The Medicinal Plant Potential Parts and Species Diversity as Antipyretic: Ethnobotany Study at Senduro Lumajang

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Abstract. Fever is characterized by high body temperature caused by a bacterial infection, virus, and other pathologist conditions. Traditional medicine role in reducing fever by using medicinal plants, mainly potentially as antipyretic. One of the communities that still maintain the use of the medicinal plant is the Senduro sub-district community Lumajang regency, which is occupied by the Tengger, Javanese, and Madurese ethnic. This research aims to investigate the antipyretic plant species diversity and the parts utilized by the community. This research was implemented mix method approach with an explorative, descriptive research type. The used data collection techniques were direct observation, interview, documentation, and Focus Group Discussion (FGD). The data analysis techniques were qualitative and quantitative, while Miles and Huberman's analysis technique was used in the qualitative analysis. The research result shows that the Senduro sub-district community uses 21 species of antiphrastic plant which included in 16 groups of families, such as Amaryllidaceae, Annonaceae, Araceae, Arecaceae, Brassicaceae, Clusiaceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Musaceae, Pandanaceae, Piperaceae, Poaceae, Rutaceae, and Zingiberaceae. The plant parts that tend to be utilized are the fruits, seeds, rhizomes, leaves, tubers, flowers, and shoots.

INTRODUCTION

Indonesia is one of the mega-biodiversity nations which high in biodiversity [1]. Indonesia's biodiversity supports the development of traditional community elements in daily life to be known as a culture [2]. There are 30,000 plant species recorded in Indonesia out of 40,000 species in the world [3]. These plants are utilized by Indonesians in supporting their daily life; one of them is for medicine. About 7,500 plant species are recorded efficacious as medicine [2]. The Indonesian community has long been utilizing plants as medicine [4] because it is proven to be useful in curing disease [5]. The use of medicinal plants for health is still needed and developed under traditional knowledge that passed down hereditary.

Traditional knowledge concerning plants for the local community is essential in maintaining life sustainability. That knowledge became a vital resource that should be preserved [6]. However, environmental change and new information entry caused the development of cultural modernization. Then, the knowledge about the utilization of medicinal plants is decreased caused by the entrance of modern medicine. These days, the young generation is less motivated to explore medicinal plants known by the elders. This may gradually cause extinction of traditional heritage [7]. To overcome this condition, a form of documentation is needed for the medicinal plants. Until now, the Indonesian community is still using traditional plants as a treatment of various diseases, mainly fever.

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Fever can be caused by a bacterial infection, virus, and other pathologist conditions, such as heart attack, tumor, tissue injuries, and so on [8]. Fever can be treated by consuming antipyretic drugs because it can reduce fever temperature [9]. Synthetic antipyretic preparations often consumed by the Indonesian community are paracetamol, ibuprofen, and aspirin [3]. The ancestors' alternative way in resolving health problems and anticipating the use of synthetic drugs is by utilizing traditional plants [10].

One sub-district that still lacks research on antipyretic plants is the Senduro sub-district Lumajang Regency, east java. The research about medicinal plants at the Senduro sub-district, mainly on Tengger ethnic, has been carried out. It identifies 26 types of diseases in 8 disease categories treated by using traditional medicine from 54 medical plant species [11]. However, the previous research's scope and limitations were too broad and nonspecific on one medicinal plant but an inventory of all kinds of plants for various types of disease at Tengger ethnic. Therefore, this research investigates various ethnic medical plant utilization at the Senduro sub-district, focusing on fever.

METHODS

This type of research was descriptive explorative with a mixed-method approach and sequential explanatory model [12]. The sampling technique used in this research was purposive sampling in the qualitative approach and snowball sampling in the quantitative approach. The data collecting techniques used in this research were direct observation, interview, documentation, and Focus Group Discussion (FGD).

The data validity test was carried out using a credibility test with triangulation techniques, namely sources triangulation and methods triangulation [12]. At the same time, the quantitative data analysis technique presented in a percentage form. Meanwhile, the qualitative data analysis was completed using Miles and Huberman analysis consisting of three activity steps, namely data reduction, data presentation, and conclusion/verification [13].

