INTL J TROP DRYLANDS
Volume 6, Number 1, June 2022
Pages: 1-10

E-ISSN: 2580-2828
DOI: 10.13057/tropdrylands/t060101

Ethnobotanical study of the non-medicinal plant by village communities in the karst area of Pacitan, East Java, Indonesia

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Manuscript received: 10 January 2022. Revision accepted: 30 April 2022.

Abstract. *Cahyaningsih AP, Arifiani KN, Aprilia D, Nugroho ME, Setyawan AD. 2022. Ethnobotanical study of the non-medicinal plant by village communities in the karst area of Pacitan, East Java, Indonesia. Intl J Trop Drylands 6: 1-10.* The local community of Pacitan District, East Java Province, Indonesia, especially in the karst area in several villages of Tulakan Sub-district, has a yard and farm usually planted with many species of plants that have various benefits. These plants are edible, animal feed, spices, biopesticides, and plant growth hormones. However, the knowledge of the local community of Tulakan Sub-district regarding the various benefits of plants is only known from generation to generation, conveyed orally and in daily practice habits, so a study is needed to document this information. This study aims to reveal the knowledge of local communities and the diversity of non-medicinal plant species to meet communities' daily lives. The location of research was carried out in 2 villages located in Tulakan Sub-district, Pacitan District, East Java, Indonesia, namely Bungur Village and Tulakan Village. Data was collected through field surveys and direct interviews using the snowball sampling technique. A total of 40 respondents were interviewed, with details 14 male and 26 female. Respondents with the majority of high school educational backgrounds have around 46-55 years old. The inventory of non-medicinal plants amounted to 60 species of angiosperm plants from 43 families. The plants used consisted of 34 species for the edible plants, 20 for the fodder plants, 6 for herbs, 1 for biopesticide, and 1 for natural growth hormone. Based on the study results, it is known that local people use plants as edible plants with more diverse plant species compared to other uses.

Keywords: Edible plant, fooder plant, karst area, local knowledge, Pacitan

INTRODUCTION

Ethnobotany is one of the studies that learn about the relationship between humans and plants using traditional methods in the local community. In the diverse aspect of human life, local communities are used biodiversity around their residence. The history of human growth indicates that plants have an important function in the local community's cultural preservation (Sukmawati et al. 2013). Therefore, an ethnobotanical study is expected to become one factor that supports cultural sustainability in the utilization of plants. Local community knowledge also contributes to improving science and technology (Arsyad 2018) and provides scientific practices that can be further developed for future sustainable uses (Cao et al. 2020).

The community can use various types of plants for various purposes. Its uses are like plants that humans and livestock can eat in the form of vegetables or fruit. Local people are more interested in consuming edible plants that are wild or cultivated because the vegetables and fruit are still fresh, have good nutrition for health and daily needs, are protected from a polluted environment, and are free from the use of chemical fertilizers and pesticides. Especially for local people who live in rural mountainous areas with difficult access to transportation and far from the city center, to meet their daily food needs, people rely more on traditional markets, cultivate their crops, or utilize the diversity of plants in nature that grow wildly (Cao et al. 2020).

In rural areas, especially the karst mountains in East Java, Indonesia, most local communities own housing areas with large yards and utilize the karst areas for agroforestry. Rural communities generally plant various types of plants in the yard with various benefits. The large yard can be a habitat for plants to grow and maintain high biodiversity in residential areas (Yulianti et al. 2018). Plant diversity creates environmental preservation in an area, so the yard plays an important role in meeting the needs of daily life and providing a comfortable home (Mukarlina et al. 2014). On the other hand, local people also take advantage of plants that can grow in the karst area to meet their needs. The rural communities of Pacitan District, East Java, Indonesia, especially in the karst area, have yards and gardens, usually planted with many plants that have various benefits to meet their daily needs. Plant parts used include leaves, fruit, flowers, rhizomes, seeds, shoots, tubers, and roots. These plants are usually used as food and cooking spices, animal feed, natural pesticides, and natural plant growth stimulants for local communities that have livestock and work as farmers.

With the growing era, developments in modern agriculture and industry, and urbanization, it is feared that

more or less will affect the village community in terms of meeting basic needs. Globalization which makes it easier to access mountainous and rural areas, can also change the habits of rural communities in terms of utilizing various plants for daily needs. Modernization that directly and indirectly occurs in the younger generation of rural communities can cause the transmission of local knowledge from the older generation to be hampered and will not always be guaranteed and even decrease (Ghanimi et al. 2022). Moreover, the knowledge of local communities regarding the various benefits of plants is only known from generation to generation and is conveyed orally.

Therefore, a study is needed to determine the knowledge of local communities regarding the use of plants in the present and to document the information. This study aims to reveal the knowledge of local communities and the diversity of non-medicinal plant species to meet people's daily lives in the village of Tulakan Sub-district, Pacitan, East Java, Indonesia.

