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Utilization of Plants as Natural Dyes in Batik Incung of the Kerinci Community, Jambi Province, Indonesia

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Abstract

Background: *Batik Incung, a specialty in Sungai Penuh City, is a unique product that incorporates historical Kerinci tribe motifs, flora, and fauna. The use of plants as natural dyes enhances the value of the batik.* **Methodology:** *This ethnobotanical research employs an exploratory approach and was conducted in three central villages of Incung batik production, namely Sungai Penuh, Simpang Tiga Rawang, and Penawar Village. Data were collected through interviews with four Incung Batik artisans, compleneted by field surveys and direct observations to identify the plants used as dyes.* **Findings:** *The results showed that there were 14 species of plants used by Incung Batik artisans. The plant parts used were leaves, stem bark, seeds, roots, rhizomes, fruits, and fruit peels. These plants were obtained through cultivation, either from the wild or purchased in the market.* **Contribution:** *This research documents and enriches ethnobotanical data to support the preservation of local biodiversity, particularly within the Incung batik industry. Consequently, it promotes the development of innovative batik industry grounded in local wisdom, sustainability, and eco-friendliness.*

Keywords: *Batik Incung; Biodiversity; Ethnobotany; Natural Dye; Plant*

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INTRODUCTION

Batik is one of the industrial products that is also the identity of the people of indonesia. The presence of batik as a folk craft industry grows on the basis of fulfilling the need for clothing and depicting socio-cultural (Soeroto, 1983). Batik is regarded as an original indonesian piece of art that should be conserved (Rahayuningsih et al., 2020).

Batik has not only grown in java but also spread to parts of Sumatra, including the province of Jambi. According to Karmela (2014), batik began to become popular in the province of Jambi in 1982. At that time, batik was utilized in a variety of customary and religious rituals as a mark of exclusivity and royalty. The type, function, color, pattern, and design of the batik that is generated serve as examples of this.

Batik is growing throughout the province of Jambi in many areas, each with its own distinct themes, patterns, and color schemes. Among these is Batik Incung, a specialty of Sungai Penuh City, distinguished by the use of designs featuring historical Kerinci tribe characters, flora, and animals. Introduced for the first time in 1993, Batik Incung began to gain popularity in 1995. A key element contributing to batik's appeal is the dying process. Both artificial and natural colors are employed in this technique. Using locally available plants and animals as natural dyes is one way to utilize natural resources. Natural dyes have been used for a very long time; they can be obtained from plants, animals, and microorganisms (Hussaan et al., 2023).

Plant as natural dyes are very adventageous because they are easily obtainable around the house and require no cost (Uskono et al., 2025). Plant serve as asource of various eco-friendly colors due to the diverse pigments they dontain, including chlorophyll, flavonoids, carotenoids, anthocyanins and other (Mukkun et al., 2024). The use of plants as natural dyes adds value to the batik produced. Because the colors produced from the use of natural materials may differ in various production processes, as a result, the batik produced will be limited. Waste produced from the use of natural dyes is also eco-friendly because it comes from organic materials that are easily decomposed naturally. Many plant colors also offer therapeutic, aesthetically pleasing and physiological advantages for human health (Adeel et al., 2021; Yang et al., 2023). Because of the growing awareness of environmental standards for global health and the use of green technology in their extraction and separation, natural products have long been valued (Adeel et al., 2021).

However, there are drawbacks to plant dyes as well, such as poor color fastness, a narrow color spectrum, restricted availability, and exorbitant prices (Datta et al., 2023). In addition, different plants will produce different secondary metabolites. In addition to producing secondary metabolites in the form of color, it is possible that plants also contain other secondary metabolites that can inhibit the process of color absorption in fabrics, which has an impact on failure, or the resulting color may not be in accordance with the planned design.

