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Pragmatical utilization of *beneng* taro (*Xanthosoma undipes*) based on local knowledge of the community of Mount Karang, Pandeglang, Indonesia

GUT WINDARSIH[1,♥], AZIZAH FAUZIAH RAHMA[1], DENI MULYANA[1], MUHAMMAD RIFQI HARIRI[2], INA ERLINAWATI[2], INDIRA RIASTIWI[3], MUHAMMAD EFENDI[4]

[1]Program of Biology, Faculty of Science, Universitas Islam Negeri Sultan Maulana Hasanuddin Banten. Jl. Syech Nawawi Al Bantani, Serang 42116, Banten, Indonesia. Tel./fax.: +62-254-200-323, ♥email: gut_windarsih@yahoo.com

[2]Research Center for Biosystematics and Evolution, National Research and Innovation Agency. Jl. Raya Jakarta-Bogor Km 46, Cibinong, Bogor 16911, West Java, Indonesia

[3]Research Center for Genetic Engineering, National Research and Innovation Agency. Jl. Raya Bogor-Jakarta Km 46, Cibinong, Bogor 16911, West Java, Indonesia

[4]Research Center for Plant Conservation, Botanic Gardens and Forestry, National Research and Innovation Agency. Jl. Raya Bogor-Jakarta Km 46, Cibinong, Bogor 16911, West Java, Indonesia

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Abstract. *Windarsih G, Rahma AF, Mulyana D, Hariri MR, Erlinawati I, Riastiwi I, Efendi M. 2023. Pragmatical utilization of* beneng *taro* (Xanthosoma undipes *K.Koch*) *based on local knowledge of the community of Mount Karang, Pandeglang, Indonesia. Biodiversitas 24: 6415-6424. Beneng* taro (*Xanthosoma undipes* K.Koch) belongs to the order Arales and family Araceae. It is one of the staple crop commodities cultivated extensively in Mount Karang, Pandeglang District, Banten, Indonesia. This research aimed to assess the utilization of *beneng* taro by the local community in Mount Karang. The study was classified as descriptive research. The research used exploratory surveys and participatory rural appraisal as methodological approaches. Data collection techniques were collected through interviews, questionnaires, observations, and documentation. Moreover, 30 participants were selected using purposive sampling and snowball sampling methods. The plants were sampled randomly, 5 per location, to observe morphological traits. The findings of this study indicate that there are two local cultivars of *beneng* taro found in Mount Karang, including green leaf sheath and red leaf sheath cultivars. All *beneng* taro plant parts possess significant economic worth, including leaf blades, leaf sheaths, petioles, corms, cormels, and exudates. This plant is frequently used for food and beverage, cigarettes, medicinal ingredients, fabric production, crafts, organic fertilizer, livestock feed, fish pellets, and decorative plants. However, *beneng* taro with green leaf sheath is more widely cultivated in the area and consumed for food and beverage.

Keywords: *Beneng* taro, local cultivar, Mount Karang, pragmatical utilization, *Xanthosoma undipes*

INTRODUCTION

Beneng taro is one of the staple crop commodities abundantly grown in Pandeglang District, Banten (Yursak et al. 2021; Nurtiana et al. 2022). *Beneng* taro, scientifically known as *Xanthosoma undipes* (K.Koch and C.D.Bouché) K.Koch, is a member of the Araceae family (WFO 2023). The species is native to Costa Rica (García-Robledo et al. 2005) and several tropical regions in the Americas (Ara and Hasan 2012; POWO 2023; USDA 2023).

Xanthosoma undipes is a terrestrial shrub with a height of up to 225.7 cm; the leaves clustered at the apex. The petiole length measures 182.3 cm, yellow-green, glossy, and spongy. The number of leaves is 5.3 blades; the leaf blade is ovate, the leaf apex is acute or obtuse, and the leaf base is sagittate. The length and width of the leaf blade are 108.7 cm and 85 cm, respectively. The upper leaf blade surface is green and weakly glossy; the lower leaf blade surface is paler green. The primary tuber exhibits a length of 1-4 m, a weight of 42 kg, and a diameter of 10-20 cm. There are several inflorescences per axil; peduncle has a length of 14-16 cm, pale green; spathe erects, has a length of 7-10 cm and a width of 3-4 cm; spathe tube has a length of 6.5 cm, pale green, weakly glossy; spadix has a length of 10-18 cm, consisting of the orange pistillate, creamy-white staminate, and creamy-yellow sterile staminate (Minantyorini and Hanarida 2002; Yursak et al. 2021; Nurtiana et al. 2022; GBIF 2023; POWO 2023). *Beneng* taro exhibits optimal growth in tropical regions with adequate annual rainfall levels ranging from 1,750 to 2,500 mm and air temperatures from 21 to 27°C. This species has been observed to thrive within an altitude range of 200 to 2700 meters above sea level (masl). Additionally, it has been found to favor sandy loam soils (Minantyorini and Hanarida 2002; Yursak et al. 2021).

