

Ethnobotanical Investigation to Conserve Home Gardens's Species of Plants in Tambakrejo, Sumbermanjing Wetan, Southern of Malang

Ratih Nila Pamungkas*, Luchman Hakim

Biology Departement, Faculty of Mathematics and Natural Sciences, Brawijaya University, Malang, Indonesia

ABSTRACT

In developing countries, traditional knowledge of indigenous people is being widely threatened by current trends of economic globalization especially in tourism destination area such as in Tambakrejo village, Sumbermanjing Wetan, Malang. This region covers Sempu Island as well as the proposed protected area. The aims of the investigation are to find out the diversity of species of plants that made up home garden species, to measure the use value of each species of plants using ethnobotany indexes, and to describe methods of preparation and uses of the important plants. The study represents the first step to documenting significant utilization of the species of plants in home gardens based on indigenous knowledge before it disappears. Data was collected through depth and semi structured interviews. Information gathered was about traditional uses of wild plants as well as cultivated plants. All the collected data was filled into an analytical table and, for the ease of analyses, was grouped into ten categories continued with detailed information on uses. Data was calculated using synthetic indexes, namely Relative Frequency of Citation (RFC) and Cultural Importance Index (CI). One hundred and one plants were cited by informants as being traditionally used in the area. These 99 ethnospecies belong to 45 families. From the 10 categories, most of them are used for allimnetary, medical, and economical plants. For allimentary plants, 316 citations, 58 species, and 5 different uses were recorded. For medical plants, there were 63 citations, 22 species, and 4 different uses of categories. A few species of plants belong to others categories, like erotion control. The study shows that traditional uses of plants especially at home gardens still survives as part of cultural heritage of the community, for some economical reasons, and also for daily activities.

Keywords: *ethnobotanical, home garden, traditional knowledge*

INTRODUCTION

The investigation on ethnobotanical study based on indigenous knowledge has brought much contribution for ecologists, pharmacologists, taxonomists, and also environmental managers to protect their field of work, especially the ones related with high quality biodiversity areas. For example, in the field of pharmacology, plant-based traditional knowledge has become a recognized tool in search of new sources of drugs and neutraceuticals [1, 2]; the knowledge is also important for maintaining germplasm in a conserved area. Knowledge on the utilization and traditional food processing techniques as well as

types of germplasm maintained by farmers are a prerequisite for investigating ways to improve the germplasm maintenance of food crop [3].

Ethnobotanical research addresses the characteristics of traditional knowledge to establish priorities together with the local community as to ensure that local values are translated into rational uses of resources and effective conservation of biological diversity and cultural knowledge [4]. Plants as bioresource are responsible for the socioeconomic uplift of the area and the people. The people of the area are mainly poor, depend mainly on agriculture, government services, and forest resources. Therefore, the forest is under severe biotic pressure. Forest reservation is a constant source for maintaining genetic diversity of plants and animals; and these resources should be available to human through proper conservation. In developing countries, traditional knowledge of indigenous people is being widely threatened by current trends of economic globa-

*Corresponding address:

Ratih Nila Pamungkas

Biology Department, Faculty of Mathematics and Natural Sciences, Brawijaya University, Jalan Veteran, Malang, Indonesia 65145

E-mail: ratih_nilapamungkas@yahoo.com

lization that promote intensive agriculture, industrialization, and the migration of rural population to urban areas [5]. Those cases also appear in Sumbermanjing Wetan, Malang, especially in tourism destination area such as Tambakrejo village. This region includes Sempu Island as well as the proposed protected area. Most of the young females are more interested in being a TKW (female workers) in other countries than in developing their own region. Thus, it is worry some that tradisional cultural heritage and a lot of local uses of plants are not maintained as well as before. The aims of the investigation were to find out the diversity of species of plants that made up home gardens species, to measure the use value of each species of plants using ethnobotany indexes, and also to describe methods of preparation and use of the significant plants. The study represents the first step to documenting significant utilization of the species of plants in home gardens based on indigenous knowledge before it disappears.

