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Overview of the handicraft products of *Lepironia articulata* (Retz.) Domin (Cyperaceae) in Wawonii Island, Southeast Sulawesi, Indonesia

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Lepironia articulata or the *kolosua* is a species of herbaceous plant from the Cyperaceae family used as a raw material for weaving crafts. The woven craft of *kolosua* is one of the additional incomes of the local community on Wawonii Island. This study aims to find out local knowledge about the utilization of *kolosua* as handicraft, various handicraft products, and the problems faced by craftsmen so that the plant species can be considered for local government policies in terms of using *kolosua* to increase people's income and environmental regulations to maintain their natural habitat. An ethnobotanical study on the utilization of *kolosua* by the local community in Wawonii Island was carried out by semi-structured and "open-ended" interviews, and direct observations in the field. *Lepironia articulata* is one species of plant that is used as raw material for woven crafts. Generally, handicraft products are produced for craftsmen's use or sold to traditional markets on Wawonii Island. Art and craft products are one of the sources of community income. The income from the sale of *kolosua* woven products was around IDR 100,000 (USD 7) up to IDR 150,000 (USD 10) after deducting transportation costs. The role of local governments is needed to provide awareness counseling on the use of *kolosua*. This study has implications for the local community and government to increase people's income, environmental regulations and to maintain their natural habitat.

Keywords: Ethnobotany, Indonesian's handicraft, *Lepironia articulata*, Sulawesi, Wawonii Island

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Wawonii is an island adjacent to the southwestern part of mainland Sulawesi. The island is about 69.4 km east of Kendari, the provincial capital of Southeast Sulawesi, and with a size of 867.6 km^2. The island is considered a small island, referring to the definition established by the Government of Indonesia[1]. It is one of the small islands strings that make the Regency of Konawe Islands; at least there are three other important small islands in the Regency, *i.e.,* Buton, Kabaena, and Muna. Etymologically, the name of the island, Wawonii, means the land of the coconut in the local language derived from "wawo", which means land, and "nii", which means coconut (*Cocos nucifera* L.; Arecaceae); referring to the fact that coconut is the dominant plant species found in the island[1].

Based on the size of the island, the plant diversity in Wawonii Island is regarded as low, below 1000 recorded species[2]; one of them is the species studied in this current study, *Lepironia articulata* (Retz.) Domin (Cyperaceae). Although the general ethnobotanical study has been done previously by Rahayu and Rugayah, the island's handicraft products have never been wholly recorded and studied[3]. Botanically, *L. articulata* is the only member of one genus within the sedges family (Cyperaceae)[4,5]. The species is widely dispersed from Madagascar through tropical and subtropical areas of Asia (including the Malesian Floristic Region) and northern and eastern coastal areas of Australia to the Western Pacific, including Fiji and New Caledonia[5,6].

L. articulata is considered as weeds, usually found in peat swamps, waterlogged areas, riverbanks, and swamps, and even grow well in reasonably acidic soils[7-9]. Apart from rattans, very few species of plants are known to be the sources of woven materials employed by the indigenous people of Wawonii Island[3]. Due to the rarity of the rattans, people harvest *L. articulata*, which is then utilized as essential source materials for various handicrafts, such as for making containers. The practice of weaving *kolosua* is

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primarily done by women in Lampeapi Village[3]. It is very rare to see men have done the practice. *L. articulata* or the *kolosua* is implemented into the production of various handicrafts, mainly for household needs. The source of materials can be harvested free and easily from the nearby wild habitat.

The *L. articulata*-based handicrafts have recently been recognized to have the opportunity to be developed as a part of the fast-growing Indonesian creative industry, which in 2015 contributed 7.38% to the Indonesian national economy[8]. This current study aims to gather up-to-date ethnobiological data of *L. articulata* from Wawonii Island as the foundation for better improvement in the home industries, particularly the handicrafts and conservation of the species. In other words, the current study is intended to provide a basis for better management in protecting the sources of one of the important economic activities on the island.

