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Traditional Knowledge on Malaria of Gayo People in Central Aceh, Indonesia

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ABSTRACT Medicinal plants are used by eighty percent of the people from the developing countries to fulfill their primary health needs, occupying a key position on plant research and medicine. Taking into account that besides their pharmaceutical importance, these plants contribute greatly to the ecosystems' stability, a continuous documentation and preservation of the traditional knowledge is a priority. 5 medical plants from Central Aceh, Indonesia have the potential for controlling malaria disease among the Gayo people. This study confirmed that *Andrographis paniculata, Carica papaya, Momordica charantia, Curcuma xanthorrhiza,* and *Tinospora crispa* have been proven as medicinal plants for controlling malaria disease among the Gayo people, Central Aceh, Indonesia. These plants have been used for decades and have not been documented. The aim of this study was to organize a database of these medicinal plants including their applications and associated procedures by the Gayo people, of Central Aceh, in Indonesia.

INTRODUCTION

Traditional knowledge is generally defined as the long-standing traditions and practices of certain regional, indigenous, or local communities encompassing the wisdom, knowledge, and teachings of these communities. It constitutes a cumulative body of knowledge, know-how, practices, and representations maintained and developed by the people with extended histories of interaction with the natural environment (Feng Shui Times 2003). Considered as an asset, it focuses on the use of knowledge such as traditional technical know-how, or traditional ecological, scientific or medical knowledge. The Secretariat of the Permanent Forum on Indigenous Issues (2005) defines traditional knowledge as developed from experience gained over the centuries and adapted to the local culture and environment, and transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, artistic expressions, proverbs, cultural events, beliefs, rituals, community laws, languages, agricultural practices, including the development of the plant species and animal breeds, traditional know-how relating to architecture, textile-making and handicraft-making, fishery, health and forestry management.

Ethnobotany tries to study the relationship between the humans and the nature. Ethnic people are highly knowledgeable about the plants and their medicinal values. This knowledge is passed through oral communication from generation to generation (Ayyanar and Ignacimuthu 2005). Over the last century, ethnobotany has evolved into a specific discipline that looks at the people–plant relationship in a multidisciplinary manner, such as ecology, economic botany, pharmacology, public health and other disciplines as needed (Balick 1996). Tribal population provides considerable information about the use of many plants or plant parts as medicine. World Health Organization (WHO) stated that as many as eighty percent of the world's people depend on traditional medicine for their primary healthcare needs (Azaizeh et al. 2003). There are considerable economic benefits in the development of these indigenous medicines and in the use of the medicinal plants for the treatment of various diseases.

In ancient times, medicinal plants were used all over the world as a unique source of medicines and constituted the most common human use of biodiversity (Hamilton 2004; Hiremath and

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Taranath 2010). Besides that, there is a global consensus on the benefits of phytopharmacy and at present medicinal plants occupy a key position in plant research and medicine. These facts are associated with the progressive loss of traditional knowledge, due to rural exodus, and with the threats to which the Plant Genetic Resources (PGR) are exposed, makes the efforts to study and preserve PGR relevant in every respect. Several conservation studies have been performed (De Vicente et al. 2006; Faleigh 2006; Gepts 2006).

Indonesia as a tropical country has many prospective natural resources. Arung et al. (2005) reported that some 44 medical Indonesian plants had the potential as tyrosinase inhibitors and 14 other Indonesian medical plants were also reported from West Kalimantan (Arung et al. 2009). Nuri et al. (2010) reported that extracts from 11 vegetables of Indonesian origin contained flavonoid, total phenolics, and antioxidant activity. Flavonoid content in mg/100 g fresh weight (fw) was apparently initially reported for *Cosmos caudatus* H.B.K. (52.19), *Polyscias pinnata* (52.19), *Pluchea indica* Less. (6.39), *Nothopanax scutellarius* (Burm.f.) Merr (5.43), *Talinum triangulare* (Jacq.) Willd. (3.93), *Pilea melastomoides* (Poir.) Bl. (2.27), and *Etlingera elatior* (Jack) R.M.Sm (1.18). The flavonoid content of the vegetables studied were mainly quercetin and kaempferol and ranged from 0.3 to 143 mg/100 g fw, with the highest level found in *Sauropus androgynus* (L) Merr. *C. caudatus* H.B.K. had the greatest total phenols among the vegetables analyzed, with 1.52 mg GAE/100 g . *P. indica* Less. and *C. caudatus* H.B.K. had the highest antioxidant activity as measured by the ferric cyanide reducing power, DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,22 -azino-bis-(3-ethylbenzthiazoline-6-sulphonic acid) scavenging, and inhibition of linoleic acid oxidation.

There are no records on the traditional knowledge of the medical plants of the Gayo people in Central Aceh, Indonesia. Hence, this paper is presented to give etnobotanical information on some medical plants for controlling the malaria disease.