MATERIALS AND METHODS

Study area

This research was conducted in two villages in the karst area of Southern Mountain, namely Bungur Village and Tulakan Village, Pacitan District, East Java, Indonesia (Figure 1). Bungur Village is located at the coordinates of -8° 10' 22.8", 111° 16' 37.2"E with a land area of 596,616 hectares with an altitude of 150 m to 450 m above sea level. The second location is Tulakan Village, located at the coordinates of 8°10'28.3"S, 111°15'47.1"E, with an altitude of 700 m asl., with a land area of 496.51 hectares (Fendi 2016; Tulakan Sub-district 2022).

Data collection and analysis

Information on non-medicinal plants used by local communities was collected from the two villages. Data were collected using survey techniques and open interviews using the snowball sampling method to obtain 40 informants. The interview technique was carried out with direct questions regarding the use of various non-medicinal plants, local names of plants used, plant parts used, and methods of using plants (Bhandary 2021). The conversations were recorded during the interview, and the information was well-written. As a result, the local name information of plants is identified and analyzed. The results of the interviews of non-medicinal plant list data and supporting information are presented in tables and graphs to combine information for easy understanding (Silalahi 2018) and analyzed using descriptive statistics in frequency and percentage (Purba and Silalahi 2021).

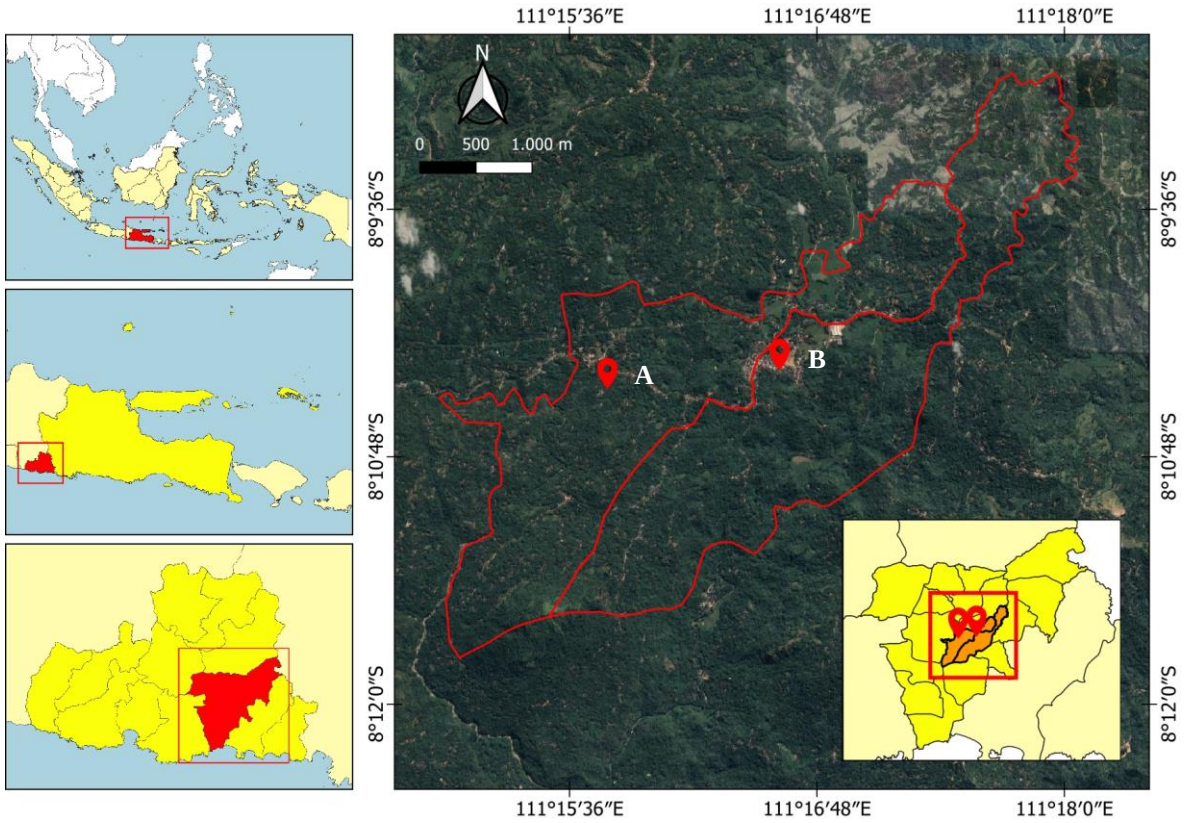

Figure 1. Map of the study area in the karst area of Tulakan Sub-district, Pacitan, East Java, Indonesia. A. Tulakan, B. Bungur

RESULTS AND DISCUSSION

A total of 40 sources were obtained as informants in this study, with details of 14 men and 26 women. The educational background consists of elementary school to college education, but most informants graduate from high school. The age range is 15-75 years, with the most being 46-55 years old and married. The village head became the first informant at each research location to collect information based on the snowball technique.

Based on the informant's demographic data (Table 1), it is known that the knowledge of local communities regarding the use of non-medicinal plants in the villages of Bungur and Tulakan is still well maintained from old to young age, even though information on plant use is only based on daily practice and becomes a habit of the residents. Furthermore, based on the results of the interviews, it is also known that information regarding the use of plants in the surrounding environment is passed down from parents to children within the household and is also taught by community leaders such as village heads to villagers or residents who have higher education to residents within the scope of one village. In addition, the daily practice of villagers who are always carried out also makes information about the use of plants can be maintained.

