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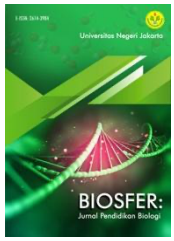

Ethnobotany of taro plant diversity (*Colocasia esculenta* L. Schott) in Magelang as a biological reference book

Yunika Nurma Wakhidatunnisa[1], Serafica Btari Christiyani Kusumaningrum[1]*, Ericka Darmawan[1], Tri Suwarni Wahyudiningsih[2]

[1] Biology Education, Faculty of Teacher Training and Education, Universitas Tidar, Indonesia
[2] Agrotechnology, Faculty of Agriculture, Universitas Tidar, Indonesia

*Corresponding author: seraficabtarick@untidar.ac.id

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ABSTRACT

The diversity of taro plants in the Magelang area has been used for a long time by traditional communities from generation to generation. But knowledge related to the use of taro plants for purposes other than food is not widely known to the public. This study aims to determine the untilization of taro plants (Colocasia esculenta L. Schott) and analyze the feasibility of ethnobotanical reference books of taro plant diversity (Colocasia esculenta L. Schott) in Magelang City and Regency. This study is a type of mixed method research, which is a combination of ethnographic research methods with Research and Development (R&D) research. The results of ethnographic research are then used as a source of reading through the development of reference books. Development research was carried out using a 4-D research model and then limited to 3-D (define, design, and develop) due to time constraints. Based on the research that has been carried out, it is known that there are 5 varieties of taro plants (Colocasia esculenta L. Schott) that are found and used by the local people of Magelang, namely Taro Pratama 1, Pratama 2, Pratama 3, Taro Water/Bogor, and black Taro which are used by the community for various life purposes. The reference book based on the ethnobotanical study of taro plant diversity developed is suitable for use as a biological reference book with a percentage of 91% in material experts with excellent category, 83% in media experts with good category, and 95.89% in the results of community response tests with excellent category..

INTRODUCTION

Indonesia is famous as an archipelagic country with the second highest level of biodiversity after Brazil (Setiawan, 2022). Approximately 38,000 species of flora are spread throughout Indonesia (Susanti & Febriana, 2013), and one-third of them are beneficial plants and 7,000 out of 30,000 species of flora are believed to have the potential to be medicinal ingredients (Sujarwo, 2023; Jumiarni & Komalasari, 2017). More than 3,000 plant species contribute highly as a food source (Berlin, Linda, & Mukarlina, 2017), and only about 10% of the total plant species in Indonesia have been used in various life purposes (Walujo, 2011).

Plants are widely used by indigenous peoples to meet their needs, one of which is tuber plants. Currently, taro is one of the types of tubers that are in demand by the public because it is low in calories but rich in nutrients that are good for body health. Taro plants have the potential to be a substitute for local food besides rice. Taro tubers can be used as vegetables because they are rich in carbohydrates, proteins, minerals, and vitamins (Shah et al., 2022) In addition, the taro plant also has additional compounds such as: *saponins, tannins, flavonoids, insulin, raffinosa,* and *lactulose* which have the potential to be prebiotics (Ladeska et al., 2021) Taro plants can be used as traditional medicine (Silaban et al., 2019). Taro plants contain compounds such as *flavonoids* and *saponins that* have the potential to be alternative treatments, which are efficacious for accelerating wound healing (A. A. Putri, 2022). Taro (*Colocasia esculenta* L. Schott) is one of the food crops that is widely found in tropical areas and Southeast Asian countries such as Indonesia. Studies on taro (*Colocasia esculenta* L. Schott) recorded in Central Java identified 14 varieties of taro that are used as food (Triyono, 2013). In Indonesia, taro is widely used as buntil vegetables, lompong vegetables (Supriati, Timi, & RR, 2013), and chips. Based on topographic studies conducted by researchers in the preliminary stage. It is known that in the Magelang area, five varieties of taro are found to grow wild, both on roadsides, yards, pond edges, gardens, and rice paddies.