MATERIALS AND METHODS

Description of the study area

Tambakrejo village is located south to Malang region. It covers 2735.830 ha of land, consisting of Tamban district and Sendang Biru area. This region includes Sempu Island as well as the proposed protected area (Figure 1). The population of the area is around 6,890 people. In average, there are 255 families live in Tamban district and the others live in Sendang Biru. Until 2011, the livelihood of people in Tambakrejo are in agriculture, fishery, cattle breeding, tailor, carpenter, and seller. The landscape includes forest, hills, and beaches, with altitude of 0-100 m, and average temperature of 26 °C-30 °C. Based on the data from a survey in 2010 by Malang government, Tambakrejo village has 123 ha area used as

home gardens and 511 ha used as settlement. Most of Tambakrejo villagers are Javanese and just some of them are Maduranese. There are some traditional rituals that usually take place there, such as *larung sesaji* and *petik laut* tradition, traditional wedding ceremony, pregnancy ceremony, baby delivery ceremony, death ceremony, and also *bersih desa*. Beside those rituals, the culture of *bertegur sapa* and *rembug desa* are still done by the people of Tambakrejo village [6].

Sampling procedure

The investigation was carried out from September 2012 to Januari 2013. Information was collected on traditional uses of species of plants in each of home gardens, both wild plants and cultivated plants. Only 23 informants from 23 home gardens areas were selected and involved in the study. The requirement of the informants were people who were born and had always lived in the area. In addition, we also made sure that the source of their knowledge about local uses of plants had come only from their traditional culture.

Local society refers to people who live and stay in a region for a long periode, who can maintain their community that is different from other communities, especially the modern people [7]. Similar questions were given to each informant as to get compilation of indigenous knowledge. Information was collected through deep interviews in their local language (Javanese language) and Indonesian. Specimens of the cited species of plants were prepared as herbarium and deposited in LIPI Botanical Garden, Purwodadi, Pasuruan, for identification. Systematic arrangement and nomenclature were made based on Flora of Java and Botanical Garden Catalogue. Deep interviews were done to get short description on how the local people used those plants.



Figure 1. Map accessibility south of Malang region

Data analysis

Data was collected and arranged in analysis table employing Microsoft Excel 2007. Data was classified into ten general categories, those were: alliment, medicine, animal food, firewood, construction, cultural ceremony/ritual, craft and technology, economy, ornament, and others. The category of alliment included human food and beverage, as well as cooking spices. Plants belonging to ritual category were the ones used in religious events, *larung sesaji* ceremony, wedding ceremony, etc. Craft category included plants used for making handicraft, rope and others objects. Finally, the last category, others, included species for nginang, hedges, and aromateraphy.

Quantitative analysis of the data was done to know the diversity of species of plants in all home gardens, to verify the potential of local knowledge of Tambakrejo villagers, and also to find out utility aspects based on the ten categories above. Therefore, from the citations, the number of species, the number of informant who gave some information, and the utility aspects were known. The ethnobotanical indices are found on the basic structure of the ethnobotanical information; those are informants mentioning the categories of uses [8]. Data analyses were followed by ethnobotanical indexes. The data analyses were:

Relative frequency of citation (RFC) is used to find out probability between number of people who giving citation to each species and number of all informants. The result is describe local importance of each species. RFC was calculated by Formula (1)[9].

$$RFC = \frac{FC}{N} \quad \dots (1)$$

Note: NF: number of informant who gave citation at each species

N :total of informant (in this studi 23 informant)

Cultural Important Index (CI) can be used to compare the plant knowledge among different cultures [10], this also can be used to know diversity information within each species if collaborated with diversity indexes [5]. CI was calculated by Formula (2)[9]:

$$CI_s = \sum_{u=1}^{u=NC} \sum_{i=1}^{i=N} UR_{ui} / N \quad \dots (2)$$

Note: NC: total number of different categories of uses
UR: total number of use reports for each species total
N: number of informant (23 in this study)

These are much more detailed and numerous than the use categories

RESULT AND DISCUSSION

The total number of informants was 23 people, each of whom had their own home garden. Most of the informants (82%) were female. The most of plant resources, especially alimentary and medicinal plants, are managed by women [11]. The informants were mostly elderly people and had worked in the region for many years. Most of the informants (43 %) were at the age of 41 until 50 years old. The reason to choose people above 30 years of age was based on consideration that people above 30 had larger knowledge, had more experience, and were also wiser in thought. From those 23 informants, 52 % graduated from elementary school, 17 % graduated from junior high school or senior high school, and the rest 13 % were bachelors. The informants' work included housewives, farmers, baby healers, retired people and others.