Using *beneng* taro as a food ingredient has a role in increasing food diversification. The tuber of *beneng* taro contains protein (6.25% wb), ash (3.43% wb), carbohydrate (84.88% wb), amylopectin (70.24% wb), crude fiber (2.29% wb), and dietary fiber (7.19% wb). Besides that, the taro tuber contains minerals such as potassium, phosphorus, manganese, and copper (Temesgen and Retta 2015). People of Pandeglang utilized the tuber by frying, steaming, or boiling. In addition, it is also processed into flour (Nurtiana

et al. 2022), which has the potential to be processed into various culinary products, such as noodles (Muttakin et al. 2015) and cakes (Nurtiana et al. 2022). The *beneng* taro flour contains nutritional contents consisting of water content is 6.1%, ash 6.11%, fat 0.39%, protein 6.7%, carbohydrate 80.7%, energy 353.13 kcal/100 mg of flour, dietary fiber 2.43%, carotene 6.92 ppm, oxalate 648.87 ppm, iron (Fe) 16.24 mg/100 g of flour, and zinc (Zn) 7.49 mg/100 g of flour (Budiarto and Rahayuningsih 2017). On the other hand, the leaves can be used as materials for manufacturing cigarettes (Yursak et al. 2021). In addition, *X. undipes* also has potential as a medicinal plant, including the treatment of infection (POWO 2023), reducing the risk of coronary heart disease and cancer (Nurtiana et al. 2022), and the treatment of malaria (Frausin et al. 2015).

Several previous studies have investigated the characteristics and utilization of *beneng* taro. For instance, Yursak et al. (2021) researched the morphological characterization of *beneng* taro from Pandeglang, Banten. Fatmawaty et al. (2018) also studied the phytochemical analysis of *beneng* taro leaves. To date, the residents of Banten persist in their endeavors to innovate in the processing of *beneng* taro, aiming to create novel products that possess enhanced economic worth. Hence, the primary objective of this study was to investigate the utilization of *beneng* taro among the local community residing in Mount Karang, Pandeglang District, Banten, Indonesia.

MATERIALS AND METHODS

Study area

This research was conducted in Mount Karang, Pandeglang District, Banten Province, Indonesia, from August to October 2023. Data collection was carried out in three sub-districts, including (i) Pandeglang Village, Pandeglang Sub-district; (ii) Juhut Village, Karang Tanjung Sub-district; and (iii) Saninten Village, Kaduhejo Sub-district (Figure 1).

Procedures

This study employed a descriptive research design to investigate the utilization of *beneng* taro among the local community in Mount Karang, Pandeglang, Banten. The study encompassed elements like ethnomedicine, ethnofood, ethnoeconomic, and ethnoecology. The study methodology encompasses exploratory surveys and participatory rural evaluation techniques (Müller et al. 2015; Milad et al. 2023). Data was gathered using interviews, questionnaires, observations, and documentation procedures. The types of questions included in the questionnaire combined closed-ended and open-ended questions. Therefore, 30 participants were selected from the three locations through the purposive and snowball sampling techniques. Participants were selected based on the criterion of possessing expertise in either the utilization or cultivation of *beneng* taro (Windarsih et al. 2023). The key respondents consist of (i) respondents who cultivate *beneng* taro and (ii) who process *beneng* taro into various economically valuable products; meanwhile, the non-key respondents included the general public who use *beneng* taro. The plants were sampled randomly, 5 plants per location, for morphological traits observation. A sample of plant materials (leaves, flower, corms, and cormels) were collected for herbarium specimens. Data of habitat, location, coordinates, and altitude were recorded. The herbarium specimens were deposited in BO (Herbarium Bogoriense).

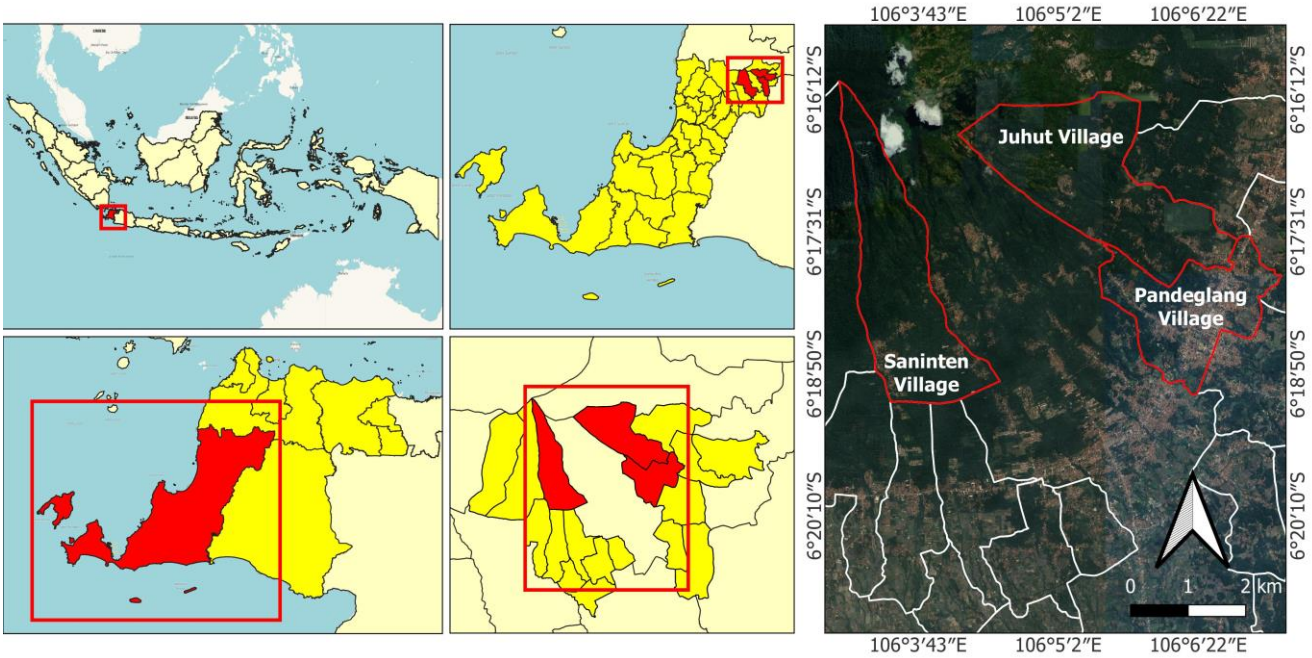

Figure 1. Map of the research location in Mount Karang, Pandeglang District, Banten, Indonesia