On the needs analysis studies conducted by the researchers, the use of various varieties of taro in Magelang is limited to food needs. Knowledge about the ethnobotany of taro plants is also not widely known due to limited information, and there are no reading sources in the form of reference books based on ethnobotanical studies of taro plants. Ethnobotany is a study that studies the relationship between plants and their traditional use by the community so that it can add to people's insight (Dewantari, Lintang, & Nurmiyati, 2018). Ethnobotany can be used as a tool to document the knowledge of local communities (Dewi, 2014). Strengthened by the results of Saridewi's (2019) research on the ethnobotany of sandalwood (*Santalum album* L.), and after being used as a reference book, the community can utilize sandalwood further. Then, research by Hellyatunisa (2022) on the ethnobotany of coconut (*Cocos nucifera* L.) as a reference book obtained a good response and increased public knowledge about the use of coconuts in the surrounding environment. This shows that the integration of ethnobotanical research results into biology reference books is very appropriate to increase public knowledge.

This study aims to determine the utilization of taro plants (*Colocasia esculenta* L. Schott) and analyze the feasibility of ethnobotanical reference books on taro plant diversity (*Colocasia esculenta* L. Schott) in Magelang City and Regency. The existence of this research is expected to increase community knowledge in realizing regional potential and documenting it. Moreover, it is important to document ethnobotanical knowledge before this information is lost through generational changes and modernization. Through this research, the community can understand the optimal use of taro plant diversity for contributions in various aspects of life.

METHODS

Research Design

This research is a mixed method research, which is a combination of phase I research methods (ethnography) and phase II research (4-D model *Research and Development* (R&D) research) developed by Thiagarajan (1974) and later limited to 3-D (*define, design, and develop*) due to time constraints. The research was conducted in 11 sub-districts spread across Magelang City and Regency, Central Java, as seen in Figure 1. The tools and materials used include stationery, interview instruments, field notes, voice recorders, and cameras.