Table 1. Basic information of informant in Tambakrejo village

	N	%
Age (year)		
30-40	4	17 %
41-50	10	43 %
51-60	7	30 %
>60	2	8,6 %
Sex		
Female	19	82 %
Male	4	17,3 %
Level of education		
Elementary School	12	52 %
Junior High School	4	17,3 %
Senior /vocational High School	4	17,3 %
Bachelor Dgree	3	13 %
Occupation		
Housewife	4	17,3 %
Govermental Employer	3	13 %
Farm worker	4	17,3 %
Farmer	3	13 %
Serabutan	4	17,3%
Baby's Healer	1	4 %
Sailor	1	4 %

Diversity of home garden plants spesies in Tambakrejo village

Home gardensare areas of land whose boundaries are hedges or other ornamental plants. Mostly are cultivated with useful plants which are used to fill local people' daily needs [12]. Home gardens are some kinds of artificial forest located in a village, which issystematically arranged, well maintained, located surrounding home, has certain boundaries, such asfence, and

Table 2. Ethnobotanical plants

Families	Number of ethnospecies	Number of Citation	Number of Categories	Families	Number of ethnospecies	Number of Citation	Number of Categories
Amaranthaceae	1	3	1	Palmae	1	1	1
Muntingiaceae	1	3	1	Asparagaceae	1	2	1
Poaceae	3	15	1	Cycadaceae	1	1	1
Rutaceae	3	9	1	Cracaceae	1	3	1
Araceae	6	124	7	Apiaceae	1	4	2
Rubiaceae	3	33	3	Oxalidaceae	2	14	2
Solanaceae	1	2	1	Cannaceae	1	2	1
Mucaceae	5	53	3	Pandanaceae	1	6	2
Zingiberaceae	3	38	2	Sapotaceae	1	13	2
Solanaceae	3	15	1	Piperaceae	3	13	2
Caricaceae	1	19	2	Sapindaceae	1	11	3
Moraceae	5	45	3	Nyctaginaceae	1	9	1
Euphorbiaceae	8	39	5	Verbenaceae	1	5	3
Lamiaceae	1	6	1	Myrtaceae	2	14	2
Fabaceae	7	37	4	Liliaceae	3	4	1
Compositae	4	19	3	Asteraceae	2	12	2
Malvaceae	4	10	3	Maranthaceae	2	5	1
Apocynaceae	3	13	2	Amaryllidaceae	1	2	1
Cactaceae	1	13	1	Acanthaceae	1	2	1
Oleaceae	1	10	2	Portulacaceae	1	2	2
Arecaceae	1	9	2	Lauraceae	1	4	2
Leguminosae	2	16	3	Sterculiaceae	1	2	1
Anacardiaceae	2	18	1				

is usually cultivated with heterogeneous species of plants [13].

Based on botanical identification of the specimens, these 99 ethnospecies belong to 101 taxa and 46 families. Each of the taxa was identified directly by the informants while the observation was being done. There were three kinds of species with the same local name as *petetan*, although those are actually different species. There is usually a difference between local names and botanical names of species, in which a single ethnospecies may sometimes be identified as more than one botanical species, and although sometimes the species may belong to different families [14]. The family having the highest number of ethnospecies was Euphorbiaceae (Table 2), followed by Fabaceae (7 members) and Araceae (6 members). The families mostly mentioned were Rubiaceae with seven different categories of uses, followed by Mucaceae with three different categories, and Moraceae with three different categories.

