

Ethnobotanical study of the medicinal plant used by local communities in karst area of Pacitan District, East Java, Indonesia

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Abstract. Ammar LA, Kurniawati B, Anggorowati D, Cahyaningsih AP, Setyawan AD. 2021. *Ethnobotanical study of the medicinal plant used by local communities in karst area of Pacitan District, East Java, Indonesia. Intl J Trop Drylands* 5: 84-93. Local people's trust in traditional medicine methods is still high, especially in rural areas. Most of the villagers in Tulakan Sub-district, Pacitan District, East Java, Indonesia, grow their medicinal plants in their yards. However, local people's knowledge of various medicinal plant types is only conveyed orally from parents to children and community practice habits. Information about the using medicinal plants may begin to degrade from time to time. This study aimed to investigate the knowledge of local communities regarding the use of medicinal plants and the plant diversity, especially in the village of karst areas. The research was conducted in Bungur Village and Tulakan Village, Tulakan Sub-district, Pacitan District, East Java, Indonesia. Data collection was carried out using the snowball technique through open interviews and field surveys. A total of 40 respondents with 7 people of young age range 15-40 years and 33 people of old age range 41-75 years. Respondents with the most educational backgrounds are high school graduates. A total of 51 species were found, from 46 genera and 29 families, with 35 diseases being treated. Fever, cough, and external wounds are the most commonly treated diseases. The most widely used medicinal plant is *Zingiber officinale* Roscoe to warm the body, prevent fever, and increase immunity. During the COVID-19 pandemic, the villagers orally consumed ginger for post-COVID-19 positive recovery and maintained health. The most used plant parts are leaves and rhizomes by decoction and consumption orally. Based on the research results, it is known that the knowledge of the local communities and the use of medicinal plants is still quite good among the older and younger people with various types of plants.

Keywords: Diversity, karst area, local knowledge, medical plant, Pacitan

INTRODUCTION

Local communities, particularly those in rural regions, continue to use medicinal plants directly, specifically simplicia in the form of leaves, bark, roots, stems, flowers, or fruit (Latifah et al., 2020). People are accustomed to using natural remedies and continue to believe in their health benefits (Widianto et al., 2019). People generally determine their method of composing medicinal plants, such as chewing finely, chopping and then boiling, finely ground then soaking in cold water overnight, and so on, as well as using doses in less standard sizes, such as a handful of adults, a thumb size, a pinch, and so on (Muharni et al. 2017). Local people's knowledge of medicinal plants from various regions follows a consistent pattern, which is passed down from generation to generation from parents to children in their mother tongue, and it becomes a habit of the community that can spread in an area without written documentation (Ramadhani et al. 2021).

Most people in Bungur and Tulakan Villages have spacious yards where they can grow various plants, including medicinal herbs that can be used whenever needed. Bungur and Tulakan Villages are located in the Southern Mountains karst region of East Java, Indonesia,

where residents can cultivate various medicinal plants that are often utilized for health requirements, both disease prevention, and healing. In addition to the house yard to grow the plants, the traditional market in the local village contributes to the availability of plant materials, making it possible for the community to obtain the medical plants they require.

The issue frequently raised concerning the village community's knowledge of medicinal plants is their sustainability, both in cultivation and consumption. Rural areas, including mountainous karst areas, will gradually create more sufficient health care facilities, raising concerns about the long-term viability of traditional remedies, which are only spread from generation to generation and by habit, are also feared to be increasingly degraded for future generations (Silalahi et al. 2015). A study on ethnobotany is required to investigate the level of knowledge and applications of rural communities regarding the use of plants, particularly medicinal plants. This study aims to investigate the knowledge of the people of Bungur and Tulakan Villages in the karst area about the use and diversity of medicinal plants in the two villages.

MATERIALS AND METHODS

Study area

The study was conducted in December 2021 in Bungur and Tulakan Villages, Tulakan District, Pacitan District, East Java, Indonesia (Figure 1). Tulakan District, Pacitan, is located at an altitude of 200 to 700 meters above sea level and is 25 km to the east of Pacitan. Tulakan District is located at the coordinates of latitude $8^{\circ}10'13''$ S and longitude $111^{\circ}16'39''$ E with the structure of highlands and karst mountain areas and limestone mountain areas. Rural communities in Bungur and Tulakan Villages primarily work as farmers, utilizing agroforestry land and house yards to meet their daily needs.

Data collection and analysis

A total of 40 respondents were obtained using the snowball technique, with the village head in each research area serving as the first resource person. The snowball technique was carried out by collecting a large amount of data through relationships from one person to another, then searching for further relationships through the same process, and so on (Nurdiani 2014). Data regarding the demographic structure of the respondents (Table 1) and the use of medicinal plants by each respondent were gathered through an open interview method using Indonesian and the local language (Javanese). Respondents are local

residents of Bungur and Tulakan Villages aged 14 to 75 years. During the interview process, recording and taking notes were carried out. The data obtained in local names of medicinal plants, plant parts used, cured diseases, preparation methods, and consumption methods are presented descriptively in tables and graphs, analyzed in terms of frequency and percentage, and presented descriptively (Navia et al., 2021).