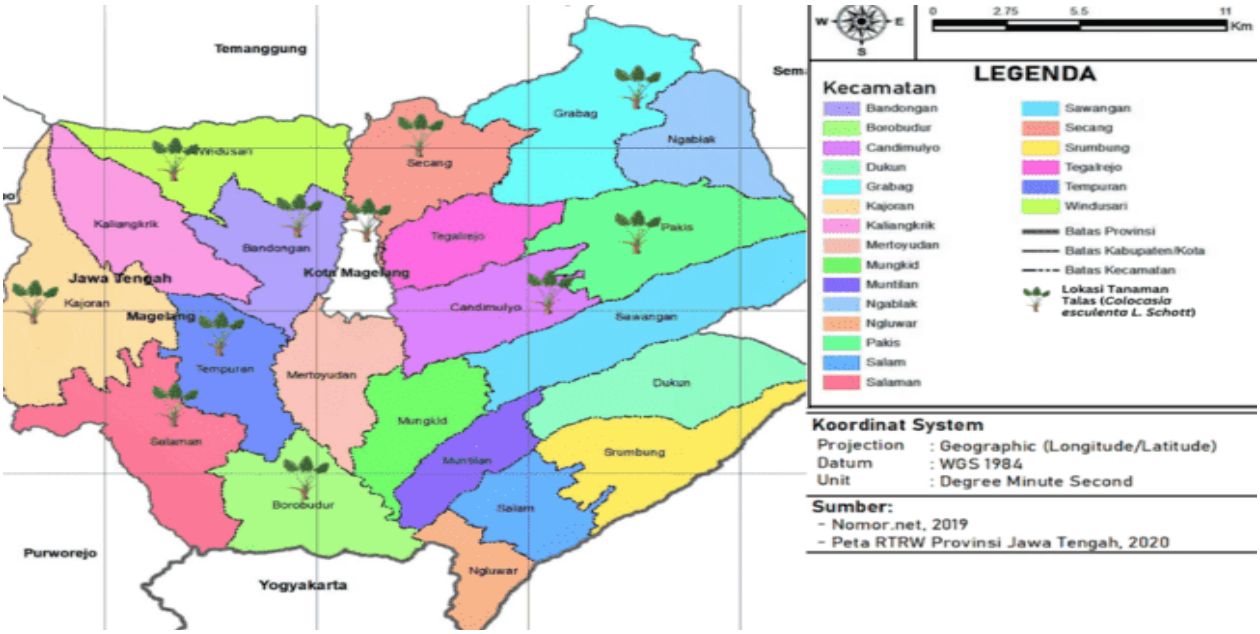


Figure 1. Map of the Research Location

Population and Samples

The population in this study is the people of the Magelang area. The sample of this study was 25 respondents consisting of (6 farmers, 4 traders making taro plant products, and 15 community leaders and the general public) in Secang, North Magelang, Borobudur, Bandongan, Kajoran, Windusari, Tempuran, Salaman, Grabag, Pakis, and Candimulyo Districts. The selection of respondents was carried out through *a purposive sampling* technique with the criteria of people who are considered to have knowledge about the types and uses of taro plants in life aspects and are at least 21 years old. The sampling of samples with various backgrounds greatly supports the acquisition of complete information needed in ethnobotanical research. Therefore, the selection of 25 respondents as a sample is very representative of the community from the 11 specified research locations.

Instrument

The instruments used in ethnographic research are observation sheets, interview sheets, field notes, *voice recorders*, and cameras. In the development research, the use of reference book needs analysis sheet instruments, Taro Germplasm Characterization and Evaluation Guidebook (2002) as support, and validation instruments (material experts and media experts) to assess the reference books Etnobotani that have been made. The last instrument is a community response test to see the community's response to the reference book that has been developed.

Procedure

The ethnographic research stage begins with observation and exploration activities on taro plant diversity. The study was carried out by a purposive sampling technique. Data was collected through interviews, documentation, and characterization techniques. The interview was conducted to explore information related to the ethnobotany of taro plants in the local community of Magelang. After that, characterization and literature studies were carried out to verify the data from the interviews. The characterization technique is carried out through the identification of taro plant varieties that are used by the community (through morphological characterization based on information from taro plant enthusiasts and literature studies). Then, characterization of the part of the taro plant that is used, benefits/uses, processing methods, and how to use the part of the taro plant is carried out.

Development research was carried out using a 4-D model, which was limited to the stage (define, design, develop) due to time constraints. The define stage involves analysis, including the needs analysis stage and material analysis. The design stage includes the initial design of the reference book product. The develop stage includes the development of the initial draft of the reference book,

validation by material experts and media experts, phase 1 revision, community response test, and final product in the form of a reference book.

Data Analysis Techniques

The ethnographic data analysis technique is carried out through the reduction and presentation of interview data in the form of tables and images of ethnobotanical characterization. Data analysis techniques in the development of reference books are carried out based on the analysis of the validation instruments of material experts and media experts, as well as response test instruments given to the community and students. The determination of reference book validation uses Anikan's (2014) formula. The scores that have been obtained are then averaged and converted into categorized values in Table 1.

Table 1

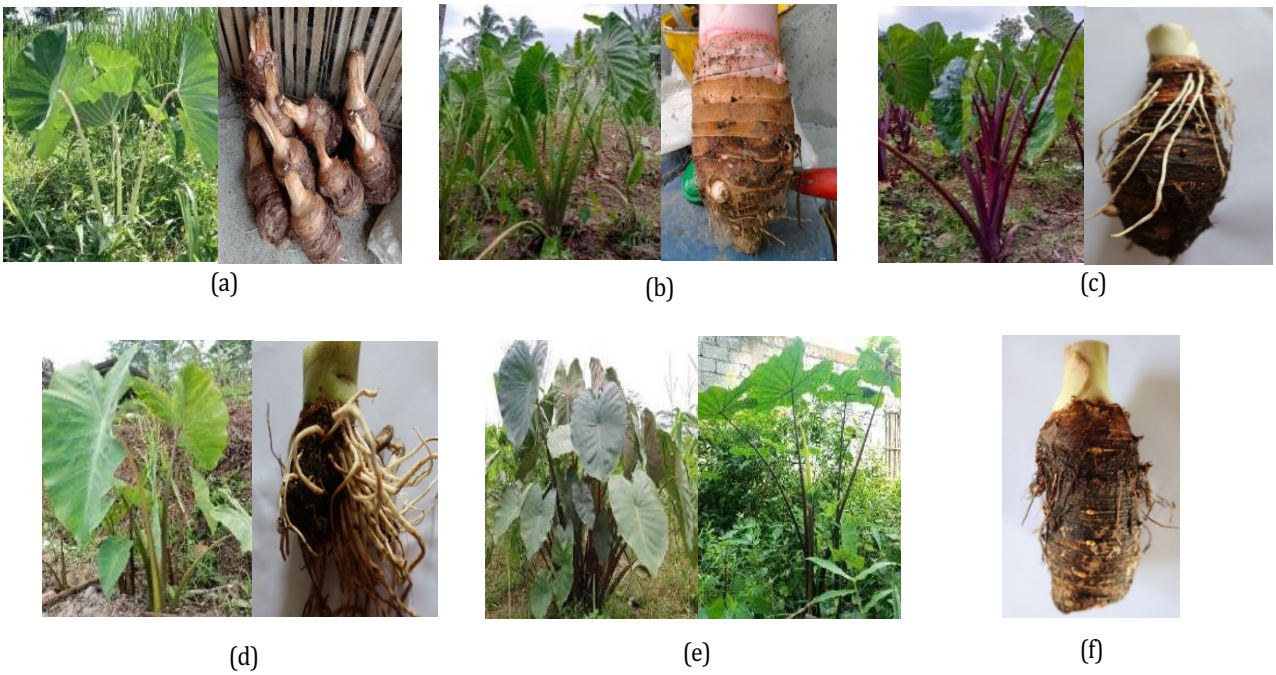
Reference Book Assessment Criteria.