Materials and Methods

Study area

This study was conducted in the vicinity of Lampeapi, approximately 19 km south of Langara, the capital of the Konawe Islands Regency. Despite being generally a village, Lampeapi is the capital of the Central Wawonii Subdistrict (Fig. 1). The community consists of the majority indigenous Wawonii tribe (approximately 90% of the population) and several other immigrants, such as Bajo, Bugis, Javanese, Sundanese, Buton, and Tolaki[1].

Data collection and analysis

The data collection method implemented in this present study followed Suminguit (2005), and Nolan and Turner (2011), namely semi-structured and "open-ended" interviews, and direct observations in the field[9,10]. The informants willingly provided their consent to engage in the research interviews after carefully reading and receiving comprehensive explanations, and fully comprehending the purpose of this study. The interviews focused on the local community, mainly the *kolosua*-based craftsmen in Lampeapi village from the indigenous Wawonii ethnic group, who have lived there for at least 30 up to 35 years. The data collection included the natural habitat of *L. articulata*, how many times per month that *L. articulata* is harvested, the quantity, the process of making a product (woven), its traditional name, usages, problems faced when producing it, and how the indigenous people of Wawonii tribe see their *kolosua*. The Marginal Survival Theory proposed by Bronislaw Malinovsky and Firth was implemented in this current study, especially when explaining the antiquity of the usage of Cyperaceae, including *L. articulata*, in Sulawesi and the indigenous people of Wawonii[11,12].

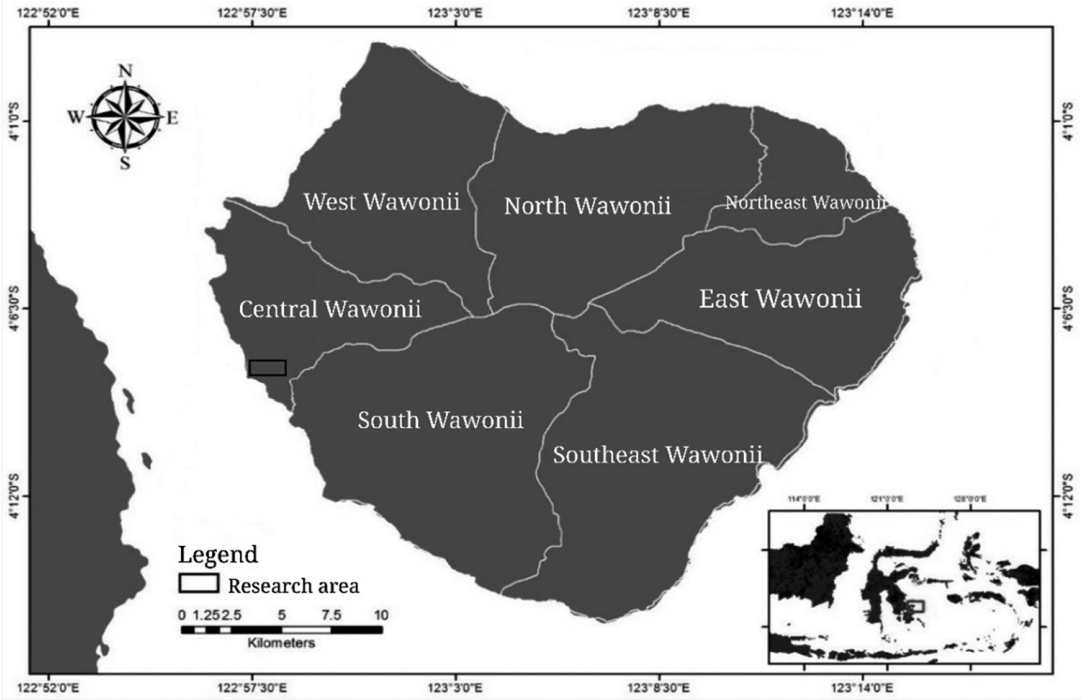

Fig. 1 — Map of the study area (Source: Authors)

Results and Discussion

Characteristic of informants

The majority of the inhabitants of the village are farmers, with cashew (*Anacardium occidantale* L.) and coconut (*C. nucifera*) as the main commercially planted trees[1]. Besides that, the people of Lampeapi are also conducting shifting cultivation, gardening, and forest foragings such as harvesting fruits, rattans, wild honey, and timbers. The Bajo people are still focused on the fishery. Although almost the entire population is Muslims[1], the daily activities, including medicine, medical treatments, and midwifing, are still influenced by traditional pre-Islamic beliefs. It is pronounced in the indigenous Wawonii people's activities by the presence of a shaman (known as *sando* in the local language) and traditional midwives, who are the actual and "always available" health service officers. The informants were selected based on their gender, age, occupation, and education level, as shown in Table 1.

