

Ethnobotany and Distribution of Wild Edible Tubers in Pulau Redang and Nearby Islands of Terengganu, Malaysia

M. Nashriyah, M. Y. Nur Athiqah, H. Syahril Amin, N. Norhayati, A. W. Mohamad Azhar, M. Khairil

Abstract—An ethnobotanical study was conducted to document local knowledge and potentials of wild edible tubers that has been reported and sighted and to investigate and record their distribution in Pulau Redang and nearby islands of Terengganu, Malaysia. Information was gathered from 42 villagers by using semi-structured questionnaire. These respondents were selected randomly and no appointment was made prior to the visits. For distribution, the locations of wild edible tubers were recorded by using the Global Positioning System (GPS). The wild edible tubers recorded were *ubi gadung*, *ubi toyo*, *ubi kasu*, *ubi jaga*, *ubi seratus* and *ubi kertas*. *Dioscorea* or commonly known as yam is reported to be one of the major food sources worldwide. The majority of villagers used *Dioscorea hispida* Dennst. or *ubi gadung* in many ways in their life such as for food, medicinal purposes and fish poison. The villagers have identified this *ubi gadung* by looking at the morphological characteristics; that include leaf shape, stem and the color of the tuber's flesh.

Keywords—Ethnobotany, distribution, wild edible tubers, *Dioscorea hispida* Dennst., *ubi gadung*

I. INTRODUCTION

THE term ethnobotany was devised in 1895 by a North American botanist, John Harshberger to describe studies of plants used by primitive and aboriginal people [1]. Ethnobotany is a multidisciplinary science which can be defined as the interaction between plants and people. This is where the relationship between plants and human cultures is not limited to the use of plants for food, clothing and shelter but also include their usage in religious ceremonies, and for ornamentation and health care [2].

Genus of *Dioscorea*, or commonly called yam, is a monocotyledon and belongs to the family Dioscoreaceae which is used worldwide as food in the tropics and subtropics [3]. [4] revised that it comprises 350-400 species and distributed throughout the world, especially in the West Africa, parts of Central America and the Caribbean, the Pacific Islands and Southeast Asia. According to the International Institute of Tropical Agriculture (IITA), yam has attracted many research attentions in recent decades. [5] has reported that yam contributes as major economic and cultural importance in sub-Saharan Africa which accounts for about

95% of the world population. From the study by [6], they found that 23 indigenous yam types belonging to at least four *Dioscorea* species in Southeast Ethiopia, where this shows that yam is widely distributed in Ethiopia. Wild edible tuber species are an important source of food in India and have a significant place in the dietary habits of small and marginal farm families and forest-dwelling communities during periods of food scarcity [7]-[8]. Although yam contributes a lot in economy and culture in some parts of the world, its distribution especially in Malaysia has not been studied in detail. Some species of yam are cultivated for their edible tubers, for medicinal use, and for other uses, whereas some other species are grown wild and people are looking for them for other purposes as well. Based from a study by [9], there are nine wild tuber species found across the Jeypore district of India: *Dioscorea oppositifolia*, *D. glabra*, *D. tomentosa*, *D. wallichii*, *D. hamiltonii*, *D. bulbifera*, *D. puber*, *D. pentaphylla* and *D. hispida*. Most of the tubers are collected and consumed from time to time by tribal and rural people there.

Yam is important as it become a staple food in many African countries because of its eating quality. People consumed yams as a cooked vegetable; whether fried or roasted. In West Africa, boiled yam is often pounded into a thick paste and is eaten with soup. From recent studies, most people throughout the West African yam belt eat whole roasted yam as snack when they are away from home and this became a popular snack among them [10].

As from medicinal aspect, [11] stated that people in Rajasthan, India uses yams as medicine to cure various ailments. For instance, *Dioscorea bulbifera* is used by tribal ladies as contraceptive. The tribal people also used *Dioscorea pentaphylla* as medicine for ailments related to digestive tract and respiration. [12] have also reported that the corn infuse from *Dioscorea hispida* Dennst. can decrease the blood glucose. [13] found that the Temuan tribe of Malaysia uses the pounded leaves from intoxicating yam for healing sores of *yaw*. [9] also found out from their study that people in Jeypore of India used the intoxicating effect of *Dioscorea hispida* to forget their sorrows as they get the similar effect as drinking beer.