Local importance and cultural importance of species plants in Tambakrejo home garden

Based on the quantitative analysis for each species of plants found in Tambakrejo home gardens (Table 3), we can find out local and cultural importance of each species. *Cocos nucifera* was the most useful species (RFC= 0.739) and the most culturally significant (CI= 2.391). Followed by *Mangifera indica* and *Sterblus asper*, with the same RCF (0.5217). But, *S. asper* had higher CI value (0.652) than *M. indica* (0.521). The difference on the CI value between these two kinds of species was caused by differences on the use value of the plants. Another important property of the CI index is that each addend value is measure of the relatively importance of each plant uses [15]. As an example to this case, we found that *Ixora grandiflora* was generally cited by 11 people or 48 % of the informants, under 3 different categories of uses—alliment cited by 1.7 % of the informants, ritual cited by 48 % of informants and also ornament cited by 48 % of

Table 3. Result of analysis used by RFC and CI indexes for most relevant species

Species	Basic value			Ethnobotanical Indexes		Ranking	
	FC	NC	UR	RFC	CI	RFC	CI
<i>Carica papaya</i>	8	19	3	0.3478261	0.826087	6	3
<i>Cocos nucifera</i>	18	55	5	0.7826087	2.3913043	1	1
<i>Musa paradisiaca</i> var. Kepok	10	17	3	0.4347826	0.7391304	4	4
<i>Solanum melongena</i>	8	8	1	0.3478261	0.3478261	6	11
<i>Canavalia ensiformis</i>	10	10	1	0.4347826	0.4347826	4	9
<i>Mangifera indica</i> var. Manalagi	12	12	1	0.5217391	0.5217391	2	7
<i>Ixora grandiflora</i>	11	22	2	0.4782609	0.9565217	3	2
<i>Alpinia galanga</i>	10	16	3	0.4347826	0.6956522	4	5
<i>Bougainvillea glabra</i>	9	9	1	0.3913043	0.3913043	5	10
<i>Sterblus asper</i>	12	15	2	0.5217391	0.6521739	2	6
<i>Averrhoa bilimbi</i>	4	10	2	0.173913	0.4347826	10	9
<i>Nephelium lappaceum</i>	7	11	3	0.3043478	0.4782609	7	8
<i>Sesbania grandiflora</i>	7	12	2	0.3043478	0.5217391	7	7
<i>Curcuma longa</i>	6	12	2	0.2608696	0.5217391	8	7
<i>Kaempferia rotunda</i>	7	10	2	0.3043478	0.4347826	7	9
<i>Manihot esculenta</i>	4	10	3	0.173913	0.4347826	10	9
<i>Jasminum sambac</i>	5	10	2	0.2173913	0.4347826	9	9
<i>Paraserianthes falcataria</i>	7	12	2	0.3043478	0.5217391	7	7
<i>Artocarpus heterophyllus</i>	5	15	3	0.2173913	0.6521739	9	6
<i>Pluchea indica</i>	4	10	3	0.173913	0.4347826	10	9

the informants. The CI value of *Ixora grandiflora* was higher than *M. indica* although 12 people or 52 % of the informants cited *M. indica*. This was caused by the fact that *M. indica* was only used for alliment, which was for fresh fruit consumption.

In addition, *Alpinia galanga* or *laos* also had a high value of Cultural Importance, after *Musa paradisiaca*. Local people in this area mostly used *laos* as a cooking spice, since the special product of this region was sea food. *Averrhoa bilimbi* or *belimbing wuluh* also played an important role in the processing of sea food, especially to vanish the bad odor of fish. *A. bilimbi* fruit was also used to make syrup and its flower could be used to treat cough. From those examples above, we know that the low citation of species of plants by informants does not mean that species were less interesting and useful. The CI index is an efficient tool for highlighting those species with high cultural agreement for the whole survey area and for recognizing the shared knowledge of these people [9].

Plant Used Based on Indigenous Knowledge

Indigenous knowledge (IK) is one of unique experiences applied to traditional knowledge that

is transferred to younger generation and is still developed by rural indigenous communities in specific geographical areas. The characteristics of IK appear and are developed in specific society; they are unique and exclusive [16].

