

Ethnobotanical utilization and cultural significance of taro (*Colocasia* spp.) in Berau District, East Kalimantan, Indonesia

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Abstract. Oktavianingsih L, Wulandari N, Susanto D, Arif MF. 2025. Ethnobotanical utilization and cultural significance of taro (*Colocasia* spp.) in Berau District, East Kalimantan, Indonesia. *Biodiversitas* 26: 5458-5467. Taro (*Colocasia* spp.) is a tuber crop of the Araceae family valued for its high nutritional and medicinal properties, widely distributed across tropical and subtropical regions. Indonesia, particularly Kalimantan, harbors rich taro diversity and a long history of its utilization. However, comprehensive ethnobotanical studies on taro remain limited, especially concerning varietal diversity, plant parts used, processing methods, and cultural contexts. This study aimed to identify taro varieties in Berau District, East Kalimantan, and document their utilization by different ethnic groups. Data were collected through exploratory surveys, field observations, and semi-structured interviews involving approximately 50 informants from 14 ethnic groups across 26 villages in 10 sub-districts. Twenty accessions belonging to *Colocasia esculenta* var. *esculenta* and *C. e.* var. *antiquorum* were recorded, thriving in diverse habitats such as home gardens, swamps, and roadsides. Plant parts utilized included tubers (64%), stems (27%), leaves (6%), leaf stalks (2%), and leaf tips (1%). Taro served multiple purposes: staple food and vegetables, ceremonial materials (e.g., natural nail dye for weddings), traditional remedies for skin irritation, and livestock feed. Common preparation methods comprised frying, boiling, sautéing, and steaming. Women constituted the majority of users (92%), predominantly homemakers (60%), with most consumers aged 41-50 years. This study represents the first comprehensive ethnobotanical documentation of taro in Berau, highlighting its cultural and nutritional significance. The findings emphasize the urgency of preserving traditional knowledge to support germplasm conservation, local food innovation, and food security enhancement in tropical regions.

Keywords: *Colocasia esculenta*, crops, ethnobotany, food security, taro

INTRODUCTION

Taro (*Colocasia* spp.) is a tuber crop from the Araceae family and a key food source in many tropical and subtropical regions. It originates from Southeast Asia, Australia, and Papua New Guinea (Matthews et al. 2015; Grimaldi et al. 2018b; Guzzon et al. 2025). *Colocasia* includes about 20 species across tropical and subtropical Asia (Li and Boyce 2010; Ahmed et al. 2020), with *Colocasia esculenta* (L.) Schott being the most widely cultivated and economically important. As one of the oldest domesticated crops, taro is grown worldwide (Esposito et al. 2023), including throughout Indonesia. Borneo Island, known for having the highest diversity of Aroid plants (Ridley 1905; Oktavianingsih et al. 2017), is considered an early center of taro cultivation along with several native fruit species (MacKinnon et al. 2000).

Taro is rich in starch and valuable pharmacological compounds (Pereira et al. 2021). All plant parts are edible, with tubers providing essential nutrients such as calcium, iron, vitamins, and minerals important for health (Esposito

et al. 2023; Kubal et al. 2023). Indonesia is known for its traditional root crops (Aprianita et al. 2014), including taro, which is high in carbohydrates and may lower the risk of obesity, heart disease, and diabetes. Besides being a staple food, taro also offers medicinal benefits. Its antioxidants, particularly phenolic compounds, show bioactivities, such as immunomodulatory, antioxidant, antitumor, antimetastatic, antimutagenic, antihyperglycemic, antihypercholesterolemic, antimicrobial, antiviral, and anticancer effects (Simsek and El 2015; Esposito et al. 2023).

Taro also supports food diversification and sustainable agriculture in developing countries due to its nutrient content and adaptability to low-input farming systems (Aditika et al. 2022). In Southeast Asia, it is commonly cultivated as a secondary crop alongside rice and is a staple for small-scale farmers (Matthews 2023). Though often grown in rural areas and considered of low economic value (Otekinrin et al. 2021; Pereira et al. 2021), taro is increasingly seen as a crop with the potential to fight hunger and malnutrition, especially in Asia (Siddique et al. 2021). Indonesia, has long been an alternative carbohydrate

source to rice, with sufficient nutritional value (Mulyaningsih et al. 2019). However, most studies emphasize agronomy and nutrition, with limited focus on its ethnobotanical roles documentation traditional knowledge of taro diversity, processing, and cultural uses is crucial for conservation and breeding efforts.

Communities in Kalimantan, including East Kalimantan Province, have a long tradition of using taro. The province is inhabited by various ethnic groups such as the Dayak, Banjar, and Kutai (Oktavianingsih et al. 2017). In Berau District, indigenous communities include the Banua (Berau), Dayak, and Bajau (Merdekawati 2015), along with migrant such as the Javanese, Bugis, and Batak (Humairah 2021). These groups hold traditional knowledge on identifying, using, and processing taro, which is embedded in local food systems and passed down through generations. Ethnobotanical knowledge varies among ethnic groups, influenced by cultural values and community perceptions (Susandarini et al. 2021). Processing practise also varies with local wisdom, and preserving them is important for cultural diversity and taro genetic conservation. Documentation of traditional knowledge and using Aroid plants, including taro, is crucial (Oktavianingsih et al. 2017). Without it, taro's cultural role may decline, threatening its survival as a traditional food crop (Matthews 2004).

Although taro has significant economic value, ethnobotanical data remain limited in several regions (Grimaldi et al. 2018a). In Borneo, traditional cultivation is widespread, yet detailed information on its uses is lacking, creating opportunities to improve food security and crop diversification. Ethnobotanical studies can reveal the extent of crop diversity and support future breeding research. Knowledge of local plant diversity can provide important

genetic resource for breeding (Purwanto 2021). Research on taro is expected to improve cultivation, strengthen germplasm collections, enhance conservation, contribute to food security, and encourage wider taro consumption (Pereira 2021). Based on these considerations, this study aims to identify taro varieties in Berau District, East Kalimantan, and explore how different ethnic groups use the plant, focused on the consumed and the processing methods.

MATERIALS AND METHODS

Study period and area

The study was conducted from July to December 2023 in Berau District, East Kalimantan Province, Indonesia (116°-119° E, 1° N-2° 33' S), covering 26 villages in ten sub-districts (Figure 1). The area has a humid tropical climate with annual rainfall exceeding 2,000 mm, temperatures of 25-30°C, and diverse landscapes from coastal plains (6 masl) to hilly terrains (550 masl) with alluvial to lateritic soils, complemented by rivers, swamps, and estuaries suitable for taro cultivation. The vegetation type includes lowland tropical forests, mangroves, peat swamps, and secondary growth mixed with agricultural land where taro (*C. esculenta*), banana, sugarcane, coconut, and fruit trees are common. The district is home to multiple ethnic groups whose livelihoods center on agriculture, fishing, and small-scale trade, with taro cultivated in home gardens, fields, and wetlands, serving as a staple food, ceremonial material, and medicinal resource, supported by traditional knowledge passed through generations.

