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ETHNOBOTANICAL STUDY OF JAVA ACID PLANT (*Tamarindus indica*) IN PAGATAN BESAR VILLAGE, TANAH LAUT REGENCY

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ABSTRACT

Ethnobotany is a branch of biology that studies the use of plants by an ethnic group in a certain area for life needs such as food, medicine, dyes, building materials, ritual ceremonies, myths, and so on. This study aims to describe the Ethnobotany of Java Acid plant *(Tamarindus indica*) in Pagatan Besar Village, Tanah Laut Regency. This research methods using qualitative descritives. The results of the study show an Ethnobotanical study of the Java Acid plant *(Tamarindus indica)* with a tree habit where the leaves are believed to be able to treat smallpox wounds and the fruit is used as a medicine for coughs and bruises (pharmacology). The Java Acid plant *(Tamarindus indica)* is used as a pisit at civil ceremony events (weddings) and as a condition for giving to midwives who assist in childbirth (socioanthropology). Java Acid plant *(Tamarindus indica)* is useful as greenery and shade (ecology). This plant is called Asam Kamal by the local community because it comes from the Banjar language, from the word Java Acid because it tastes sour and kamal which means lump or lump (linguistic) which is used as a mixture when cooking, a mixture of pickles, sour candies, and charcoal (economy).

Introduction

The diversity of plants in an area is the diversity of species that occupy an ecosystem (Dewi & Iswandaru, 2018). According to Marpaung & Hartawan (2017) a country that has a wide variety of plant diversity, one of which is Indonesia. Indonesia is rich in biodiversity, both plants (flora) and animals (fauna) (mega biodiversity).

The types of flora that exist in Indonesia start from plants which have high levels to plants that have low levels that live

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in the lowlands and highlands as well as terrestrial (land) and aquatic (water) areas (Rahadiantoro et al., 2022). There are many kinds of plants, both those with high levels and those with low levels, which live in the lowlands and highlands. According to Srimulat (2021), plants that are commonly recognized are plants that have a low level, for example, ferns and mosses, while examples of plants that have a high level are herbs, trees, shrubs and shrubs.

The spread of tree plant diversity is found in all regions of Indonesia, one of the many distribution areas is in Pagatan Besar Village, Tanah Laut Regency, South Borneo Province. As one of the villages that has a coastal area, Pagatan Besar Village is a place for local potential plant growth, one of which is Java Acid plant (*Tamarindus indica*). Communities that take advantage of the diversity or richness of germplasm are known as ethnobotany in the world of education.

According to Deda (2019) the definition of Ethnobotany is a branch of science that examines tribes in an area and plants used for necessities of life, for example for medicines, building materials, myths, food, coloring materials, ritual ceremonies, and etc. As a science, ethnobotany studies plants and the relationship that exists between humans and plant resources that humans generally use. Dharmono (2019) states that Ethnobotany has several kinds of studies. These studies are botanical studies, pharmacological studies, socioanthropological studies, ecological studies, linguistic studies and economic studies.

The timeframe for publication in the Pagatan Besar Village area is still limited and has not been widely published, especially on local potential plants in coastal areas. Previous research also has not explored more tribes and vegetation in Pagatan Besar Village. The research that will be carried out in the coastal area of Pagatan Besar Village is expected to be able to broaden knowledge about the utilization of local potential plants in the region.

Based on the explanation described above, this study aims to describe the ethnobotanical study of Java Acid plant (*Tamarindus indica*) in Pagatan Besar Village, Tanah Laut Regency.

Materials and Methods

The research was conducted in Pagatan Besar Village, Tanah Laut Regency from July – December 2022. The research method is descriptive using the *Snowball Sampling* technique (Kurniawan et al., 2019). Interviews with the community in Pagatan Besar Village were conducted mainly to respondents who mastered the use of Java Acid (*Tamarindus indica*) plants based on etnopharmacological, ethnosocioanthropological, ethnoecological, ethnolinguistic, and ethnoeconomic instruments. Observations of plant morphology and habitat were also carried out on this plant. Environmental parameters were measured, the parameters measured were soil moisture, air temperature, wind speed, air humidity, light intensity and altitude.

