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Nutritional potential of wild edible fruits, traditionally used by the local people of Meghalaya state in India

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The nutritional potential of five wild edible fruits of the plant e.g. *Artocarpus gomezianus* Wall. ex Trécul, *Baccaurea sapida* Muell.-Arg., *Gomphogyne cissiformis* Griff., *Gymnopetalum cochinchinense* Kurz and *Zanthoxylum armatum* DC., collected from Meghalaya state in India were evaluated by determining proximate and phytochemical composition. These plants are used by the local people of Meghalaya state in India as their food. The present study revealed that for different plant species, the crude fat content ranged between 0.75±0.02 - 12.54±0.04 %. The crude protein content was determined high in the fruits of *G. cochinchinense* (20.83±0.02 %), *A. gomeziana* (19.50±0.02 %) and *G. cissiformis* (18.82±0.02 %) while the available carbohydrate content was highest in the fruits of *B. sapida* (85.83±0.03 %). The nutritive value ranged from 343.01±0.09 - 418.18±0.08 kcal/100g in the various wild edible plants. Among the various macronutrients estimated in the samples of plants under study, potassium was present in the highest quantity (6.16±0.16- 57.22±0.84 mg/g) followed by calcium (2.88±0.11-10.74±0.13 mg/g) and sodium (0.17±0.004-0.66±0.005 mg/g). Micronutrients, such as iron, zinc, copper, manganese and magnesium were analyzed. The result indicates that nutritional values and mineral contents of these fruits under investigation were richer than that of the commercial fruits and could be used for nutritional purpose. The present study also gives an account of ethnobotanical importance of the wild plants under investigation.

Keywords: Wild edible plants, Meghalaya, Nutritional composition, Mineral contents.

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Introduction

Meghalaya is a small state in north-eastern India. It comprises of South Garo hills, West Garo hills, East Garo hills, West Khasi hills, East Khasi hills, Ribhoi and Jaintia Hills districts. This state is bounded in North by Assam and by Bangladesh on the South. This state about 300 km long (East-West) and 100 km wide, with a total area of about 8,700 sq m (22,720 km²). About one third of the state is forested. The Meghalaya subtropical forests ecoregion encompasses the state; its mountain forests are distinct from the lowland tropical forests to the North and South[1]. The forests of Meghalaya are notable for their biodiversity of mammals, birds, and plants[2]. A large part of the region is botanically under-explored or even unexplored. In the hilly regions, population density is very low. Most of the area lacks industrialization and communications and, consequently, is under-developed. The local inhabitants subsist on limited agriculture and local products of plant and animal origin. The area is, thus, very interesting ethnobotanically[3]. The forests of Meghalaya provide a large number of plants whose fruits, seeds, tubers, shoots etc make an important contribution to the diet of the tribal people. These wild plants serve as an indispensable constituent of human diet supplying the body with minerals, vitamins and certain hormone precursors, in addition to protein and energy[4]. These plants also provide some useful products like medicine, fibre, fodder, dyes, etc[2]. The study of wild edible plants is important not only to identify the potential sources which could be utilized as alternative food but also to select promising types for domestication.

The present communication deals with the analysis of the fruits of *Z. armatum*, *G. cissiformis*, *G. cochinchinense*, *A. gomeziana* and *B. sapida* collected from different market of Meghalaya for their nutritional composition and mineral contents. The main target of our research was to find out the nutritional potential of these wild edible plants. The

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traditional use and ethnobotanical importance of these plants has also been mentioned. *Z. armatum* known as Jaiur in Meghalaya belongs to the family Rutaceae. It is an important medicinal plant and the bark, fruits and seeds are extensively used in indigenous system of medicine as a carminative, stomachic and anthelmintic. The fruit and seeds are employed as an aromatic tonic in fever and dyspepsia. The extract of the fruits are reported to be used in the treatment of toothache. The dried fruits are used as spice. It possesses antilarvicidal, antifungal, hepatoprotective and alleopathic properties[5].

G. cissiformis Griff. known as *Soh-thliem* in Meghalaya belongs to the family Cucurbitaceae. The leaves and fruits of this plant are used by the local people of the state as vegetable[2]. *G. cochinchinense* known as Swathang in Meghalaya also to the family Cucurbitaceae. The whole plant is used by the tribal people of North-East for the treatment of high blood pressure, fever, jaundice, gastritis, killing maggots and wound healing in cattle[6]. *A. gomeziana* Wall. known as *Soh-ram* in Meghalaya belongs to the family Moraceae. The seeds and fruits of this plant are roasted and eaten by the tribal people of the state.

B. sapida Roxb. known as *Soh-ramdieng* in Meghalaya belongs to the family Euphorbiaceae has yellowish, edible fruits when ripe, and are available during May–July. In fact, the flesh or aril around the seed coat can be eaten and tastes delicious. The rind of the fruits is occasionally used for making chutney. It is sold in the market at Rs 16-20/ kg and the fruit yield is 21-156 kg/tree. Squash making has increased the value of the fruits up to Rs 17.4/kg. It can be a good source of vitamin C (273 mg/100 g) as recorded in this investigation[7].