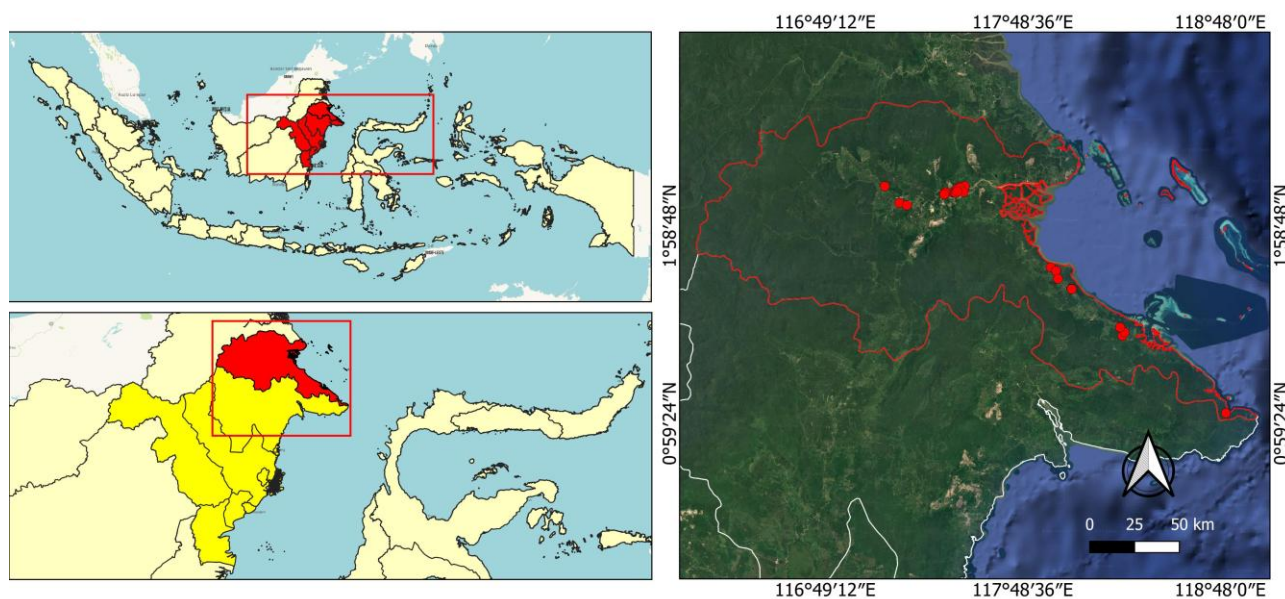


Figure 1. Map of the study area in Berau District, East Kalimantan Province, Indonesia, showing the geographical distribution of taro accession collection sites

Data collection procedures

This study applied an exploratory survey combined with direct interviews to collect ethnobotanical data on taro (*C. esculenta*). Figure 1 present a map of the sampling sites for the collected taro accessions. Field activities began with a preliminary survey to gather baseline information, identify key informants, and select respondents who were familiar with and regularly consumed taro. During this stage, the habitats where taro grows were also recorded, along with descriptions of the surrounding environment, village layout, and community conditions.

Semi-structured interviews were conducted using a questionnaire that included four main sections: (i) plant species used; (ii) plant parts utilized; (iii) methods of processing and preparation; and (iv) respondent demographic profile. Eligible respondents were individuals aged 17 years or older, from diverse ethnic backgrounds, with past or present experience in cultivating, preparing, or consuming taro. A total of 50 respondents representing 14 ethnic groups were interviewed: 13 Javanese, 12 Bugis, 6 Dayak, 5 Banjar, 3 Toraja, 3 Banua, and one each from Mandar, Makassar, Batak, Sunda, Flores, Sasak, Madura, and Timur.

Interviews were conducted in respondents' homes, gardens, or taro cultivation areas, and were complemented by direct field observations. For each site visited, information was recorded on planting location (e.g., home gardens, wetlands, mixed-crop fields, roadside plots), soil type, associated vegetation, and plant morphological features. GPS coordinates were taken for each accession, and photographic documentation was made of the plant, its habitat, and processing activities when applicable. All interviews were accompanied by detailed note-taking to ensure data accuracy.

In addition to verbal data, representative taro samples were collected to support morphological verification. Each specimen was documented for traits such as tuber size and shape, leaf blade dimensions, and petiole color. This combination of interviews, field observations, and specimen collection ensured that ethnobotanical information was both culturally grounded and biologically verifiable.

Data analysis

Taro (*C. esculenta*) samples collected during fieldwork were identified using standard morphological and varietal assessment references for aroids, namely the *Taro Plant Characterization and Evaluation Guide* (Kusumo 2002) and *Descriptors for Taro (Colocasia esculenta)* (IPGRI 1992). Identification focused on key diagnostic traits, including leaf shape and size, petiole characteristics, tuber morphology, and color variations, ensuring accurate differentiation of varieties.

Data from surveys, interviews, and field inventories were systematically coded and grouped into four main categories: (i) respondent characteristics (age, gender, ethnicity, occupation); (ii) plant parts utilized; (iii) processing and preparation methods; and (iv) habitat types where taro was found. Additional variables recorded for each accession included GPS location, variety name, local name, and photographic documentation.

Microsoft Excel was used for data entry, organization, and analysis. Descriptive statistics (e.g., frequency and percentage) were applied to summarize responses, while the software was also used to generate graphs, diagrams, and tables to visualize patterns of use, variety distribution, and habitat association. All records were cross-checked with field notes and photographs to verify accuracy before final interpretation.

RESULTS AND DISCUSSION

Distribution and habitat of taro in Berau District

Based on exploration, 20 plant accessions of taro (*C. esculenta*) were identified as food crops, each with distinct local names. Oktavianingsih et al. (2017) reported that taros in Borneo possesses numerous traditional cultivars and vernacular names, reflecting its cultural and genetic diversity. All accessions belonged to two *C. esculenta* varieties: *Colocasia esculenta* var. *esculenta* and *C. E.* var. *antiquorum* (Table 1). Among these, *C. esculenta* is predominantly cultivated and consumed as a staple food crop, with most cultivated cultivars originating from this variety (Matthews et al. 2015; Lebot 2020).

Taro grows well at altitudes of 6-90 masl and across diverse habitats, including ditches, swamps, vacant lots, roadsides, and home gardens. Oktavianingsih et al. (2019) reported that taro is widely distributed across Kalimantan, thriving in gardens, along riverbanks, beside roads, and in swampy areas. According to Matthews (2023), taro is extensively cultivated in home gardens across the Pacific Islands and Southeast Asia. In addition, Guzzon et al. (2025) documented its cultivation in home gardens in several European countries, including Greece. Taro adaptability to various agroecological conditions from tropical wetlands to temperate regions, supporting its global food security potential (Lebot 2020).

