UNIVERSITI PUTRA MALAYSIA

AVAILABILITY, DIVERSITY, USES AND NUTRITIONAL STATUS OF WILD AND SEMI WILD PLANTS FROM SELECTED NATIVE MARKETS OF CENTRAL SARAWAK, MALAYSIA

MUHD ARIF SHAFFIQ SAHRIR

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By

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AVAILABILITY, DIVERSITY, USES AND NUTRITIONAL STATUS OF WILD AND SEMI-WILD PLANTS FROM SELECTED NATIVE MARKETS OF CENTRAL SARAWAK, MALAYSIA

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MUHD ARIF SHAFFIQ BIN SAHRIR

July 2013

Chairman : Prof. Japar Sidik Bujang, PhD

Faculty : Agriculture and Food Sciences

Surveys on wild and semi-wild plants were conducted at four native markets (Bintulu, Sibu, Sarikei and Selangau) in central Sarawak. This study was to determine the availability, diversity, uses and the nutritional status of the wild and semi-wild plants. Edible parts of the plants were brought back to the laboratory and were subjected to proximate analyses, minerals and sugar contents based on the standard methods. A total of 49 wild and semi-wild plants were recorded with Sibu native markets have the highest number of plants species (40 species and 25 families). The most abundant plant family traded in the markets was Arecaceae (18.25 %) based on the trader involved. Forty five species of wild and semi-wild plants recorded were consumed as foods, two species (*Helminthostachys zeylanica* and *Nephrolpeis biserrata*) used for both food and medicine, two species (*Myrmecodia tuberosa* and *Lycopodiella cernua*) as medicine and two other species used as household items e.g., food wrapper (*Licuala spinosa*) and mosquito repellent (*Goniothalamus velutinus*).

Based on the proximate analyses based on dry weight basis, the crude protein for fruits (0.04-3.17%), vegetables (0.14-2.98%) and seeds (1.06-4.69%). The crude fat content ranged from 0.04 to 18.06 % for fruits, 0.04 to 0.66% for vegetables and 1.23 to 34.18% for seeds. Leafy vegetables such as *Ficus grossularioides* provides good source of fiber (12.18%) while fruits provides good source of carbohydrate ranged from 70.54 to 96.99%. The minerals analyses indicated that ferns such *Diplazium esculentum* have high content of P, Na, Mg and Ca which provides good source of minerals with affordable price. The sugar contents (sucrose, fructose and glucose) of 11 fruits of wild and semi-wild plants were analysed using HPLC. Results indicated that most of the fruits analysed have high amount of glucose and fructose compared to sucrose. *Artocarpus odaratissimus* recorded significantly high amount of glucose (3.99 g per 100 g) and fructose (4.85 g per 100 g) compared to other wild fruits. Information on the nutritional status of wild and semi-wild plants also can help the agronomist in determining their potential as new crops and increase their function in local diets. Documentation of traditional knowledge on the uses of wild and semi-wild plants are important to provide information on consumption, various uses, mode of preparation and medicine for future utilization.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KETERDAPATAN, KEPELBAGAIAN, KEGUNAAN DAN STATUS NUTRISI TUMBUHAN LIAR DAN SEPARA LIAR DARI PASAR TAMU TERPILIH DI SARAWAK TENGAH, MALAYSIA

Oleh

MUHD ARIF SHAFFIQ BIN SAHRIR

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Pengerusi : Profesor Japar Sidik Bujang, PhD

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Tinjauan terhadap tumbuhan liar dan separa liar telah dijalankan di empat tamu (Bintulu, Sibu, Sarikei dan Selangau) Sarawak tengah. Kajian ini dijalankan untuk mengenal pasti kebolehdapatan, kepelbagaian, kegunaan dan status nutrisi tumbuhan liar. Bahagian yang boleh dimakan bagi tumbuhan tersebut dibawa balik ke makmal dan dijalankan analisis proksimat, mineral dan kandungan gula berdasarkan kaedah piawai. Sejumlah 49 spesies tumbuhan liar dan separa liar telah direkodkan dengan tamu Sibu mencatatkan jumlah spesies tumbuhan tertinggi (40 spesies dan 25 famili). Famili tumbuhan yang paling banyak dijual di tamu ialah Arecaceae (18.25%) berdasarkan jumlah penjual yang terlibat. Empat puluh lima spesies tumbuhan liar dan separa liar yang direkodkan adalah adalah sebagai makanan, 2 spesies (*Helminthostachys zeylanica* dan *Nephrolpeis biserrata*) digunakan untuk makanan dan ubatan, 2 spesies (*Myrmecodia tuberosa* dan *Lycopodiella cernua*) digunakan sebagai ubat-ubatan manakala 2

spesies yang lain digunakan untuk barangan isi rumah contohnya pembalut makanan (*Licuala spinosa*) dan penghalau nyamuk (*Goniothalamus velutinus*).