Achievement Rate (%)	Category
X > 90	Excellent
80 < X ≤ 89	Good
70 < X ≤ 79	Enough
50 < X ≤ 69	Less
X < 49	Very Less

(Anikan, 2014)

RESULTS AND DISCUSSION

Based on the results of exploration and interviews in 11 sub-districts spread across the city and district of Magelang, it was found that 5 varieties of taro plants (Colocasia esculenta L. Schott) were used and utilized by the community, namely taro pratama 1, taro pratama 2, taro pratama 3, taro bogor / taro water, and black taro. The results of the study show the diversity of taro plants in Magelang City and Regency, Indonesia (Figure 2).



(a) (b) (c)

(d) (e) (f)

Figure 2. Diversity of Taro Plants (*Colocasia esculenta* L. Schott) (a) Taro Pratama 1 (yellowish-green to green stems/fronds. The leaves are yellowish-green to green and have dark stripes with white to yellow petiol), (b) Taro Pratama 2 (dark green stems/fronds with purple to grayish-red streaks. The leaves are green and streaked with dark or purplish stripes with reddish-purplish petiol), (c) Taro Pratama 3 (stems/fronds are purple to dark purple. The leaves are green and streaked with dark purple stripes with purple petiol), (d) Taro Bogor or Taro Water (the stem/frond is dark green to brown, and further up it is red to blackish-purple to the tip of the petiole. Has light green to green leaves with white petiol), (e and f) Black Taro (dark purplish to black stems/fronds. The leaves are dark green with blackish-purple petiol), black taro (f) has smaller stems/fronds and is longer than black taro (e).

Based on Figure 2, it is known that each taro variety has its characteristics. Between Taro Pratama 1, 2, and 3 can be distinguished by the color of the stem or leaf sheath. Taro Pratama 1 has a yellowish-green to green color, Taro Pratama 2 has a dark green color with purple to grayish-red strokes, while Taro Pratama 3 has a purple to dark purple color. Furthermore, between bogor taro or water taro and black taro, they can also be distinguished based on the color of the stem or leaf sheath. Bogor taro or water taro has a unique color, which is dark green to brown, and further up it is red to blackish-purple to the tip of the petiole. Meanwhile, black taro has a dark purplish to black color. Based on the results of interviews with the local people of Magelang, it is known that the Bogor taro plant or water taro also has a local name, namely taro slomot. Meanwhile, black taro is known to have several local names, namely taro benak, taro glutinous, and taro ngalendro.

The results of ethnobotanical characterization are known that there are 6 uses of taro plants in the local community of Magelang, namely 48% for food consumption, 19% for sources of income, 15% for feed, 10% for medicine, 4% for traditional ceremonies and ornamental plants which can be seen in Table 2. Based on Table 2 on the ethnobotany of taro plants in the local community of Magelang, it is known that there are 6 uses of taro plants, which are described in the following subheading.