Local names of taro (*Colocasia* spp.) by ethnic communities in Berau District

Taro has multiple local names that vary across ethnic communities in Berau District. In the Toraja community, it is known as *Salonggo*, *Bite*, and *Keladi* (Table 2). *Bite* is a taro type from the Toraja highlands, typically cultivated around 1,300 meters above sea level (Pasanda et al. 2022). The Bugis community uses names such as *Aladi*, *Tungke*, and *Bote* for taro. As one of the ethnic groups residing in Kalimantan, which borders Malaysia, the Bugis language has been influenced by Malay, resulting in lexical borrowing such as *Aladi* and *Keladi* (Sah and Jaafar 2022).

The Dayak community refers to taro as *Lueh*. According to Savira (2019), this is the local name the Dayak use for the taro. In addition to *Lueh*, other names for taro within the Dayak community include *Ufa*, *Kew*, and *Sukai*. Meanwhile, the Batak ethnic group calls taro *Suhat*. This group utilizes taro not only as food but also as animal feed. Savira (2019) confirmed that *Suhat* is the local name for taro among the Batak people.

Table 1. Accessions and locations of taro in Berau District, East Kalimantan, Indonesia

Accessions Number	Sub-district	Elevation (masl)	Local name	Species name
1	Tanjung Redeb	10	<i>Keladi Jahe</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
3	Tanjung Redeb	15.5	<i>Keladi Botek</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
6	Tanjung Redeb	8.3	<i>Keladi Malaysia</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
13	Gunung Tabur	8.4	<i>Keladi Liar</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
15	Sambaliung	6	<i>Keladi Jahe</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
17	Segah	40.1	<i>Keladi Hitam</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
18	Segah	40.1	<i>Keladi Minyak</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
19	Segah	8.3	<i>Keladi Rose'</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
21	Biatan	37	<i>Keladi Bote</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
22	Biatan	37	<i>Keladi Tungke</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
23	Biduk-biduk	70	<i>Keladi Tikus</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
24	Tabalar	22	<i>Keladi Aladi</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
25	Tabalar	6.3	<i>Keladi Putih</i>	<i>Colocasia esculenta</i> var. <i>antiquorum</i>
26	Tabalar	6.3	<i>Keladi Minyak</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
27	Biatan	20.2	<i>Keladi Malaysia</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
28	Batu Putih	90	<i>Keladi Ungu</i>	<i>Colocasia esculenta</i> var. <i>antiquorum</i>
29	Batu Putih	68.3	<i>Keladi Uwi</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
30	Talisayan	54	<i>Keladi Putih</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
31	Talisayan	54	<i>Keladi Minyak</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>
32	Biatan	35.7	<i>Keladi Sukai</i>	<i>Colocasia esculenta</i> var. <i>esculenta</i>

In the Javanese community, taro is called *Uwi* and other local names include *Bentul* and *Bode*. The Madurese community calls *Botek*, while the Sundanese ethnic group refers to it as *Tales* or *Lompong*. In Indonesia, particularly on the island of Java, taro is commonly known as *Lompong* (Sulistiani and Isworo 2022). The leaves are often used in cooking, with one popular dish being sayur lompong from West Java (Sofihidayati et al. 2022).

In Eastern Indonesia, especially in Kupang District, Timor Island people call taro *Rose* or *Roset* (Naisali et al. 2023). The Sasak people of East Lombok District uses taro leaves for medicinal purposes, such as treating scratches and locally refer to the plant as *Lomak* or *Tojang* (Alauddin's 2020). These diverse local names reflect linguistic differences, cultural adaptations and traditional uses of taro across Indonesia.

Utilization of taro by ethnic communities in Berau District

Taro is a highly versatile food crop processed in various simple ways. The tuber can be made into vegetables and chips or prepared by frying, steaming, or baking into cakes (Table 3). According to Oktavianingsih et al. (2017), several ethnic groups in Kalimantan use taro as both a vegetable and a substitute staple. As a food, taro could be processed by roasting, toasting, boiling, and processing into fresh or fermented pasta, flour, drink, and crispy chips (Mulyaningsih et al. 2019). Taro derived products include flour, pasta, canned goods, and snacks (Esposito et al. 2023). In addition, taro leaves, leaf stalks, and petioles, are widely consumed as vegetables (Lebot 2020; Kubal et al. 2023).

Beyond human consumption, taro is used as animal feed, particularly for pigs, ducks, and Muscovy ducks, with wild cultivars often preferred. Wild taro has long been valued in Southeast Asia for human and animal diets

(Matthews et al. 2015; Matthews 2023). In Indonesia, leaves and stems are fed to pigs, chickens, and ducks (Anjalani 2020; Lucio et al. 2023). Taro leaves also have cultural uses, such as in the Bugis wedding tradition of *pacci*, a natural nail dye that imparts a yellow color and adheres well during ceremonies.

Taro contains calcium oxalate crystals, particularly in its tubers. Community knowledge in Berau District suggests washing tubers thoroughly, sprinkling them with salt and heating them before cooking to remove sap and reduce itching. Rubbing taro sap on skin exposed to leaf sap is also believed to alleviate irritation. Heating reduce calcium oxalate levels (Rudyatmi et al. 2014; Otekurin et al. 2021). However, further research is needed to optimize processing methods to ensure safe consumption (Otekurin et al. 2021).

Table 2. Local names of taro (*Colocasia esculenta* (L.) Schott.) by ethnic communities in Berau District, East Kalimantan, Indonesia

No.	Ethnic communities	Local name
1.	Toraja	<i>Salonggo, Bite, Keladi</i>
2.	Bugis	<i>Aladi, Tungke, dan Bote</i>
3.	Dayak	<i>Lueh, Ufa', Kew dan Sukai</i>
4.	Batak	<i>Suhat</i>
5.	Javanese	<i>Uwi, Bentul, Bode'</i>
6.	Sundanese	<i>Lompong</i>
7.	Timourese	<i>Rose</i>
8.	Madurese	<i>Botek</i>
9.	Sasak	<i>Lomak</i>
10.	Flores	<i>Keladi</i>
11.	Banua	<i>Keladi</i>
12.	Banjarese	<i>Keladi</i>
13.	Makassar	<i>Keladi</i>
14.	Mandar	<i>Keladi</i>

Different ethnic groups in Berau prepare specific taro cultivars in distinct way. The Toraja community processes *C. e. var. esculenta* "Talas Malaysia" (A-27) by boiling and frying them. However, this variety rarely produces tubers, so the community primarily uses the leaf stalks instead (Figure 3.A). The Bugis community uses "Keladi Aladi" (A-24) for *kolak*, frying and vegetable dishes (Figure 3.B); "Keladi Minyak" (A-31) (Figure 3.C) for clear and sour vegetable soups; "Keladi Tungke" (A-22) (Figure 3.G) and "Keladi Bote" (A-21) for layered cakes (*baje keladi*), with the tubers and leaf stalks being various vegetable soup (Figure 2.A); "Keladi Tikus" (A-23) (Figure 3.D) is used for sour vegetable soup, steaming and frying. Additionally, *C. e. var. antiquorum* "White Taro" (A-25) is typically prepared into clear vegetable soup using leaf stalks and tubers. These varieties differ in tuber shape, size, and weight, influencing culinary applications (Setyawan et al. 2021).