Berdasarkan analisis proksimat berasaskan berat kering , nilai protein kasar bagi buah-buahan (0.04-3.17%), sayur-sayuran (0.14-2.98%) dan biji benih (1.06-4.69%). Julat kandungan lemak kasar adalah dari 0.04 sehingga 18.06% bagi buah-buahan, 0.04 sehingga 0.66 % bagi sayur-sayuran dan 1.23% sehingga 34.18% bagi biji benih. Sayuran berdaun seperti *Ficus grossularioides* membekalkan sumber serat (12.18%) yang baik manakala buah-buahan merupakan sumber karbohidrat yang baik berjulat dari 70.54 sehingga 96.99%. Analisis mineral menunjukkan yang paku pakis seperti *Diplazium esculentum* mengandungi kandungan P, Na, Mg dan Ca yang tinggi, di mana boleh membekalkan mineral dengan harga yang berpatutan. Kandungan gula (sukrosa, fruktosa dan glukosa) bagi 11 buah-buahan dari tumbuhan liar dan separa lair telah dianalisis menggunakan HPLC. Keputusan mendapati bahawa kebanyakan buah-buahan mempunyai kandungan glukosa dan yang tinggi berbanding sukrosa. *Artocarpus odaratissimus* mencatatkan nilai signifikan glukosa (3.99 g per 100 g) dan fruktosa (4.85 g per 100 g) yang tinggi berbanding buah-buahan lain. Maklumat mengenai kandungan nutrisi tumbuhan liar dan separa liar adalah penting bagi membantu ahli agronomi dalam menentukan potensi tumbuhan sebagai tanaman baru dan meningkatkan fungsi dalam diet penduduk setempat. Penyimpanan rekod tentang maklumat tradisi tumbuhan hutan adalah

penting bagi menyediakan maklumat mengenai penggunaan, kepelbagaian penggunaan, kaedah penyedian dan ubatan bagi tujuan pengunaan di masa hadapan.

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I certify that a Thesis Examination Committee has met on 12 July 2013 to conduct the final examination of Muhd Arif Shaffiq Bin Sahrir on his thesis entitled "Availability, Diversity, Uses and Nutritional Status of Wild and Semi-Wild Plants From Selected Native Markets of Central Sarawak, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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I hereby confirm that:

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LIST OF ABRREVIATIONS

AAS	Atomic Absorption Spectrophotometry
AI	Adequate intake
AOAC	Association of Analytical Communities
Ca	Calcium
Cu	Copper
DI	Daily intake
DM	Dry matter
FAO	Food and Agriculture Organization
Fe	Iron
K	Potassium
Mg	Magnesium
Mn	Manganese
Na	Sodium
P	Phosphorus
PCA	Principal Component Analysis
WHO	World Health Organization
Zn	Zinc

CHAPTER 1

INTRODUCTION

1.1 Background

Plants whether cultivated or collected from the fields, forests or even aquatic environments have played important role in human daily life. They provide foods, medicine to treat ailments and materials for building shelters. Muller and Durbek (2005) defined plants collected from natural areas and they grow without any agricultural means and not exploited generally are referred to as wild plants. Some wild plant species are likely similar to cultivated plants or their varieties, but they are still considered as "wild" as they are gathered from the forest and not privately managed (Noweg *et al*., 2003). However, some believed that plants are not entirely "wild" even though they grow in natural ecosystem or semi natural ecosystem e.g., forest edge and with no direct human management. According to Gonzalez *et al*. (2011), such plants are cultivated but neglected in the means of management and they defined them as semi-wild plants. Others referred semi-wild plants as those that grow in places such as abandoned garden or orchard and edge of the forest (Department of Army USA, 2009).

In this present study, the plants surveyed conformed to both the terms described as wild and semi-wild plants. It is rather difficult to categorize separately those plants purely as wild plants or semi-wild plants. As such all plants surveyed in this study are grouped under a single term as wild and

semi-wild plants and they are collected or gathered by the locals from many areas i.e., fields, forest, swamps and aquatic environments aside from managed farms.