Table 2
Ethnobotany of Taro Plant Diversity (*Colocasia esculenta* L. Schott) in Magelang City and Regency.

No	Benefits or Uses	Utilization by Traditional Communities
1	 Food Consumption	The leaves, stems or fronds of taro are usually used as vegetables for side dishes, and processed into snacks. The tubers of taro are processed by steaming, boiling, mashing, cooking to dry taro until it is processed into various dishes and snacks.
2	Resources 	The leaves, stems or fronds, and taro tubers are used by tradtional people to increase their income by selling them at collectors and nearby markets.
3	Feed 	Taro leaves are used directly by the community for alternative fish feed (dumbo catfish, gurameh, tilapiah, and tawes). Broodstock bulbs or baboons are chopped for animal feed mixtures such as (ducks, mentok, and goats).
4	Treatment 	The sap and bark of the trunk or taro fronds are used as alternative medicine for cut wounds and wound dressings. Processed taro tubers are consumed as an alternative medicine for diseases such as gout; prevent diabetes; suitable for diet programs; for gout medicine and lowering cholesterol.
5	Ceremonies 	The taro tuber part was used directly by the ancient traditional community as a complement to offerings or uborampe in the traditional ceremony “pologoro”. In addition, prcessed steamed taro tubers that are cut and sprinkled with coconut become a complementary food to “wedangan” during rest time in the tradition of cleaning the tomb to welcome the month of Shawwal.
6	Ornamental Plants 	The use of taro plants as ornamental plants by planting them in the yard of the house or in flower pots. The type of taro that is commonly grown as decoration is black taro because it has a high slender butt, and has aesthetic value.

Taro Plants as Food Consumption

The results of ethnobotanical studies show that all species of *Colocasia esculenta* L. Schott are widely used by traditional communities for food consumption. Almost all parts of the taro plant can be used because it contains high nutrients. Taro plants can be used as raw materials for making food (Amala, Achsen., & Rahmawati, 2018) The variety of taro plants that are commonly used by the local people of Magelang to take the leaves and process them into vegetable side dishes is taro bogor or taro. People used to process it into a typical food of the Magelang area, namely vegetable "Buntil"

(Sukamto & Saefudin, 2010). In addition, the varieties of pratama taro and black taro are widely used by the stems or fronds to be processed into vegetables by stir-frying, and used as snacks by frying them into chips. Taro tubers have been used by ancient people by being processed traditionally such as steamed, boiled, and ground into getuk. In simple terms, people process taro tubers by steaming them (Dewi, Dwiloka, & Setiani, 2017). Taro tubers are also commonly cooked into dried taro until processed into various dishes such as (taro compote; prekedel; coconut steamed taro) and various snacks such as (chips; taro pots; and taro brownis). To relieve itching in the tubers, traditional people usually soak peeled taro tubers using salt water. Taro tubers are often consumed by the public as an alternative carbohydrate source to replace rice because they are rich in carbohydrates, proteins, minerals, and vitamins (Shah et al., 2022).

Taro Plants as a Source of Income

The diversity of taro plants found is known to have great potential to improve the economy of the local community of Magelang. Taro plants are used by the community as a source of income to meet daily basic needs (Ode, Prabawati, & Triyoso, 2023). The community and farmers used to sell the harvest of taro tubers, leaves, stems or fronds to vegetable collectors to traditional markets. Bogor taro can be bought by middlemen and sold in the form of fresh tubers (Handoko & Abubakar, 2023). In addition, the community also processes taro plants into products in the form of chips, potil, taro sticks and so on to be sold to consumers. The innovation of processing nutrient-rich taro into snacks in the form of chips has a high selling value and can improve the community's economy (Maretik et al., 2024). Taro plants, especially primary varieties that grow and are cultivated well, usually produce bulbs weighing up to 6 kg per seed. Based on the results of interviews and observations, it is known that the price of taro tubers is relatively high in the local market, reaching Rp 6,000.00 per kg. In addition, traditional communities also sell processed taro products such as snacks to vegetables to increase income. This shows that taro plants, both in raw and processed conditions, have a contribution to improving the economy of the local community. If taro cultivation is pursued by farmers, it has the potential to increase the economy and family income by 40.7% (Handoko & Abubakar, 2023). In addition, taro cultivation activities also have the potential to encourage economic growth for villagers, especially in efforts to utilize areas with peatland (Pratama & Guswandi, 2021).