In Tambakrejo village, 59 species of plants were documented as traditional alliment belonging to 33 families (Figure 2) and wide spread in all home gardens. This indicates the diversity of traditional alliment in Tambakrejo village. The highest species were Araceae, Mucaceae and Moraceae, each of which had 4 members, followed by Zingiberaceae with 3 members. Araceae included *Colocasia giganteum*, all members of *C. nucifera*, and *Arenga pinnata*. Mucaceae included all members of *M. paradisiaca*. Moraceae included *Artocarpus* genus (*A. camansi*, *A. heterophyllus*, *A. elasticus*, and *A. altilis*). Members of Zingiberaceae mostly were used as cooking spices, such as *C. longa*, *K. rotunda*, *A. galanga*.

The second category of alliment with the largest numbers of species were the ones used for cooking vegetables, salad, fresh fruit, snack, and cooking spices. The mostly mentioned species was *C. nucifera* (coconut tree) since local people drink the water from young coconuts, eat the coconuts directly, and take the coconut milk or

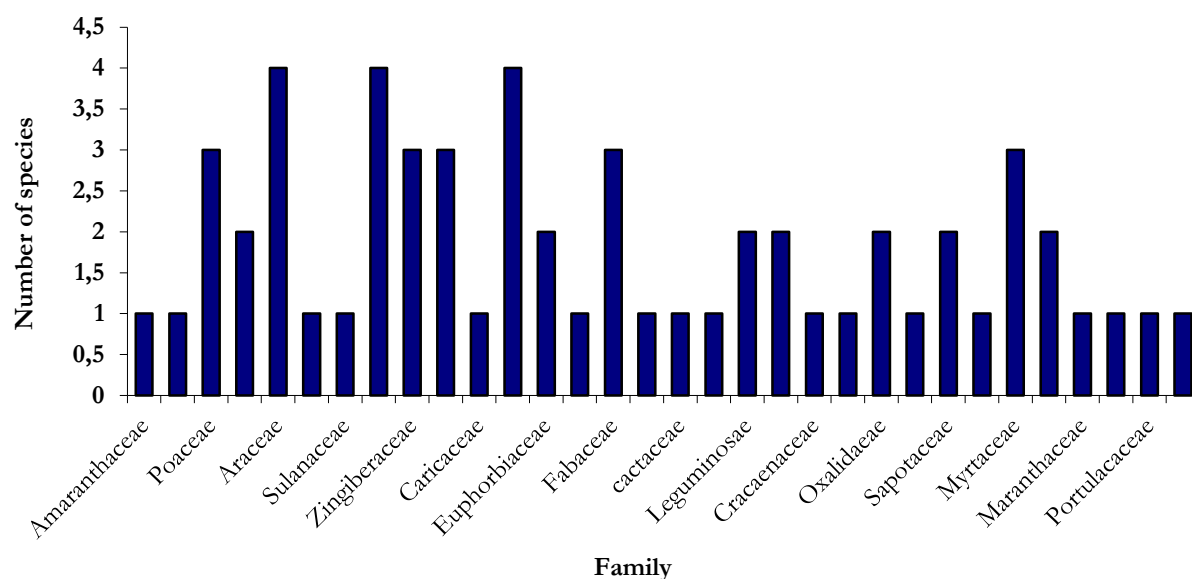


Figure 2. Plants families most commonly used for traditional alliment by indigenous people in Tambakrejo village

santan from the old ones. The next mostly mentioned species was papaya (*C. papaya*); most of the local people plant papaya trees in their home gardens, they usually cook the young fruit, papaya flowers, and leaves as vegetable, and use the ripe fruit as fresh fruit, cocktail, and salad. *Buah naga* or dragon fruit (*Hylocereus polyrhizus*) was cited by 13 informants, and all of them used the fruit as syrup and ate it as fresh fruit. Next was *M. indica* which was used as fresh fruit or salad. There was also one kind of species of plants that was usually used to strengthen the flavor of food, the name of the plant is arrow-root (*Marantha arundinaceae*); the local people said that *jelarut* could be used to make cakes, such as doughnuts and cookies, since it has strong good flavor. Additionally, children also liked to suck the sweet nectar of *suko* flowers (*I. grandiflora*). *Gude* or *Cajanus cajan* was used to be cooked and eaten as vegetable or to be made as cakes (from their bean).