Several studies have reported the utilization of plantas as natural dyes in indonesia's textile industry. Among these, Martuti et al., (2020) described nine plant species used by batik artisans in Kampung Malon, Semarang. Rahayu et al., (2020) identified 13 plant species as natural dyes in tradisional Pringgasela woven Fabric in East Lombok, West Nusa Tenggara Province. Furhthermore, Seran et al., (2024) found 18 plant species used in traditional Ikat weaving by The Belu community in East Nusa Tenggara Province. Mukkun et al., (2024) documented 20 plat species utilized in Ikat weaving by Timorese etchnic community in East Nusa Tenggara Province, while Uskono et al., (2025) reported 10 plant species used in woven fabric production in Tainsala village, Nort Centra Timor.

Although studies on natural dyes have been conducted, regarding the diversity of plant used in Batik Incung remain limited. Initial interviews also revealed variation in

the plant species used among batik artisans. Despite the many benefits and advantages offered, the use of plants as natural dyes is still limited by technical challenges and resource availability. Therefore, documenting is a strategic step to overcome these issues and to support the sustainable preservation and development of batik Incung with natural dyes.

METHOD

This research was condacted in Sungai Penuh City, Jambi Province, Indonesia, focusing on the Kerinci community. The study took place in three villages that serve as the production centers for Incung Batik: Sungai Penuh, Simpang Tiga Rawang, and Penawar Village. This research was conducted from August to September 2023. This research is an ethnobotanical research with an exploratory approach, aimed at exploring and documenting artisans's knowledge regarding the utilization of plants as natural dyes in the production of Incung Batik.

Participant

The participants in this study were selected using a purposive sampling technique. The participants consisted of four Incung batik artisans located in Sungai Penuh City, who are indigenous people of Kerinci

Data collection

Interviews were used to gather data related to the use of plants as natural dyes in batik production, including parts of plants utilized, plant sources, additional functions of the plants, and the challenges faced in using natural dyes. Additionally, field surveys and direct observations were carried out to identify the plants used as dyes.

Procedure

The research began with an intial survey of batik Incung artisans who still use plants as natural dyes. Based on the survey result, it was found that two artisans continue to utilized plants as natural dyes in producing batik, the other artisans no longer use plants as natural dyes. Subsequenly, the researcher conducted in depth, unstructured interviews with the artisans. This approach was adopted to gather more extensive and specific data. The identification of plant species and plant parts used as dyes was conducted through field surveys and direct observations, as weel as by utilizing plant identification reference such as Flora Malesiana by Steenis & Kruseman (1973), Plant Resources of South-East Asia No.3. Dye and Tannin-Producing Plants by Lemmens & Soetjipto (1991), and other references.

Data analysis

The data was analyzed descriptively. The data was categorized based on scientific name, family, common name, local name, life form, utilized plant parts, resulting color, method of plant acquisition, and additional uses.

RESULT AND DISCUSSION

The results revealed that there were 14 plant species used as natural dyes in Incung Batik (Table 1). Plants used as natural dyes for Incung Batik come from various sources: some are deliberately planted in yards, some grow wild, some are leftover foodstuffs, and some are ordered in paste form. However, none of these species are mass-propagated specifically for the purpose of producing natural dyes in Incung Batik. Some types of plants that are deliberately cultivated include *Psidium guajava, Piper betle, Garcinia mangostana, areca cathecu, Curcuma longa, Mangifera indica*, and *Camelia sinensis*. Meanwhile, *Pithecellobium lobatum, Morinda citrifolia, Indigofera* spp, *Bixa orelluna,* and *Rhyzophora* spp are types of wild plants. *Acasia mangium* and *Swietenia mahogani* are deliberately planted as shade trees along roadsides.