Results and Discussion

Based on the results of research that has been carried out related to the ethnobotanical study of Java Acid plants in Pagatan Besar Village including studies of botany, pharmacology, socioanthropology, ecology, linguistics, and economics, namely:

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Botanical Studies

Table 1. Observations on the botanical study of Java Acid (*Tamarindus indica*) in Pagatan Besar Village

Numb.	Indicators		Observation results
A	**Habitus**		Tree
	Flower		
	1. Kinds of Inflorescences		Infinitely compound
	2. Shape		Bunches
	3. Color		Brown yellow white
	4. Location		*Axillary Floss*
	5. Kalix	Amount	4
		circumstances	Not attached
	6. Korola	Amount	3
		circumstances	Not attached
	7. Stamens	Amount	3
		circumstances	Attached; on top of the seeds
	8. Pistilum	Amount	1
		circumstances	Attached; on top of the seeds
	9. Flower Formula		K4, C3 + 0, A3, G1
B	**Fruit**		
	1. Type		Fleshy single true
	2. Amount		2-5 Pieces
	3. Type		Pods
	4. Color		Dark brown
C	**Leaf**		
	1. Kinds of leaves		Pinnate compound
	2. Layout		Perfect double pinnate
	3. Leaf shape		Elongated round
	4. Edge of the leaf		Flat
	5. Leaf surface		Gloomy slick
	6. Leaf color		Dark green (top) Light green (bottom)
	7. Base		Rounded
	8. Edge		Blunt
	9. Texture		Soft thin
	10. Length / width		Long Overall 14.2cm Short strands 0.4 cm ; Strands 0.9 cm long Wide Overall 7.3cm Short strands 0.2 cm ; Strands Length 0.4 cm
D	**Stem**		
	1. High		191 cm / 1.91 m - 272 cm / 2.72 m
	2.Diameters		80-90 cm
	3. Branching		Monopodial
	4. Shape		Cylinder
	5. Color		Dark brown
	6. Direction of growth		Perpendicular
E	**Root**		
	1. Arrangement of roots		Buttress roots
	2. Root color		Dark brown

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Based on the results of morphological observations that have been carried out on Java Acid (*Tamarindus indica*), it can be seen that the morphology and color of the roots of this plant have a root structure, namely buttress roots with a blackish brown color. According to Islami (2022), the Java Acid plants has a taproot with buttresses. This can be demonstrated by the presence of a radicle which can grow in a prolonged period to form a taproot (radish) and branch off to form roots that are smaller in size. This condition causes the roots of the plant to become large and have branches on the sides that are visible from the top of the plant.

The stem of the Java Acid (*Tamarindus indica*) adapts the habitus of this plant, namely plants that have a tree habitus where growth has a perpendicular direction. The stem height of this plant ranges from 1.91 m to 2.72 m with a diameter of 80-90 cm. The results showed that Java Acid (*Tamarindus indica*) has monopodial branches with blackish-brown cylindrical (rounded) stems.

According to Tjitrosoepomo (2020) monopodial stems are stems that grow perpendicularly upwards and can be distinguished between their branches. The stem of this plant has sufficient hardness and is large, with a height of up to 24 m, which in diameter can reach 2 meters and the bark has a grayish brown color and has a vertical grooved pattern (Islami, 2022). Azzahra et al. (2022) also stated that Java Acid plants have a type of tree architecture that has a vase shape, this can be shown by the presence of a canopy spread across the top, the shape of the canopy that is owned can be used as a cover that has a wide tree canopy, with thus blocking the glare of the sun.

The leaf morphology of this plant belongs to pinnate compound leaves. The leaves of this plant have a perfect double pinnate leaf layout and have an elongated round shape and flat-edged leaves. The leaf surface of this plant is smooth and dull on the top and bottom, dark green on top while light green on the bottom. The base of the leaves of this plant is rounded with a blunt tip and has a soft, thin texture. In measuring the length of the leaves, namely 14.2 cm (overall), 0.4 cm (short strands), 0.9 cm (long strands) and 7.3 cm (overall) leaf width, 0.2 cm (short strands), 0.4cm (long strands).