This study was aimed at documenting ethnobotanical knowledge and potentials of wild edible tubers that has been reported and sighted, and to investigate and record their distribution throughout Pulau Redang and nearby islands.

II. MATERIALS AND METHODS

A. Study Area

This study was carried out at Pulau Redang and nearby islands (Pulau Pinang and Pulau Lang Tengah), which lies

M. Nashriyah is a lecturer at the Universiti Sultan Zainal Abidin, Gong Badak Campus, Gong Badak, 21300 Kuala Terengganu, Terengganu, Malaysia (phone: 609-6660104; fax: 609-6660244; e-mail: nashriyah@unisza.edu.my)

M. Y. Nur Athiqah, H. Syahril Amin, Norhayati N., A. W. Mohamad Azhar, and M. Khairil are with the Universiti Sultan Zainal Abidin, Gong Badak Campus, Gong Badak, 21300 Kuala Terengganu, Terengganu, Malaysia (phone: 609-627 5626; e-mail: norhayatingah@unisza.edu.my)

approximately 45 km off the coast of Terengganu state in Malaysia (Figure I). Pulau Redang is the largest of a group of nine protected islands dotting the South China Sea. Terengganu is divided into seven districts: Besut, Dungun, Hulu Terengganu, Kemaman, Kuala Terengganu, Marang and Setiu; and Pulau Redang is included in the Kuala Terengganu district. It has an equatorial climate with uniform temperatures throughout the year, where the temperatures range from 22 °C in the early morning to 34 °C at noon.

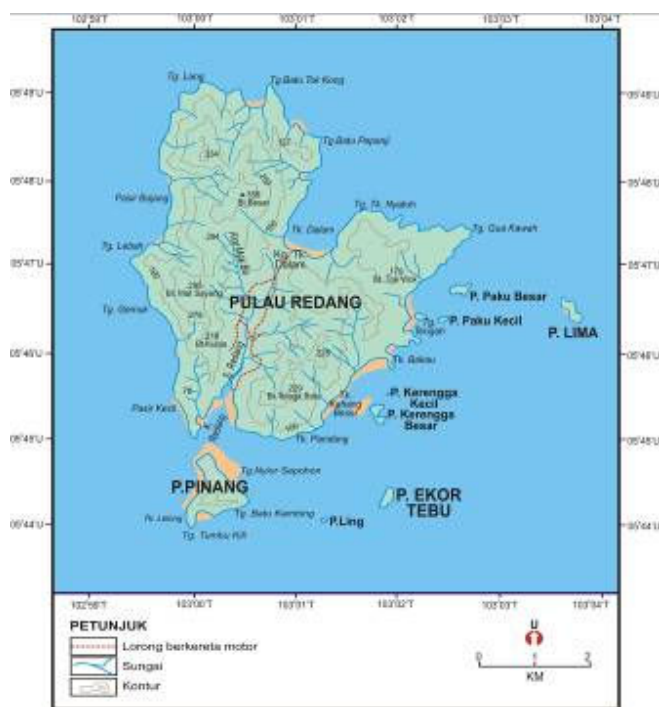


Fig. 1 Map of pulau redang

B. Data Collection

The ethnobotanical survey was carried out from 17th until 19th May 2011 by using semi-structured questionnaire. Up to 42 villagers were randomly selected from the only village at Pulau Redang (Pulau Lang Tengah and Pulau Pinang are “locally uninhabited” but known as agrotourism sites with chalets and hotels), whereby 21 respondents were male and 21 respondents were female. The respondents were men and women at various ages. No appointment was made prior to the visits. Ethnobotanical and other relevant information pertaining to *Dioscorea* and other wild edible tubers were investigated by interviewing these villagers that include some teenagers. For distribution, the locations of all edible tubers that has been reported and sighted were recorded by using the Global Positioning System (GPS) (Table I).

III. RESULTS AND DISCUSSION

A. The Distributions of Wild Edible Tubers

The locations of these tubers found in Pulau Redang and nearby islands (Pulau Pinang and Pulau Lang Tengah), their common names and their coordinates were recorded. The records of these tubers are as listed in Table I.