Table 1. Plants used as natural dye in Incung Batik of the Kerinci community in Jambi Province, Indonesia

No	Scientific Name	Family Name	Indonesia Name	Local Name	Plant Form
1	*Psidium guajava* L.	Myrtaceae	Jambu biji	Jambeu Paraweh	Tree
2	*Mangifera indica* L.	Anacardiaceae	Mangga	Mangga	Tree
3	*Areca catechu* L.	Arecaceae	Pinang	Pina	Tree
4	*Curcuma longa* L.	Zingiberaceae	Kunyit	Kunyit	Herb
5	*Piper betle* L.	Piperaceae	Sirih	Siheh	Vine
6	*Garcinia mangostana* L.	Cluseaceae	Manggis	Manggaih	Tree
7	*Camellia sinensis* (L.) O. Kuntze.	Theaceae	The	Teh	Tree
8	*Pithecellobium lobatum* Benth.	Mimosaceae	Jengkol	Jeheng	Tree
9	*Morinda citrifolia* L.	Rubiaceae	Mengkudu	Mengkudeu	Tree
10	*Bixa orelluna* L.	Bixaceae	Bixa	Bixa	Tree
11	*Indigofera* spp.	Fabaceae	Indigofera	indigo	Shrub
12	*Rhizophora* spp.	Rhizophoraceae	Bakau	Bako	Tree
13	*Acasia mangium* (Wild.)	Fabaceae	Akasia	Akasia	Tree
14	*Swietenia mahagoni* (L.) Jacq	Meliaceae	Mahoni	Mahang	Tree

Psidium guajava and *Mangifera indica* are commonly found in the yards of local houses in Kerinci. The part of the plant used as a dye is the leaves. *Psidium guajava* produces a brownish-red color, while *Mangifera indica* produces a greenish-brown color. *Psidium guajava* is a naturally occurring plant that yields a dazzling brown color (Ragab et al., 2022). The chemical properties of guava leaves that play a role in producing color consist of flavonoids and tannins (Ran & Jeong, 2011). The leaves of *Mangifera indica* leaves contain mangiferin, which gives brown color (Sutrisna et al., 2020). Both plants produce fruit that is usually consumed as a source

of vitamin C. In addition to being a natural dye for batik, the leaf shoots of *Psidium guajava* are also often used as traditional medicine for diarrhea. Stomach pain is the most prevalent medical use in Mexico. Infusions made from guava leaves and pulp are used to treat cough, fever, diarrhea, and dysentery (Gutierrez-Montiel et al., 2023).

Table 2. The plant parts used for dyeing, the colors, the resources, and the use of plants by the Kerinci community

No	Scientific Name	Part of Plant Used	Dye Color	Source	Usage
1	*Psidium guajava* L.	Leaf	Brownish Red	Cultivated	Cloth, Food
2	*Mangifera indica* L.	Leaf	Greenish brown	Cultivated	Cloth, Food
3	*Areca catechu* L.	Seed	orange, Brown	Cultivated	Cloth, Food, medicinal uses
4	*Curcuma longa* L.	Rhizome	Yellow	Cultivated	Cloth, Food, medicinal uses
5	*Piper betle* L.	Leaf	Brownish red	Cultivated	Cloth, medicinal uses
6	*Garcinia mangostana* L.	Fruit Peel	Violet	Cultivated	Cloth, Food
7	*Camellia sinensis* (L.) O. Kuntze.	Leaf	Brown	Cultivated	Cloth, Food
8	*Pithecellobium lobatum* Benth.	Fruit Peel	Cream, dark Brown	Wild, also in the market	Cloth, Food
9	*Morinda citrifolia* L.	Root	Red, Brown	Wild	Cloth, medicinal uses
10	*Bixa orelluna* L.	Fruit	Red, Yellow	Wild	Cloth
11	*Indigofera* spp.	Leaf	Blue	Wild	Cloth
12	*Rhizophora* spp.	Root	Reddish Brown	Wild	Cloth
13	*Acasia mangium* (Wild.)	Bark	Brown, light yellow	Wild	Cloth
14	*Swietenia mahagoni* (L.) Jacq	Bark	Brownish red, Terracotta	Wild	Cloth, Shade Plants