Tambakrejo villagers used *Senna siamea* for firewood and construction. Fresh young leaves and fresh young flower of *S. siamea* have been used as vegetables in Thailand by boiling them in water for half an hour and then the boiled water is discarded. The marc is reboiled for another 1-2 times as before and the boiled leaves are then mixed with coconut milk and curry paste and cooked as a curry. The meal is recommended to be consumed as a healthy food to be a mild laxative and sleeping aid [17].

There were 22 ethnospecies found as traditional medicinal plants (see Table 4). Plants used for treatment for more than 10 different medicinal conditions were grouped into several categories according to uses by indigenous people.

Those categories were gastro intestinal disorders, dermatological conditions, illness associated with pain and/or fever, women medicine plants, eye remedies, and other uses.

Table 4. Categories of use plant species home garden at Tambakrejo village

Category	Number of Citation	Number of Species	Number of Use
Alliment	316	59	12
Medicinal	63	22	10
Animal Food	14	5	2
Firewood	31	13	1
Construction	46	13	2
Ritual/cultural	48	10	5
Craft	13	2	1
Economic	65	7	1
Ornamental	70	23	1
Others	14	6	3

Seven informants cited that *C. nucifera* or *degan ijo* was used for detoxicant, especially to treat food or beverage allergy. Detoxicant or depurant means that the plants can help the recovery process from different diseases since the plants are able to purify the blood and remove toxins and scum, and are possible to stimulate diuresis [18].

Six informants cited that *C. longa* or turmeric could be used for gastrointestinal disorder, woman medicine, and also fever. The informants said that a potion, with or without honey, might be prepared as medicine. Importantly, turmeric can also be mixed with chicken food to reduce the bad smell of the feces. The leaves, stems, roots and flowers of *C. papaya* are effective to treat malaria. The leaves of papaya are made as decoction. Other species were recorded to treat

sto-machache, and diarrhoea. Treatment for diarrhoea is done using the leaves of *Psidium guajava*, drank as decoction. Circular massage is done with the leaves of *Jatropha curcas* to treat flatulence that causes stomachache. Decoction from the bark of *Artocarpus altilis* and *Morinda citrifolia* is also used in Philippine and Tonga to treat stomachache [19], because those plants contain cardenolides and cerotic acid [20]. But people in Tambakrejo village only used those plants as fresh fruit, or vegetable.

Euphorbia hirta or *patikan* has been documented as being used to treat eye complaint including inflammation. Often drops are prepared by extracting liquids from the squashed leaves. *Piper betle* was also used to treat eye irritation and infection. The leaves are soaked or boiled in a bucket of water for about a few minutes prior to washing the eyes with the extracted water, the eye are opened and closed several times during this process. Three people cited *A. galanga* or *laos* as dermatologically healing; in their opinion, *laos* effectively treats scabies. Additionally, *sambiloto* or *Andrographis paniculata* can be used to treat abscesses and other dermatological diseases caused by bacteria. The treatment is mainly done by drinking decoction.

As many as twenty-three ethnospecies were cited as ornamental. The highest, as many as 11 citations, was for *I. grandiflora*, followed by *B. gtabra* with 9 citations. Other categories of uses is economic, especially for trading. *C. nucifera* and *M. paradisiaca* have an important role in improving the economic aspect of the local people in Tambakrejo village.

CONCLUSION

The local people of Tambakrejo village have been using at least 98 species of plants as sources of daily activities. These species are grouped in ten categories, but mostly were used as alliment, medicine, ornament, and economical plants. The plants were widely distributed among 101 genera and 46 families. From the information above we know Tambakrejo villagers were rich in traditional knowledge especially in the uses of species of plants of home gardens. Integrating traditional uses, management of species of plants, and indigenous knowledge are needed in order to support the existence and survival of the knowledge.

ACKNOWLEDGEMENTS

We are grateful to all people in Tambakrejo village who kindly shared their indigenous know-

ledge and time during our study. Thanks are also addressed to the local government of the village who gave us permission to do our research there. We are also thankful to Purwodadi Botanical Garden and Mr. Kiswoyo for helping us to identify the species of plants, to Mrs. Febri, a local villager of Tambakrejo, for helping us with the accommodation, and everyone who helped us to introduce ourselves to and to build good relationship with the local people.

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