TABLE I
LOCATION AND COORDINATE OF WILD EDIBLE TUBERS

No.	Location	Tubers (Common name)	Coordinate
1	Kampung Baru, Pulau Redang	<i>Ubi gadung</i>	RQ557369 WMR639091
2	Pengkalan Hulu, Pulau Redang	<i>Ubi gadung</i>	5d46'21.2"N 103d00'27.9"E
3	Pengkalan Hulu, Pulau Redang	<i>Ubi gadung</i>	5d46'22.0"N 103d00'27.4"E
4	Bukit Sari, Pulau Lang Tengah	<i>Ubi gadung</i>	5d47'31.5"N 102d53'44.8"E
5	Kampung Baru, Pulau Redang	<i>Ubi seratus</i>	WA562960 WMR476359
6	Taman Marin, Pulau Pinang	<i>Ubi seratus</i>	05d46.753"N 103d00.688"E
7	Taman Marin, Pulau Pinang	<i>Ubi seratus</i>	5d44.678"N 102d59.985"E
8	Pengkalan Hulu, Pulau Redang	<i>Ubi kertas</i>	5d46'21.8"N 103d00'27.4"E

B. The Ethnobotanical Survey

The questionnaire in Table II was divided into two parts, part A and part B. For part A, the respondents were asked on *Dioscorea hispida* or *ubi gadung* whilst for the part B, the questions are related to other wild edible tubers that can be found at Pulau Redang and nearby islands.

TABLE II
LIST OF QUESTIONS AND THE ANSWER'S PERCENTAGE

Questions	Percentage	
	Yes	No
Have you ever heard of <i>ubi gadung</i> ?	93 %	7 %
Do you know other common names for <i>ubi gadung</i> ?	0 %	100 %
Did you ever try or see people commonly cultivate <i>ubi gadung</i> ?	5 %	95 %
Have you ever seen people selling <i>ubi gadung</i> ?	31 %	69 %
Do you know that <i>ubi gadung</i> contains toxic?	88 %	12 %
Have you ever tried eating <i>ubi gadung</i> ?	79 %	21 %
Do you know the uses of <i>ubi gadung</i> as traditional medicine?	17 %	83 %
Do you know the uses of <i>ubi gadung</i> for cosmetics?	2 %	98 %
Do you know the other uses of <i>ubi gadung</i> ?	10 %	90 %

From Table II, 93% of respondents answered that they have heard of *ubi gadung* or *Dioscorea hispida* from their ancestors while 7% of them never heard of *ubi gadung*. All respondents did not know the other common names for *ubi gadung*. Only 5% of respondents answered that they had tried or see people cultivating *ubi gadung*, while 95% answered no. Up to 31% of respondents told that they have seen people selling *ubi gadung* in market, shops or from villagers that sell processed *ubi gadung*, while 69% told that they have not seen people selling *ubi gadung*. Only 12% of respondents did not know that *ubi gadung* is poisonous, while the rest of respondents know that *ubi gadung* contains toxin and can affects them. Up to 79% of respondents answered that they tried eating *ubi gadung* and 21% never try to eat *ubi gadung* before. A total of 83% of respondents answered they did not know the uses of *ubi gadung* as traditional medicine; while 17% answered they know *ubi gadung* can be used as traditional medicine. 25% of respondents know the uses of *ubi gadung* as cosmetics while the rest did not know. Only 10% of respondents know other uses of *ubi gadung* whilst the other respondents did not know.

All the respondents, which are the villagers, had identified *ubi gadung* plant by looking at the physical characteristics. They identify this plant by looking at the intoxicating yam leaves that looks like betel leaf but hairy and are also three foliolate. The leaflets can be up to 12 to 20 centimeters long. The tendrils are hairy as well and the stem is covered with few or many short and sharp spines. *Dioscorea hispida* is a creeping plant, where the stems and tendrils can reach a length of several meters. The tubers however, grow in abundance. The tuber's flesh is of yellowish white and a bit sticky. Most of the respondents answered tuber with yellow flesh has better taste than the white flesh because the yellow one tastes starchier.



Fig. 2 *Dioscorea hispida* (*ubi gadung*). (a) three foliolate leaves. (b) tendril and stem covered with sharp spines. (c) tendrils can grow to several meters. (d) tubers grow in abundance. (e) yellow tuber flesh. (f) germinating tuber

Based from the answers from the questionnaire, the respondents said that the processed *ubi gadung* yam can be purchased at Pasar Payang in Kuala Terengganu town, wet market in Kuala Berang town, and also from some villagers in Pulau Redang itself who consumed and sell *ubi gadung*. The price range was between RM 3-5 per kilogram of unprocessed *ubi gadung*. The much higher price of processed *ubi gadung* was not revealed.