Taro Plants as Feed

Tuber plants are widely used to support the needs of local communities, one of which is used as an ingredient or mixture for animal feed (Mutaqin et al., 2020). In addition to being used as a vegetable, parts of the taro plant such as leaves are widely used by the traditional people of Magelang for fish feed (Putri, 2022). Taro plants not only play a role as an alternative food for carbohydrate producers and industrial raw materials, but also for animal feed (Rudyatmi & Rahayu, 2014). The use of taro leaves for fish feed has been carried out since ancient times in fish cultivation such as dumbo catfish, gurameh, tilapia, and tawes. Based on the results of research by Febriyanti & Wijayanti (2023), it is known that the use of taro as a feed mixture can increase carbohydrate levels in fish feed. People usually use taro leaves directly by throwing them into the cultivation pond. In addition, taro broodstock or baboons are also used by the community for feed mixtures (Putri, 2022) of livestock such as ducks, mentok, and goats. by being chopped and then mixed with feed such as bran and so on.

Taro Plant as a Medicine

The use of taro plants for medicine by the traditional people of Magelang has been carried out since ancient times. People believe that consuming taro tubers has efficacy for alternative treatment such as gout; prevent diabetes; suitable for diet programs; for gout medicine and lowering cholesterol. Consuming taro tubers as an alternative source of carbohydrates in a diet program is very suitable, because taro has a low glycemic index (Torizellia et al., 2022). It is reinforced that in addition to having various nutrients, taro plants also have additional compounds such as *saponins*, tannins, *flavonoids*, insulin, raffinosa, and lactulose which have the potential to be prebiotics (Ladeska, Am, & Hanani, 2021). Taro leaves contain secondary metabolite compounds that play a role in the regeneration of pancreatic tissue and endocrine tissue that produce the hormone insulin to prevent diabetes and other diseases (Sofihidayati, Rustiani, & Yulia W, 2022). In addition, the *flavonoid*

content in plants also has the potential to be antidiabetic (Maryam, Kartikawati, & Sari, 2022). In addition, the sap and bark of taro leaf stalks can be used as an alternative medicine for cut wounds by dripping, up to wound dressings (Hibai, Herwin, & Kosman, 2015). This is because the sap and bark of taro leaf stalks contain active substances in the form of *flavonoids* and *saponins* that are useful for accelerating wound healing and as a natural antiseptic and antimicrobial. In addition, the petioles of *Colocasia esaculenta* L. Schott contain alkaloids and steroids that have antimicrobial and antioxidant effects (Widyastuti, Yuliawati, & Kodir, 2019).

Taro Plants as a Traditional Ceremony

The results of ethnobotanical studies show that the use of taro plants, especially tubers, has been carried out by traditional communities since ancient times. This is evidenced by the involvement of taro tubers as uborampe or offerings in traditional ceremonies or traditions "Pologoro", which is an activity by giving (offering) when entering the harvest season which contains taro, kimpul, tubers, and other rice in the first waterway to enter irrigation. This pologoro tradition is carried out by the local community as a way of gratitude to God for the blessings that have been given. In the pologoro tradition, taro tubers are used whole. Since ancient times, tubers such as taro (*Colocasia esculenta* L. Schott) and sweet potato (*Ipomea batatas* L. lam) have been used as offerings in the traditional ceremony to welcome the month of suro as a complement to the offerings of the pendhem polo group (Akbar, 2018). In the pologoro tradition, taro tubers are used whole. In addition, taro tubers are also one of the foods in the traditional activities of cleaning the tomb to welcome the month of Shawwal. Usually, people process taro tubers by cutting them into small pieces and mixing them with coconut, to be eaten together with the term "wedangan" when resting.