Materials and Methods

Plant materials

The five plant materials e.g. the fruits of *Z. armatum*, *G. cissiformis*, *G. cochinchinense*, *A. gomeziana* and *B. sapida* were purchased from different market of Meghalaya on August 2011 and authenticated in our office. The voucher specimens were preserved in the Plant Chemistry department of our office under registry no BSITS 32, BSITS 33, BSITS 43, BSITS 45 and BSITS 48, respectively. The plant parts were shed-dried, pulverized and stored in an airtight container and proximate composition and mineral contents were carried out in our laboratory.

Estimation of ash

5 g of each sample was weighed in a silica crucible and heated in muffle furnace for about 5-6 h at 500 °C. It was cooled in a desiccator and weighed. It was heated again in the furnace for half an hour, cooled and weighed. This was repeated consequently till the weight became constant (ash became white or grayish white). Weight of ash gave the ash content[8].

Estimation of moisture

2 g of each sample was taken in a flat-bottom dish and kept overnight in an air oven at 100-110°C and weighed. The loss in weight was regarded as a measure of moisture content[8].

Estimation of crude fat

2 g moisture free of each sample was extracted with petroleum ether (60-80 °C) in a Soxhlet apparatus for about 6-8 h. After boiling with petrol, the residual petrol was filtered using Whatman no. 40 filter paper and the filtrate was evaporated in a preweighed beaker. Increase in weight of beaker gave crude fat[8].

Estimation of crude fibre

2 g of moisture and fat-free material of each sample was treated with 200 mL of 1.25 % H_2SO_4. After filtration and washing, the residue was treated with 1.25 % NaOH. It was the filtered, washed with hot water and then 1 % HNO_3 and again with hot water. The washed residue was dried in an oven at 130 °C to constant weight and cooled in a dessicator. The residue was scraped into a pre-weighed porcelain crucible, weighed, ashed at 550 °C for two hours, cooled in a dessicator and reweighed. Crude fibre content was expressed as percentage loss in weight on ignition[8].

Estimation of crude protein

The crude protein was determined using micro Kjeldahl method. 2 g of each sample compound was decomposed by digestion with concentrated sulphuric acid in the presence of a catalyst, ammonium sulphate is produced. An excess of sodium hydroxide solution was added to the diluted reaction mixture, the liberated ammonia was distilled in steam and absorbed in a measured excess of standard sulphuric acid. Titration of the residual mineral acid with standard sodium hydroxide gives the equivalent of ammonia obtained from the weight of the sample taken. From this the percentage of nitrogen in the compound can was calculated. On the basis of early

determinations, the average nitrogen (N) content of proteins was found to be about 16 percent, which led to use of the calculation N x 6.25 (1/0.16 = 6.25) to convert nitrogen content into protein content[8].

Estimation of available carbohydrate

Percentage of available carbohydrate was given by: 100- (percentage of ash + percentage of fat + percentage of protein + percentage of crude fibre)[8].

Estimation of nutritive value (energy)

The three components of foods which provide energy are protein, carbohydrate and fat. One gram carbohydrate and protein yield 4 kcal energy whereas one gram fat yields 9 kcal energy. Therefore the energy content of each plant samples were determined by multiplying the values obtained for protein, fat and available carbohydrate by 4.00, 9.00 and 4.00, respectively and adding up the values[8-9].

Estimation of minerals in plant material

Plant material was taken in a precleaned and constantly weighed silica crucible and heated in a muffle furnace at 400°C till there was no evolution of smoke. The crucible was cooled at room temperature in a desiccator and carbon-free ash was moistened with concentrated sulphuric acid and heated on a heating mantle till fumes of sulphuric acid ceased to evolve. The crucible with sulphated ash was then heated in a muffle furnace at 600°C till the weight of the content was constant (~2–3 h). One gram of sulphated ash obtained above was dissolved in 100 mL of 5 % HCl to obtain the solution ready for determination of mineral elements through atomic absorption spectroscopy (AAS) (AA 800, Perkin- Elmer Germany). Standard solution of each element was prepared and calibration curves were drawn for each element using AAS[10]. All assays were carried out at least in triplicate and values were obtained by calculating the average of three experiments and data are presented as Mean ± SEM.

Results and Discussion

The edible parts of fresh plant materials *e.g* the fruits of *Z. armatum*, *G. cissiformis*, *G. cochinchinense*, *A. gomeziana* and *B. sapida* collected from different places of Meghalaya market have a relatively high moisture content when compared to ash, crude protein, crude fat, dietary fibre and available carbohydrate content (Table 1). The edible parts of all plants contain minerals like sodium, potassium, calcium, manganese, magnesium, iron, zinc and copper in varying concentration with potassium having highest concentration (Table 2).

