

Short Communication: Ethnobotanical study of *Lygodium circinnatum* and its utilization in crafts weaving in Indonesia

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Abstract. Rahayu M, Kuncari ES, Mahdawia, Setiawan M. 2020. Short Communication: Ethnobotanical study of *Lygodium circinnatum* and its utilization in crafts weaving in Indonesia. *Biodiversitas* 21: 617-621. *Lygodium circinnatum* (Burm.f.) Swartz, locally known as ketak, is a species of ferns that is currently widely used as raw material for making woven artifacts. In Indonesia, the center of *L. circinnatum* handicrafts, among others, is the island of Bali, Lombok and the city of Kendari. A variety of products are in great demand, not only by domestic tourists but also by foreign tourists. Cultivation of *L. circinnatum* has not been undertaken effectively, therefore raw material supply is still from wild populations. This ethnobotanical study conducted to review the traditional use of *L. circinnatum* and its cultivation efforts. This is essential as the use value of the *L. circinnatum* is increasing and also to ensure the continued availability of raw materials.

Keywords: Ethnobotany, ketak, *Lygodium circinnatum*, woven crafts

INTRODUCTION

In Indonesia, various species of plants are used as raw materials for industries, including making of woven crafts. *Lygodium circinnatum* (Burm. f.) Swartz, commonly called ketak, is a fern species widely used as a raw material for making of woven crafts which are popular in many countries, including Indonesia (Heyne 1987).

Fiber is very useful for human life. The usefulness of fiber, among others, as a woven raw material. Fiber can come from living things like animals and plants. Vegetable fibers can come from roots, stems, leaves, fruits or seeds. *Lygodium circinnatum* (Burm.f.) Swartz is one of the fiber-producing plants as raw material for woven crafts (Darmayanti 2014).

Rice (2016) found that local woven crafts are generally inherited from generation to generation, created from a historical concept or folklore as outlined in various types of art. The weaving craft is one product that is currently known among art lovers. This craft is known for its durability and flexibility, which process is conventional and often combined with other plants such as bamboo or rattan (Setiawan et al. 2014; Gusmawarni et al. 2019). It is also known as "hata" in Pangandaran District, and included among Non-Timber Forest Product commodities (Suyarno 2019). In Bali and Lombok islands, fabric woven from *L. circinnatum* has a high artistic value.

The *Lygodium* genus is a group of ferns that propagates and always propagates in other plants. This genus is very different from other species of ferns because it has rhizome roots that spread above the ground and can only live in an

open area as a light demanding plant (Shinta et al., 2012).

The products woven from *L. circinnatum* appear similar to those of rattan. The stems of *L. circinnatum*, which are used for weaving, have a fine, tough and strong texture when compared to other handicraft raw materials, such as rattan, bamboo and pandanus. This makes the *L. circinnatum* woven products superior and more priced than those made from other raw materials.

Due to its increasing public interest and also export market potential, this craft product, is considered to be one of the supporting economic sources of tourism. But, unfortunately, cultivation of this fern to meet the needs for raw materials has not been carried out effectively.

The objective of this ethnobotanical study is to provide an overview the use of *L. circinnatum* as the important raw material for woven crafts. In addition, other benefits of *L. circinnatum* is also presented so that they can be used as reference materials for further development of this traditional activity.

MATERIALS AND METHODS

The method used in this study refers to Martin (1995) and Cunningham (2001) with modifications including interviews, herbarium observations and artifacts.

Information was gathered by direct observations at the center of handicrafts located in Beleke Village of Lombok Island, Karang Asem of Bali Island and Kendari city of Southeast Sulawesi; interviews with the craftsmen engaged in *L. circinnatum* weaving; examination of herbarium

specimens at Herbarium Bogoriense (BO), Botany Division, Research Center for Biology, Indonesian Institute of Science (LIPI), Bogor, Indonesia, and observation of artifact collections at the National Museum of Indonesian Natural History, Bogor, Indonesia. Data recorded from weaving centers included the locations of obtaining raw materials, the process of making woven crafts and the locations of sale; from the herbarium specimens regarding the collector's name, year of acquisition, specimen collection location, habitat, and use; and from the artifact collection centers include the name of the artifact, the location of its acquisition and its use. In addition, relevant information was collected from related published literature.

RESULTS AND DISCUSSION

Lygodium circinnatum, earlier included in the family Schizaeaceae (Praptosuwiryo, 2003), but currently is a member of Lygodiaceae (Madeira et al. 2008). Synonyms of this species include *L. basilanicum* Christ; *L. dichotomum* (Cav.) Sw. and *L. pedatum* (Burm.f.) Sw. (Rugayah et al. 2015). Globally, *Lygodium* genus consists of 40 species, mostly found in Southeast Asia and Central America. *L. circinnatum* is distributed from Sri Lanka, northeast India to southern China, continues to Southeast Asia to the Solomon Islands and Vanuatu (Praptosuwiryo 2003).