The Dayak community uses "Keladi Sukai" (A-32) (Figure 3.E), processing its tubers and leaf stalks into a variety of dishes such as sour vegetables, clear vegetables, stir-fried vegetables, coconut milk vegetables, and chips. Meanwhile, the Banjar community uses the tubers, leaf stalks, and leaves "Talas Jahe" (A-15) (Figure 3.F) to make coconut milk dishes, vegetables, and clear soups. Additionally, the tubers can be transformed into chips, fried foods, *kolak* (a sweet dessert), and bakpao fillings. The Banua community prepare the tubers and young leaf stalks "Keladi Tungke" (A-22) to prepare compote and boiled dishes. Similarly, on the Greek island of Ikaria, taro consumed as salads, soups, or cooked with nuts and meat, showing its culinary parallels with potatoes (Kahraman et al. 2020; Guzzon et al. 2025). Recording traditional knowledge and the uses of aroid plants, including taro, holds significant importance. For a crop such as taro, how

farmers utilize and manage its diversity plays a crucial role in conserving its genetic resources.

The Javanese ethnic community utilizes several taro cultivars, specifically *C. e. var. esculenta* "Keladi Uwi" (A-29) (Figure 3.H), "Keladi Minyak" (A-31), and *C. e. var. antiquorum* "Keladi Putih" (A-25), and "Keladi Ungu" (A-28). "Keladi Uwi" tubers are processed into chips and sour vegetables, while the leaf stalks are used in coconut milk dishes. "Keladi Putih" is made into chips, *getuk*, fried dishes, and boiled tubers. According to Quenum et al. (2023), taro can be prepared through boiling, frying, mashing, and making chips. "Keladi Minyak" tubers and leaf stalks are turned into sour vegetables, coconut milk dishes, and stir-fries, while tubers are also used to make snake fruit seed cakes. The Sundanese ethnic community cultivates *C. e. var. esculenta* "Keladi Jahe" (A-1) and "Keladi Hitam" (A-17) (Figure 3.I). Tubers from these cultivars are processed into taro chips and *getuk*, with leaf stalks and tubers incorporated into coconut milk dishes. Respondents explained that in making taro chips, the tubers are cleaned and squeezed with guava leaves to remove mucus and reduce itchiness, then drained in a warm place to extend shelf life.

Among the Madurese ethnic community, *C. e. var. esculenta* "Keladi Botek" (A-3) (Figure 3.J) tubers are boiled and also used as animal feed. In the Batak ethnic community, *C. e. var. esculenta* "Keladi Jahe" (A-15) tubers are boiled, while the leaves and stalks serve as animal feed (Figure 3.F). In Eastern communities, *C. e. var. esculenta* "Keladi Rose" (A-19) tubers and young stalks are cooked into sour or clear vegetable dishes, or made into *kolak* and steamed preparations. These plant parts also used for livestock feed. The Flores ethnic community processes *C. e. var. esculenta* "Keladi Liar" (A-13) tubers and stalks into vegetable dishes; this variety typically grows wild along roadsides.

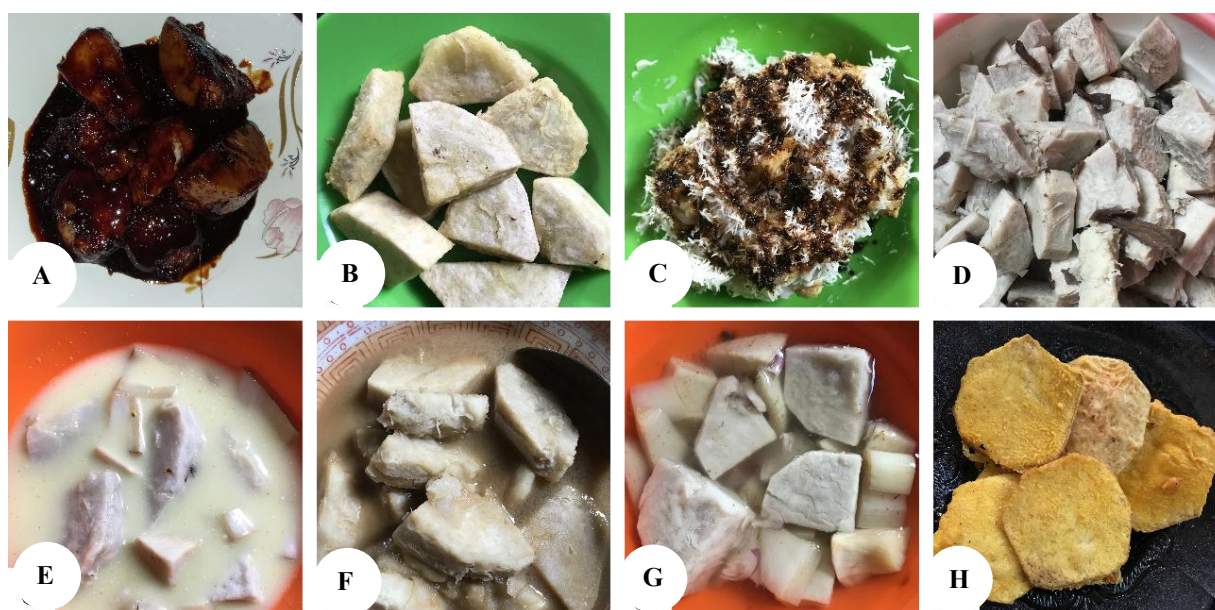


Figure 2. Various types of processed food from taro: A. *Baje keladi*, B. Fried taro, C. *Getuk*, D. Boiled taro, E. Coconut milk vegetable soup, F. *Kolak*, G. Clear vegetable soup, H. Chips

Table 3. Taro used as food crops in Berau District, East Kalimantan, Indonesia, and the processing methods