Taro Plants as Ornamental Plants

The results of ethnobotanical studies show that taro plants have uses as ornamental plants. The varieties of taro plants that are commonly used as ornamental plants are black taro, especially those that have small, tall stems, because they are considered to have aesthetic value. This type of black taro has a smaller stem (Attaufiqy & Waluyo, 2022). The use of taro plants as ornamental plants by planting them in the yard of the house or in flower pots. Araceae plants have the potential to be used as ornamental plants, and one of the Araceae species that has aesthetic value for ornamental plants is taro plants (Maretni, Mukarlina, & Turnip, 2017).

At the development research stage, the information obtained from the entography research was used as material for the development of reference books. The products developed are then developed based on material experts, media experts, and community response tests. The results of the feasibility analysis of the ethnobotanical reference book on taro plant diversity (*Colocasia esculenta* L. Schott) as a whole show that the product developed is suitable for use as a biological reference book. The feasibility of this reference book is proven through the results of the validation assessment of material experts, media experts, and community response tests. Based on the results of the analysis of material experts, results were obtained with an average of 91% in the score range of $X > 90$, so it is included in the very good category. Based on the results of the analysis of media experts, results were obtained with an average of 83% in the score range of $80 < X \leq 89$, so it is included in the good category. Based on the analysis of the response test, the results were obtained with an average of 95.89% in the score range of $X > 90$, so it is included in the very good category (Anikan, 2014).
Based on the data from the validation and response tests, overall the reference books developed received a good response from the community and have met the aspects of feasibility of presentation, content, language, and graphics. With the fulfillment of these aspects, it can be concluded that the reference book on the results of ethnobotanical studies on taro plant diversity is stated to be good and suitable for use as a source of biology learning.

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Table 3
Analysis of the Results of Material Expert Validation.

Assessment Aspects	Precentage (%)	Eligibility Criteria
Content Eligibility	88.00	Good
Serving Technique	100.00	Excellent
Linguistics	85.00	Good
Average	**91.00**	**Excellent**

Based on Table 3, it is known that the results of the analysis of the validation data of material experts in the aspects of content feasibility, presentation techniques and linguistic aspects obtained an average percentage of 91% in the score range of X > 90, so it is included in the very good category.

Table 4
Analysis of Media Expert Validation Results.

Assessment Aspects	Precentage (%)	Eligibility Criteria
Reference Book Size	80.00	Good
Reference Book Cover Design	85.00	Good
Design and Illustration of Reference Book Contents	90.00	Excellent
Typography of Simple Reference Book Contents	80.00	Good
Functions and Benefits of Media	80.00	Good
Average	**83.00**	**Good**

Based on Table 4, it is known that the results of the analysis of validation data by media experts on the aspects of reference book size, reference book cover design, design and illustration of reference book content, typography of simple reference book content, and media functions and benefits obtained an average percentage of 82% in the score range of 80 < X ≤ 89, so it is included in the good category.

Table 5
Analysis of Response Test Results.

Assessment Aspects	Precentage (%)	Eligibility Criteria
Product Eligibility	96.78	Excellent
Serving Components	95.00	Excellent
Average	**95.89**	**Excellent**

Based on Table 5, it is known that the results of the analysis of response test data conducted on 8 validators in the aspect of product feasibility and presentation components obtained an average of 95.89% in the X > 90 score range, so it is included in the very good category. The results of the response test of this reference book are good and suitable for use as a source of biology learning.

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Based on the data from the validation and response tests, overall the reference books developed received a good response from the community and have met the aspects of feasibility of presentation, content, language, and graphics. With the fulfillment of these aspects, it can be concluded that the reference book on the results of ethnobotanical studies on taro plant diversity is stated to be good and suitable for use as a source of biology learning.

CONCLUSION

Based on the results of the research that has been carried out, it is known that there are 5 varieties of taro plants (*Colocasia esculenta* L. Schott) that are found and used by the local people of

Magelang, namely Tara Pratama 1, Pratama 2, Pratama 3, Taro Water /Taro Bogor, and Black Taro. The diversity of existing taro plants is used by the community for various life needs, namely for food, feed, medicines, traditional rituals/ceremonies, and for ornamental plants. The reference book based on the ethnobotanical study of taro plant diversity developed is suitable for use as a biological reference book with a percentage of 91% in material experts with excellent category, 83% in media experts with good category, and 95.89% in the results of community response tests with excellent category.

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