Leaves that have a young age on plants *Tamarindus indica* has a sour taste and is referred to as *synom* in Javanese, this is intended to make a difference with leaves that have an old age. Faridah (2018) states that each leaflet has a brownish green or light green color, long round is the shape, with a length ranging from 1 to 2.5 cm and 4 to 8 mm is the width, the tips of the leaves sometimes have indentations, the base of the leaves is shaped like a circle, the edges of the leaves are flat and between one and another almost parallel. The leaves have very short stalks, thus having a resemblance to sitting leaves. The surface of the two leaves is smooth and slippery, and the surface on the underside has a slightly lighter color.

The flower morphology of this plant is included in infinite compound interest. The flowers of this plant have the form of bunches with a brownish-white color. The location of the flowers is in the axils of the leaves (*Axillary Floss*) with the number of calyxes, namely 4 not attached, 3 corollas not attached, 3 stamens above the ovule and 1 pistilum which is above the ovule. The flower formula for Java Acid (*Tamarindus indica*) can be written as K4, C3, A3, G1.

Islami (2022) states that reddish yellow is the color of plant flowers *Tamarindus indica*. Reddish yellow is the color of the Java Acid flower, which consists of being found off the ends of the axillary leaves/twigs. The flower length can be up to 16 cm with 4-5 petals, and has a nice fragrance. Faridah (2018) expressed an opinion that the crown has a whitish yellow color where there are veins that have a reddish

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brown color up to 1.5 cm. Wardhini & Iriawati (2019) stated that Java Acid flowers are a zygomorphic type of flower. The type of zygomorphic flower is a flower that only has one symmetry or has one division plane that has bilateral characteristics.

The fruit belongs to a single fleshy true fruit and is of the pod type with 2-5 fruits on each stalk and is dark brown in color. Faridah (2018) stated that Java Acid fruit has the shape of a pod with the number of fruits on each stalk totaling 2-5 and dark brown in color. The inside of the fruit not only has the skin which functions as a wrapper for the flesh of the fruit, it has a flat shape which is also accompanied by a brown to black color (Faridah, 2018). Islami (2022) the color of the flesh (*mesocarp*) that are immature and young are greenish-white, and when ripe the taste is sour and the texture is sticky. Java Acid fruit morphology can be seen in Figure 1 below:

Figure 1. Morphological photo of Java Acid (*Tamarindus indica*) fruit

Ethnopharmacological Studies

Pharmacological studies of Java Acid plants can be shown in Table 2 as follows:

Table 2. Results of interviews on the pharmacological study of Java Acid (*Tamarindus indica*) in Pagatan Besar Village

Numb.	Statement	Interview result
1.	Utilization of these plants as medicine	1. Cough medicine [1,2,3,7,8] 2. bruise medicine[2,3] 3. Medication for smallpox[1,10,11]
2.	The part of the plant that is used as medicine	1. Fruit[1,2,3,7,8] 2. Leaves [1,10,11]

Information:
1. Atun[43] 2. Enor[69] 3. Syahginan[61] 7. Puah[55]
8. Baihaki[53] 10. Sahrin[53] 11. Nursyiah[61]

The Java Acid plants (*Tamarindus indica*) or commonly called the people of Pagatan Besar Village with the Java Acid plant has various benefits for the community. This plant, according to several community respondents, is used as cough medicine, smallpox medicine, and bruise medicine where the main use is in the leaves and fruit. Utilization of Java Acid plants as medicine, namely:

Cough medicine

Java Acid is used by the people of Pagatan Besar Village as a cough medicine,

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especially dry cough medicine. The people of Pagatan Besar Village say that part of this plant, namely the fruit, can be used as a dry cough medicine mixed with warm water. This drink can be drunk in dry cough sufferers who are believed by the public to be able to relieve coughs in sufferers.

Research by Nuraeni et al. (2022) stated that Java Acid fruit can be used as a cough medicine with a mixture of lime and hot water. Processing is done by means of squeezed lime and then given the addition of Java Acid which is then done by boiling and filtering. This research is in line with the use by the people of Pagatan Besar Village where it is useful as a traditional medicine for cough sufferers, especially dry coughs.

Smallpox Medication

Java Acid leaves are also used by the people of Pagatan Besar Village as a concoction for smallpox wounds. The people of Pagatan Besar Village use Java Acid leaves as a medicine for smallpox wounds by mixing Java Acid leaves with loose powder and water which is then pulverized using a mortar (*panai*; Banjar language). This herb can be applied to smallpox wounds to cure smallpox and get rid of smallpox scars.