Accessions Number	Habitat	Plant parts used	Utilization	Processing methods	Ethnic
A-1	Swamps	Corm/tuber, leaf stalks, leaves Corm/tuber	Coconut milk vegetable soup Clear vegetable soup	Boil the tubers, stems and leaves, drain the boiling water and add coconut milk, cook until done. Boil the tubers and cook until tender.	Banjarrese Sundanese, Batak
A-3	Yards	Corm/tuber	Boiled taro Animal feed	Boil the tubers, add seasoning, and cook until done. Peel and grate the tubers, wash them thoroughly, mix with bran, stir, and they are ready to be fed to livestock.	Madurese
A-6	Swamps	Stem	Sour vegetable soup Sauté vegetables Clear vegetable soup	Boil the leaf stalks, drain, sauté red chilli, lemongrass, ginger, tamarind and shrimp paste, then add the leaf stalks and cook. Peel the bark, cut it, soak it in hot water, add salt, and drain. Sauté the spices and add the leaf stalks and cook. Boil the leaf stalks, add seasoning and cook until done.	Toraja
A-13	Roadsides	Corm/tuber and stem	Sour vegetable soup	Boil the leaf stalks and tubers, then drain. Sauté the red onion, lemongrass, ginger, tamarind, and shrimp paste, then add the leaf stalks and tubers and cook until done.	Flores
A-15	Yards	Corm/tuber, stem and leaves	Coconut milk vegetable soup	Boil the tubers, leaf stalks and leaves, then drain the water, add coconut milk and seasoning. Cook until done.	Banjarese, Batak
A-17	Yards	Corm/tuber	Chips <i>Getuk</i>	Slice the tubers thinly, soak them in salt and fry them. Steam the tubers, mash them, add sugar and flavoring, shape and cut them, then add brown sugar and grated coconut.	Sundanese
A-18	Yards	Corm/tuber	Chips <i>Getuk</i>	Slice the tubers thinly, soak them in salt and fry them. Steam the tubers, mash them, add sugar and flavoring, shape and cut them, then add brown sugar and grated coconut.	Bugis, Javanese
A-19	Yards	Corm/tuber and stem Corm/tuber Corm/tuber, stem and leaves	Sour vegetable soup Clear vegetable soup <i>Kolak</i> Steamed taro Animal feed	Boil the tubers and leaf stalks, then drain. Sauté the shallots, lemongrass, ginger, tamarind, and shrimp paste, then add the tubers and leaf stalks. Cook until done. Boil the tubers and leaf stalks, add seasoning and cook until done. Cut the tubers into pieces, cook, add brown sugar and salt, stir well, allow the brown sugar to dissolve, then add coconut milk and cook until boiling. Cut the tubers, add salt and steam until cooked. Boil the leaves, tubers, and stems. Remove from heat, drain, mix with bran, and feed to animals.	Timourese
A-21	Yards	Leaves Corm/tuber	<i>Pepes ikan</i> <i>Kolak</i>	The leaves are cleaned and used to wrap fish. Clean the tubers, cook them, add brown sugar, and let the brown sugar dissolve.	Bugis
A-22	Yards	Corm/tuber Corm/tuber Corm/tuber Corm/tuber and stem	Layer cake <i>Baje Keladi</i> Coconut milk vegetable soup Clear vegetable soup Sour vegetable soup	Clean the tubers, steam them, mash them and pound them. Mix with brown sugar, eggs, sugar and wheat flour, and steam. Steam the tubers, melt the brown sugar, add the tubers and cook until dry. Boil the tubers and stems, discard the boiling water and add coconut milk. Boil the tubers and leaf stalks, add seasoning and cook until done. Boil the tubers and leaf stalks, then drain. Sauté the onion, lemongrass, ginger, and shrimp paste, then add the stems and tubers and cook until done. Add tamarind.	Bugis, Banua

A-23	Yards	Corm/tuber Corm/tuber and stem	Fried taro Steamed taro	Cut the tubers, add salt, coat with flour and fry. Cut the tubers, add salt, and steam until cooked.	Bugis
A-24	Yards	Corm/tuber	Sour vegetable soup <i>Kolak</i>	Cut the tubers, boil them and drain them. Grind the spices, add the tubers and cook until done. Cut the tubers, cook them, add brown sugar, let the brown sugar dissolve, add coconut milk and let it boil.	Bugis
A-25	Yards	Corm/tuber and stem	Fried taro Sour vegetable soup	Cut the tubers, add salt, coat with flour and fry. Cut the tubers, boil them and drain them. Grind the spices, add the tubers and cook until done.	Bugis, Javanese
A-26	Yards	Corm/tuber and stem	Clear vegetable soup	Cut the tubers, place them in boiling water, add seasoning and cook until tender.	Bugis, Javanese
		Corm/tuber	Sour vegetable soup Boiled taro	Cut the tubers, boil them and drain them. Grind the spices, add the tubers and cook until done. Cut the tubers, boil them and add seasoning, cook until done.	
A-27	Drainage	Corm/tuber	Fried taro Boiled taro	Cut the tubers, add salt, coat with flour and fry. Cut the tubers, boil them and add seasoning, cook until done.	Toraja
A-28	Yards	Leaves Corm/tuber	Animal feed Chips <i>Getuk</i>	The leaves are cleaned, chopped, boiled and ready to be fed to livestock. The tubers are sliced thinly, soaked in salt solution and fried. The tubers are steamed, mashed, mixed with sugar and flavoring, cut into pieces and mixed with grated coconut and brown sugar.	Javanese
A-29	Yards	Corm/tuber Stem	Fried taro Boiled taro Chips	Cut the tubers, add salt, coat with flour and fry. Cut the tubers, boil them and add seasoning, cook until done. The tubers are sliced thinly, soaked in salt solution and fried.	Javanese
A-30	Yards	Corm/tuber and stem	Coconut milk vegetable soup Sour vegetable soup	Cut the tubers, boil them, and discard the boiling water. Add coconut milk and seasoning, and cook until done. Cut the tubers, boil them and drain them. Grind the spices, add the tubers and cook until done.	Javanese
A-31	Yards	Corm/tuber	Sour vegetable soup	Cut the tubers, boil them, and discard the boiling water. Add coconut milk and seasoning, and cook until done.	Javanese
A-32	Yards	Corm/tuber and stem	Chips Sour vegetable soup	The tubers are sliced thinly, soaked in salt solution and fried. Cut the tubers, boil them and drain them. Grind the spices, add the tubers and cook until done.	Bugis, Javanese Dayak
			Clear vegetable soup Sauté vegetables	Cut the tubers, place them in boiling water, add seasoning and cook until tender. Cut the tubers, soak them in hot water, add salt and drain. Sauté the spices, add water, add the tubers and leaf stalks and cook until done.	
			Coconut milk vegetable soup	Cut the tubers, boil them, and discard the boiling water. Add coconut milk and seasoning, then cook until done.	