Woven handicrafts with materials from rattan, pandan (usually based on leaves harvested from *Pandanus gladiator* B.C. Stone, *P. sarasinorum* Warb., and apparently cultivated *P. tectorius* Parkinson), and bamboo are produced by the people, commonly indigenous Wawonii people, primarily for souvenirs, which are one of the sources of income for the community. The Wawonii indigenous people also implement the leaves of *kolosua* or *purun* for making handicrafts. Previously only for household purposes, now it is beginning to be sold for souvenirs as well. This *kolosua* or *purun* is identified as a member of the sedges family (Cyperaceae)[4,13].

Table 1 — Characteristic and total number of informant

No	Characteristic	Number of informants
1	Gender	
	Male	14
	Female	3
2	Age (year old)	
	35 -50	15
	>51	2
3	Occupation	
	Traditional leader	2
	Farmer	3
	Housewife	14
4	Education	
	Elementary school	15
	Junior high school	2

Botany and ecology of *Lepironia articulata*

Kolosua is an annual herbaceous plant that lives in clumps and subaquatic habitat, has rhizome and leafless, and grows up to 2.5 m high. The rhizome creeps horizontally several centimeters below the surface of the mud, brownish to blackish, initially fleshy, then hardens like wood. Stem erect, unbranched, gray to glossy green, 0.5-2.5 m long and 2-8 mm thick, smooth, hollow in the middle. The leaves reduce to a reed-like sheath like a membrane covering the stem's base. Inflorescence in the form of a single "spikelet", appearing to the side on the leaves of the dressing, the leaves of the bandage are tubular, pointed, 2-5 cm long. Spikelets ovate to oblong, pointed, 1-2(-4) cm × 5-10 (-15) mm. Petals ovate inverted, broad or almost completely rounded, clear whitish, not veined, not keeled, brown or glossy brown, 4-6 x 4-6 mm. Flowers as long as or slightly shorter than the protective leaves; stamens 2-3 mm long. Fruit grain, inverted ovate or flattened almost round, grooved elongated, smooth, except at the slightly rough tip, brown, 3-4 × 2.5-3 mm.

From the results of exploration and observation of various areas on Wawonii Island, it is known that this species is only found in coastal swamp areas in Lampeapi Village[2], with a vegetation area of about 4 km^2 in a quartz sandy habitat that is flooded with fresh water (Fig. 2).

Fig. 2 — The natural habitat of *Lepironia articulata* in Lampeapi village

In Indonesia, *L. articulata* can only be found in Borneo, Sumatra, Bangka, Sulawesi (Lake Towuti), the Moluccas (Sula, Taliabu, Buru), and Indonesian New Guinea, including their adjacent islands[13]. The species has several vernacular names in Indonesia, including *purun*, *purundanau*, *tekor*, or *tiker*[7]. The vernacular names *tekor* or *tiker* apparently refers to the traditional primary usage of the species, which is for making mats, which in various traditional languages in Indonesia, from Javanese to Malay, is called *tikar* or *tiker* or *tikor*.