There are a few processes to remove the toxin from the intoxicating *ubi gadung* yam tubers before the cooking process, so that the yam can be safely eaten. Based from the answers from questionnaire, the villagers in Pulau Redang have identified several detoxification techniques of *ubi gadung* tubers. The first step was by slicing the tubers thinly as though making chips. Then they soaked the sliced yam in water that is already mixed with salt for three days. After that, the respondents put the yam in a sac and then soak it again in a river or flowing water for extra three days. The yam was

tested after detoxification by looking whether the fish is feeding on them. According to [14] in his book Food Plants of Papua New Guinea, this process also has been practiced by people in Papua New Guinea where they slice and boil the *Dioscorea hispida* tubers for two days to remove its toxin before cooking the yam. The Sakai people in Thailand also removed the toxin by prolonged boiling with wood ashes before eating the yam [15]. Villagers in Pulau Redang used this intoxicating yam in many ways in their daily life. Usages of *Dioscorea hispida* as food, traditional medicine and cosmetics were also answered by the respondents. *Dioscorea hispida* was used as their food source, for example in making popular traditional local food called *kuih putri mandi*, *kuih onde-onde*, *kuih cik mek baru*, *kuih koleh*, *lempeng* and also as *pengat* and porridge. Besides that, many of the villagers eat intoxicating yam with glutinous rice and grated coconut especially during breakfast. They also eat fried intoxicating yam with salted fish. Some of the villagers used this de-toxicated intoxicating yam by sun-drying followed by pounding for making edible flour. *Dioscorea hispida* was also used by the villagers as traditional medicine. The de-toxicated tubers were first boiled with water, and then the water can be used as diabetes medicine. [12] have reported that the corm infuse from *Dioscorea hispida* can decrease the blood glucose. Some of the villagers said that the yam can be mixed together with incense to treat shingles disease. The tendrils of intoxicating yam also can be used as de-worming medicine. Other than that, the water of soaked yam can be used as medicine for eyes. Some villagers used intoxicating yam as fish poison so that it will be easier for them to catch the fish. According to [16], some part in Asia used intoxicating yam to prepare poison, and it has been suggested that the residue that is left over after starch extraction could be used as insecticides. As for cosmetic uses, some of the villagers used the sediment from the water of soaked yam and it can also be used as medicinal powder.



Fig. 3 De-toxification techniques of *dioscore hispida* tubers. (a) tuber before process. (b) peeling the tubers skin. (c) slicing the tubers thinly. (d) sliced tubers put in basket prior to soaking step

The respondents were also asked on other wild edible tubers that can be found in Pulau Redang and nearby islands. All the tubers stated by the respondents are common names only. 16

of the respondents answered that *ubi toyo* can be found there. This yam also contains toxin as *ubi gadung*, hence the process to remove the toxin before it can be safely eaten is quite similar as the *ubi gadung* yam. Then, the tubers can be grated and the puree can be made into *sago* chips or mixed with fish also to make chips. Ten of the respondents mentioned *ubi kasu* which can also be found in Pulau Redang. This particular yam can be used as food source for example in making traditional local food called *kuih koleh* and also *jemput-jemput*. Three of the respondents answered *ubi jaga* which can be made into traditional medicine for fever as well as for women after giving birth. *Ubi kertas* was also answered by some respondents which also can be found here. On the other hand, 14 respondents answered the domesticated edible tapioca as one of their food sources in Pulau Redang.

The villagers were also asked for their opinions on commercialization of *Dioscorea hispida*, and some of them agreed that this intoxicating yam can be commercialized because it is easy to grow even without commercial cultivation. Besides, there are demands for processed *ubi gadung* especially in Pulau Redang area itself. But some of the villagers disagreed because *Dioscorea hispida* has toxin and the detoxification process is difficult, thus indirectly suggesting that a new effective technique needs to be developed for its commercialization. Other than that, some respondents also answered *ubi gadung* has no potential to be commercialized because this plant only grows in certain areas near the sea, so it is not easy to get.