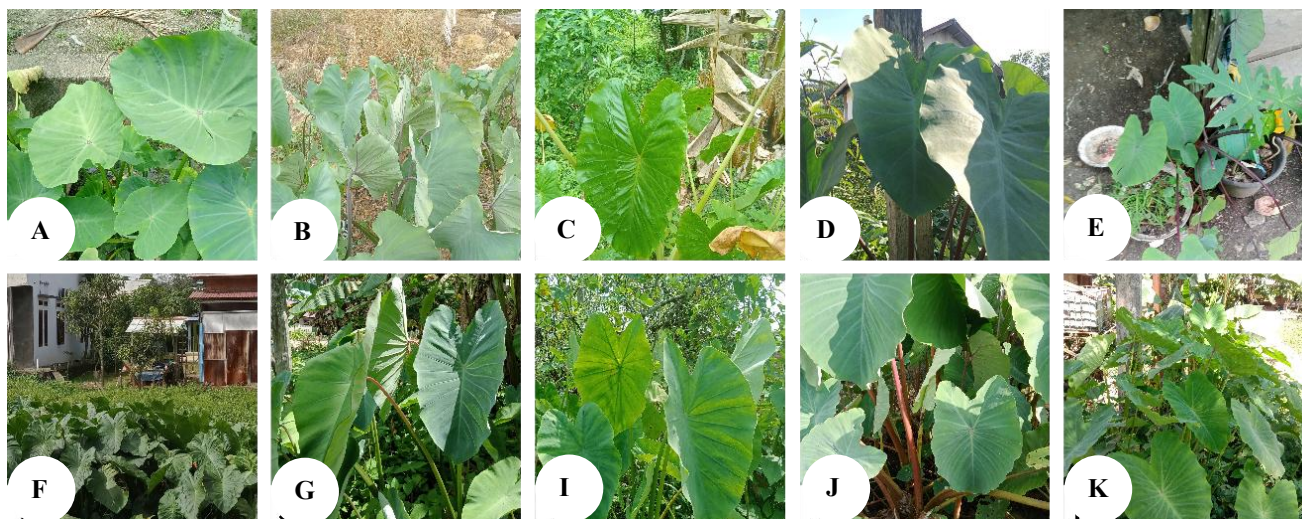


Figure 3. Taro (*C. esculenta*) that was used by several ethnic community in Berau District, East Kalimantan, Indonesia: A. “Talas Malaysia”, B. “Keladi Aladi”, C. “Keladi Minyak”, D. “Keladi Tikus”, E. “Keladi Sukai”, F. “Keladi Jahe”, G. “Keladi Tungke”, H. “Keladi Uwi”, I. “Keladi Hitam”, J. “Keladi Botek”

Parts of the taro plant used by ethnic communities in Berau District

The plant comprises five edible parts: tubers, leaves, stems, leaf tips, and stalks. Among these, tubers are the most consumed, making up approximately 64% of usage, followed by stems at 27%, leaves at 6%, leaf stalks at 2%, and leaf tips at 1% (Figure 4). Research by Pulungan and Brata (2017) documented these proportions, noting the predominance of tuber consumption over other plant parts. Guzzon et al. (2025) further affirm that the primary portion of taro traded for food is the tubers both primary and side tubers and that Indonesian consumers mainly utilize the tubers over other parts. Additionally, young leaves and stalks are also edible, as confirmed by Quenum et al. (2023).

Leaves are the third most significant part of the taro consumed by ethnic groups in the Berau district. According to Otekurin et al. (2021), taro leaves are rich in protein, minerals, secondary metabolites, and fiber. Even after cooking, processed taro vegetables retain their bioactive compounds. The high levels of dietary fiber in taro are beneficial for regulating intestinal metabolism. Additionally, taro has the potential to become a staple crop due to its adaptability to various climate conditions and its nutritional and antioxidant benefits (Aditika et al. 2022).

Characteristics of respondents of ethnic communities who use taro

According to information gathered from the respondents in 26 villages in Berau District, taro is predominantly used by women, who make up 92% of users. Among these, homemakers represent the largest group, accounting for 60%. In contrast, males comprise only 8% of taro users, and fishermen represent just 1%, indicating minimal usage. Research by Yuniriyanti and Sudarwati (2015) highlights that women, particularly homemakers, play a crucial role in food production,

including processing and preparation. Most taro users fall within the age range of 41 to 50 years, making up 28% of the population (Table 4). This finding is further supported by research conducted by Oktavianingsih et al. (2017) which states that the average age of respondents is 30-60 years and Cita and Hasibuan (2019) which indicates that the respondents most knowledgeable about using food crops are typically between 40 and 69 years old.

Most taro users only completed elementary school, with 19 individual (38%). The fewest respondents are college graduates, totaling 4 (8%). Interviewees with only elementary education cited economic hardship and the long distance to schools as reasons for limited schooling. Their knowledge of taro primarily comes from family tradition. In contrast, college educated respondents learned about taro from family and formal education.

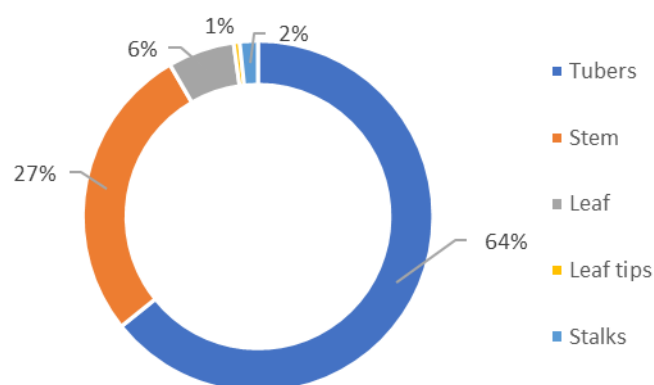


Figure 4. Parts of the taro plants used by ethnic communities in Berau District, East Kalimantan, Indonesia

Table 4. Characteristics of respondents of ethnic communities who use taro in Berau District, East Kalimantan, Indonesia

Parameters	Category	Number	Percentage (%)	
Gender	Male	4	8	
	Female	46	92	
Ages	17-30	13	26	
	31-40	7	14	
	41-50	14	28	
	51-60	10	20	
	61-70	3	6	
	71-90	3	6	
Educational level	No	3	6	
	Elementary school	19	38	
	Junior high school	5	10	
	Senior high school	19	38	
	College	4	8	
Job	Homemaker	30	60	
	Entrepreneur	1	2	
	Teacher	2	4	
	Farmer	4	8	
	Fisherman	1	2	
	Student	6	12	
	Not working	6	12	
	Salesman	1	2	
	Location	Home yard	17	34
		Traditional market	17	34
Garden		11	22	
Cultivation garden		2	4	
Forest		2	4	

In Berau District, people typically obtain taro by planting it in their yards or buying it from the market, each with 17 respondents (34%) each. This trend is understandable as many households cultivate crops in their yards for daily nutritional needs. Susandarini et al. (2021) noted that the variety of food plants sourced from local fields and forests is essential for diet diversity. Additionally, research by Hetharia et al. (2020) indicates that effectively utilizing yard space can significantly contribute to food availability.