History of *Lepironia articulata*

The main production area of *L. articulata* mats in Indonesia at the beginning of the 20th century was in Banjarmasin, South Kalimantan, where about 1400 hectares were planted, and within the period 1918 to 1925, about 3.5 to 7 million *L. articulata* mats were exported annually from this region to Java, Sumatra, northern Borneo and elsewhere, where the local use was estimated at 1.5 million mats per year[14,15]. Figure 2, 3, 4, and 5 show how vital the *kolosua*-based handicraft industries were for the Indonesian (then Dutch East Indies) economy. Although the Austronesians have made various traditional handicrafts for household purposes, such as mats, bags, and baskets from the stems of *L. articulata* since the dawn of their civilizations, they are known to have a well-known amphibious civilization. It means they have a good knowledge of their lavish lowland tropical rainforests and vast open seas. The knowledge of utilizing the stems of *L. articulata* for handicrafts-making and medicinal-related purposes might have been brought by the ancient Austronesians who sailed from the Sundaland to Sulawesi around the Late Pleistocene. This insight has been supported by the recent discovery of old cave paintings in limestone karsts of Leang Bulu in Maros and Pangkep, South Sulawesi, which were created approximately 43,900 years ago[16].

The Austronesians might have populated Wawonii Island relatively later; nevertheless, they came to Wawonii Island in about the same era, the Late Pleistocene. Thus, the Austronesians might have brought the usage and knowledge of handcrafting using *L. articulata* from somewhere in the mainland of Sundaland, which is today approximately East Kalimantan based on the discovery of even much older cave paintings (ranging from 40,000 to 51,800 years ago)[16,17] and later to mainland Sulawesi and further east to Wawonii Island and beyond. All have happened in the Late Pleistocene. Evidence also supports that Sulawesi underwent a compositional shift during the Late Pleistocene with greater dominance of C_4 species. Sedge (Cyperaceae) pollens, another potential source of C_4 leaf waxes, also increased during this period, possibly expanding in extent on exposed shoreline sediments, suggesting that the $_{\delta}13C_{wax}$ signal could be reflecting quite local changes and a not broader-scale landscape change[18,19]. In other words, during the Late Pleistocene, there were vast grassland areas in Sulawesi, where *L. articulata* might have been abundant throughout Sulawesi and adjacent islands, including Wawonii.

The approximately same condition was experienced in Sundaland, where vast areas of Savanna might have existed, which might have affected the ancient Austronesians and their culture, emerging and developing the maximal usage of *L. articulata*, which later was brought to Sulawesi and beyond. In other words, the result of this current study suggests that the usage of *L. articulata* by the people of Wawonii Island, especially the indigenous tribe, is very ancient and brought from mainland Southeast Sulawesi as early as the Late Pleistocene. It also suggests here that even as early as the Late Pleistocene, the Austronesians have had already possessed the sailing ability, a critical capability to support their subsequent great nautical journeys further east to the Pacific and beyond, in which they brought the knowledge of the usage of *L. articulata* with them as well. Although the tradition of making handicrafts from *L. articulata* is still practiced in parts of mainland Sundaland, such as in Borneo, Java, and Sumatra, the tradition has been less commonly seen, practiced, and on the brink of extinction. Fortunately, the tradition is experiencing a revival recently, at least in Sumatra[8], and surprisingly the tradition survives not in the center of the pure Austronesian civilization (*i.e.*, former Sundaland) but at the relative edge of the civilization, Sulawesi, in which it turns out not in mainland Sulawesi, but its adjacent far corner islands, particularly Wawonii.

Manufacturing process and craft products

This current study shows that *kolosua* is gradually replacing rattans and bamboos as the source material for the traditional handicraft industries due to the least and less availability of rattans. The current study also indicates that *L. articulata* is harvested twice a month, and the quantity is about the large basket volume, approximately 1 to 1.5 m high. The harvested

materials are then sun-dried for 3 to 5 days. After being thoroughly dried, the stem of *L. articulata* is split in half and later straightened or trimmed so that the surface and edges are not wavy. Then, the processed stems are rolled into approximately 75 cm to 80 cm in diameter, traditionally known as *pinare* (Fig. 3).

Besides making mats, the *pinare* can also be used to produce traditional containers for rice and beans, known locally as *gangga*, for fishes, known as *haeta*, *lepa* for containers of spices, and *beubeu* for containers of sewing equipment. Nevertheless, most of these containers are for domestic purposes only. They are not typically sold in the markets. Apart from mats, some *kolosua* woven containers are generally for personal use only (Fig. 4).