IV. CONCLUSION

There are six wild edible tubers that can be found in Pulau Redang and nearby islands; namely *ubi gadung*, *ubi toyo*, *ubi kasu*, *ubi jaga*, *ubi seratus* and *ubi kertas*. From this study, majority of the villagers knew how *Dioscorea hispida* (*ubi gadung*) can be used in many ways. They knew that this yam contains toxin and the de-toxification technique that they used was rather similar to other techniques used by other people in some parts of the world. The villagers also used *Dioscorea hispida* as alternative food source especially during rainy season, and they used this yam as medicine and cosmetic as well.

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REFERENCES

- [1] M. Balick, and P. Cox, *Plants, People and Culture: The Science of Ethnobotany*, Scientific American Library, USA. 1996. Pp. 228.
- [2] R. E. Schultes, Ethnobotany and technology in the Northwest Amazon: A partnership. In *Sustainable Harvest and Marketing of Rain Forest Products*. Plotkin and Famolare (eds.). Island Press, CA. pp. 45-76, 1992.
- [3] L. N. Sharma, and R. Bastakoti, "Ethnobotany of *Dioscorea* L. with emphasis on food value in Chepang communities in Dhading districts, central Nepal," *Journal of Plant Science*, vol. 6, pp. 12-17, 2009.

- [4] L. R. Caddick, P. Wilkin, P. J. Rudall, T. A. J. Hedderson, and M. Chase, "Yam reclassified: A recircumscription of Dioscoreaceae and Dioscoreales," *Taxon*, vol 51, no. 1, pp. 103-114, 2002.
- [5] Food and Agriculture Organization of the United Nations (FAO), Statistical database, <http://faostat.fao.org/faostat/collections?subset=agriculture> last accessed on 9 August 2011, 2004.
- [6] E. Hildebrand, S. Demissew, and P. Wilkin, Local and regional appearance in species of *Dioscorea* L. (Yams) in Southwest Ethiopia. In *Ethnobiology and Biocultural Diversity*. J. R. Stepp, F. S. Wyndham and R. R. Zarger (eds.). Proceeding of the 7th International Congress of Ethnobiology. University of Georgia Press, USA. pp. 678-695, 2002.
- [7] R. K. Arora, and A. Pandey, *Wild Edible Plants of India, Diversity and Conservation and Use*. National Bureau of Plant Genetic Resources, New Delhi, India. 1996.
- [8] B. Roy, A. C. Halder, and D. C. Pal, "Plants for human consumption in India," *Botanical Survey of India*, pp. 63-65, 1988.
- [9] S. Mishra, S. Swaih, S.S. Chaudhary, and S. Ray, "Wild edible tubers (*Dioscorea* spp.) and their contribution to the food security of tribes of Jeypore tract, Orissa, India," *PGR Newsletter, FAO-Biodiversity issue*, no. 56, pp. 63-67, 2011.
- [10] G. C. Orkwor, R. Asiedu, and I. J. Ekanayake, *Food Yams: Advances in Research*. International Institute Tropical Agriculture (IITA) Ibadan and National Root Crops Research Institute (NRCRI), Umudike. pp. 187-215, 1998.
- [11] K. Choudhary, M. Singh, and U. Pillai, "Ethnobotanical survey of Rajasthan - An update," *American-Eurasian Journal of Botany*, vol. 1, no. 2, pp. 38-45, 2008.
- [12] E. S. Sunarsih, Djatmika and R. S. Utomo, "Influence of administration of *gadung* corm (*Dioscorea hispida* Dennst.) infusion to decrease of blood glucose level at aloksan inducted male diabetic rats," *Majalah Farmasi Indonesia*, vol. 18, no. 1, pp. 29-33, 2007.
- [13] F. Hanum, and N. Hamzah, The use of medicinal plant species by the Temuan Tribe of Ayer Hitam Forest, Selangor, Peninsular Malaysia. *Pertanika Journal Tropical Agriculture Science*. Vol. 22, no. 2, pp. 85-94, 1999. Universiti Putra Malaysia Press.
- [14] French, B. R. *Food Plants of Papua New Guinea*. pp. 31, 2006.
- [15] K. Maneenoon, P. Siriruga, and K. Sridith, "Ethnobotany of *Dioscorea* L. (Dioscoreaceae), a major food plant of the Sakai Tribe at Banthad Range, Peninsular Thailand," *Journal of Plant, People and Applied Research*, vol. 6, pp. 385-394, 2008.
- [16] Natural Resources Institute, *Root Crop Second Edition*. Tropical Development and Research Institute, University of Waikato, USA. pp. 308, 1987.