Areca catechu and *Curcuma longa* are plants that are indeed found in many yards of people's homes, as they are plants used as spices for cooking and traditional medicine. Additionally, areca nuts play an important role in the traditional ceremonies of the Kerinci people. The part of *Areca catechu* that is used as a natural dye is the seeds. Seeds extracted by boiling can produce orange and brown colors. Kabir et al., (2020), the dye extracted from Areca nut developed yellow to red colors when the pH was changed (2.0 – 11.0). In the woven fabric created by the traditional people of Pringgasela in East Lombok, *Areca cathecu* seeds are used as a natural color binder (Rahayu et al., 2020). The nut of *A. catechu* contains tannin, gallic acid, catechin, alkaloids, fat, gum, and other compounds. The main pigment in *A. catechu* is gallotannic acid, which is utilized in dye-sensitized solar cells (Kabir et al., 2020). Meanwhile, the part of *Curcuma longa* used to produce the yellow color in Incung Batik is the rhizome. The research by Dass et al., (2023) showed that the extract of *Curcuma longa* rhizomes produces a deep yellow color.

To produce a natural brownish-red color, Incung Batik artisans usually extract *Piper betle* leaves. Kantheti & Mohapatra (2024), Its abundance in nature and ease of growth make *Piper betle* a potential source of vibrant colors for the eco-friendly textile industry. The tannins contained in *Piper betle* leaves have antimicrobial potential for fabrics (Huong & Hue, 2019). In addition to being a natural dye in Incung batik, it is also consumed by local people in their daily lives as a tooth enhancer and lip colorant. *Piper betle* with combination of lime betle, hard fruit, areca nuts and gambier used as mouth refresher (Hoque et al., 2012). In addition, *Piper betle* is an important plant that must be present in various traditional ceremonies. Traditional usage of *Piper betle* is divided into culture, religion, marriage and medicinal (Azahar et al., 2020).

Garcinia mangostana is a cultivated plant whose fruits are marketed locally and several cities around Sungai Penuh city and Kerinci regency. The fruit peel of *G. mangostana* is used to produce violet color. It's also reported by Sudarmin et al., (2020) that reddish-purple is produced from mangosteen rind for batik in Malon Gunungpati, Semarang. Kibria et al., (2022), using natural dyes from mangosteen leaves, peel, and pericarp, in combination with glycerin, could produce antibacterial viscose woveb fabrics that are safe for both human health and the environment.

Camellia sinensis is another plant that is also used by batik Incung artisans to produce brown colors. Tea contains thearubigins and theaflavins as its main coloring compound. The pigments of thearubigins are reddish-brown, whereas the pigments of theaflavins are yellowish brown (Hassan & Rahim, 2021). *C. sinensis* is widely cultivated in Kerinci regency for export and consumption by the local community. The tea plantation in Kerinci regency is the oldest tea plantation in Indonesia with an area of 2500 hectares. Although the number is very abundant and can be used as a natural dye in Incung Batik, the artisans rarely use it considering that the resulting color is difficult to bind to the fabric used. This is suspected to be due to the presence of inhibitory compounds contained in tea leaves. Meanwhile, Sukemi et al., (2019) states that green tea leaves waste from *C. sinensis* has high potential as a natural dye for cotton fibers, as it is abundantly available and low-cost.

Pithecelobium lobatum in Incung Batik is used to produce cream and dark brown colors. The color is produced by boiling the fruit peel. Amellia (2018), the color produced from *Pithecelobium lobatum* peel extract demonstrated the best resistance to dry rubbing, as dried jengkol peel contains a high amound of tannin.