Data analysis

Data analysis was performed to assess various aspects related to the utilization and cultivation of *beneng* taro in Mount Karang, Pandeglang, Banten. These aspects include the distribution of respondents' residence, gender dominance, age, education level, occupation, sources of information about the utilization of *beneng* taro, sources of acquiring *beneng* taro, morphological characters and habitat of *beneng* taro, the specific parts of the plant that are utilized, details about its processing and utilization, and additional information about ethnomedicine, ethnofood, ethnoecology, and ethnoeconomics. The plant's morphological traits and sample identification were examined following the methodology outlined by Minantyorini and Hanarida (2002). Both qualitative and quantitative data are analyzed descriptively. The utilization of Microsoft Excel 2007 is employed to perform computations.

RESULTS AND DISCUSSION

Respondent demographics

Thirty respondents were selected from three sub-districts in Mount Karang, Pandeglang District, including Karang Tanjung (30.00%), Kaduhejo (66.67%), and Pandeglang Sub-districts (3.33%). Gender distribution of participants comprised males (20.00%) and females (80.00%); most respondents were native residents of Pandeglang District (90.32%), while the remaining respondents were migrants from Lebak District (Banten), West Java, and Lampung, each 3.23%. The age of male respondents ranged from 23 to 50 years, while female respondents ranged from 19 to 56 years. The majority of respondents were elementary school graduates (73.33%), while the rest were junior high school (13.33%), senior high school (10.00%), and bachelor's degree graduates (3.33%). The distribution of respondents' occupations consisted of housewives (66.67%), entrepreneurs (10.00%), and unemployed (6.67%), while the rest were farmers, farm laborers, factory workers, cooperative employees, and students, each 3.33%.

The morphological characteristics of *beneng* taro

The species can easily be mistaken for *X. robustum* Schott (Figure 2). *Xanthosoma robustum*, however, can be distinguished by its shorter stem, sunken main veins on the upper surface, and a spathe tube exhibiting a green hue internally (Croat et al. 2017). Two local cultivars of *beneng* taro are found in Mount Karang, i.e. (i) *beneng* taro with green leaf sheath and (ii) red leaf sheath. Both cultivars have corm (the main tuber forms a stem) round-elongated, smooth, brown, there are primary and secondary axillary buds, cormels (the underground part of the corm branches to form lateral tubers) cylindrical or ovate, scaly and brown, the inner part of the tuber, both corm and cormel, is yellow with brown fibers; with the fibrous root system, roots are white-cream or yellowish; leaves several together; petiole round; the surface green and covered by white powder, the inside is hollow; have leaf blade sagittate, green, cup-like surface, thin and soft leaf flesh, margin undulate, the tip acute; anterior lobes widest at the base, the length of lobe is more than one-fourth of the length of the leaf blade; the upper surface waxy, shiny, and green; the lower surface not waxy, not shiny, and paler green, leaf veins on the upper surface green or yellowish-green; leaf veins prominent on the lower, the lateral veins fuse with other lateral veins before reaching the leaf edge; inflorescence erect; peduncle ovate, semi-circular, triangular, or square, with a hollow interior; the bract (spathe) spoon-shaped; tubular in the lower part, the upper part leaf-like shaped; the tip acuminate; no spadix stalk (sessile); female flowers yellow (when the leaf-like bract are still closed) or brownish-yellow (when the leaf-like bract have fully opened), with a widened tip; female and sterile flowers are protected by the spathe tube, while male flowers become visible when the leaf-like spathe opens. Almost all parts of the plant produce sticky, milky-white exudates.

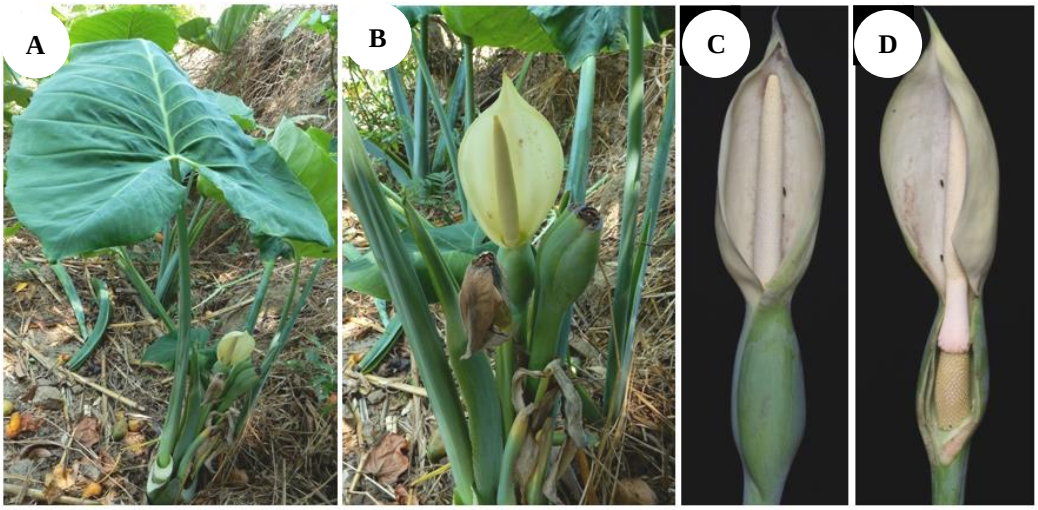

Figure 2. *Xanthosoma robustum.* A. Habit, B-C. Inflorescence, D. Inflorescence with opened-spathe consists of male, sterile, and female flowers (POWO 2023)