Purpose of use

The local community in Tulakan Sub-district utilizes non-medicinal plants for various purposes (Table 2). The most widely used by the community are edible plants, as much as 56.66%fodder plants, 33.33% natural pesticides, and plant growth regulators at 1.66%. From the study results, it is also known that several plants have multiple functions. For example, bananas used for food are also used for animal feed, and onions and garlic as herbs are also used as natural pesticides and plant growth stimulants. The diversity of non-medicinal plants in Bungur Village and Tulakan Village is still relatively high, where the plants used to consist of 60 species from 43 families.

Rural communities, especially in Java, Indonesia, are synonymous with settlements not yet crowded, large yards of houses, and raising livestock in the home area. The existence of a home yard and the maintenance of animals have made the village community continue to use plants to meet their daily needs. Using yard land for medicinal plants, food, horticulture, and others can meet family needs and increase household income if designed and planned properly (Ashari et al. 2012). The utilization of plants can be in the form of planting edible plants in the yard and fodder plants that can grow in areas around rural areas. Especially in karst mountainous areas, villagers also apply agroforestry to utilize forest areas to plant various food crops.

In addition, to using plants as edible and fodder plants, the people of Bungur and Tulakan Villages also use plants like herbs, natural pesticides, and plant growth stimulants. Although the number of species used is relatively small, this can be used as basic information to develop its application. On the other hand, the village community is still using, applying, and disseminating this information within the village scope.

Respondents in this study were mainly housewives, so the information obtained was more used as edible plants and herbs, while the male respondents mostly worked as farmers. Hence, they only understood using plants as fooders and natural pesticides. Most people in Bungur and Tulakan Villages only grow fruits, vegetables, and medicinal plants; although some care for ornamental plants, these plants are not taken from the original area of Tulakan village. Moreover, the community uses no plants for handicrafts, while none of the respondents conveyed it in detail for furniture.

Solanaceae is a plant family that acts as a food provider species. Based on ethnobotanical studies, 15 genera of Solanaceae are used as food worldwide (Samuels 2015).

Table 1. The demographic structure of informants

Parameter	Specification	Frequency
Gender	Male	14
	Female	26
Age	15-25	1
	26-35	4
	36-45	7
	46-55	12
	56-65	8
	>65	8
Education	Elementary School	9
	Junior High School	8
	Senior High School	15
	University	8
Marital status	Single	1
	Marriage	39

Table 2. Number of species, genera, and families used for non-medicinal purposes by communities of Bungur and Tulakan Villages, Tulakan Sub-district, Pacitan, East Java, Indonesia

Purposes	Number of species	Number of genera	Number of families	Percentage (%)
Edible plant	34	28	25	56,66
Fodder plant	20	17	9	33,33
Herbs	6	5	3	10
Plant growth	1	1	1	1,66
Pesticide	1	1	1	1,66

Plants used for edible plant

The people of Bungur and Tulakan Villages utilized 34 species of edible plants from 28 genera and 25 families (Table 3), with the highest utilization percentage compared to other uses. The majority of edible plants used by rural communities are planted in the house's yard, making them easier to maintain and use. Edible plants used by the majority of the community belong to the type of vegetable and fruit plants that can be eaten directly/raw, or cooked. However, based on the results of the interviews, it is known that the knowledge of the villagers about the edible plants used is only limited to plants that are often planted in the yard of the house and consumed every day, so only a little information is obtained about wild plants in the karst area which are still used by the community as edible plants.

Solanaceae family is the most widely used family group for edible plants by the people of Bungur and Tulakan Villages. The members of the Solanaceae family consisted of *Solanum nigrum* L., *Solanum melongena* L., *Solanum torvum* Sw., and *Solanum lycopersicum* L. All species of *Solanum* are harvested for cooking as vegetables. Family Solanaceae was also found in ethnobotanical studies in the Aizawl District of Mizoram, India, where Solanaceae plants can be found in home gardens, roadside, or wild plants in the area. Apart from being an edible plant whose fruit is useful as a source of protein and minerals, species such as *S. melongena* are also useful as medicinal plants (Ralte et al. 2021). However, the study results of non-medicinal plants in the villages of Bungur and Tulakan did not obtain information on using unique species as edible plants. That is also related to village areas located in tropical karst areas, so people prefer to grow food crops that are easy to grow on soil in their yards. Most of these plants are also found and used throughout Java, Indonesia. However, based on the research results, it is known that several plant species are used as edible, and not many other areas use them. These species include *Moringa oleifera* Lam. leaves, *Etlingera elatior* (Jack) R.M.Sm. flowers, *Anredera cordifolia* (Ten.) Steenis leaves and *Phytolacca acinosa* Roxb. leaves are processed into vegetables.