Table 1. The demographic structure of respondents

Parameter	Specification	Freq.	Percentage
Gender	Male	14	35.0
	Female	26	65.0
Age	15-25	1	2.5
	26-35	4	10.0
	36-45	7	17.5
	46-55	12	30.0
	56-65	8	20.0
	65-75	8	20.0
Education	Elementary School	9	22.5
	Junior High School	8	20.0
	Senior High School	15	37.5
	University	8	20.0

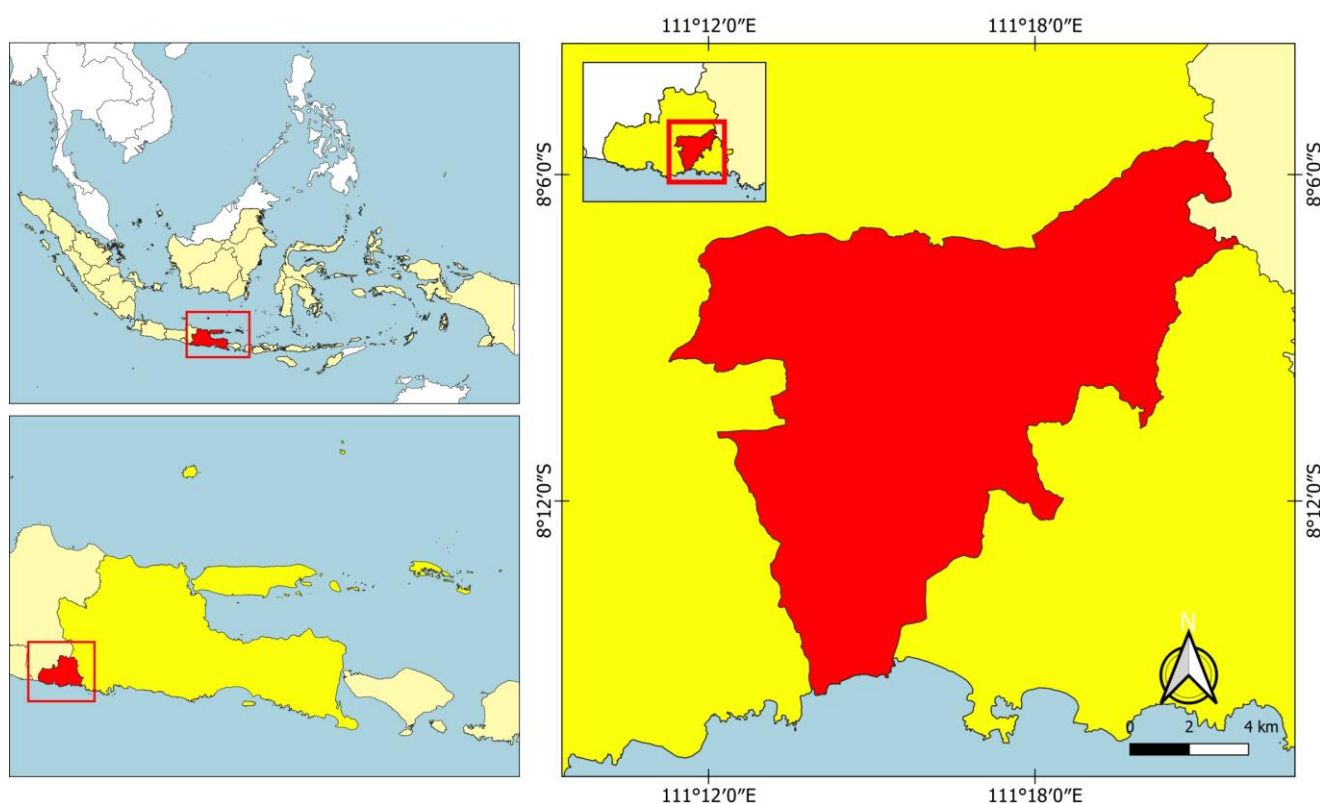


Figure 1. Map of the research location in Tulakan District, Pacitan, East Java, Indonesia

RESULTS AND DISCUSSION

Diversity of medicinal plants

Local populations in Bungur and Tulakan Villages utilize 51 species of medicinal plants belonging to 46 genera and 29 families (Table 2, Figure 2) to treat approximately 35 diseases. According to the findings of the interviews, the majority of people continue to utilize medicinal plants as an alternative treatment. Almost all medicinal plants utilized are cultivated in the community's yards, gardens, and rice fields or purchased at traditional markets. The village community employs bushes, shrubs, trees, and climbers with various parts such as leaves, rhizomes, tubers, flowers, and fruit.

According to the interview findings, many different species of plants are utilized as traditional medicines by the residents of Bungur and Tulakan Villages. *Zingiber officinale* Roscoe, widely known as ginger, is the most commonly utilized plant in Bungur and Tulakan Villages. According to Lestari et al. (2021), ginger is an easy plant to grow and care for since it has roots in rhizomes, which grow swiftly. Ginger plants are used to treat diseases such as fever, chills, coughs, and colds and boost the body's immunity. Besides ginger, another mother rhizome (*empon-empon* plants) often utilized by the community include *Kaempferia galanga* L., also known as aromatic ginger or *kencur* in the local language, which can be used for cough treatment. *Curcuma longa* L., also known as turmeric, treats ulcers and reduces menstruation pain. *Curcuma zanthorrhiza* Roxb. or *temulawak* can be used to stimulate appetite, especially in children. *Alpinia Galanga* (L.) Willd. or galangal reduces fever and cooking spices. People in Bungur and Tulakan Villages consumed a lot of boiled ginger oral throughout the pandemic to maintain and boost immunity after being found positive for COVID-19 during the health recovery period.

Medicinal plants of rhizomes or *empon-empon* such as ginger, turmeric, aromatic ginger, fingerroot, and galangal are most often needed by the community as a traditional medicine because they tend to be easy to grow and find both in yards and markets (Zufahmi and Zuraida 2018). Furthermore, in the local language, *Physalis angulata* L., also known as cutleaf groundcherry or *ciplukan*, can be utilized as medicine for heart and lung health and to lower high blood pressure (Rohman et al. 2019). *Gynura procumbens* (Lour.) Merr. or longevity spinach is used as an alternative treatment for hypertension. The leaves are believed to be capable of treating hypertension by inhibiting the angiotensin-converting enzyme (ACE) activity. This enzyme regulates blood pressure and dilates blood vessels (Simamora and Hasibuan, 2021).