Economic value

Some craftsmen sold the *pinare* for IDR 30,000 to 50,000 per roll. Five traditional mats (each of 120 × 200 cm^2) can be produced from this one roll of *pinare*. In a month, a group of craftsmen can produce ten such mats with a selling price shared among the craftsmen IDR 7,000 to 10,000 per person. In general, the regular income for each person in this *L. articulata*-based direct business ranges from 100,000 IDR to 150,000

Fig. 3 — The process of preparing *Lepironia articulata* for woven crafts

Fig. 4 — *Kolosua* weaving products from Lampeapi

IDR per month and is pretty regarded as sustainable enough for a humble living in Lampeapi.

The current status of *L. articulata* products on Wawonii Island is only available in traditional markets. The mats are sold throughout Wawonii Island's traditional markets. Once a week, they are exported to Kendari, the capital of Southeast Sulawesi Province on mainland Sulawesi. Woven *kolosua* crafts from Wawonii Island can fetch a high price if they incorporate aesthetic weaving. A recent study conducted by Arnida et al. indicates that the rhizome of *L. articulata* contains alkaloids, flavonoids, anthraquinones, saponins, and tannins[20]. The other study by Batubara et al. shows that the roots, stems, and leaves of *L. articulata* consist of lignin, holocellulose, and alpha-cellulose[7]. In other words, *L. articulata* can be regarded as a possible source of materials for paper industries, thus, reducing the usage of troublesome introduced *Acacia* spp. for sources of papers. *L. articulata* has also been proven as a bio-indicator of water pollution and a biofilter to improve water quality due to the ability of the species to absorb heavy metals, particularly toxic compounds, such as aluminum (Al), iron (Fe), sulfuric acid (H_2S), and sulfate radical (SO_4) in irrigation and drainage water channels. Moreover, it is also a bio-indicator for acidic soil of various animal species' habitats, such as dragonflies, which are also bio-indicators for clean water[21], and coloring techniques, similar to those used by *purun* weaving craftsmen in Sungai Kali Village, South Kalimantan[22] or Lubuk Kertang, North Sumatra[7] (Fig. 5).

Conservation status

L. articulata is not yet included in the IUCN Red List[23]. This species is utilized not only by the people of Wawonii Island but also by those outside, including Buton, Muna, Kabaina, and Ternate islands.

Fig. 5 — Collection of *L. articulata* craft from North Sumatra at *Munasain* (Indonesia Museum of Natural History, formerly known as Indonesia Museum of Ethnobotany)

The natural habitat of this species has experienced changes in land function, which is now used as a shrimp pond area. These changes may affect the species' natural population. Even then, there has been severe destruction to the habitat due to seawater intrusion and the uncontrolled massive shrimp pounds invasions. Currently, the habitat tends to be damaged because seawater entry resulted from the opening of shrimp ponds around the *kolosua* habitat.

Uncontrolled *kolosua* harvesting can pose a threat to its existence. Efforts are needed to conserve *L. articulata* through harvesting management and cultivation to prevent its extinction in nature. The other research of *L. articulata* that conducted at Haur Gading Subdistrict, South Kalimantan, reveals that management of *L. articulata* become an alternative business carried out by forest farmers in peat ecosystems for supporting peat ecosystem conservation[24].

Conclusions

The plant is known as *kolosua* in the language of the indigenous Wawonii tribe, especially by those who settled in Lampeapi Village, and has long been implemented as the source of handicraft, including mats, which is the most frequent item made. Therefore, the Regional Traditional Crafts Council, along with the local government, should offer guidance and counseling to the *kolosua* craftsmen in Lampeapi Village. This will enhance the aesthetic value of their work and enable them to sell their products at a higher price, ultimately leading to an increase in the daily income of the local community.

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Conflict of Interest

There is no conflict of interest.

Author Contributions

All authors contributed to editing and review of the manuscript and also approved the manuscript for final publication.

Informed Consent

Informed consent was obtained from all the knowledge holder share the data including photographs as and when required.

Data Availability

The data are exclusively retained by the authors.

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