In conclusion, this study documents 20 *C. esculenta* accessions used by 14 ethnic groups in Berau District, revealing significant diversity in varieties, local names, plant parts utilized, and processing techniques. The findings highlight taro's cultural and nutritional importance, with traditional knowledge is important to maintaining its genetic diversity and culinary uses. Conservation of taro diversity and associated ethnobotanical knowledge is crucial for safeguarding genetic resources, enhancing food security, supporting climate resilient agriculture, and sustaining cultural heritage. The adaptability of taro to diverse habitats, combined with its nutritional and medicinal properties, positions it as a strategic crop for the future particularly in Kalimantan.

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REFERENCES

- Aditika, Kapoor B, Singh S, Kumar P. 2022. Taro (*Colocasia esculenta*): zero wastage orphan food crop for food and nutritional security. *S Afr J Bot* 145: 157169. DOI: 10.1016/j.sajb.2021.08.014.
- Ahmed I, Lockhart PJ, Agoo EMG, Naing KW, Nguyen DV, Medhi DK, Matthews PJ. 2020. Evolutionary origin of taro (*Colocasia esculenta*) in Southeast Asia. *Ecol Evol* 10 (23): 13530-13543. DOI: 10.1002/ece3.6958.
- Anjalani R. 2020. Kualitas silase batang dan daun talas dengan penambahan berbagai aditif silase. *Jurnal Ilmu Hewani Tropika* 9 (2): 44-48. [Indonesian]
- Aprianita A, Vasiljevic T, Bannikova A, Kasapis S. 2014. Physicochemical properties of flours and starches derived from traditional Indonesian tubers and roots. *J Food Sci Technol* 51 (12): 3669-3679. DOI: 10.1007/s13197-012-0915-5.
- Cita KD, Hasibuan RS. 2019. Pemanfaatan tumbuhan pangan oleh etnik Sunda, di Kampung Nyangkewok, Kabupaten Sukabumi. *Jurnal Media Konservasi* 24 (3): 303-313. DOI: 10.29244/medkon.24.3.303-313. [Indonesian]
- Esposito T, Pisanti S, Mauro L, Mencherini T, Martinelli R, Aquino RP. 2023. Activity of *Colocasia esculenta* (Taro) corms against gastric adenocarcinoma cells: Chemical study and molecular characterization. *Intl J Mol Sci* 25: 252. DOI: 10.3390/ijms25010252.
- Grimaldi IM, Leke WN, Borokini I, Wanjama D, Van AT. 2018a. From landraces to modern cultivars: field observations on taro, *Colocasia esculenta* (L.) Schott in sub-Saharan Africa. *Genet Resour Crop Evol* 65 (7): 1809-1828. DOI: 10.1007/s10722-018-0651-4.
- Grimaldi IM, Muthukumaran S, Tozzi G, Nastasi A, Boivin N, Matthews PJ, Van Andel T. 2018b. Literary evidence for taro in the ancient Mediterranean: A chronology of names and uses in a multilingual world. *PLoS ONE* 13: e0198333. DOI: 10.1371/journal.pone.0198333.
- Guzzon F, Iamonicio D, Carvalho MAAP, Gouveia CSS, Nóbrega H, Grimaldi IM, Matthews PJ, Kyrtziz AC, Morales DA, Pérez V, Barrera M EV, Mesa DR, Sukal AC, Canella M, Müller JV. 2025. Taro (*Colocasia esculenta*) in Europe: A journey through fields, botanical gardens, ditches and city markets. *Genetic Resources and Crop Evolution* 1-22. DOI: 10.1007/s10722-025-02354-7.
- Hetharia C, Wattimena L, Loppies Y, Pakaila B, Ferdinandus W. 2020. Pemanfaatan lahan pekarangan selama pandemi covid-19 di Kampung Malagufuk Kabupaten Sorong. *Jurnal Pengabdian Masyarakat* 3 (2): 240-249. DOI: 10.34124/jpkm.v3i2.77.
- Humairah W. 2021. Pola Adaptasi Sosial Etnis Bugis dengan Etnis Berau (Studi Fenomenologi di Kecamatan Gunung Tabur Kabupaten Berau Provinsi Kalimantan Timur). [Thesis]. Universitas Muhammadiyah Makasar, Makasar. [Indonesian]
- International Plant Genetic Resources Institute (IPGRI). 1992. Descriptors for Taro (*Colocasia esculenta*). IPGRI, Rome.
- Kahraman B, Arici M, Tokar OS. 2021. Investigation of the properties of starch obtained from taro (*Colocasia esculenta* L. Schott) grown in Mersin. *Sigma J Eng Nat Sci* 38 (2): 875-887.
- Kubal K, Dikwalkar K, Rane A, Hodawadekar P, Bhalekar A, Dhuri N, Chavan, Barse R, Jagtap V. 2023. Pharmaceutical approach of taro (*Colocasia esculenta*). *Asian J Res Pharm Sci* 2023. DOI: 10.52711/2231-5659.2023.00040.
- Kusumo S, Maharani H, Sugiono M, Machmud T, Subadriyo, Atmadja H, Agus N, Husni K. 2002. Panduan Karakterisasi dan evaluasi plasma nutfah talas. Departemen Pertanian Badan Penelitian dan Pengembangan Komisi Nasional Plasma Nutfah, Bogor. [Indonesian]
- Lebot V. 2020. Tropical Root and Tuber Crops: Cassava, Sweet Potato, Yams and Aroids 2nd ed. CABI, UK. DOI: 10.1079/9781789243369.0000.
- Li H, Boyce PC. 2010. *Colocasia*. In: Wu Z-Y, Raven PH, Hong D-Y. (eds.) *Flora of China* 23. Pp. 73-75. Missouri Botanical Garden Press, St. Louis.