Morphological characters of green leaf sheath cultivar

Medium-sized or gigantic herbs, 177-405 cm tall, plant span 203-420 cm; the corm grows erect above the ground, 20.5-165.0 cm long, a circumference 32-75 cm, diameter 10.4-21.0 cm, 3.1-130.0 kg weight; the cortex white, axillary buds greenish-yellow, 2-6 secondary axillary buds, the cormels 53.13-437.88 g weight, 7.2-21.0 cm long, diameter 3.36-5.97 cm, 11-32 cormels per plant; the cortex white, the tip white-cream or yellowish; the leaves several together, 2-6 blades, leaf blade 84-140 cm x 58.5-99.5 cm, the length-to-width ratio (1.26-1.47):1, the lobes length 27-47 cm; the petiole 60.5-118.0 cm long, diameter 2.98-4.70 cm, petiole junction on the upper leaf surface is pale green or yellow, petiole junction on the lower leaf surface is pale green, leaf sheath 57.5-126.0 cm long; leaf sheath edges overlap each other, yellow with brownish-red spots, the base white; the leaf veins on the lower surface paler green, anterior costae with 9-13 pairs of primary lateral veins on each side diverging at 45-85°; inflorescence consists of 7-12 bunches in each leaf axil; peduncle is green, 35.0-95.9 cm long, diameter 1.5-2.64 cm; the flag leaf green or purplish, 115.0-144.2 cm long, the tip tapering or bifid; the spathe 22.5-34.5 cm long; the spathe tube 7.9-13.3 cm long and a diameter 3.45-6.23 cm, the outer surface is green, the inner surface is light green; spathe blade 12.6-22.0 cm long, both the outer and inner sides white-yellowish white; the inner surface of the spathe fold yellowish-green; the spadix 14.5-19.4 cm, consists of (i) the upper part supporting female flowers 3.1-4.7 cm long and a diameter 1.50-2.29 cm, arranged in 12-24 rows, (ii) the middle part supporting sterile flowers 4.0-5.5 cm long and a diameter of 1.18-1.45 cm, arranged in 7-18 rows, yellowish cream, and (iii) the lower part supporting male flowers 6.0-10.3 cm long and diameter 9.6-13.5 mm arranged in 46-57 rows, cream-colored; the spadix tip stout, rounded, or obtuse (Figure 3).

Morphological characters of red leaf sheath cultivar

Medium sized or gigantic herbs, 197.5-323.0 cm tall, plant span is 210-414 cm; the corm erects or recumbent above the ground, 53-154 cm long, a circumference 39.5-57.0 cm, diameter 12.00-15.84 cm, and 8.65-25.00 kg weight; the cortex pink; axillary buds pink, there are 1-6 secondary axillary buds, cormel 51.1-380.0 g weight, 4.68-15.30 cm long, a diameter 3.60-7.65 cm, approximately 15 cormels per plant; the cortex white-pink, the tip pink; the leaves several together, 3-4 blades, leaf blade 83-141 cm x 65-120 cm, length-to-width ratio (1.0-1.6):1, leaf blade lobes 22.5-45.5 cm long; petiole 52.0-108.5 cm long, diameter 2.63-4.90 cm; the petiole junction on the upper leaf blade surface is pale green, while the petiole junction on the lower leaf blade surface is pink, the leaf sheath 54-120 cm long, the edges of the leaf sheath curve inward and are purplish-red, the base pink; the leaf veins on the lower surface paler green or reddish-green, anterior costae with 9-11 pairs of primary lateral veins on each side diverging at 40-75°; the inflorescence has 7-14 clusters in each leaf axil; peduncle reddish-green, 47.0-73.5 cm long, diameter 1.82-2.69 cm; the flag leaf pink, 43.5-84.0 cm long, the tip is tapering, bifid, or trifid; the spathe 27.5-47.0 cm long; the spathe tube 10.3-16.0 cm long, a diameter 4.05-5.53 cm, the outer surface purplish-dark red; the upper inner surface yellow, the lower inner surface purplish-dark red; the spathe blade 18.2-31.0 cm long, the outer side pink, the inner side yellow; the inner surface of the spathe fold yellow; the spadix 23.2-39.0 cm long, divided into three parts: (i) the upper part supports female flowers, 3.2-6.0 cm long and diameter 1.50-2.18 cm, 18-32 rows, (ii) the middle part supports sterile flowers 5.5-8.1 cm long and a diameter 1.45-2.34 cm, 11-14 rows, dark-pink, and (iii) the lower part supports male flowers 14.2-25.5 cm long, diameter 12.8-18.5 mm, 74-90 rows, bright pink; the spadix tips tout (Figure 4).