Moringa oleifera Lam. or moringa treats various ailments, including visual abnormalities, fat accumulation in the liver, beriberi, dermatitis, hypertension, cholesterol, anemia, osteoporosis, and many more. *Moringa* leaves contain vitamins A, B, C, protein, and minerals and is believed to be able to cure up to 300 diseases (Saputra et al., 2021). *Erythrina subumbrans* (Hassk.) Merr. or *dadap serep* in the local language reduces fever. *Piper betle* L. or betel leaf is utilized by the community to treat coronary

heart disease. Betel leaf contains flavonoid compounds which are natural phenolic compounds that can reduce cholesterol levels (Naufalza 2021). *Anredera cordifolia* (Ten.) Steenis, also known as Madeira-vine or *binahong* in the local language, is used to treat ulcer disease, diabetes, hypertension, and heart disease. *Sauropus androgynus* (L.) Merr. or *katuk* leaf in the local language is used to increase the quality of breast milk in nursing women. *Katuk* leaf is a plant that is believed to boost prolactin and oxytocin levels and contains nutrients that can be used as raw materials for the synthesis of breast milk (Zhuliyani et al., 2021).

According to the results of interviews with the people of Bungur and Tulakan Villages, there were 29 plant families consisting of 6 species of Zingiberaceae (12%), 6 species of Asteraceae (12%), 3 species of Myrtaceae (6%), 3 species of Acanthaceae (6%), 3 species of Piperaceae (6%), 2 species of Phyllanthaceae (4%), 2 species of Annonaceae (4%), 2 species of Moraceae (4%), 2 species of Rubiaceae (4%), 2 species of Malvaceae (4%), 2 species of Fabaceae (4%), 2 species of Solanaceae (4%), and the remaining 1 species each from families Moringaceae, Rutaceae, Caricaceae, Basellaceae, Acoraceae, Araceae, Pandanaceae, Rubiaceae, Xanthorrhoeaceae, Lauraceae, Menispermaceae, Lamiaceae, Poaceae, Clusiaceae, Liliaceae, and Verbenaceae (Figure 2). This demonstrates that the Zingiberaceae and Arecaceae families have the greatest species diversity compared to other families. This could be attributed to topographic or soil structure characteristics in the highlands. Furthermore, changes in species diversity conditions might occur faster due to human activities and other natural occurrences that alter vegetation and the overall condition of the land (Tudjuka et al., 2014).

Most of the plant species belonging to the Zingiberaceae include *Z. officinale*, *C. longa*, *K. galanga*, *C. zanthorrhiza*, *A. galanga*, and *Boesenbergia rotunda* (L.) Mansf. are utilized as medicinal plants. The demand for medicinal plants of the Zingiberaceae family in the herbal and pharmaceutical sectors is quite significant, owing to the community's increasing demand for medicinal plants. In their research, Sari et al. (2012) stated that environmental factors such as topography greatly affect the distribution and growth of an organism. It was explained that the distribution of the Zingiberaceae plant family was affected by environmental factors and, most importantly, the community's interest and needs for Zingiberaceae plants for consumption or commerce. The interview results reveal that the Zingiberaceae family has long been used to cure various diseases. Some of the plants utilized will function effectively when combined into a mixture, specifically a mixture of plants in one herb (Hartanto et al. 2014).

The next highest species diversity in this study is the Asteraceae family. The Asteraceae family is the second-largest family in the kingdom Plantae system, dominating plant vegetation on Earth with over 24,000-30,000 species and 1,600-1,700 genera spread throughout the world and found in almost all environments. The Asteraceae family contains components of bioactive substances, including sesquiterpenes, lactones, pentacyclic triterpenes, alcohols,

alkaloids, tannins, polyphenols, saponins, and sterols. Several plants from the Asteraceae family can be utilized as traditional medicines, including *Pluchea indica* (L.)

Less., *Smallanthus sonchifolia* (Poepp. & Endl.) H. Rob., *Vernonia amygdalina* Delile, *Elephantopus scaber* L., *G. procumbens* (Simanjuntak 2017).

Table 2. Plants used as medicinal plants by the people of Bungur and Tulakan Villages, Pacitan, East Java, Indonesia