This research was conducted in September 2019 - June 2020. The research was located at three villages on the Senduro sub-district, namely Argosari, Kandangan, and Wonocempokoayu. The chosen respondents were community groups who used and had the knowledge about antipyretic plants, village elders, and traditional healers, with a total of 98 respondents determined by using the Slovin formula as the total population already known. For the identification process, the plants were identified by using the Flora of Java.

RESULTS AND DISCUSSION

Antipyretic Plants

Based on the interview results, it showed that the Senduro sub-district community utilized 21 potentially antipyretic plants. The comparison of the number of antipyretic plants utilized by every ethnicity was different. The plants used by Tengger tribe were 8 species, the Javanese tribe was 12 species, and the Madurese tribe was 8 species. Antipyretic plant utilization based on the ethnic is shown in Figure 1.

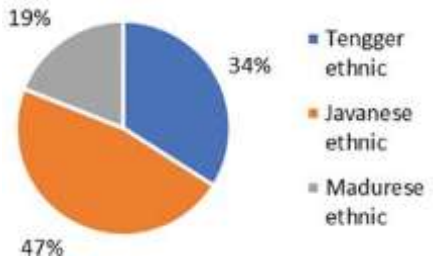

FIGURE 1. Use of Antipyretic Plants Based on Ethnic

Families of Plant for Antipyretic Remedies

According to the antipyretic plant's identification results, a total of 16 family groups were obtained. The identification results showed that the highest percentage was on the *Zingiberaceae* families with 19%, as illustrated in Figure 2.

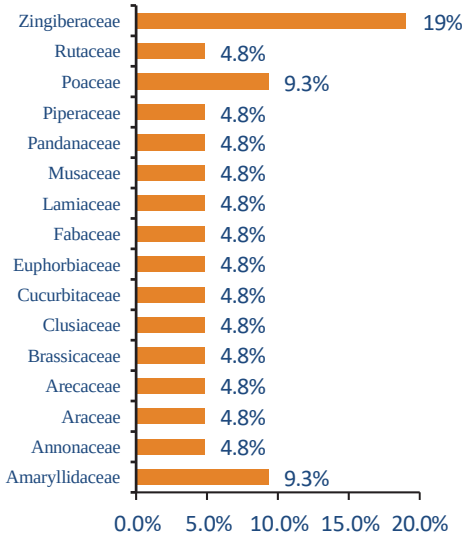

FIGURE 2. Percentage of Antipyretic Plant Familia

Antipyretic Plant Habitus

The identification results showed that the Senduro sub-district Lumajang regency community utilized the antipyretic plant's habitus in the form of herbs, shrubs, vines, bushes, lianas, and trees. The highest percentage of antipyretic plant habitus was herbs with 43%, while the lowest percentage was vines, lianas, and bushes with 10%. The percentages of the used antipyretic plants are presented in Figure 3.

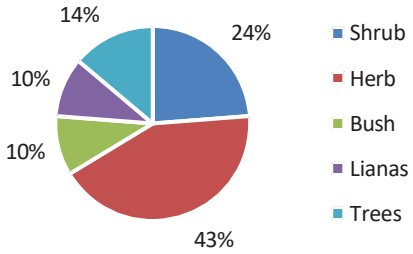

FIGURE 3. Percentage of Antipyretic Plant Habitus

Antipyretic Plant Obtainment Locations

In line with the interview results, there are 5 antipyretic plant obtainment locations, namely house yards, fields, forests, rice fields, and gardens. The highest percentage of antipyretic plant obtainment location is house yards (52%), and the lowest percentage is forest (5%) as presented in Figure 4.