- Lucio AV, Martínez AG, Serrano ER. 2020. Utilization of cooked cassava and taro as alternative feed in enhancing pig production in ecuadorian backyard system. *Animals* 13: 356. DOI: 10.3390/ani13030356.
- MacKinnon K, Hatta G, Halim H, Mangalik A. 2000. *The Ecology of Kalimantan*. Periplus Editions (HK) Ltd, Singapore.
- Matthews PJ, Nguyen VD, Tandang D, Agoos EM, Maludid DA. 2015. Taxonomy and ethnobotany of *Colocasia esculenta* and *C. formosana* (Araceae): implications for the evolution, natural range, and domestication of taro. *Aroideana* 38e (1): 153-176.
- Matthews PJ. 2004. Genetic diversity in taro and the preservation of culinary knowledge. *Ethnobot Res Appl* 2: 55-71. DOI: 10.17348/era.2.0.55-71.
- Matthews PJ. 2023. Taro (*Colocasia esculenta*) in Asia and the Pacific: Models for domestication as a food and fodder crop. In: Ikeya K, Balée (eds.). *Global Ecology in Historical Perspective*. Springer Nature, Singapore. DOI: 10.1007/978-981-19-6557-9_11.
- Merdekawati E. 2015. Karakteristik Musik Sampe' dalam Ritual Ujin Suku Dayak Ga'ai Berau Kalimantan Timur. [Thesis]. Universitas Negeri Yogyakarta, Yogyakarta. [Indonesian]
- Mulyaningsih ES, Anggraheni YGD, Sulistyowati Y. 2019. Genetic diversity in taro (*Colocasia esculenta* L. Schott) germplasm procured from seven provinces of Indonesia. *SABRAO J Breed Genet* 51 (3): 295-310.
- Naisali, Utoro PAR, Witoyo JE. 2023. Keragaman dan metode pengolahan umbi-umbian lokal Nusa Tenggara Timur. *Jurnal Pangan dan Gizi* 13 (2): 1-17. DOI: 10.26714/jpg.13.2.2023.1-17. [Indonesian]
- Oktavianingsih L, Suharyanto E, Daryono BS, Purnomo. 2017. Traditional usages of taro (*Colocasia* spp.) by ethnic communities in Borneo. *Journal Biosaintifika* 9 (2): 248-256. DOI: 10.15294/biosaintifika.v9i2.9956.
- Oktavianingsih, Suharyanto E, Daryono BS, Purnomo. 2019. Morphological characters variability of taro (*Colocasia* Spp.) in Kalimantan, Indonesia based on phenetic analysis approach. *SABRAO J Breed Genet* 51 (1): 37-56.
- Otekunrin OA, Sawicka B, Adeyonu AG, Otekunrin OA. 2021. Cocoyam [*Colocasia esculenta* (L.) Schott]: Exploring the production, health and trade potentials in sub-saharan Africa. *Sustainability* 13: 4483. DOI: 10.3390/su13084483.
- Pasanda AA, Marthinus V, Tandirerung WY. 2022. Teknik sterilisasi eksplan talas lokal Toraja "BITE" (*Colocasia esculenta*) dengan teknik in vitro. *Jurnal Agrium* 25 (2): 133-139. DOI: 10.30596/agrium.v25i2.11765. [Indonesian]
- Pereira PR, Mattos EBA, Corrêa ACNTF, Mauricio AVMA, Vania VMFP. 2021. Anticancer and immunomodulatory benefits of taro (*Colocasia esculenta*) corms, an underexploited tuber crop. *Intl J Mol Sci* 22 (1): 265. DOI: 10.3390/ijms22010265.
- Pulangan ASS, Brata W. 2017. Aktivitas antibakteri ekstrak etanol daun talas terhadap bakteri patogen. *Jurnal Sainika* 17 (1): 76-79. [Indonesian]
- Purwanto Y. 2021. Applying Ethnobiology in Sustainable Management and Utilization of Biological Resources in Indonesia. *Proceedings of KOBI 2nd International Confer* 1: 8-23. DOI: 10.29007/dknw.
- Quenum ZNJ, Kumar L, Akorada MO, Dansi A, Vetukuri RR, Bhattacharjee R. 2023. Ethnobotany and perceptions on the value of taro (*Colocasia esculenta*) among farmers in Benin Republic. *Afr J Agric Res* 19 (5): 466-481. DOI: 10.5897/ajar2022.16240.
- Ridley HN. 1905. The aroid of Borneo. *J Straits Branch Royal Asiatic Soc* 4: 169-188.
- Rudyatmi E, Rahayu, Enni S. 2012. Karakterisasi Talas Lokal Jawa Tengah dalam Rangka Identifikasi Sumber Plasma Nuttfah sebagai Upaya Konservasi Tanaman Pangan Alternatif. [Thesis]. Universitas Semarang, Semarang. [Indonesian]
- Sah MFM, Jaafar SRS. 2022. Strategi Adaptasi Kata Pinjaman dalam Bahasa Bugis: koresponden-OO. *J Lang Stud* 21 (3): 52-77. DOI: 10.17576/gema-2021-2103-04. [Indonesian]
- Savira I. 2019. Pendampingan Pemasaran Produk Olahan Umbi Talas di Desa Pagerharjo Kecamatan Samigaluh Kabupaten Kulon Progo Daerah Istimewa Yogyakarta. [Thesis]. Sekolah Tinggi Pembangunan Masyarakat Desa, Yogyakarta. [Indonesian]
- Setyawan HB, Yulianto R, Zelin O, Purnamasari L. 2021. Potential of three taro (*Colocasia esculenta* L.) cultivars as animal feed. *ASEAN J Sci Technol Dev* 38 (3): 97-102. DOI: 10.29037/ajstd.716.
- Siddique KHM, Li X, Gruber K. 2021. Rediscovering Asia's forgotten crops to fight chronic and hidden hunger. *Nat Plants* 7: 116-122. DOI: 10.1038/s41477-021-00850-z.
- Simsek S, El SN. 2015. In vitro starch digestibility, estimated glycemic index and antioxidant potential of taro (*Colocasia esculenta* L. Schott) corm. *Food Chem* 168: 257-261. DOI: 10.1016/j.foodchem.2014.07.052.
- Sofihidayati T, Erni, Rustiani W, Ike Y. 2022. Pelatihan pemanfaatan tepung kulit pisang dan daun talas sebagai pangan fungsional di Desa Jambuluwuk. *Prosiding Simposium Nasional Multidisiplin* 4: 81-87. DOI: 10.31000/sinamu.v4i1.7877. [Indonesian]
- Sulistiani RP, Isworo JT. 2022. Efektivitas jenis pelarut dan metode ekstraksi dari daun talas (*Colocasia esculenta* L. Schott). *Jurnal Gizi* 11 (2): 68-76. DOI: 10.26714/jg.11.2.2022.68-76. [Indonesian]
- Susandarini R, Khasanah U, Rosalia N. 2021. Ethnobotanical study of plants used as food and for maternal health care by the Malays communities in Kampar Kiri Hulu, Riau, Indonesia. *Biodiversitas* 32 (6): 3111-3120. DOI: 10.13057/biodiv/d220613.
- Yuniriyanti E, Sudarwati R. 2015. Pengembangan model pemberdayaan wanita dalam upaya pencapaian ketahanan pangan keluarga pada rumah tangga petani. *Jurnal Studi Manajemen dan Bisnis* 2 (2): 161-175. DOI: 10.21107/jsmb.v2i2.1494. [Indonesian]