Family	Genus	Scientific name	Local name	Growth form
Acanthaceae	<i>Andrographi</i>	<i>Andrographis paniculata</i> (Burm.fil.) Nees	Sambiloto	Shrub
Acanthaceae	<i>Graptophyllum</i>	<i>Graptophyllum pictum</i> (L.) Griff.	Daun ungu	Scrub
Acanthaceae	<i>Strobilanthes</i>	<i>Strobilanthes crispa</i> (L.) Blume	Keji beling	Scrub
Acoraceae	<i>Acorus</i>	<i>Acorus calamus</i> L.	Delingo	Herbaceous
Annonaceae	<i>Annona</i>	<i>Annona muricata</i> L.	Sirsak	Tree
Annonaceae	<i>Annona</i>	<i>Annona squamosa</i> L.	Srikaya	Tree
Araceae	<i>Amorphophallus</i>	<i>Amorphophallus muelleri</i> Blume	Coblok/Compleng	Herbaceous
Asteraceae	<i>Elephantopus</i>	<i>Elephantopus scaber</i> L.	Tapak liman	Climber
Asteraceae	<i>Gynura</i>	<i>Gynura procumbens</i> (Lour.) Merr.	Sambung Nyowo	Shrub
Asteraceae	<i>Pluchea</i>	<i>Pluchea indica</i> (L.) Less.	Beluntas, Luntas	Scrub
Asteraceae	<i>Smallanthus</i>	<i>Smallanthus sonchifolia</i> (Poepp. & Endl.) H. Rob.	Daun insulin	Scrub
Asteraceae	<i>Vernonia</i>	<i>Vernonia amygdalina</i> Delile	Daun Afrika	Scrub
Basellaceae	<i>Anredera</i>	<i>Anredera cordifolia</i> (Ten.) Steenis	Binahong	Climber
Caricaceae	<i>Carica</i>	<i>Carica papaya</i> L.	Pepaya gantung	Tree
Clusiaceae	<i>Garcinia</i>	<i>Garcinia mangostana</i> L.	Kulit manggis	Tree
Fabaceae	<i>Clitoria</i>	<i>Clitoria ternatea</i> L.	Telang	Climber
Fabaceae	<i>Erythrina</i>	<i>Erythrina subumbrans</i> (Hassk.) Merr.	Dadap serep	Scrub
Lamiaceae	<i>Cuminum</i>	<i>Cuminum cyminum</i> L.	Jinten	Scrub
Lauraceae	<i>Persea</i>	<i>Persea americana</i> Mill.	Alpukat	Tree
Liliaceae	<i>Allium</i>	<i>Allium sativum</i> L.	Bawang lanang	Herbaceous
Malvaceae	<i>Sida</i>	<i>Sida rhombifolia</i> L.	Sidaguri	Herbaceous
Malvaceae	<i>Hibiscus</i>	<i>Hibiscus sabdariffa</i> L.	Rosella	Climber
Menispermaceae	<i>Cyclea</i>	<i>Cyclea barbata</i> Miers	Cincau	Climber
Moraceae	<i>Artocarpus</i>	<i>Artocarpus altilis</i> (Parkinson) Fosberg	Sukun	Tree
Moraceae	<i>Morus</i>	<i>Morus alba</i> L.	Murbei	Tree
Moringaceae	<i>Moringa</i>	<i>Moringa oleifera</i> Lam.	Kelor	Tree
Myrtaceae	<i>Melaleuca</i>	<i>Melaleuca leucadendra</i> (L.) L.	Kayu putih	Herbaceous
Myrtaceae	<i>Psidium</i>	<i>Psidium guajava</i> L.	Jambu biji	Tree
Myrtaceae	<i>Syzygium</i>	<i>Syzygium polyanthum</i> (Wight) Walp.	Salam	Scrub
Pandanaceae	<i>Pandanus</i>	<i>Pandanus tectorius</i> Parkinson ex Du Roi	Pandan	Climber
Phyllanthaceae	<i>Sauropus</i>	<i>Sauropus androgynus</i> (L.) Merr.	Katuk	Scrub
Phyllanthaceae	<i>Phyllanthus</i>	<i>Phyllanthus urinaria</i> L.	Meniran	Scrub
Piperaceae	<i>Peperomia</i>	<i>Peperomia pellucida</i> (L.) Kunth	Sirih Cina	Herbaceous
Piperaceae	<i>Piper</i>	<i>Piper betle</i> L.	Daun Sirih	Climber
Piperaceae	<i>Piper</i>	<i>Piper ornatum</i> N.E.Br.	Sirih merah	Climber
Poaceae	<i>Imperata</i>	<i>Imperata cylindrica</i> (L.) P.Beauv.	Alang-alang	Scrub
Rubiaceae	<i>Gardenia</i>	<i>Gardenia jasminoides</i> J.Ellis	Kacapiring	Scrub
Rubiaceae	<i>Morinda</i>	<i>Morinda citrifolia</i> L.	Pace	Tree
Rubiaceae	<i>Paederia</i>	<i>Paederia foetida</i> L.	Daun Kentut	Climber
Rutaceae	<i>Citrus</i>	<i>Citrus aurantifolia</i> (Cristm.) Swingle	Jeruk nipis	Tree
Solanaceae	<i>Solanum</i>	<i>Solanum torvum</i> Sw.	Pokak/takokak	Scrub
Solanaceae	<i>Physalis</i>	<i>Physalis angulata</i> L.	Ceplukan	Scrub
Verbenaceae	<i>Lantana</i>	<i>Lantana camara</i> L.	Tembelean	Herbaceous
Xanthorrhoeaceae	<i>Aloe</i>	<i>Aloe vera</i> (L.) Burm. f.	Lidah buaya	Scrub
Zingiberaceae	<i>Alpinia</i>	<i>Alpinia galanga</i> (L.) Willd.	Lengkuas	Herbaceous
Zingiberaceae	<i>Boesenbergia</i>	<i>Boesenbergia rotunda</i> (L.) Mansf.	Temu kunci	Herbaceous
Zingiberaceae	<i>Curcuma</i>	<i>Curcuma longa</i> L.	Kunyit	Herbaceous
Zingiberaceae	<i>Curcuma</i>	<i>Curcuma zanthorrhiza</i> Roxb.	Temulawak	Herbaceous
Zingiberaceae	<i>Kaempferia</i>	<i>Kaempferia galanga</i> L.	Kencur	Herbaceous
Zingiberaceae	<i>Zingiber</i>	<i>Zingiber officinale</i> Roscoe	Jahe	Herbaceous