MATERIAL AND METHODS

Study Area

The study was conducted in the selected area of the communities in Central Aceh. The chosen sites were presumed to represent the diverse eco-epidemiologica conditions of malaria in the district and had an annual malaria transmission of three months or more. The villages were selected to represent the rural study population in its socio-cultural, demographic and geographical diversity.

Study Design

The study was exploratory and descriptive in nature, using both qualitative and quantitative approaches to data collection. The research team comprised of investigators and four trained interviewers who were familiar with the local setting and the local languages. All questionnaires were translated into the lingua franca of the study area and were pre-tested before being administered. The survey instrument was informed by findings of the qualitative research.

Qualitative Research

Focus group discussions (FGD), individual interviews and key informant interviews were conducted in four of the 10 study villages in the selected area. Ten FGDs (five with men and five with women) was held with groups of 10 participants each. The selected participants had at least one child below 5 years of age in their household, because they would have had a more specific experience with malaria and would be able to contribute more to the discussions. The discussions dealt with community knowledge of malaria-related concepts, and attitudes and practices regarding malaria prevention and treatment. This instrument deliberately focused on the naturalistic illness concepts close to the biomedical concept of malaria, relevant and amenable to the medical plant, at the expense of a more elaborate ethnographic investigation of the local illness terminologies and taxonomies, supernatural etiologies and their ethnographic context. The local illness terminology report by FGD participants was supplemented by the information from the semi structured interviews with 40 people of mixed ethnicities in the selected area of the native communities.

Quantitative Research

Concepts and categories emerging from the qualitative research were the information about

the construction of the survey instrument, notably the definition of the variables. The selected areas of the native communities comprised a random sample of two of the 10 purposely selected villages for this study. In the second stage, the urban cluster was subdivided into seven sub clusters and the rural cluster into six sub clusters. Overall, about 30 households were selected proportional to the size of the geographical cluster, and the participating households were finally chosen at random in each cluster. A structured questionnaire was administered to the heads of the selected households. The questions focused on the socio-demographic characteristics and the use of medical plants, factors determining the possession, knowledge and acceptability of the medical plant and practice of other malaria prevention and treatment methods.

RESULTS

Profiles of Respondents

The profile of respondents are summarized in Table 1. Two districts was selected in this study, District Aceh Tengah and District Bener Meriah.

Table 1: Profiles of respondents

District	*Vilage*	*Sex*		*Total*
		Male	*Female*	
Aceh Tengah	Kekuyang village	4	6	10
	Burlah village	3	7	10
Bener Meriah	Blang Paku village	3	7	10
	Simpang Balek village	2	8	10
	Total	12	28	40

Forty respondents were selected from 2 villages based on the recomendation of the Secretariat of the District in Central Aceh. 4 males and 6 females from Kekuyang village, followed by Burlah Village with 3 males and 7 females. On Bener Meriah district, the number of respondents in the Blang Paku Village were 3 males and 7 females, followed by Simpang Balek Village with 2 males and 8 females.

Most of respondents, accidentally, were females since the males went out to work in their field (coffe plantation and/or vegetables plantation). The interview was done from 10 am till 3 pm everyday. When the researcher was unavailable, the appointed assistant handled the interview and assembled the documents.

Locally Used Medicinal Plants

The locally used medical plants for controlling malaria disease are summarized in Table 2. Five plants were discovered as useful for the treatment of malaria disease among the Gayo people in Central Aceh, Indonesia.

Based on experience from the two districts, the local people of Gayo used these medicinal plants to control malaria disease. It was effective for both adults and children without any side effects while consuming these medicinal plants.

DISCUSSION

The important results obtained in this study confirmed that *Andrographis paniculata*, *Carica papaya*, *Momordica charantia*, *Curcuma xanthorrhiza*, and *Tinospora crispa* have been proven as medicinal plants for controlling malaria disease among the Gayo people, of Central Aceh, Indonesia. They have used these medicinal plants for a long time and have still kept that local knowledge until today.

Yerra et al. (2004) discovered that two flavonoids, identified as 5,7,2',3'-tetramethoxyflavanone and 5-hydroxy-7,2',3'-trimethoxyflavone, as well as several other flavonoids, andrographolide diterpenoids, and polyphenols, were obtained from the phytochemical investigation of the whole plant of Andrographis paniculata, a well-known medicinal plant. The structures of these compounds were established with the aid of spectroscopic methods, including analysis by 2D NMR spectroscopy. Similar study, from Neha and Rawal (2001) stated that *Andrographis paniculata* treatment prevented BHC induced increase in the activities of enzymes y-Glutamyl transpeptidase, glutathione-S-transferase and lipid peroxidation. The activities of the antioxidant enzymes like the superoxide dismutase, catalase, glutathione peroxidase and the levels of glutathione were decreased following the BHC effect. The study shows that antioxidant and hepatoprotective action of *A. paniculata* cured liver problems.