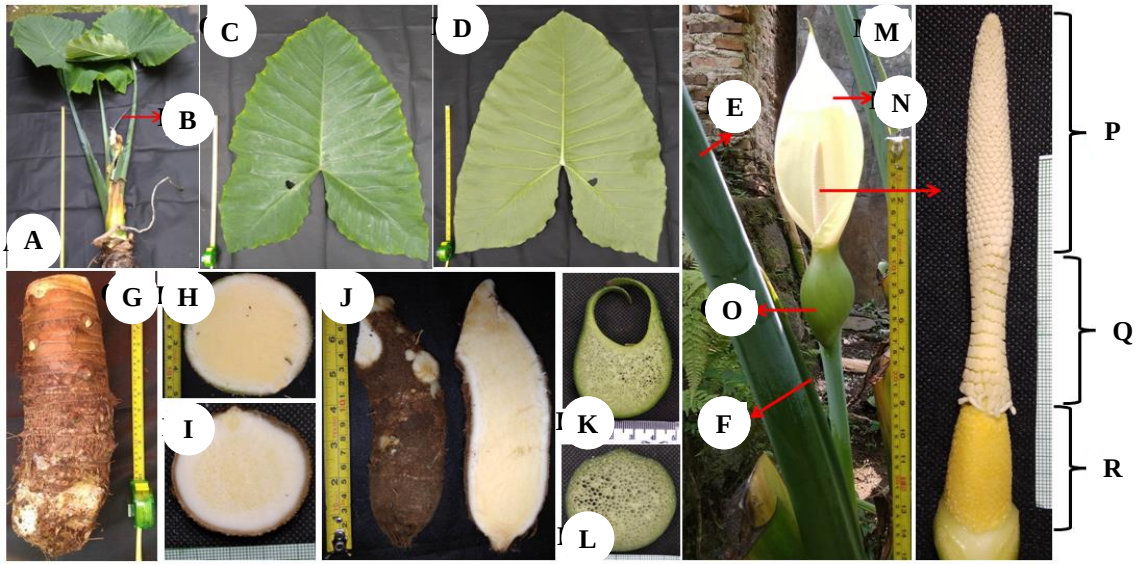

Figure 3. Morphological characteristics of *beneng* taro cultivar with green leaf sheath in Mount Karang, Banten. A. Habit, B. Leaf flag, C. The upper surface of leaf blade, D. The lower surface of leaf blade, E. Petiole, F. Leaf sheath, G-H. Corm, I-J. Cormel, K. Cross-section of leaf sheath, L. Cross-section of petiole, M. Inflorescence, N. Spathe blade, O. Spathe tube, P. Male flowers, Q. Sterile flowers, R: Female flowers

Habitat of *beneng* taro

Beneng taro grows in hilly-mountainous areas at elevations from 442-604 masl. At the Mount Karang area, this plant is cultivated in wetlands with a soil pH of 6.5-7.0, soil temperature of 24-29°C, air humidity of 46-74%, and air temperature of 26.8-36.1°C. Naturally, *X. undipes* is distributed over the geographical region spanning from Nicaragua to Panama, specifically at elevations ranging from (200)-1,000 to 2,200 masl, with a higher prevalence at elevations ranging from 1,800 to 1,900 masl (Kerbs 2015; Croat et al. 2017). The individuals of this particular species have a rapid colonization ability and are observed in many habitats. This species mostly occupies the Premontane wet forest, Premontane rain forest, and Lower montane rain forest living zones (Croat et al. 2017). These habitats include primary cloud forests and areas with significant disturbance, such as clear-cut regions and grassy areas previously utilized as cattle pastures (Kerbs 2015).

Beneng taro is a perennial shrub (POWO 2023). In Mount Karang, it is widely cultivated in gardens using intercropping system (Figure 5) with six species of horticultural crops, similar to those in *X. sagittifolium* (Orji et al. 2019), belongs to four families, i.e., Euphorbiaceae, Caricaceae, Musaceae, and Solanaceae (Table 1). This plant is cultivated in shaded conditions, either full or partial, under the canopy of trees (Suhaendah et al. 2021), including 28 species that belong to 15 families (Table 2).

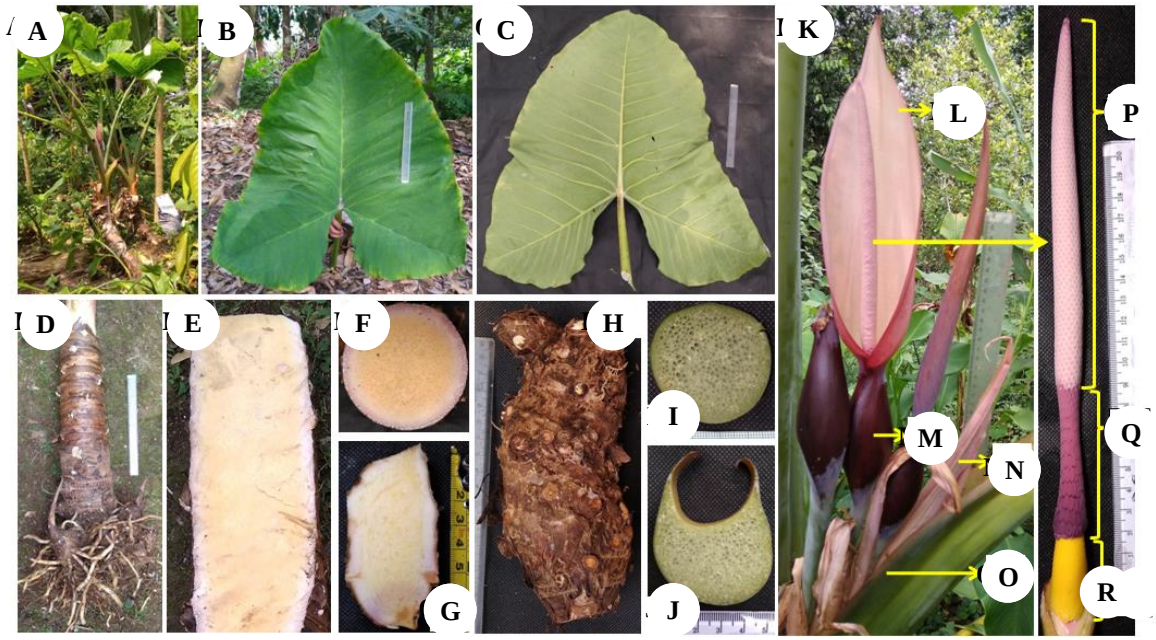

Figure 4. Morphological characteristics of *beneng* taro cultivar with red leaf sheath in Mount Karang, Banten. A. Habit, B. The upper surface of leaf blade, C. The lower surface of leaf blade, D-F. Corm, G-H. Cormel, I. Cross-section of petiole, J. Cross-section of leaf sheath, K. Inflorescence, L. Spathe blade, M. Spathe tube, N. Flag leaf, O. Leaf sheath, P. Male flowers, Q. Sterile flowers, R. Female flowers