The *M. oleifera* leaves are more commonly consumed by the public as medicinal plants in extracts and capsules because of their phytochemical content and broad pharmacological benefits (Paikra et at. 2017; Bhattacharya et al. 2018). However, for the residents of Bungur and Tulakan Villages, most people consume the leaves as vegetables by boiling and processing them into soup. Based on Sallau et al. (2012), the boiling process of *M. oleifera* leaves can reduce the antinutrient content in the form of cyanide, oxalate, phytate, and trypsin inhibitors, so the process of boiling *M. oleifera* leaves will maximize the utilization of its nutrients. Apart from being a medicinal plant, actually the *M. oleifera* species has a high nutritional content; the leaves contain lots of minerals and vitamins (Sultana 2020; González-Burgos 2021), which also have been proven to be used to treat malnutrition (Gopalakrishnan et al. 2016). Therefore, for most people in Bungur and Tulakan, *M. oleifera* is one of the plants commonly consumed daily as a vegetable. This plant grows wild in rural areas or is planted in the house's yard.

The people of Bungur and Tulakan Villages also consume *E. elatior* flowers (Figure 2A) as food, cooked as vegetables. Based on several studies, *E. elatior* flowers, globally known as torch ginger, are used as ingredients in food, garnishes, salads, soups, appetizers, and desserts (Barash 1997). Traditionally it is also widely consumed by local Thai people for medicinal and nutritional purposes (Rachkeeree et al. 2018). It is also used in dishes by local Malaysians because it has a unique aroma and taste that can enhance food flavor (Wijekoon et al. 2011). The *E. elatior* flowers contain high levels of vitamins, fiber, fat, and protein (Nazikussabah et al. 2017), unsaturated fatty acids, amino acids, other mineral compounds, and low heavy metal contaminants (Juwita et al. 2018). Some of these nutritional characteristics can be used as information for human food and its potential in the food industry (Nazikussabah et al. 2017).

The *A. cordifolia* is a plant quite well known as a medicinal plant, but for the people of Bungur and Tulakan Villages, the leaves of this species are consumed daily as food by cooking. Globally, *A. cordifolia* is considered an unconventional food plant because the leaves and tubers can be eaten in various forms, such as for making bread (Alba et al. 2020). However, the people of southern China in coastal areas use *A. cordifolia* species as an edible plant also carried out by consuming young leaves and stems cooked in soup or with noodles. In addition, *A. cordifolia* leaves can be a source of dietary fiber, containing calcium, iron, and vitamin C (Xu et al. 2020).

The *P. acinosa*, a wild plant, is also consumed by local people in Bungur and Tulakan Villages as a cooked vegetable. Several other ethnobotanical studies have also revealed that *P. acinosa* species are classified as wild leafy vegetables and food plants that are rarely explored. Residents of the Nanda Devi Biosphere Reserve, India, consume the young leaves of *P. acinosa*, which are widely grown in forest borders by cooking (Misra et al. 2008). *P. acinosa*, as a wild plant, has a higher micronutrient and mineral content than commercial vegetables (Seal et al. 2017).

The diversity of non-medicinal plant species used by the local community in Bungur Village and Tulakan Village is still relatively high but lower compared to ethnobotanical studies from other regions in Indonesia. For example, Sunesi and Wiryono's (2007) research recorded 113 species of plants that grow in settlements and forests used by the community in Kandang Village, Kepahiang District, Bengkulu Province. Nahlunnisa et al. (2015) recorded 168 species used as food crops in Nyungcung Village, Malasari Village, Nanggung District, Bogor. Then, Iqbar et al. (2018) list 146 species used for various needs and obtained from settlements and forests in the Seulawah Valley, Aceh Province.

Table 3. Plants used for the edible plant by communities of Bungur and Tulakan Villages, Tulakan Sub-district, Pacitan, East Java, Indonesia