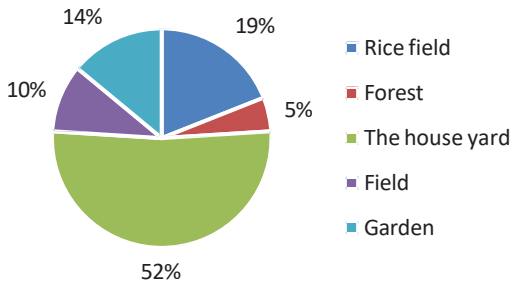

FIGURE 4. Percentage Antipyretic Plants of Obtainment Locations

Plant Parts Utilization

According to the interview results, the utilized antipyretic plant parts by the community are the leaves, tubers, fruits, rhizomes, shoots, flowers, and seeds. The highest percentage of the antipyretic plant part is the leaves (43%), while the lowest is shoots, flowers, and seeds (5%), as presented in Figure 5. Some plant parts that are used had some specific requirements, as said by the former elders. Those particular requirements became local wisdom that is believed to be more efficient in the healing process until now.

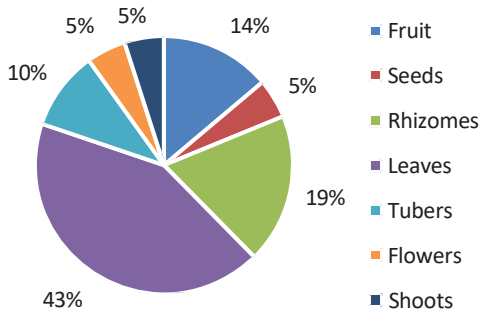

FIGURE 5. Percentage of Antipyretic Plant Parts

The antipyretic plant species identification results showed that the Senduro sub-district community utilized 21 antipyretic plants, which included in 16 groups of families. *Zingiberaceae* families had the most utilization percentage among them because the community believed in its efficacy of reducing fever for generations. Besides being medicine, the *Zingiberaceae* family is also utilized as a seasoning because it is easy to grow in the yard. Many people use the *Zingiberaceae* families as the medicine for generations, considering the essential oils and resin ingredients as a carminative and stimulant in medicine, as well as giving aroma or flavor [14]. Then, it is also the most used medicine by many people in the rural area [15].

Antipyretic plants with herbal habitus achieved the highest percentage compared to other habitus. It happened due to it is easily planted and cultivated even in a small space. Hence, it was accessible and easy to be found in the yard. Planting herbal habitus does not require a large area or spaces so that it can be planted in the yard, as well as it is easy to be planted and grown [16]. Herbaceous plants have better conservation than other types because herbs are easy to grow in various locations so that they have a fast growth and reproduction rate [17]. The most utilized antipyretic plant by the community is *Curcuma domestica* Val, based on the total quantity used by the respondent. Turmeric is widely used as a traditional medicine in Java island [18]. World Health Organization (WHO) stated that turmeric is the most commonly used medicinal plants in various countries. Turmeric (*Curcuma Domestica* Val) had the properties of an antipyretic because it contains curcumin that decreases the body temperature in a fever condition [19].

The large number of antipyretic plants utilized by the Tengger, Javanese, and Madurese ethnic is high because of some factors, such as inadequate health facilities, the community that still believe in the habit of utilizing antipyretic plants hereditary. Besides, it is also because of a fertile environmental condition that made antipyretic plants easy to

find because Senduro District area was at the foot of Mount Semeru and included in the Bromo Tengger Semeru National Park (TNBTS) area. The area at the foot of Mount Semeru has fertile soil and fresh and comfortable air [20]. The fertile soil in the area is caused by Mount Semeru, which releases various materials for soil fertility every day. In Indonesia, especially in rural communities, they had a problem with access to health services [21]. Although so far, the government shows its efforts in building health service facilities. The community still can not reach so that they use plants around them as medicines. The back to nature lifestyle is also a factor that made the community utilized medicinal plants [22].

Antipyretic plant utilization based on ethnics had different numbers, and types found based on the plant's diversity in each region. Those differences are influenced by the knowledge and the environmental condition that reside in each ethnic territory. That in every ethnic in Indonesia had clearly defined cultural characteristics and identities [23]. Therefore, community knowledge of traditional medicinal plants in their environment is utilized differently. The comparison of the number of antipyretic plants obtained from each ethnic group shows that the Javanese ethnic uses the most antipyretic plants with 12 plant species compared to the Tengger and Madurese ethnic. This is related to the existence of the Javanese ethnic as the oldest ethnic that occupied the Senduro sub-district compared to other ethnicities. The Javanese were the indigenous native ethnic and more dominant, so that they knew more about the existence and the plant species with antipyretic potential. The different level of knowledge in the use of plant resources by each ethnic or community group occurs caused by cultural levels of difference and residential environmental conditions [24].