Based on Maharani's research (2019) Java Acid leaves (*Tamarindus indica*) in eliminating smallpox, the leaves are used as a decoction and can be used for the treatment of measles and smallpox because they have antibacterial properties. To make a Java Acid plant mask, the leaves are taken and then put in a bowl to wash so that any dirt or dust that may be on the leaves can be removed. Java Acid leaves that have been washed, rice and jasmine leaves are put in a mortar and pestle to be crushed, with the addition of a little water. The fine leaves are placed in a container and then applied to people who have smallpox. The use of Java Acid leaves as a medicine for smallpox wounds can be seen in Figure 2 below

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Figure 2. Photo of using Java Acid leaves (*Tamarindus indica*) as smallpox wound medicine

Bruise Medicine

Java Acid fruit is also used by the people of Pagatan Besar Village as a concoction for bruises. The people of Pagatan Besar Village use Java Acid fruit as a medicine for bruises by mixing Java Acid fruit which has been separated from the skin and seeds with salt and a little salt. This preparation is trusted by the people of Pagatan Besar Village to heal bruises resulting from being hit by a hard object or heavy activity.

Based on the research results of Haziki et al. (2021) stated that Java Acid fruit can be used as a medicine for bruises. Processing is done by taking part of the contents of the Java Acid fruit which has been separated from the

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skin and seeds, the next step is adding a little water and affixing it around the bruise. This preparation is trusted by the public to relieve bruises due to collisions and strenuous sports activities.

The parts of the *Tamarindus indica* plant that are generally used as medicine include the bark, seeds, parts of the leaves and also the flesh of the fruit. Faridah (2018) states that there are many chemical constituents of Java Acid fruit. These ingredients include flavonoids, alkaloids, anthocyanins, β-carotene, saponins, steroids, tannins, volatile components and ascorbic acid. The other part, namely Java Acid leaves, has antifungal activity at a concentration of 10% to 100%, but colonies are still found that are experiencing growth at a concentration of 100%.

Ethnosocioanthropological Studies

The Java Acid plants (*Tamarindus indica*) is used in traditional ceremonies or traditional activities, namely used as a pisit at civilized activities or weddings and pisit to give a midwife who has assisted in childbirth. The way to use it is to use Java Acid fruit that is ripe (already become Java Acid/Java Acid) and then collect it in a container (basin) with several other accompanying ingredients, namely rice, peeled coconut, brown sugar, salt, sugar, ginger, kencur, laos, turmeric, candlenut, kerosene and cooking oil. The *piduduk* tradition is believed to be a rejection of *bala* so that they can avoid evil spirits that can hinder the implementation of the wedding ceremony. The community has the notion that there will be a danger that could occur if the *piduduk* that has been described is not carried out (Marsukin, 2017). Astarina (2022) stated that along with the development of the times that has become a habit, this has continued and has been preserved until now. Factors and other causes because people are afraid that if sitting is not available, they will get disaster and distress, such as being possessed, fainting and other things that are not expected when the celebration event takes place (Norsam, 2018).

Ethnoecological Studies

Ecological studies of Java Acid plants can be shown in Table 3 as follows:

Table 3. Observations on the ecological study of Java Acid (*Tamarindus indica*) in Pagatan Besar Village

Numb.	Tool's name	Measurement	Unit	range	Reference
1.	Thermometer	Measureair temperature	^{o}C	30-35	22-37ºC (**)
2.	Anemometer	Speedthe wind blows	m/s	0-1.81	1.8m/s (****)
3.	Luxmeter	Light intensity	Lux	1350-1918	4100-6650 (****)
4.	Hygrometer	Humidity	%	64-78	52-62% (***)
5.	Soil tester	Soil acidity (pH)	-	6-6,4	6-8 (**)
		humidityland	%	20-66	18%-70% (****)
6.	Altimeter	Measure the height of a place	mdpl	0	Reached 1,500 mdpl (*)

Information:
* Azzahra et al., 2022
**Windiati, 2021
*** Hakim & Suryani, 2019
****Shabirin et al., 2020

Based on the results of observations of ethnoecological studies on the area around the growth of Java Acid plants (*Tamarindus indica*) in Pagatan Besar Village, data for measuring environmental parameters in the area were obtained. The intended data is composed of various aspects, namely there are biotic and abiotic aspects. The biotic aspect that

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has an influence is the activity of the individual or the presence of several animals found in the surrounding habitat. Abiotic aspects, for example, are wind speed, air humidity, air temperature, light intensity, altitude, soil moisture and soil pH. The environmental criteria that play a role in the growth of Java Acid plants themselves are soil moisture and soil pH which can be said to be optimal.