Table 2: Locally used medicinal plants

S.No.	*Scientific name*	*Classification*	*Local name*	*Part used*	*Uses*
1	*Andrographis Paniculata*	Order: Lamiales Family: Acanthaceae Genus : *Andrographis*	Sambiloto	Leaf	The leaf was cut into small pieces, cleansed by water, boiled, and drink 3 times/day
2	*Carica Papaya*	Order: Brassicales Family: Caricaceae Genus: *Carica*	Daun Pepaya	Leaf	The leaf was cut into small pieces, cleansed by water, boiled, and drink 3 times/day
3	*Momordica Charantia*	Order : Violales Family: Cucurbitaceae Genus: *Momordica*	Pare	Leaf	The leaf was cut into small pieces, cleansed by water, boiled, and drink 2 times/day
4	*Curcuma Xanthorrhiza*	Order : Zingiberales Family: Zingiberaceae Genus : *Curcuma*	Temu Lawak	Root/	Rhizome Dried roots/rhizome are powdered and taken orally
5	*Tinospora Crispa*	Order : Ranunculales Family : Menispermaceae Genus : *Tinospora*	Brotowali	Stem Bark	The stem bark was cut into small pieces, cleansed by water, boiled, and drink 2 times/day

Most of respondents reported to prefer using the *Carica papaya* leaf instead of any other medicinal plants to control malaria disease. They argued that the bitter taste that came from the *Carica papaya* leaf was the best medicine for malaria. *Carica papaya* leaf extract can mediate a Th1 type shift in human immune system. Noriko et al. (2010) suggested that the *Carica papaya* leaf extract may potentially provide the means for the treatment and the prevention of selected human diseases such as cancer, various allergic disorders, and may also serve as an immune adjuvant for vaccine therapy.

Momordica charantia was found effective for controlling malaria disease among the local people in Central Aceh. They used this fruit as an ingredient during cooking and serving food. Bitter melon (*Momordica charantia*) is an alternative therapy that has primarily been used for lowering the blood glucose levels in the patients with diabetes mellitus. Components of bitter melon extract appear to have structural similarities to the animal insulin. Antiviral and antineoplastic activities have also been reported in vitro. Four clinical trials found bitter melon juice, fruit and dried powder to have a moderate hypoglycemic effect. However, report on the adverse effects of bitter melon include hypoglycemic coma and convulsions in children, reduced fertility in mice, a favism-like syndrome, increases in the ã-glutamyl transferase and alkaline phosphatase levels in animals and headaches. Bitter melon may have additive effects when taken with other glucose-lowering agents (Ethan et al. 2003)

Sutha et al. (2010) reported that the standardized *Curcuma xanthorrhiza* ethanolic extract showed peripheral and central antinociceptive activity associated with neurogenic pain as well as a relative absence of the toxic effects which could compromise the medicinal use of this plant in folk medicine. The study also shows that standardized ethanolic extract of *Curcuma xanthorrhiza* is non-toxic and possesses peripheral antinociceptive effects by blocking the inflammation pain response. The standardized ethanolic extract of *Curcuma xanthorrhiza* also exhibited a central antinociceptive effect which is associated with the neurogenic pathway and not the opioid pathway. Xanthorrhizol, one of the major constituent quantified in this extract, may contribute to the respective antinociceptive effects. This study can explain the mechanism of *Curcuma xanthorrhiza* for the treatment of malaria disease among the local people in Central Aceh.

Farkaad et al. (2011) reported that *T. crispa* has a high antioxidant and radical scavenging activity potential established *in vitro* in addition to containing antioxidant flavonol glycosides (apigenine), picroretoside, berberine, palmatine, picroretine and resin. All these compounds are responsible for the bitter principle of the stems of *T. crispa* extract which is freely

soluble in alcohol. The stems of *T. crispa* contain apigenin which is best known for its ability to act as a powerful antioxidant.

CONCLUSION

It is reasonable to assume that the widespread use of *T. crispa* in the traditional practice of medicine in the South-eastern Asia countries as well as registration of the drug (stem) in Indonesia can be attributed to these antioxidant phytochemicals present in this plant. The various ethnic groups inhabiting in the tropical country like Indonesia depend on to a great extent up on the tropical and sub-tropical forests for their essential requirements of life. In the recent years there has been great awareness and enthusiasm for the studies of life style, food habit, sociocultural and various aspects of society's activities including herbal plant.

Despite the encouraging data on the chances of finding new drugs in the near future, evidence was little sufficient on the treatment of malaria disease by means of herbal plants. Therefore, herbal plants should be recommended after the conduction of clinical trials designed more subtle. Efficient training of patients and doctors about herbal medicine seems necessary.

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