In Indonesia, *L. circinnatum* is known by several local names, such as “paku kawat” (Shinta et al. 2012), “pakis rambat”, “pakis ata” (Javanese), “paku ata” (Sundanese), “ata” (Balinese), “masem” (Minahasa), “raga-raga” (Makasar), caweng (Bugis), “mongodo” (Halmahera), “gomoho” (Ternate) and “gomongo” (Tidore) (Heyne 1987), “ribu-ribu” (West Kalimantan) (Hasibuan et al. 2016). Some of the local names are indicative of certain features of this plant, for example, the name “paku kawat” is given because the plant is strong like a wire, “pakis

rambat” indicates the nature of propagation, and “ribu-ribu” refers to the production of large number of spores reaching thousands.

Lygodium circinnatum (Figure 1) is a terrestrial fleshy fern that has a short rhizome, which spreads on the ground. The stem is generally called rachis, the length can reach up to 10 m, 2-5 mm in diameter; sterile rachis branching like a fork (dichotomous), brownish green; fertile rachis branching also like a fork (dichotomous), brownish green, the direction of rotation to the right (dextrorsum volubilis). The leaves are facing each other, finger shaped, 2-5 indentations, jagged edges, pale green color. Sometimes it has two branches and each branch has two more branches. Fertile leaves are generally located at the tip of the plant and the edges of the leaves are more bumpy than sterile leaves (Dwiyanti et al. 2017). Sporangia are located on the lower surface of the fertile leaf (Holtum 1966; Shinta et al. 2012).

Observation of herbarium specimens in Herbarium Bogoriense, Botany Division, Research Center for Biology, Indonesian Institute of Science (LIPI), Bogor, Indonesia indicated that this fern is distributed in various regions in Indonesia including Sumatra, Java, Kalimantan, the Lesser Sunda Islands, Sulawesi, Maluku and Papua New Guinea; and its habitat ranges from the coast, rocky land, open land, marginal/poor soil nutrient forest, secondary forest, tropical forest, lowland forest, and dipterocarpa hill forest; at an altitude of 2-1,350 m above sea level. Thus, it may be concluded that this species grows in different ecosystems and does not require any special habitats for growth.

The older herbarium collections of this species (Figure 2) deposited in BO, among others, were collected from Java by Teysman (1854), Dr. Scheffer (1870), Dr. Scheffer (1871), Buck & Marchy (1892), Hallier (1893), and Amdjah (1898). The use of this species has been recorded as a vegetable material (its young leaves), in the herbarium specimen.



Figure 1. *Lygodium circinnatum* (Burm.f.) Swartz with wiry rachis



Figure 2. Specimens of *Lygodium circinnatum* deposited in Herbarium Bogoriense



Figure 3. Preparing *Lygodium circinnatum* stem for weaving purpose. A. Leaves and twigs; B. The inner bark; C. Bark or pendaos (local name)

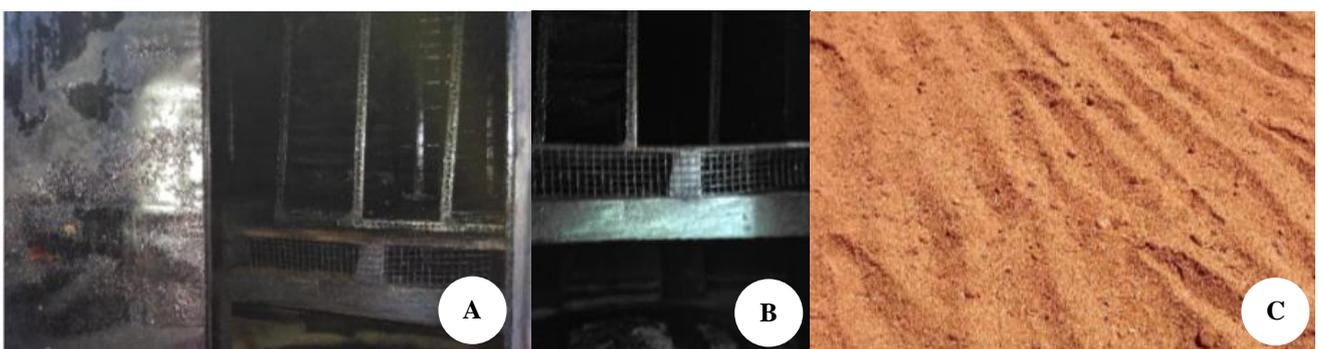


Figure 4. *Lygodium circinnatum* drying system and wood powder used for drying. The purpose is to ensure that they are not hard and rigid when weaving. A. The woven artefacts are heated in the oven; B. Arranged standing artefacts in the oven; C. Sun-dried wood powder used to burning artefacts

Various ethnomedicinal uses have been reported from different regions. According to Praptosuwiryo (2003), in Malaysia, the young leaves of *L. circinnatum* are used as a postpartum medicine; and exudate from rhizome as insect repellent and to treat aquatic animal and snake bites

(Hanum and Nurulhuda 1999). In New Guinea, it is used as a birth control drug and in the Philippines, a tapel from crushed leaves is used to cover the wounds. In Indonesia, the squeezed leaves are applied to injured area to neutralize the effect of poisonous animal bites. The leaves are also

crushed with the rhizome of *Curcuma* sp. and are applied as a sprain medicine. Among the other traditional uses, the bark is used as a rope material (Heyne 1987). All parts of this plant are used in rice planting ceremonies in Sumatra (LBN-LIPI 1979).