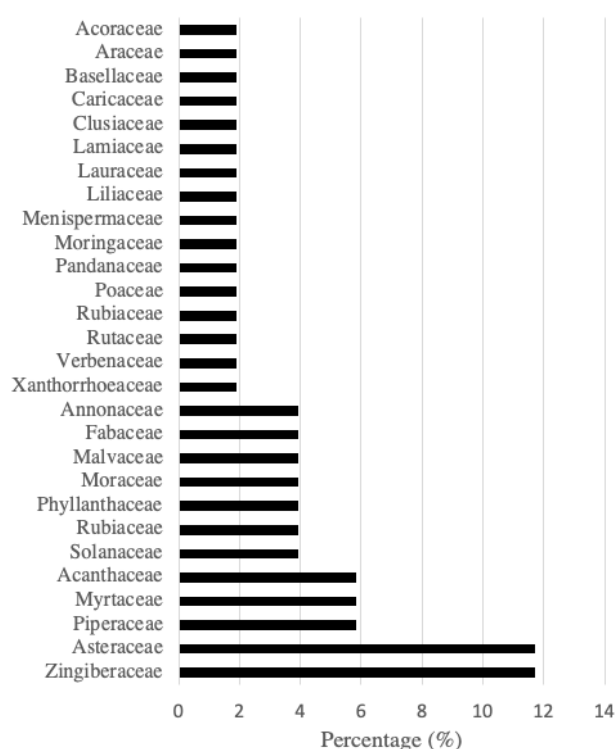


Figure 2. Family of plants used by the people of Bungur and Tulakan Villages, Pacitan, East Java, Indonesia, as medicinal plants

Growth form and plant part used

The growth form of the entire plant utilized as a medicinal plant is made up of several sorts of plants (Figure 3). Shrubs are the most common type of growth, accounting for up to 35% of all growth. The percentage of growth in the form of shrubs is in the second-highest order at 26%. Then it is followed by trees, which account for up to 21% of the total. Vine growth was the least common, accounting for only 18% of all observed growth.

Betel leaves are one of the most widely used herbal medicinal plants. Betel leaves have nutritional, organoleptic, therapeutic, prophylactic, functional, antimicrobial, and antioxidant characteristics (Madhumita et al., 2020). Besides betel leaves, bay leaves can be utilized as medicinal ingredients to treat various diseases such as diabetes, cancer, hypertension, and endometriosis (Abdulrahman et al., 2018). Ginger is one of the medicinal plants that grow as a shrub. Ginger is unique because it may create a wide range of natural compounds with great nutritional value (Deme et al., 2021).

Guava plants grow in the form of tree plants. Guava contains a lot of phenols and other antioxidants (Angulo-López et al. 2021). The *beluntas* plant, for example, has the least encountered growth form of medicinal plants, with the growth form of vines. Active phytochemicals in *beluntas* plants include flavonoids, triterpenoids, phenols, sterols, glycosides, and essential oils. Flavonoids are classified into numerous classes, one of which is a flavonol, which contains the most prevalent ingredient in *beluntas*, quercetin. Quercetin has previously been shown to have antioxidant and antifibrotic properties.

Medicinal plants used include several types of parts. The most widely used plant part is the leaf part, accounting for 67% of all plant parts. The rhizome part of the plant is the second most commonly used plant part, accounting for 13% of all plant parts. The fruit was the second most commonly used plant part, accounting for 10%, followed by the flower (6%), stem (2%), and tuber (2%).

The plant whose leaves are utilized as medicine is the leaves of *Acorus calamus* L. The *A. calamus* leaves exhibit antioxidant and anti-cytolytic properties (Andryushayev et al., 2021). A plant that is used as part of the rhizome as medicine, for example, is galangal. Galangal root can treat tuberculosis, skin problems, nausea, and stimulating properties (Eram et al. 2019).

The fruit part of the medicinal plant, for example, is found in the garcinia fruit. *Garcinia* fruit can treat wounds, ulcers, and dysentery (Santo et al., 2020). The medicinal plant's useable floral component is found in the *Lantana camara* L. plant. The *L. camara* is used for its anti-rheumatic, carminative, antibacterial, antispasmodic, vomiting, antifungal, and antitumor activities, bronchopulmonary disease, malaria, ulcers, cancer, high blood pressure, tetanus, tumors, eczema, wounds, catarrhal infections, stomach viscera atony, smallpox, measles, asthma, fever, sore throat, cough, conjunctivitis, toothache, skin rash and itching, headache and runny nose, diarrhea, stimulant, and treatment of jaundice (Cabrido and Demayo 2018). Meanwhile, the part of the tuber that may be used as a medicinal plant can be found in the garlic plant. Several studies state that garlic is an effective drug in preventing and treating several diseases, such as atherosclerosis, due to its lipid-lowering effect, mild arterial pressure reduction, and fibrinolytic and platelet anti-aggregation activity. Garlic also contains antioxidant, hypotensive, antimicrobial, antifungal, antitumorigenic, and immunomodulatory properties (Patiño-Morales et al., 2022).

Preparation and application methods

People in Bungur and Tulakan Villages, in general, continue to use traditional methods of preparation and application that have been passed down through generations and need little equipment. Preparation methods include decoction, crushed, raw, extracting, juicing, and drying (Table 3). Many people utilize the decoction method for plant material in leaves and rhizomes; however, the community prefers fruit's direct consumed/raw, juicing, and drying methods. The village community still uses this method because the traditional method is thought to have greater efficacy and be simple. After all, its naturalness is preserved.

The people of Bungur and Tulakan Villages boil some plant parts such as leaves, rhizomes, stalks, and flowers; parts of the plant are boiled to obtain boiled water consumed directly. This method is easy because it requires few tools and takes few steps. The boiled method is the most common and the most widely used method by local people in Indonesia, such as the local community of Subang, West Java (Putri et al. 2016), Cianjur, West Java (Malini et al. 2017), the Tengger (Jadid et al. 2020), and

Labu Village, Aceh (Elfrida et al. 2021). In Iran, a decoction of flowers, roots, and sap of *Astragalus fasciculifolius* Boiss, known as “Gineh or Ginja,” is widely used for body heating, easing joint pain, toothache, and diabetes (Mosaddegh et al. 2012). In some areas, the leaves of the Zygophyllaceae are boiled and used to treat diabetes (Bouyahya et al., 2021). Some decoctions of the leaves, roots, and bark are also used in steam baths (Nguyen et al., 2019).