Scientific name	Family	Local name	Growth form	Parts used	Method of use
Moringa oleifera	Moringaceae	Kelor	Tree	Leaf	Cooked
Ipomoea aquatica	Convolvulaceae	Kangkung	Herbaceous	Leaf	Cooked
Ipomoea batatas	Convolvulaceae	Ubi jalar	Climber	Leaf, tuber	Cooked
Carica papaya	Caricaceae	Pepaya	Tree	Leaf, flower, fruit	Cooked, raw
Cosmos sp.	Asteraceae	Kenikir	Scrub	Leaf	Cooked
Gynura procumbens	Asteraceae	Sambung nyowo	Tree	Leaf	Cooked
Gnetum gnemon	Gnetaceae	Dongso/Melinjo	Tree	Leaf, fruit, seed	Cooked
Brassica rapa subsp. *chinensis*	Brassicaceae	Sawi	Scrub	Leaf	Cooked
Brassica oleracea	Brassicaceae	Kubis	Scrub	Leaf	Cooked, raw
Manihot esculenta	Euphorbiaceae	Singkong	Scrub	Leaf, tuber	Cooked
Amaranthus sp.	Amaranthaceae	Bayam	Herbaceous	Leaf	Cooked
Amaranthus tricolor	Amaranthaceae	Bayam merah	Herbaceous	Leaf	Cooked
Phytolacca acinosa	Phytolaccaceae	Bayam Belanda	Herbaceous	Leaf	Cooked
Ocimum basilicum	Lamiaceae	Kemangi	Scrub	Leaf, flower	Raw
Anredera cordifolia	Basellaceae	Binahong	Scrub	Leaf	Cooked
Etlingera elatior	Zingiberaceae	Kecombrang	Scrub	Flower	Cooked
Bambusa sp.	Poaceae	Rebung	Tree	Shoot	Cooked
Sechium edule	Cucurbitaceae	Manisah	Climber	Fruit	Cooked
Momordica charantia	Cucurbitaceae	Pare	Scrub	Fruit	Cooked
Morus alba	Moraceae	Murbei	Tree	Fruit	Raw
Vigna unguiculata	Fabaceae	Kacang panjang	Climber	Fruit	Cooked
Psophocarpus tetragonolobus	Fabaceae	Ciper/Kecipir	Climber	Fruit	Cooked
Musa paradisiaca	Musaceae	Pisang	Tree	Fruit	Raw
Solanum nigrum	Solanaceae	Leunca/ranti	Herbaceous	Fruit	Cooked
Solanum melongena	Solanaceae	Terong	Scrub	Fruit	Cooked
Solanum torvum	Solanaceae	Pokak/takokak	Scrub	Fruit	Cooked
Solanum lycopersicum	Solanaceae	Tomat	Scrub	Fruit	Cooked, raw
Nephelium lappaceum	Sapindaceae	Rambutan	Tree	Fruit	Raw
Mangivera indica	Anacardiaceae	Mangga	Tree	Fruit	Raw
Durio zibethinus	Malvaceae	Durian	Tree	Fruit	Raw
Psidium guajava	Myrtaceae	Jambu	Tree	Fruit	Raw
Annona muricata	Annonaceae	Sirsak	Tree	Fruit	Raw
Hylocereus polyrhizus	Cactaceae	Buah naga	Climber	Fruit	Raw
Daucus carota	Apiaceae	Wortel	Scrub	Root	Cooked, raw

Figure 2. Examples of edible plants in the villages of Bungur and Tulakan, Pacitan, East Java, Indonesia. A. *Etlingera elatior* flower. B. *Carica papaya*

Plants used for fodder

Most rural communities in Java, Indonesia, are no exception in Bungur and Tulakan, Pacitan, East Java, raising livestock by building cattle pens behind their houses. The livestock usually kept are cows, goats, chickens, and ducks. Villagers raise livestock to support daily food consumption for chickens and ducks or for future savings for cows and goats, usually sold at certain times. The daily lives of villagers who have livestock at home will also need to look for animal feed. The people of Bungur and Tulakan Villages who live in the karst area use the plants in their area to meet livestock needs. Table 4 shows which species are widely used by the community as animal feed. The people of Bungur and Tulakan Villages used plants as animal feed, with a total of 20 species from 9 families with a percentage of 33.33%, and became the second largest number after edible plants.

Rural communities most widely use Poaceae and Fabaceae families as animal feed. The majority of Poaceae family members used grass species consisting of *Brachiaria mutica* (Forssk.) Stapf, several cultivars of *Pennisetum purpureum* Schumach., *Setaria sphacelata* (Schumach.) Stapf & C.E.Hubb. ex Moss, and *Megathyrsus maximus* (Jacq.) B.K.Simon & S.W.L.Jacobs. This type of grass grows wild in rural areas, and residents search around houses, roadsides, and forest borders every day. This grass is used as animal feed for cows and goats, with preparations only being cut and then given directly to livestock. Meanwhile, from the Fabaceae family, residents use the leaves of *Leucaena leucocephala* (Lam.) de Wit, *Albizia chinensis* (Osbeck) Merr., *Gliricidia sepium* (Jacq.) Kunth, *Canavalia gladiata* (Jacq.) DC. as feed for cows and goats, which are given directly.

Some plant species are used for one type of livestock only. For example, species only given as feed for goats are *C. gladiata* leaves, *Manihot glaziovii* Müll.Arg., *Manihot esculenta* Crantz, *Gmelina arborea* Roxb. ex Sm., and *Carica papaya* L. leaves. The preparation of using leaves as goat feed is only taken from the leaves and given directly to livestock. The animal feed species only given to cows are dried straws from *Oryza sativa* L. For ducks, residents use crushed *Cucurbita* fruit and mostly use mashed rice seed husks for chickens. The crushed leaves of *Colocasia esculenta* (L.) Schott and mashed soybean seeds are used as feed for chickens and ducks.

Three cultivars of the P. purpureum species are used by the residents of Bungur and Tulakan Villages as feed for cattle and goats, namely the common elephant grass, *P. purpureum*, the dwarf elephant grass *P. purpureum* cv. Mott, and *P. purpureum* cv. Thailand. The difference between common elephant grass and dwarf grass is the size of the plant where common elephant grass has a height of 3-4 meters (Reksohadiprodjo 1994), while dwarf elephant grass is a such of grazing grass that has a height of 125 cm (Ako 2013). The use of the Poaceae family, especially *P. purpureum*, as animal feed is also known from several ethnobotanical studies, namely in Gumantar Village, North Lombok District (Jannaturrayyan et al. 2020) and in Toba Samosir by the Parmalim Batak community (Amrul et al. 2019). That shows that elephant grass is a species that is widely used as animal feed for rural communities in general. Village communities that use elephant grass a lot as animal feed can be related to the character of elephant grass, which has good adaptation during the dry season, especially in karst areas. In particular, dwarf elephant grass is easy and fast-growing (Rusdy 2016) with high nutritional content (Maleko et al. 2019). Therefore, it is suitable for ruminant feed for grazing and cutting, and transport systems (Sirait 2017).