Wild and semi–wild plants are one of the important sources of food and income for local or rural people especially in developing countries. They provide food, medicines and nutrients for the rural communities. Sarawak has about 8,700,000 hectare of remaining forest with 245,172 hectare (about 0.20% of Sarawak total land area) is designated as national parks (Jamadon *et al*., 2007). The vast tropical rainforest provides forest products to local people in Sarawak. Even though, people nowadays are more focusing to the cultivated crops product, local peoples in Borneo still continue their gathering activities and depend on the forest for food and treating ailments (Brookfield *et al*., 1995). Food gathered from forest or wild usually free from chemicals compared to cultivated ones. Collecting and gathering activities play important role to local people for daily life, especially for those who reside near the forest. However gathering activities are just part of their life other than farming.

Local native markets or "tamu" are placed for marketing activities as natives gather to barter and buy their collected plants, handicrafts, traditional wares, cultural instruments, food, fruits, vegetables and also other forest products. The local weekly markets are one of the important components for social

gathering and socioeconomic of local people in Sarawak. Markets are valuable area of gathering information on the plants uses and consumption by the locals. Usually edible, medicinal and ornamental plants and various ethnobiological utility items are often found at local level however in a smaller amount and very few of them flow out of the regions (Manju and Sundriyal, 2004).

1.2 Research justification

Commonly wild and semi-wild plants are known only by local people. The uses of the plant species by the locals were due to the availability and diversity of the plants in the region (Katewa, 2003). The knowledge of utilizing plants is important in determining the certain community could maintain nutritional well-being (Ng *et al*., 2012). In recent years, people are more focusing on cultivated plants and resulting in reduction of dietary diversity (Agea *et al*., 2011) and hindered the importance of wild and semi-wild plants species. The reliance on few species as source of nutrients can contribute to many problem such as food scarcity when major blight occur. Poor knowledge on uses and method of consumption on wild and semi-wild plants species will eventually cause problem to human during war and droughts. Thus, proper documentation of the knowledge concerning of the uses of wild and semi-wild plants is a requisite to the conservation of traditional useful knowledge that have been passed from one generation to another.

Fruits from wild and semi-wild plants are source of nutrients and means of generating cash essential for buying the required household goods in rural area. The demand for these fruits are limited in the urban area due to their seasonal availability and limited commercialization of indigenous fruits (Dagmar and Hermann, 2003). Sarawak's wild and semi-wild plants such as *Canarium odonthophyllum* Miq. and *Stenochlaena palustris* (Burm. f.) Bedd. gain their importance as reported by Voon *et al.* (1992). However, there are lack of information pertaining Sarawak wild and semi-wild plant's diversity and availability in the native markets.

People assumed that wild and semi-wild plants are usually low in nutrient and quality. The negative impressions on these plants have made them become inferior compared to the cultivated and imported plant. Importance of wild and semi-wild plants in diet and provides adequate nutrients have been reported in several researches by Achinewhu *et al*. (1995) in Nigeria, Ogle *et al*. (2003) in Vietnam and Gupta and Bains (2006) in India. In Sarawak, research on the nutrient of wild and semi-wild plants had been conducted by Voon and Kueh (1999), concerning the proximate composition (energy, moisture, protein, fat, CHO, crude fibre and ash) and minerals. The study is only focusing on the nutritional value in term of fruits and leaves without separating the components of the plant used based on the usage by local people. Data on the nutritive value of the edible wild and semi-wild plants are important for better food selection and lead to the consequent

improvement in nutritional status of the diet of the local people in Sarawak. Furthermore research concerning on the variability of nutrient contents of these plants could be a desirable feature for breeding selections with improved nutritional quality.

Considering the importance of wild and semi-wild plants in local peoples especially in Sarawak, therefore the objectives of this study are: 1) to determine the diversity and availability of wild and semi-wild plants in selected local native markets, 2) to describe the uses of wild and semi-wild plants and, 3) to determine the nutritional value and potential of wild and semi-wild plants for food and non-food utilization.

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LIST OF PUBLICATIONS

1. Ramaiya, S. D., Bujang, J. S., Zakaria, M. H., King, W. S., and **Sahrir, M. A. S**. (2012). Sugars, ascorbic acid, total phenolic content and total antioxidant activity in passion fruit (Passiflora) cultivars. *Journal of the Science of Food and Agriculture*.
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