Observation of abiotic factors in the Pagatan Besar Village area, namely air temperatures ranging from 30-35^{o}C with wind speeds that have a range of 0-1.8 m/s. The light intensity during measurement ranged from 1350-1918 lux, air humidity ranged from 64-78%, soil pH ranged from 6-6.4, soil moisture ranged from 20-66%. This plant grows at an altitude of 0 meters above sea level.

In areas that have a height of up to 1,500 meters above sea level, Java Acid plants can grow well and the average annual rainfall is 500 to 1,500 mm (Azzahra et al., 2022). According to Windiati (2021) the type of soil that is good for the growth of this plant is deep alluvial soil that has good aeration. These plants are generally able to live in the temperature range of 22^{o}C-37^{o}C and the optimum soil moisture ranges from 70% -90%. Air humidity also has an effect where the maximum and minimum humidity each has a range (Hakim & Suryani 2019).

According to Windiati (2021) the type of soil that is good for the growth of Java Acid plants is alluvial soil which is related to the soil pH ranging from 6-8, which means that the results of data collection are significant for the suitability of the optimum pH of Java Acid plants. In general, soil pH and soil moisture can have a major influence on the growth of Java Acid. This condition resulted in a large population of Java Acid in the Pagatan Besar Village Area because the soil is an alluvial type in the form of sediment, this sediment is formed from fine sand and silt and stagnant water in the lowlands (Ilgeo, 2022).

Soil moisture also affects the growth of Java Acid seeds, seeds that have a thicker skin, it will be difficult to germinate. The skin that has the hard nature described has an impact on the difficulty of water and air to penetrate the intended seed coat. The physical condition of the seed coat can cause dormancy, besides that dormancy can also be caused by the physiological conditions of the embryo or a combination of these two conditions. The state of dormancy may exist since the seed is in a physiologically ripe state when it is still in the mother plant or it is possible after the seed is released from the parent plant which affects soil moisture. Germination is influenced by 2 aspects, namely internal and external aspects.

Ethnolinguistic Studies

Based on the results of interviews regarding the ethnolinguistic study of the Java Acid plants (*Tamarindus indica*) to the people of Pagatan Besar Village, they generally call it *Asam Kamal*. Naming *Asam Kamal* because it has been conveyed since ancient times. Giving the name *Asam Kamal* because it tastes sour and kamal in the Banjar language means lumpy or lumpy.

Various Regions in Indonesia, Java Acid has various special designations that characterize certain regions. Some names for Java Acid in other regions are *Asam* (Malay); *Asam Jawa/Asem* (Java); *Asam Kamal/Asem* (Sundanese); *Asam Kamal* (Borneo); *Accem* (Madura); *Asang Jawa* or *Asang Jawi* (Sulawesi); *Celagi* (Bali); *Camba* (Makassar); *Bage* (Bima); *Mange* (Flores); *Kanefo* (Timor); *Asam Bak Mei* (Aceh). Common names for Java Acid in the world are *Tamarindo* and *Tamarindan sampalok*. Some of the names for Java Acid are related to differences between various regions and differences between common names in various parts of the world (Silalahi, 2020).