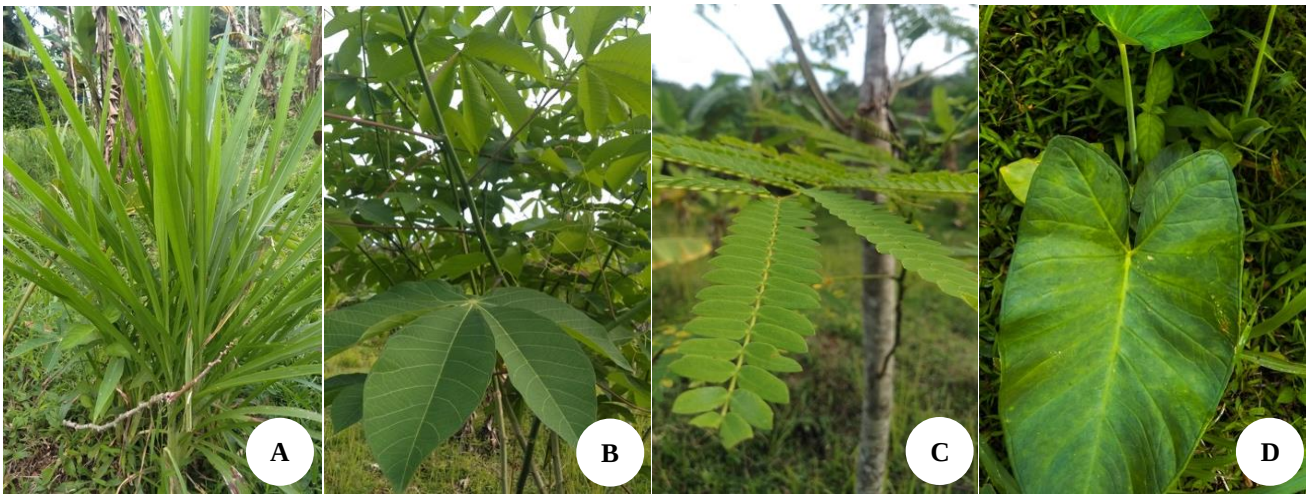

Figure 3. Some examples of species for fooder in the villages of Bungur and Tulakan, Tulakan Sub-district, Pacitan, East Java, Indonesia. A. *Pennisetum purpureum* cv. mott, B. *Manihot glaziovii*, C. *Albizia chinensis*, D. *Colocasia esculenta*

Table 4. Plants used for fodder by communities of Bungur and Tulakan Villages, Tulakan Sub-district, Pacitan, East Java, Indonesia

Scientific name	Family	Local name	Growth form	Parts used	Method of use	Livestock
Brachiaria mutica	Poaceae	Kolonjono	Scrub	Leaf	Cut, fed directly	Goat, cow
Pennisetum purpureum	Poaceae	Rumput gajah	Scrub	Leaf	Cut, fed directly	Goat, cow
Pennisetum purpureum cv. Mott	Poaceae	Rumput odot	Scrub	Leaf	Fed directly	Goat, cow
Pennisetum purpureum cv. Thailand	Poaceae	Rumput pakchong	Scrub	Leaf	Cut, fed directly	Goat, cow
Setaria sphacelata	Poaceae	Setaria	Scrub	Leaf	Fed directly	Goat, cow
Megathyrsus maximus	Poaceae	Rumput benggala	Scrub	Leaf	Fed directly	Goat, cow
Oryza sativa	Poaceae	Jerami	Herbaceous	Stem, seed coat	Dried, crushed, mashed	Cow, chicken
Leucaena leucocephala	Fabaceae	Mlanding/lamtaro	Tree	Leaf	Fed directly	Goat, cow
Albizia chinensis	Fabaceae	Sengon	Tree	Leaf	Fed directly	Goat, cow
Gliricidia sepium	Fabaceae	Gamal/sono	Tree	Leaf	Fed directly	Goat, cow
Canavalia gladiata	Fabaceae	Koro benguk	Climber	Leaf	Fed directly	Goat
Glycine max	Fabaceae	Kedelai	Climber	Seed	Mashed	Duck, chicken
Manihot glaziovii	Euphorbiaceae	Telo Jerman	Scrub	Leaf	Fed directly	Goat
Manihot esculenta	Euphorbiaceae	Singkong	Scrub	Leaf	Fed directly	Goat
Melia azedarach	Meliaceae	Mindi	Tree	Leaf	Fed directly	Goat, cow
Gmelina arborea	Verbenaceae	Gamar	Tree	Leaf	Fed directly	Goat
Colocasia esculenta	Araceae	Talas	Herbaceous	Leaf	Crushed	Duck, chicken
Artocapus heterophyllus	Moraceae	Nangka	Tree	Leaf	Fed directly	Goat, cow
Carica papaya	Caricaceae	Pepaya	Tree	Leaf	Fed directly	Goat
Cucurbita sp.	Cucurbitaceae	Waluh	Climber	Fruit	Crushed	Duck