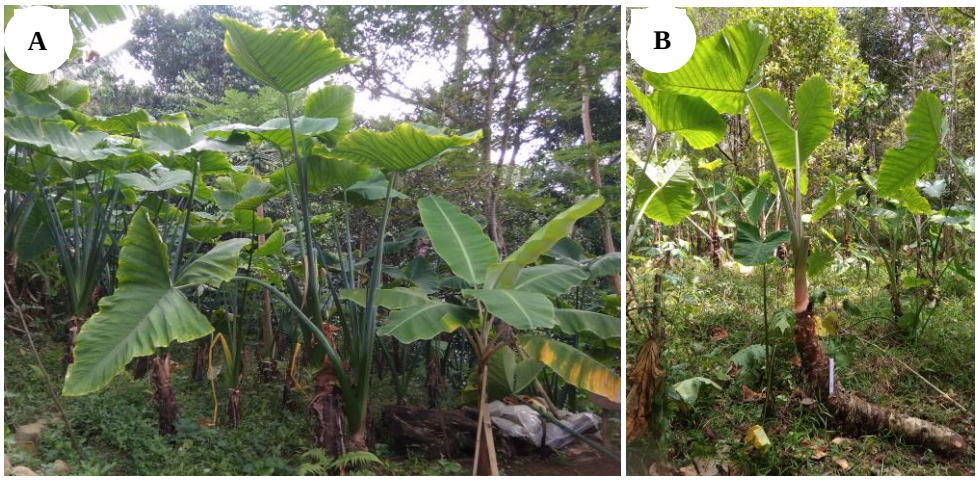

Figure 5. Cultivation of *beneng* taro in the garden using intercropping system. A. *Beneng* taro cultivar with green leaf sheath, B. Red leaf sheath

Table 1. The horticultural plants planted as intercrops in the cultivation location of taro in Mount Karang, Pandeglang, Banten

Common name	Scientific name	Family	Location (Village)
Chaya	*Cnidoscolus aconitifolius* (Mill.) I.M.Johnst.	Euphorbiaceae	Saninten
Cassava	*Manihot utilissima* Pohl	Euphorbiaceae	Juhut, Saninten
Papaya	*Carica papaya* L.	Caricaceae	Pandeglang, Juhut
Banana	*Musa x paradisiaca* L.	Musaceae	Pandeglang, Juhut, Saninten
Chili	*Capsicum* sp.	Solanaceae	Pandeglang, Juhut
Tomato	*Solanum lycopersicum* L.	Solanaceae	Juhut

Table 2. The list of trees as a canopy in the cultivation location of *beneng* taro in Mount Karang, Pandeglang, Banten

Common name	Scientific name	Family	Location (Village)
Mango	*Mangifera indica* L.	Anacardiaceae	Pandeglang, Saninten
Kuweni	*Mangifera odorata* Griff.	Anacardiaceae	Saninten
Coconut	*Cocos nucifera* L.	Arecaceae	Pandeglang, Juhut
Salak	*Salacca zalacca* (Gaertn.) Voss	Arecaceae	Pandeglang
Mangosteen	*Garcinia mangostana* L.	Clusiaceae	Juhut
Calik angin	*Mallotus paniculatus* (Lam.) Müll.Arg.	Euphorbiaceae	Pandeglang
Jengkol	*Archidendron pauciflorum* (Benth.) I.C.Nielsen	Fabaceae	Pandeglang, Juhut
Dadap	*Erythrina* sp.	Fabaceae	Pandeglang
Petai	*Parkia speciosa* Hassk.	Fabaceae	Pandeglang, Juhut, Saninten
Melinjo	*Gnetum gnemon* L.	Gnetaceae	Pandeglang, Juhut, Saninten
Avocado	*Persea americana* Mill.	Lauraceae	Pandeglang
Durian	*Durio zibethinus* Murray	Malvaceae	Pandeglang, Juhut, Saninten
Santol	*Sandoricum koetjape* (Burm.fil.) Merr.	Meliaceae	Pandeglang
Mahogany	*Swietenia mahagoni* (L.) Jacq.	Meliaceae	Pandeglang, Juhut, Saninten
Suren	*Toona sureni* (Blume) Merr.	Meliaceae	Juhut
Guava	*Psidium guajava* L.	Myrtaceae	Pandeglang, Saninten
Cloves	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	Myrtaceae	Pandeglang, Juhut, Saninten
Water apple	*Syzygium aqueum* (Burm.fil.) Alston	Myrtaceae	Saninten
Malay apple	*Syzygium malaccense* (L.) Merr. & L.M.Perry	Myrtaceae	Pandeglang
Bay leaf	*Syzygium polyanthum* (Wight) Walp.	Myrtaceae	Pandeglang
Jackfruit	*Artocarpus heterophyllus* Lam.	Moraceae	Pandeglang, Juhut
Cempedak	*Artocarpus integer* (Thunb.) Merr.	Moraceae	Juhut
Menteng	*Baccaurea racemosa* (Reinw. ex Blume) Müll.Arg.	Phyllanthaceae	Juhut
Otaheite gooseberry	*Phyllanthus acidus* (L.) Skeels	Phyllanthaceae	Pandeglang
Coffee	*Coffea* sp.	Rubiaceae	Pandeglang, Juhut, Saninten
Orange	*Citrus* sp.	Rutaceae	Pandeglang, Saninten
Longan	*Dimocarpus longan* Lour.	Sapindaceae	Pandeglang
Rambutan	*Nephelium lappaceum* L.	Sapindaceae	Pandeglang, Saninten