The direct way of using medicinal plants is a method that does not include the processing of the parts consumed. This is typically the fruit or stalk of the vines. The extraction method is done on the *Aloe vera* (L.) Burm. f. plant. This plant can be ingested directly by crushing or extracting and processing it as desired. Regardless of the varied processing methods used, the benefits will be useful to consumers. Another example is indigo leaf extract, which has anabolic, astringent, and detergent-like properties (Speranza et al., 2020). The people of Bungur Village frequently process medicinal plants that produce fruit into juice.

Furthermore, the fruit of medicinal plants can be dried, brewed, and the water can be directly consumed. The dried powdered petals, like *biduri* leaves, can be cooked in sugar and used to cure asthma (Timilsina et al., 2020). The local

residents of Karlioiva used to dry wild plants so that medicinal plants may be preserved for a year throughout the season (Nadiroğlu et al., 2019).

The boiling process has the highest percentage, followed by other methods, including ingested directly, powdered, dried, mashed, and extracted. The residents of Bungur and Tulakan Villages continue to use simple and inexpensive traditional preparation methods and applications. Meanwhile, the most common application method is consumed directly.

As depicted in Figure 4, the study results show that the preparation by decoction is the most widely utilized method for processing medicinal plants, accounting for 88 percent of the total. It is followed by the method of being consumed directly or raw, accounting for 4%. Then, the remaining is 2% for each method, including crushed/ground, dried, mashed, blended, and extracted. These results align with a study conducted in Ngadisari, showing that rural communities use various methods to process medicinal plants, with the most common being boiling (Jadid et al. 2020). Another study stated that decoction is most often utilized (Malik et al. 2018). The boiled method is fairly easy for the community to implement (El Amri et al., 2015).

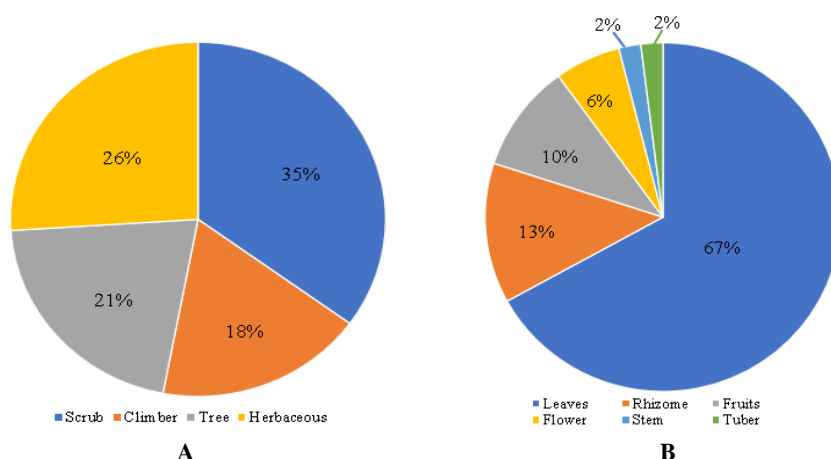


Figure 3. Percentage of growth form and plant part used by the people of Bungur and Tulakan Villages, Pacitan, East Java, Indonesia as medicinal plants. A. Growth form, B. Plant part used

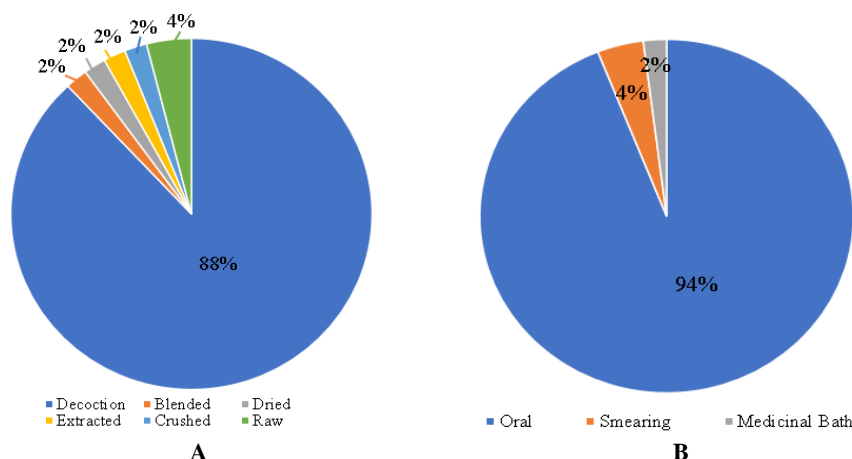


Figure 4. Percentage of preparation and application methods by the people of Bungur and Tulakan Villages, Pacitan, East Java, Indonesia, as medicinal plants. A. Preparation, B. Application methods

Table 3. Preparations, applications, and diseases cured by medicinal plants used by the people of Bungur and Tulakan Villages, Pacitan, Indonesia