The people of Bungur and Tulakan Villages also use a lot of plants from the Fabaceae family to feed cows and goats, especially *A. chinensis*, which has not been widely used by other regions. *Albizia* is a plant that is not well known as food (Karda and Spudiati 2006). In the areas of Bungur and Tulakan Villages, the people also plant a lot *of A. chinensis* trees in addition to their leaves for animal feed as well as for their wood needs which can be sold, so this species is also commonly found around roadsides or village markets which also sell *A. chinensis* seedlings. The *A. chinensis* can be used as animal feed because ruminants easily eat the leaves, and the wood can be used for building houses and furniture (Akkasaeng and Gutteridge 2016).

Apart from goats and cows, the people of Bungur and Tulakan Villages also raise chickens and ducks as livestock. Raising chickens and ducks for rural communities, especially in Java, is a habit despite having no specific purpose. Raising chickens and ducks in the village is usually used for eggs, meat, or sale at certain times. The people of Bungur and Tulakan Villages used fine rice bran, mashed soybean seeds, and crushed pumpkin. These chicken and duck feed ingredients have been widely used in various regions with many methods and advantages (Viet and Kien 2001; Kumar et al. 2014; Bakshi and Wadhwa 2017; Lourenco et al. 2019; Egorov et al. 2020). However, residents also use crushed taro leaves, which is not commonly practiced in other areas. Villagers take advantage of *C. esculenta* leaves because the plant grows wild in rural areas. Taro is an energy source that is less desirable than human food, so it can be developed as an alternative energy source for animal feed (Adejumo et al. 2013). Taro is also recommended as animal feed because of its nutrition in high protein content in leaves and stems (Setyawan et al. 2021).

Plants used for other purposes

The people of Bungur and Tulakan Villages also use plants for various other purposes, such as herbs, biopesticide, and plant growth regulators, by utilizing plants grown in their yards. Villagers mostly use the Zingiberaceae and Amaryllidaceae families for this purpose (Table 5). For seasoning, the herbs used are *Zingiber officinale* Roscoe, *Kaempferia galanga* L., *Curcuma longa* L., *Allium cepa* L., and *Allium sativum* L. Plants used for seasoning can be used fresh or dry mixed in dishes to add aroma and flavor. The parts of plants that contain phytochemicals produced by plants are part of the plant's metabolic process (Robi et al. 2019).

Species *A. cepa* and *A. sativum* also have a dual function where *A. cepa* is used as a natural plant growth regulator, and *A. sativum* is used for biopesticides. Natural growth regulators from shallots are usually applied when plants' vegetative propagation, such as grafts and stem cuttings, by applying grated shallot to the cut end of the stem where the potential roots will grow. As for pot plants, shallot filtrate is applied by soaking the grated shallots overnight, adding water, filtering, and then spraying on the plants. Shallots act like auxin to stimulate root and shoot growth during vegetative propagation. Several studies have also been conducted regarding the application of shallots as natural growth regulators; Susanti (2011) tested the shallot filtrate on *Syzygium aqueum* (Burm.fil.), Alston cuttings, Marfirani et al. (2014) on jasmine cuttings, Manurung et al. (2020) on *A. cordifolia*, Prameswari and Pratomo (2021) on cuttings of *Mucuna bracteata* D.C. ex Kurz. Based on

some of these studies, it has been proven that onion filtrate can stimulate root growth because shallots contain the hormone auxin, vitamin B1, nicotinic acid, and *allin* compounds which turn into *allicin* compounds when onions are chopped or cut. The direct practice of using shallots as plant growth regulators, such as those carried out by the people of Bungur and Tulakan Villages, needs to be informed so that the general public can carry it out.

Local people also use garlic as a biopesticide to treat the plants they grow in their yards. That is related to all the plants they plant in their yards, which will be consumed along with their families to avoid using chemical pesticides. Residents make a concoction of garlic by mixing mashed garlic with water and dry tobacco with high nicotine content. This mixture can be used to eradicate caterpillars that usually attack vegetable and fruit crops. The use of garlic extract or juice has been widely studied globally. It has been shown to be effectively used as a natural pesticide to eradicate various pests, such as research by Li and Zhihui (2009) to control *Phytophthora capsici* (Leonian, 1922) in China, Magwenya et al. (2016) controlled for *Aphis gossypii* (Glover, 1877) in Zimbabwe, and Hardiansyah et al. (2020) to control rice-eating bird pests in Tonasa village, South Sulawesi, Indonesia. Based on the results of these ethnobotanical studies and references, the use of biopesticides such as garlic is expected to be further developed and applied more widely to reduce the use of chemical pesticides.