***Beneng* taro utilization**

Beneng taro has several local names, including *beneng*, *balitung*, *sente biah*, *mandiah*, *sente koneng* (Hakiki and Maulani 2020), *teglok*, and *mandalungan*. The word '*beneng*' comes from Sundanese, consisting of 'beuneur' means big, and 'koneng' means yellow (Yursak et al. 2021). Based on research, *beneng* taro found in Mount Karang, consists of two local cultivars: *beneng* taro with green and red leaf sheath. However, *beneng* taro with green leaf sheath is more widely used and cultivated in the area. In addition, the processing and utilization methods are diverse (Table 3, Figures 6-7).

Knowledge about the utilization of *beneng* taro by the Mount Karang community is generally obtained through inheritance from parents, family members, or friends (Supiandi et al. 2019). For consumption purposes, most residents obtain *beneng* taro by cultivating it in the gardens, from the harvest of other family members, or by foraging for wild-grown plants in the forest, as Fufa et al. (2021) reported. The utilization of *beneng* taro by the community in Mount Karang can be grouped into four categories: ethnofood, ethnomedicine, ethnoeconomics, and ethnoecology.

Ethnofood function

People in Mount Karang generally utilize *beneng* taro for various purposes, including food and beverages. The main part of the *beneng* taro plant that is often consumed is the tuber, both corm and cormel. The local community favors tubers across all age groups, from toddlers, children, teenagers, and adults to the elderly. Corms are consumed by boiling, steaming, or processing into flour (Nabiu et al. 2023) or starch. *Beneng* taro flour can be used to make cakes, such as donuts, brownies (Salsabil et al. 2023), and eggrolls, and starch is also used for making various pastries. Meanwhile, cormels can be consumed by boiling or processed into chips or '*beneng* mustofa,' sliced like

chips but smaller and thicker. Besides that, tubers of *beneng* taro were processed into analog rice, an artificial rice that functions as an alternative food substitute for rice, shaped like a grain of rice. Various culinary products, like *rengginang*, mud cake, and cookies, and many other innovations are produced from the *beneng* taro tubers processing. The utilization of taro tubers, specifically from the species *Colocasia esculenta* (L.) Schott or *Xanthosoma sagittifolium* (L.) Schott has been frequently documented as a key ingredient in the production of pastries and cakes (Akonor et al. 2018; Hyacinthe et al. 2018; Adanse et al. 2021; Bamidele and Ogundele 2022). Therefore, it is reasonable to consider *X. undipes* as the primary ingredient in snack production. In their study, Hakiki et al. (2019) documented the application of *X. undipes* as the main material for Nata De Taro, besides being utilized as the main food. On the other hand, leaf blades are utilized for beverage ingredients because they are rich in vitamin C, which boosts the immune system. The utilization of leaf blades for beverage ingredients is similar to those in *X. sagittifolium* and *X. mafafa* (Ukom et al. 2022).

Not all *beneng* taro cultivars are edible, but only the green leaf sheath cultivar can be consumed. The tubers of red leaf sheath cultivar cause an itching sensation due to the exudate content produced in almost all parts of the plant, such as the leaf blade, petiole, leaf sheath, corms, and cormels (Maretta et al. 2020). The itching sensation is probably because of the high oxalate content commonly found in members of the Araceae family (Muttakin et al. 2015; Nurtiana et al. 2022).

Table 3. Utilization of *beneng* taro by the local community in Mount Karang, Pandeglang, Banten, Indonesia