Scientific name	Part used	Preparation	Application methods	Disease
<i>Acorus calamus</i>	Leaves	Decoction	Oral	Inflammation and fever
<i>Allium sativum</i>	Tuber	Raw	Oral	Coronary, diabetes, cholesterol
<i>Aloe vera</i>	Leaves	Extracted, crushed	Smearing	Hair growth shampoo, wound
<i>Alpinia galanga</i>	Rhizome	Decoction	Oral	Fever, warm the body
<i>Amorphophallus muelleri</i>	Leaves	Decoction	Oral	Cholesterol
<i>Andrographis paniculata</i>	Leaves	Decoction	Oral	Flu
<i>Annona muricata</i>	Leaves	Decoction	Oral	Heart attack, gout, hypertension, cholesterol, anemic, insomnia
<i>Annona squamosa</i>	Leaves	Decoction	Oral	Diabetes, body endurance
<i>Anredera cordifolia</i>	Leaves	Decoction	Oral	Diabetes, cholesterol, lung detoxing
<i>Artocarpus altilis</i>	Leaves	Decoction	Oral	Diabetes, coronary, digestion, cholesterol
<i>Boesenbergia rotunda</i>	Rhizome	Decoction	Oral	Cough, digestion
<i>Carica papaya</i>	Leaves	Decoction	Oral	Diabetes
<i>Citrus aurantifolia</i>	Leaves	Decoction	Oral	Cough
<i>Clitoria ternatea</i>	Flower	Decoction	Oral	Cholesterol
<i>Cuminum cyminum</i>	Leaves	Decoction	Oral	Digestion, inflammation
<i>Curcuma longa</i>	Rhizome	Decoction	Oral	Coronary, diabetes
<i>Curcuma zanthorrhiza</i>	Rhizome	Decoction	Oral	Supplement, weight gain, stomach ache
<i>Cyclea barbata</i>	Leaves	Decoction	Oral	Maag, stomach ache, stroke
<i>Elephantopus scaber</i>	Leaves	Decoction	Oral	Fever, coronary, hepatitis
<i>Erythrina subumbrans</i>	Stem	Decoction	Oral	Digestion
<i>Garcinia mangostana</i>	Fruits	Dried, decoction	Oral	Cancer, diabetes, cholesterol, stroke
<i>Gardenia jasminoides</i>	Leaves	Decoction	Oral	Diabetes, disgestion, stroke, maag
<i>Graptophyllum pictum</i>	Leaves	Decoction	Oral	Painful, wound
<i>Gynura procumbens</i>	Leaves	Decoction	Oral	Inflammation
<i>Hibiscus sabdariffa</i>	Flower	Decoction	Oral	Lose triglycerides, cholesterol
<i>Imperata cylindrica</i>	Rhizome	Decoction	Oral	Kidney failure
<i>Kaempferia galanga</i>	Rhizome	Decoction	Oral	Cough, inflammation, fever
<i>Lantana camara</i>	Flower	Decoction	Oral	Poison detoxification
<i>Melaleuca leucadendra</i>	Leaves	Distilled	Smearing	Headache, flu/cold
<i>Morinda citrifolia</i>	Leaves	Decoction	Oral	Diabetes, cholesterol, hypertension
<i>Morinda citrifolia</i>	Fruits	Blended	Oral	Diabetes, cholesterol, hypertension
<i>Moringa oleifera</i>	Leaves	Decoction	Oral	Cholesterol
<i>Morus alba</i>	Leaves	Decoction	Oral	Diabetes, coronary,
<i>Paederia foetida</i>	Leaves	Decoction	Oral	Cough, digestion
<i>Pandanus tectorius</i>	Leaves	Decoction	Oral	Hypertension, painful
<i>Peperomia pellucida</i>	Leaves	Decoction	Oral	Cholesterol
<i>Persea americana</i>	Leaves	Decoction	Oral	Kidney, hypertension, diabetes, coronary
<i>Phyllanthus urinaria</i>	Leaves	Decoction	Oral	Fever
<i>Physalis angulata</i>	Fruits	Raw	Oral	Diabetes, eye health, kidney, cholesterol
<i>Piper betle</i>	Leaves	Decoction	Medicinal bath	Wound
<i>Piper ornatum</i>	Leaves	Decoction	Oral	Vaginal discharge, smallpox, eye health
<i>Pluchea indica</i>	Leaves	Decoction	Oral	Diabetes, cholesterol
<i>Psidium guajava</i>	Leaves	Decoction	Oral	Diabetes, cholesterol
<i>Sauropus androgynus</i>	Leaves	Decoction	Oral	Inflammation, wound, diabetes, bone health
<i>Sida rhombifolia</i>	Leaves	Decoction	Oral	Gout
<i>Smallanthus sonchifolia</i>	Leaves	Decoction	Oral	Hypertension
<i>Solanum torvum</i>	Fruit	Decoction	Oral	Stomach ache, diabetes
<i>Strobilanthes crispata</i>	Leaves	Decoction	Oral	Diabetes, kidney stones, wound
<i>Syzygium polyanthum</i>	Leaves	Decoction	Oral	Cholesterol, gout, inflammation, coronary, digestion
<i>Vernonia amygdalina</i>	Leaves	Decoction	Oral	Thypus
<i>Zingiber officinale</i>	Rhizome	Decoction	Oral	Body endurance