The 8 antipyretic plant species are utilized by the Madurese ethnic. The number is lower than Javanese ethnic but the Madurese use some plants similar to the Javanese, namely *Sechium edule* (Jacq.) Swartz, *Curcuma domestica* Val, *Citrus aurantifolia* (Christm) Swingle, and *Alpinia galanga* (L.) Willd. This is influenced by the fact that these tribes lived side by side at the same location at the Senduro sub-district. However, the Madurese population in that area is small, since they were the immigrant. Meanwhile, the Javanese are the majority. People who lived in an area inhabited by different ethnic groups have a low level of similarity to the used medicinal plant species, while people who lived in different regions but were occupied by the same ethnic or ethnic group have a high level of similarity to the used plant species in traditional medicine [25].

The use of antipyretic plants in Tenggar ethnic is different from Javanese and Madurese ethnic. It is due to environmental conditions such as remote locations and religious differences between Tenggaer and other ethnicities. The majority of the Tengger ethnic religion is Hindu, while the majority of Javanese and Madurese are Muslim. Religious beliefs and values play a significant role in the traditional ways of treatment [26]. The environmental conditions in each area cause the growth amount and species of plant difference, so there are plants utilized in certain, but they are not used in a different area [27].

The most utilized antipyretic plants by the Tengger ethnic are *Nasturtium montanum* Wal. ex Hook f. & Thomson, *Acorus calamus* Linn., and *Allium sativum* Linn. These plants are used only by the Tengger ethnic, while Javanese and Madurese ethnic do not use these plants as antipyretics at all. This is related to the beliefs of each ethnic's ancestors. Especially, the Tengger ethnic has a substantial order of community life in preserving tradition from generation to generation and a unique traditional knowledge in utilizing natural resources and the environment. The Tengger ethnic existence is recognized as a traditional society that strongly preserved the traditional elements and ancestral customs compared to other ethnicities [16]. The interview results show that the Tengger ethnic is not only utilized plants as an antipyretic but also for *suwuk* traditional treatment by the local shamans, especially Hindus. *Suwuk* means giving a special prayer that could only be done by traditional healers. Thus, the Tengger ethnic not only used plants as medicine but also used *suwuk* or incarnation as the media [28].

Each part of the plant has a different medicinal function, so the medicine can be obtained from one or more plant parts. The utilization of plant parts with the highest percentage of antipyretic potential is coming from the leaves. The plant is mostly used by the people of Kayu Ara Village in Menyuke Subdistrict. Landak Regency is the leaves because it is easy to find and can treat internal and external diseases [16]. In general, the reason was because of how easy it was to obtain in large quantities. It did not wilt the plant, easy to dry, easy to regenerate, and had a flexible structure, so they were easy to cultivate. Mostly leaves have the highest concentration of bio-active secondary metabolites. It is believed for generations that leaves have high efficacy; it is easier to be found than other plant parts [29]. The use of leaves do not interfere with the plant survival, so it is considered a conservation effort for plants. It is stated that leaves have high regeneration to sprout while it does not affect the growth so that the use of leaves does not bring a significant effect on a plant compared to other parts [30].