Literature analysis related to the nutritional content and active compounds of this plant leaf that acts both as a vegetable and traditional medicine indicated that such studies are very limited. Research conducted by Riana et al (2017) found that *Lygodium circinnatum* contains phenolic and flavonoid active compounds with flavonoid content is higher than phenolic. This is in line with research conducted by Lai and Lim (2011), which revealed that the antioxidant compound *Lygodium circinnatum* was lower than compound of the other species such *Cyathea latifolia*, *Cibatium barometez*, *Drymaria quercifolia*, *Blechnum orientale* and *Dyrcranopteris linearis*. Yamautchi et al. (1996) stated that this species contains antheriogen compounds. Antheriogens are chemicals released by the gametophytes that control the sex ratio in the plant by inducing the formation of male organ, the antheridium, in ferns (Tanaka et al. 2014).

From the descriptions given above, it may be known that *L. circinnatum* is not only a raw material for woven crafts, but also used as a vegetable ingredient, herbal medicine and have religious value as it is one of the plants used in the traditional rice planting ceremony.

The weaving of *L. circinnatum* had actually begun for daily household needs. However, with design guidance from the government, these “pengulat” craftsmen are able to produce various kind of products with different designs and styles thus adding value to this practice. Conventionally, *L. circinnatum* was woven into a variety of handicrafts such as trays, tissue boxes, containers of various sizes, boxes for wedding delivery, and bags.

The stages of weaving of *L. circinnatum* are as follows: selection of *L. circinnatum* stems which are not too old and have been cleaned of leaves and twigs (Figure 3.A), the bark is peeled off the stem to separate the inner stem

(Figure 3.B), and the “pendaos” (Figure 3.C). The inner stem is used as “reinforcing material” of the artefact to be formed. “Pendaos” and the inner stem are dried for 3-4 days so that they are not easily attacked by fungi. Before weaving the “reinforcing material” to the desired shape of the craft, pendaos are soaked in water for about 1-2 hours. The purpose is to ensure that they are not hard and rigid when weaving. Artefacts thus woven are then heated in the oven (Figures 4.A-B) for about 2 days and 2 nights. This is to completely dry them to prevent attack by fungi or fleas. Also, a brown color is formed by drying which looks brighter. Burning material used to heat the oven is sun-dried wood powder (Figure 4.C).

The interviews conducted with “pengulat” weaving craftsmen indicated that the *L. circinnatum* stem raw material used were obtained mainly from Kalimantan, Sumbawa and Pangandaran. *L. circinnatum* plants grow wild in these areas and are collected from the forests. Earlier to 1980, *L. circinnatum* ferns were also found in the island of Lombok. However, because their collection was carried out continuously and excessively without any effort to cultivate, *L. circinnatum* population is rarely found here, at present. Especially since 1986, *L. circinnatum* weaving intensified in the island of Lombok. The diverse products of *L. circinnatum* handicrafts (Figure 5) from the Beleke Village were mostly sold to Bali. As the variety of *L. circinnatum* products is not as much as from Lombok, the products of Kendari are traded mainly at “Dekranasda” National Crafts Council in Kendari area. *L. circinnatum* handicrafts also has potential export markets abroad, in countries such as Germany, France, Britain and Japan (Dinas Perindustrian dan Perdagangan 2010).

Lygodium circinnatum is a species plant of economic value as a producer of non-wood forest products in the form of handicraft raw materials. However, there are no detailed data on the size and potential distribution of the population as raw material for industry experiencing significant obstacles (Wahyuningsih et al. 2017).



Figure 5. Products made from *Lygodium circinnatum*

Lygodium circinnatum can be cultivated in two ways, generatively by germinating spores and vegetatively by dividing saplings or adventitious shoots. Propagation by spores require a relatively longer time, however it can produce more plants than by vegetative propagation. The success of this method is influenced by many factors, such as spore maturity, planting media and environmental conditions (Siregar et al. 2014). Propagation of *L. circinnatum* can also be done in a more modern way by tissue culture technique. This method can produce more *L. circinnatum* plants in a relatively short period of time. Generally, the explants used are spores (Siregar et al. 2014; Dwiyananti et al. 2017).

As with the local woven handicraft industry, several factors inhibit woven handicrafts in Indonesia (Razak & Elyta, 2017). The similar condition are also experienced in *L. circinnatum* handicrafts in this study, such as the pattern of thinking of local people who are less innovative due to the lack of educational and fostering institutions, marketing productivity of handicraft products, and availability raw materials are increasingly rare.

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