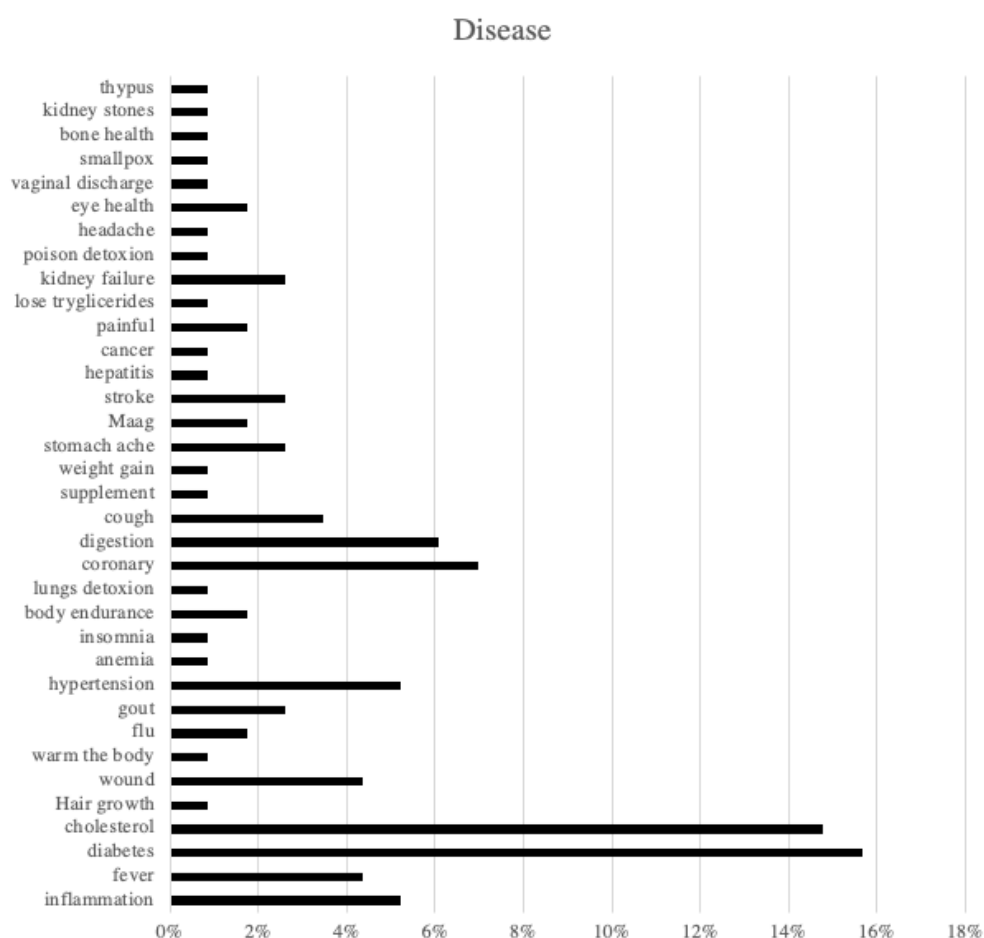


Figure 5. Percentage of diseases treated

The most common preparation method, decoction, affects the application method of these medicinal plants. The method of application with the highest percentage is consumed directly by mouth with 94%. It is followed by the smear method (smearing), accounting for 4%. Another study states that the Sasak people in Lombok are also more likely to drink medicinal plants directly in their area (Damayanti and Suhirman, 2021). Other studies show direct consumption is the most popular traditional method, followed by dermal, nasal, and anal orifice treatment (Gebremedhin and Beyene 2018).

Disease treated

From 51 plant species in total, there are 35 diseases ranging from mild to severe diseases (Figure 5). In Figure 5, it is illustrated that the people of Bungur and Tulakan mostly use medicinal plants around their homes to relieve the symptoms of diabetes, with a percentage of 15.65% of the total curable diseases. As research has been done in Morocco, some plants with less use value (UV) are believed to be used to treat diabetes (Mechchate et al., 2020). Of the various parts of the plant, leaves are the most common part for curing diabetes, supported by research that has been conducted in Congo (Masunda et al. 2019).

Then the disease that may be cured by plants from Bungur and Tulakan villages is cholesterol, with a percentage of 14.78%. Previous research has also stated that some plants, such as betel leaf, garlic, and star fruit, can cure cholesterol (Jaya et al., 2019).

A percentage of 6.96% may also alleviate heart disease. As is the case with research conducted in Guizhou, China, people believe that consuming herbal tea will improve body care (Geng et al., 2022). Medicinal plants in Bungur and Tulakan also have an efficacy, such as maintaining fitness while reducing symptoms of heart disease. The next curable disease is digestive problems, with 6.09%. There are 54 species that could cure and relieve digestive problems (Bhattarai 2020). This further strengthens that digestive problems are a common problem in society, and many medicinal plants can be used to cure them. The next is to relieve the inflammation problem and high blood pressure with 5.22%. In the survey conducted in Togo, it was stated that at least one species was found in each study related to medicinal plants. This shows that hypertension can potentially be cured through various plants and processing methods (Gbekley et al., 2018).

The next efficacy that is felt by the community is to relieve and heal wounds with a percentage of 4.35%.

Besides, some plants can also relieve cough, which is calculated by the percentage of 3.48%. Medicinal plants in Bungur and Tulakan produce many efficacies such as easing gout, stomach acid, stroke symptoms, and kidney failure with a percentage of 2.61% of the total disease. In addition, it can also cure flu, increase endurance, relieve ulcer disease, relieve pain, and improve the eyes health condition by 1.74%. Other efficacy that the community can feel is growing the hair, warming the body, relieving anemia, reducing insomnia, detoxifying the lungs, increasing appetite, gaining weight, relieving symptoms of hepatitis and cancer, lowering triglyceride levels, detoxifying toxins, relieving headaches, eliminate chickenpox, improve bone health, reduce kidney stones, and relieve typhus symptoms with a percentage of 0.87% of the total.

In conclusion, the people of Bungur and Tulakan Villages utilize plants as medicine with relatively diverse species. Fifty-one (51) species of plants were identified. These medicinal plants offer properties that may treat 35 symptoms of diseases in humans. The Zingiberaceae family is the most widespread in this region, and the species is the most widely used by the community. The leaf is the most commonly used part of the plant, and it is prepared in the most typical method, which is decoction. In this area, it is also described that there is no difference in information knowledge between men and women regarding medicinal plants and traditional medical procedures. In addition, education levels do not significantly affect people's knowledge regarding medicinal plants. Meanwhile, the age of the people significantly affects their knowledge regarding the medicinal plants, with older residents tend to have better knowledge regarding the medicinal plants than younger ones. Furthermore, no special medicinal plants were found growing in the karst areas of Bungur and Tulakan Villages.

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