TABLE 1. Antipyretic plant utilization based on ethnic

No	Scientific Name	Local Name (Indonesia)	Tengger tribe	Javanese Tribe	Madurese Tribe	Parts of Plants	Special Provisions
1.	*Nasturtium montanum* Wal. ex Hook. f. & Thomson	Sawi Hitam or Sawi Tanah	✓			Leaves	Must be small
2.	*Acorus calamus* Linn.	Dringo	✓			Leaves	
3.	*Allium sativum* Linn.	Bawang Putih	✓			Tubers	Single tuber
4.	*Zingiber zerumbet* (L) Roscoe ex Sm.	Lempuyang	✓		✓	Rhizomes	
5.	*Sechium edule* (Jacq.) Swartz.	Siem or manisah	✓	✓	✓	Fruit	The fruit is young and small
6.	*Curcurma domestica* Val.	Kunyit	✓	✓	✓	Rhizomes	Yellow turmeric rhizome
7.	*Garcinia mangostana* Linn.	Manggis	✓			Leaves	
8.	*Cymbopogon citratus* (DC.) Stapf	Serai	✓			Leaves	
9.	*Citrus aurantifolia* (Christm.) Swingle	Jeruk Nipis		✓	✓	Fruit	
10.	*Ocimum tenuiflorum* Linn.	Kemangi		✓		Leaves	
11.	*Piper betle* Linn.	Sirih		✓		Leaves	The leaf bones should are parallel and each end of the bone meets
12.	*Allium cepa* Linn.	Bawang Merah		✓		Tubers	
13.	*Pandanus amaryllifolius* Roxb.	Pandan			✓	Leaves	
14.	*Cananga orodata* Hook. F. and Thom.	Kenanga			✓	Flowers	
15.	*Musa paradisiaca* Linn.	Pisang		✓		Shoots	Types of saba bananas and their shoots are exposed to direct sunlight
16.	*Cocos nucifera* Linn.	Kelapa		✓		Fruit	The fruit must be young
17.	*Manihot utilissima* Crantz	Singkong			✓	Leaves	
18.	*Alpinia galanga* (L.) Willd	Lengkuas		✓	✓	Rhizomes	
19.	*Curcuma xanthorrhiza* Roxb	Temulawak		✓		Rhizomes	
20.	*Oryza sativa* L. ssp. indica	Beras Hitam		✓		Seeds	
21.	*Tamarindus indica* Linn.	Asam jawa		✓		Leaves	The leaves should be small and young

There are several criteria in utilizing the antipyretic plant to reduce the fever. This criterion is believed by the community in Senduro Subdistrict for generations, as the knowledge passed on by the previous ancestor. It is believed that to affect the outcome of treatment, therefore, the community still follows it. Besides, there is local wisdom believed by the community in processing and utilizing plants as medicinal ingredients so that the efficacy will be faster to cure the diseases [31]. For example, *Piper betle* Linn., the leaf bones should are parallel, and each end of the bone meets. *Piper betle* Linn. has antipyretic activity because there are flavonoid compounds [32]. This is related to plant conservation so that people do not take these plants in large quantities. Then, the criteria for *Allium sativum* Linn is illustrated in Figure 6. It should be single bulb garlic, which is commonly called *lanang* garlic. The content of *lanang*

garlic and ordinary garlic is the same except for the measure [33]. However, people more believed in the efficacy of *lanang* garlic than regular garlic. The content of active compounds in *lanang* garlic cloves is equivalent to 5-6 ordinary garlic cloves because all the substances are collected in this single clove. Thus, the number of substances contained in *lanang* garlic is bigger than other types of onions, and the aroma of *lanang* garlic is more pungent [34]. In conclusion, single garlic has an antipyretic effect due to the presence of flavonoids. Flavonoid compounds are the largest group of phenolic compounds that work as Cyclooxygenase (COX) inhibitors, which deter prostaglandin biosynthesis so that it can reduce body temperature [35].

(a) **(b)**

FIGURE 6. (a) *Piper betle* Linn, (b) *Allium sativum* Linn.

SUMMARY

There are 21 types of medicinal plants with antipyretic potential utilized by the Tengger, Javanese, and Madura ethnic in Senduro Subdistrict, which is classified into 16 families group. Differences in the use of potential antipyretic plants based on ethnicity are caused by culture, regional conditions, and religion. The parts of plants that are utilized as antipyretics by the people of the Tengger, Javanese, and Madurese ethnic in Senduro Subdistrict consisted of leaves, tubers, fruit, rhizomes, shoots, flowers, seeds, which mostly.

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