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Ethnoeconomic Studies

The economic study of Java Acid plants can be seen in Table 4 as follows:

Table 4. Results of interviews on the economic study of Java Acid (*Tamarindus indica*) in Pagatan Besar Village

Numb.	Statement	Interview result
1.	Utilization of these plants as a source of food, firewood, building materials, or others	1. Plants are used as a food source [1,2,4,5,6,7,8,9,11] 2. Plants used as Charcoal [3,10,12]
2.	The part of the plant used as a source of food, firewood, building materials, or something else	1. Leaf[8] 2. Fruit [1,2,4,5,6,9,11] 3. Leaves and fruit[7] 4. Tree trunk [3,10,12]

Information:
1. Atun[43] 2. Enor[69] 3. Syahginan[61] 4. Zulfa[50]
5. Sarni[53] 6. Asrani[67] 7. Puah[55] 8. Baihaki[59]
9. Isaw[63] 10. Sahrin[53] 11. Nursyiah[61] 12. Amrani[56]

The Java Acid plants (*Tamarindus indica*) is used by the community as a source of food and other materials such as charcoal. This plant is used as a food source, for example the leaves are used as an ingredient for making Java Acid vegetables, the fruit is used as an ingredient for ready-to-use Java Acid, pickled mango (*cacapan asam*; Banjar language), as well as Java Acid candy and its old and dead stems are used for make charcoal. The ingredients in the manufacture of Java Acid that have economic value if sold are granulated sugar as a mixture for making sour candies, spices and water as a mixture for making Java Acid vegetables, as well as salt, young mango, Java Acid and water for mixed ingredients for pickled mango (*cacapan asam*; Banjar language).

Other parts of the plant that have economic value are Java Acid fruit which has been processed into ready-to-use Java Acid. This product has a selling price among the people of Pagatan Besar Village, but if it is still in the form of fruit and still has seeds it is only used for their own interests. Ready-to-use Java Acid is sold in the market area of Pagatan Besar Village at a relatively affordable price, which is around Rp. 17,500.00 per 1/4 kg or around Rp. 70,000.00/kg. The public can use this ready-to-use Java Acid for various kitchen purposes, to add to cooking spices and mixed ingredients for preparations such as *cacapan asam*

Other plant parts that can be used are the stem parts of the Java Acid plant that have died and can be used as charcoal. This charcoal can be sold to people in South Borneo and even outside the area with an average price per pack of Rp.8000.00.-10000.00. The charcoal produced will later help people in need in the process of cooking, trading and others. The process of community utilization of local plants is able to increase the income of most of the people of Pagatan Besar Village.

The fruit flesh of Java Acid is often used in cooking and as a spice in several dishes. Based on the statement stated by Suseno et al. (2021) Java Acid is also used as an ingredient for making jellies, syrups, herbs and jams. Java Acid stems and leaves (*Tamarindus indica*) can be used in pharmaceuticals, food, industry, beverages, crafts, textiles, chemicals and as building materials. Java Acid based on processed products from Nglopang Village is also processed into *Gummy* Java Acid. *Gummy* Java Acid as one of the products that is packaged to provide an introduction to the potential of the Village with preparations that have appeal and all groups like them.

Java Acid fruit can also be processed into syrup by the Community Service Program (PKM). This program is a community collaboration carried out regarding techniques for processing Java Acid fruit to be made into

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Java Acid syrup and techniques for sterilizing packaged bottles in Bintang Mas Village, Rasau Jaya sub-district. The purpose of this program is so that the community can process Java Acid fruit to be used as a drink that has a fresh, clean, hygienic, healthy sensation in a natural way in the form of syrup and can provide Java Acid utilization for a more diverse range as a profitable business (Dirhamsyah, 2018). Ready-to-use Java Acid processed by the people of Pagatan Besar Village can be seen in Figure 3 below:

Figure 3. Photo of ready-to-use Java Acid processed by the people in Pagatan Besar Village

Conclusions

The results showed 6 ethnobotanical studies of the Java Acid plants (*Tamarindus indica*) which is a plant with a tree habit (botanical studies) which is used by the people of Pagatan Besar Village as a cough medicine, smallpox medicine, and bruise medicine (pharmacological studies), as well as *piduduk* at cultural events *adab-adab* or marriage as well as *piduduk* to be given to midwives who assist deliveries (socyanthropological studies). Java Acid plants (*Tamarindus indica*) is used as shade and greenery in coastal areas and settlements in Pagatan Besar Village (ecological studies), this plant is named *Asam Kamal* because it comes from the taste of *asam* and *kamal* which means lump or lump (linguistic studies), Java Acid fruit is sold as ready-to-use Java Acid and Java Acid candy, the leaves are used as an ingredient in Java Acid vegetables, and old and dead stems are used as charcoal (economic studies).

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