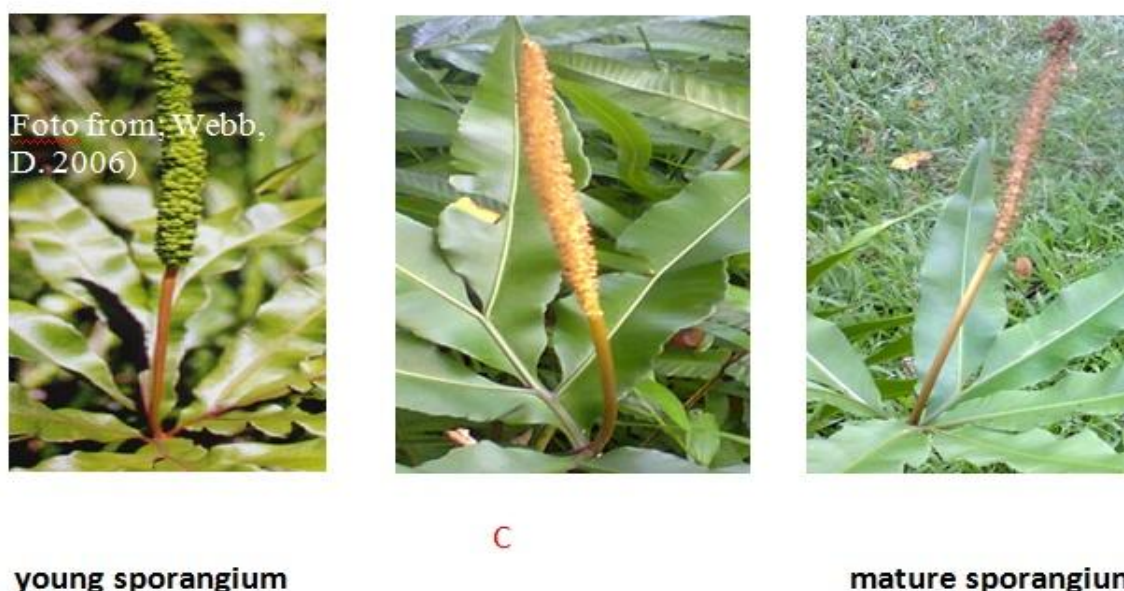


Figure 5. Sporophyll morphology that spike like shape
(A: Sporophyll part (a) and tripartite trophophyll (b), B : Stalk part and spike of sporophyll, C: Sporangium development from young with green color until mature with yellow/brown color).

Fertile part called sporophyll shaped a spike like, where sporangia attached. Sporophyll length of about 12-26 cm from the bottom leaves trophophyll (or from base of tripartite trophophyll). Sporophyll consists of the stalks with a length of about 5-11 cm and parts spike (containing sporangium) of about 7-15 cm. Young sporangium is green color, compact in spike, when the mature sporangium is yellow to brown, mature spores will be separated from the stalk spike (Figure 5).

CONCLUSIONS

Helminthostachys zeylanica found in plantations / plantation cacao /clove near the rain forest at an altitude of 352-360 m above sea level in the Kikian village, Selemadeg district, Tabanan, Bali. Grown on soils with high humidity and rich in organic matter. Is an annual plant, grows well in the wet season. Existence of this species in the habitat is very rare. Plant habitus is herb, part of sterile frond (trophophyll) and fertile (sporophyll) is different. Frond part trophophyll composed palmatus, divided into 3 parts leaf (tripartite). Sporophyll part shaped spke like with tightly attached sporangium, green (when young) to yellow/brown (when mature). Sporophyll appears above the base of the leaves trophophyll (tripartite). Rhizomes are stiff, short, creeping in soil that contains a number of fleshy roots.

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