Parts and methods used

The use of plants by the people of Bungur and Tulakan Villages for non-medicinal plants consists of various parts and methods of use. The community primarily uses the leaves with 53.22% and mostly uses it as an edible and fooder plant. The fruit is the second largest part after the leaves, with 29.03%. Even with a small percentage, the community uses 6.45% of tubers, 4.48% of flowers, rhizomes, and seeds, and 1.61% of stems, shoots, and roots (Figure 4A).

Table 5. Non-medicinal plants are used for other purposes by communities of Bungur and Tulakan Villages, Tulakan Sub-district, Pacitan, East Java, Indonesia

Scientific name	Family	Local name	Growth form	Part used	Purposes	Method of use
Capsicum frutescens	Solanaceae	Cabai	Scrub	Fruit	Herbs	Cooked
Zingiber officinale	Zingiberaceae	Jahe	Herbaceous	Rhizome	Herbs	Cooked
Kaempferia galanga	Zingiberaceae	Kencur	Herbaceous	Rhizome	Herbs	Cooked
Curcuma longa	Zingiberaceae	Kunyit	Herbaceous	Rhizome	Herbs	Cooked
Allium cepa	Amaryllidaceae	Bawang merah	Herbaceous	Tuber	Herbs, natural plant growth regulator	Cooked, mashed
Allium sativum	Amaryllidaceae	Bawang putih	Herbaceous	Tuber	Herbs, biopesticide	Cooked, mashed

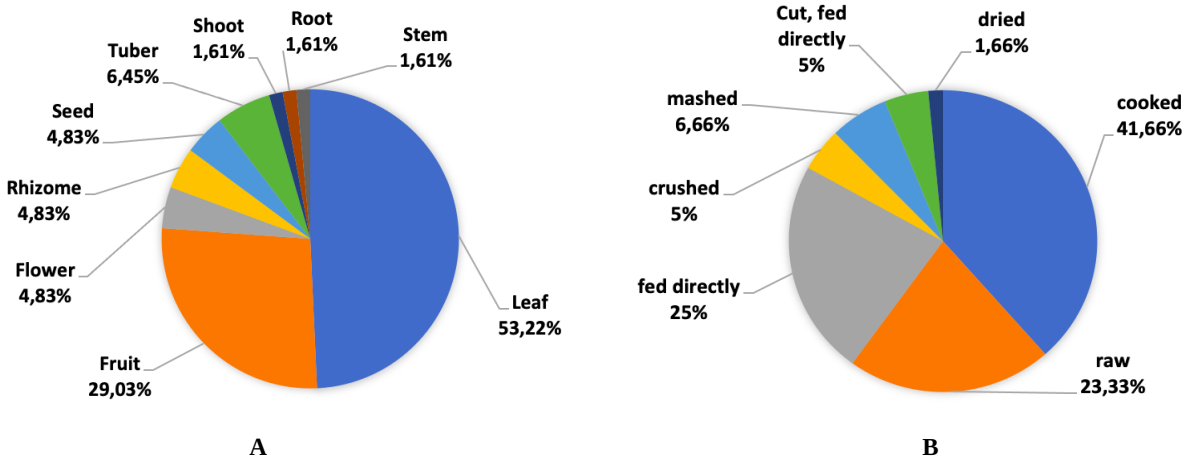

Figure 4. Percentage of plant parts and methods used by the community of Bungur and Tulakan Villages, Tulakan Sub-district, Pacitan, East Java, Indonesia. A. percentage of plant parts used, B. Percentage of methods used

Umartani and Nahdi (2021) research revealed that the people on the slopes of Mount Merapi and Merbabu used the leaves and fruit widely as edible plants. The same thing also happened in ethnobotany studies by ethnic groups in Jiangcheng County, Southwest China which mostly used leaves, fruit, and stems as edible plants (Cao et al. 2020). The most widely used method is cooking, where most residents cook it by boiling. The second most commonly used method is eating raw vegetables and fruit as edible plants. Plants used as animal feed are fed directly as much as 25%, while the method that requires cutting is only 5%. With a small percentage, the community uses the crushed method by 5% and mashed by 6.6%. The results of this study are the same as the ethnobotanical study in Nepal, with the category of using edible plants by cooking as vegetables for the highest percentage and eating raw methods for fruits (Uprety et al. 2012). Based on the percentage of parts and the method of use, it is known that the villagers prefer to use plants in a practical, easy, and quickly obtained way.

In conclusion, the people of Bungur and Tulakan Villages use plants for edible plants, fodder plants, herbs, biopesticides, and natural growth regulators. Village communities use plants for this purpose by planting in their yards or taking wild plants in rural areas. The leaves and fruit are the most widely used plant parts as edible plants and fodder plants. The method of use is mainly cooked and raw. The community's knowledge and diversity of species are still relatively high from the old to the young. Still, this knowledge may be further degraded if there is no knowledge teaching about the traditional use of plants in the village.

ACKNOWLEDGEMENTS

We thank the villagers of Bungur and Tulakan Villages, Tulakan Sub-district, Pacitan, East Java, Indonesia, who have participated as informants to assist in this research.

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