To produce red or brown colors, the batik Incung artisans use the extract of *Morinda citrifolia* root. Seran et al., (2024) found that *Morinda citrifolia* is one of the 18 plats used as natural dyes in the tradisional woven of the Belu community in East Nusa Tenggara province, Indonesia. The roots of this plant produce a maroon color. Do et al., (2024), Morindone dye was used to produce red shades in silk fabric. Uskono et al., (2025), unlike the community in Tainsula village, East Nusa Tenggara regency, which uses the bark of *Morinda citrifolia* to produce a dark brown color as a natural due for woven fabrics. Morinda is on of the seven main plants used as natural dyes. Main plants are those that are capable of producing colors for woven without the need to add other plants. The fruit is another part of Morinda that is also use by the Kerinci community as an ingredient in traditional medicine. Pandiselvi et al., (2019), it has historically been used as an immunostimulant, antihelminthic, analgesic, antibacterial, anticancer, and anti-inflammatory drug.

Figure 1. Examples of Incung batik fabrics made using natural plant-based dyes

Bixa orelluna and *Indigofera* spp are plants that rarely exist around the neighborhood where residents live. The extract of Bixa fruit is used by batik Incung artisans as a source of red or yellow. Yameen et al., (2024), Bixa contains the pigment bixin, is composed of carotenoid. It can produce an orange-red color. In the international market, Bixa is known as Annato. Shahid-ul-Islam et al., (2016), Annato

seeds are widely recognized as a global natural dye, commonly used in industries including textiles, food, paint, and cosmetics. In Indonesia, Indigofera is known as Nila or Tarum (Handayani & Mualimin, 2013). It contains a unique indigo pigment that is used as a natural dye (Li et al., 2019). Indigo leaves are used by Icung batik artisans as a source odf blue color. Due to its rarity in Sungai Penuh city and Kerinci regency, the demand for Bixa and Indigofera is typically met by purchasing their pasta preparations, which are sourced from Java.

Rhizophora spp is a species found in mangrove areas, so it is not found in Sungai Penuh city or Kerinci regency. The use of mangroves as dyes is rarely used because the part used is the root, so there is a risk for the sustainability of the plant. In addition, it is not easy to obtain it because of the existence of plants that are far from the center of batik production. Batik Incung artisans use the extract of the roots as a source of reddish-brown color. This color is produced from the tannins. Meanwhile, the community fo Malaka regency in East Nusa Tenggara province uses the bark of Rhizhopra to produce a red color (Seran et al., 2022).

Natural dye is not always used by Incung batik artisans unless there is a special order. This is because the production process requires a large amount of materials and a relatively long dyeing time when compared to synthetic dyes. The colors produced are also inconsistent with each production, resulting in limited color options for the batik products. Consequently, the price of Incung Batik made with natural dyes is 2 to 4 times higher than the price of Incung Batik produced with synthetic dyes. Despite this, batik with natural dyes is very popular among non-local and foreign tourists. Particularly concerning environmental issues, natural dyes are eco-friendly.

CONCLUSION

The use of 14 plants as natural dyes by the batik Incung artisans is influenced by several factors, including the colors produced, the parts of the plants used, the ease of obtaining them, and the level of color absorption in the fabrics used. The use of mangroves as dyes is rarely used because the part used is the root, so there is a risk for the sustainability of the plant. In addition, it is not easy to obtain it because of the existence of plants that are far from the center of batik production. *Camellia sinensis* is also a type that is rarely used, even though it is abundant in Kerinci regency. This is because tea leaves contain compounds that can inhibit the absorption of color by fabrics, so it is necessary to add other compounds. Plants that are usually used include *Psidium guajava, Bixa orelluna, Indigofera* spp and *Pithecelobium lobatum*. Guava leaves are used because the color they produce is attractive, and to obtain them is not difficult. Bixa and Indigofera are often used by ordering the form of pasta from the island of Java. Meanwhile, the peel of the *Pithecelobium lobatum* fruit is the leftover of unused foodstuffs. Each color produced by plants on fabric is influenced by the pigments and parts of the plants used, the type of fabric fibers, the process and the mordants applied. The results indicate that artisans use various plant species as natural dyes int the production of Incung bati, primarily sourced from the surrounding environment. This study demonstrated that the development of eco-friendly Incung batik can be both

advanced and sustained. The documentation of plant species usedserves as an essential first step in addressing technical challenge and ensuring resource availability.

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