Parts of the plant	Purpose of use	Methods of use/processing
Cormel	Chips	Cormels are peeled, washed thoroughly, sliced thinly, soaked in salty water for approximately one hour, and fried in hot oil.
	Beneng mustofa	Cormels are peeled, washed thoroughly, sliced smaller and thicker than chips, soaked in salty water for about one hour, and fried in hot oil.
	Staple food and medicine	Cormels are washed thoroughly, boiled or steamed until cooked; they are peeled before consumed as a substitute for rice to help maintain blood sugar levels for individuals with diabetes.
Corm	Flour	Corms are washed thoroughly, peeled, cut into smaller pieces, sun-dried for 1-2 days, and ground into fine flour.
	Starch	Corms are peeled, washed thoroughly, cut into smaller pieces, grated, added with water, then strained to obtain the extract. The extracted liquid is allowed to settle overnight, and then the sediment is dried to obtain starch.
	Brownies	Butter and chocolate bars are melted and left to cool. Eggs are beaten, then mixed with sugar until the mixture expands and becomes stiff. The mixture is added with *beneng* taro flour, Mocaf flour, cocoa powder, melted butter, and chocolate, respectively, while stirring. The mixture is placed into a buttered and floured-edged mold, topped with cheese or others, placed in the oven at 180°C for approximately 45 minutes.
	Eggroll	Eggs are beaten, added with sugar and cake emulsifier, and stirred until the mixture is thickened. The mixture is supplemented with wheat flour, *beneng* taro flour, sago flour, baking powder, and powdered milk, stirred until well combined, and shaped into thin skins in a hot pan. The mixture is rolled and then lifted from the pan.
	Rengginang	Corms are peeled, washed thoroughly, grated, fermented, molded, sun-dried, and fried in hot oil.
	Mud cake	Eggs and sugar are beaten until they expand, added with salt, vanilla, steamed and mashed *beneng* taro corms, wheat flour, coconut milk, and melted margarine. The mold is greased with oil, and the mixture is poured in until it fills about one-third of its volume. The mixture is baked at a temperature of 150°C until half-cooked, added with the topping like raisin, and baked again.
	Cookies	Butter and margarine are beaten using a mixer until the color turns pale-white. Egg yolks, fine sugar, cornstarch, cocoa powder, milk powder, nuts, and *beneng* taro flour are added and stirred until well mixed. The baking pan is greased with butter; the mixture is shaped into a flat round and baked in the oven for about 25 minutes until fully cooked.
	Staple food and medicine	Corms are peeled, cut into smaller pieces, boiled, or steamed until fully cooked. It is consumed as a substitute for rice and helps regulate blood sugar levels for individuals with diabetes.
Leaf blade	Cigarettes	Leaves are chopped, then dried, and used for making cigarettes.
	Medicine	Leaves are boiled and then drunk for diabetes medication.
	Immune system	Leaves are chopped, dried, and made into powder, consumed by steeping it in hot water.
Petiole and leaf sheath	Crafts	Petiole and leaf sheath are peeled, dried, and used for crafting
	Thread	The inner petiole and leaf sheath are pressed to reduce moisture content, then dried to produce coarse fibers as material for crafting. The coarse fibers can also be further processed into finer threads for bulletproof fabric.
Exudate	Medicine	Exudate is applied directly to the wound.

Figure 6. Various culinary products from *beneng* taro tubers. A. Starch, B. Flour, C. *Rengginang*, D. *Beneng* taro rice (analog rice), E. Eggroll, F. Chips, G. *Beneng mustofa*, H. Cookies

Ethnomedicine function

Beneng taro has medicinal properties as an ethnomedicine ingredient. The benefits of ethnomedicine in plants are generally categorized into therapeutic, care, and health functions (Windarsih et al. 2023); the results of this study explained that *beneng* taro fulfills all these functions. The therapeutic function includes *beneng* taro utilization for external wound healing, to treat infection (POWO 2023), and treating diabetes and malaria diseases (Frausin et al. 2015), the care function involves helping maintain blood sugar levels in diabetes patients and preventing against coronary heart disease and cancer (Nurtiana et al. 2022), while the health function includes boosting the immune system.

Ethnoecology function

The optimal cultivation of *beneng* taro is done in partially or fully shaded wetlands. Therefore, the plant is extensively cultivated as an intercrop with various horticultural crops or under tree canopies. According to a study by Suhaendah et al. (2021), the increased growth of the *beneng* taro plant in agroforestry systems indicates the development of cultivating this species within forested regions. Nevertheless, this plant is also cultivated in gardens or office yards as an ornamental plant. The cultivation of *beneng* taro by the community around the Mount Karang area was generally conducted environmentally friendly, called eco-farming, evidenced by the absence of chemical fertilizers utilization. Fertilization uses organic fertilizers derived from animal manure, such as cows, goats, and chickens. Additionally, waste from starch residue is utilized as organic fertilizer for *beneng* taro plants. Weed management is performed manually by cutting and weeding. However, weeding is rarely done during the dry season to maintain soil moisture and humidity around the plants, preventing the plants from succumbing to drought. Pest and disease control is done manually by uprooting or removing and disposing of affected plants. According to Fatmawaty (2018) and Hermita et al. (2019), the tannins in *beneng* taro leaves show the potential for biopesticide in eco-friendly farming systems, but it is not yet being explored.

Ethnoeconomics function

Almost all parts of taro species, as well as *beneng* taro (Herawati et al. 2023), have an economic value ranging from corms, cormels, leaf blades, petioles, to leaf sheaths (Table 3). Both corms and cormels of green leaf sheath cultivar are generally used for processed food production; cormels are used for seedling production. On the contrary, the tubers of red leaf sheath cultivars are rarely used for consumption because of their itching sensation. On the other hand, the leaves are the most economically valuable part of the *beneng* taro plant, both green and red leaf sheath cultivars. The leaf blades are processed for cigarette production (Pieter et al. 2022). *Beneng* taro cultivar with red leaf sheath is preferred for cigarette production because of a higher nicotine content than the green leaf sheath cultivar. Meanwhile, petiole and leaf sheath are used for thread production as material for bulletproof fabric; they are also used as materials for crafts, such as tissue box covers, pencil holders, and flower vases. Up to 100 tons of leaves can be harvested from one hectare of land. Additionally, starch production waste is used for organic fertilizer, livestock feed, and fish pellets.

Figure 7. Utilization of *beneng* taro leaves for making cigarettes and crafts. A. Chopped and dried leaves, B. Cigarettes, C. Coarse fibers from petiole and leaf sheath, D. Flower vase made from *beneng* taro coarse fibers

The research revealed that almost every part of the *beneng* taro plant is used for many products, including leaf blades, leaf sheaths, petioles, corms, cormels, and exudates. This plant is commonly used for food and beverages, cigarettes, medicine, thread for making fabric, crafts, organic fertilizer, livestock feed, fish pellets, and ornamental plants. However, only the *beneng* taro cultivar with green leaf sheath can be used for consumption.

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