The proximate analysis of the nutritive contents of five plants is depicted in Table 1. The results obtained from analytic chemical analysis of all five wild edible fruits establishes that nutritive value of the fruits of *A. gomeziana* was maximum (418.18±0.08 kcal/100g) followed by the fruits of *B. sapida* (381.13±0.13 kcal/100g) and fruits of *Z. armatum* (374.42±0.30 kcal/100g) and. The fruits of *G. cissiformis* were found to be of less nutritive value (361.36±0.33 kcal/100g) but due to high moisture content (96.01±0.08 %) it has a very good nutritive value and may be used as fodder. The crude protein contents ranged from 20.83±0.02 % (fruits of *G. cochinchinense*) to 6.94±0.025 % in the fruits of *B. sapida*. The crude protein content in *G. cochinchinense* found to be very much comparable with those of almond (20.80 %), cashewnut (21.20 %)[(Ref.11)]. The crude protein content in the fruits of *G. cochinchinense* (20.83±0.02 %), *A. gomeziana* (19.50±0.02 %), *G. cissiformis* (18.82±0.02 %) and *Z. armatum* (18.36±0.02 %) were very much high than the protein content in some commercial fruits like apple (0.2 %), wood apple (7.1 %) and litchi (1.1 %) (Table 3)[(Ref.12)]. This indicates that low cost plant samples are very good sources of protein. The fruits of *B. sapida, G. cissiformis*, *G. cochinchinense* and *A. gomeziana* with high content of available carbohydrates (85.83±0.03 %, 67.05±0.04 %, 63.23±0.03 % and 63.28±0.0 5 %, respectively) compared well to that reported for almond (10.50 %), apple (13.7 %)[(Ref.11)], wood apple (18.1 %), potato (20.9 %) and ripe mango (14.9%) (Table 3)[12] and these could be a supplements in feed formulations. The ash content was found lowest in *A. gomeziana* (3.13±0.03 %) and highest in *G. cissiformis* (11.03±0.01 %). The fat content in the fruits of *Z. armatum* (12.54±0.04 %) and *A. gomeziana* (9.67±0.01 %) was particularly high and well compared to that reported for some common fruits like wood apple (3.7 %), litchi (0.20 %), ripe mango (0.4 %) (Table 3)[(Ref.12)]. The fruits of *Z. armatum* contained the highest amount of crude fibre (17.06±0.03 %) and the lowest amount is found in the fruits of *B. sapida* (0.80±0.02 %) and similar to commercial fruits and vegetables like apple (3.2 %), broad beans (8.9 %), cabbage (2.8 %), potato (1.7 %), spinach (2.5 %) (Table 3)[(Ref.12)]. The proximate composition of these plants were very

much comparable to some other wild edible fruits like *Morus indica* L., *Myrica nagi* Hook f., *Myrica esculenta* Buch.-Ham., *Parkia roxburghii* G. Don, *Prunus nepalensis* Hort. & C. Koch, *Terminalia bellirica* Roxb., etc collected from different tribal market of Meghalaya[13].

The mineral composition of edible parts of the plants is shown in Table 2. High concentrations of sodium (Na) were present, ranging from 0.17±0.004 mg/g (*G. cissiformis*) to 0.66±0.005 mg/g (*B. sapida*). The sodium levels of some cultivated vegetables and fruits vary between 30-1249 mg/kg (Table 4)[(Ref.12)]. The

Table 1—Proximate composition of the wild edible fruits collected from Meghalaya state

Name of the Plant	Local name at Meghalaya	Parts used	Ash %	Moisture %	Crude fat %	Crude fibre %	Protein % 6.25x % of N	Carbohydrate %	Nutritive value kcal/100g
A. gomeziana	*Soh-ram*	Fruits	3.13±0.03	75.61±0.03	9.67±0.01	4.42±0.04	19.50±0.02	63.28±0.05	418.18±0.08
B. sapida	*Soh-ramdieng*	Fruits	5.31±0.02	87.55±0.02	1.11±0.02	0.80±0.02	6.94±0.02	85.83±0.03	381.13±0.13
G. cissiformis	Soh-thliem/ Jhur thliem	Fruits	11.03±0.01	96.01±0.08	1.99±0.04	1.12±0.04	18.82±0.02	67.05±0.04	361.36±0.33
G. cochinchinense	Swathang	Fruits	5.95±0.02	89.94±0.02	0.75±0.02	9.24±0.02	20.83±0.02	63.23±0.03	343.01±0.09
Z. armatum	Jaiur	Fruits	5.01±0.01	54.23±0.03	12.54±0.04	17.06±0.03	18.36±0.02	47.03±0.04	374.42±0.30

Each value in the table was obtained by calculating the average of three experiments (n=3) and data are presented as Mean ± SEM

Table 2—Minerals content of the wild edible fruits collected from Meghalaya state

Name of the Plant	Local name at Meghalaya	Parts used	Minerals present mg /g							
			Na	K	Ca	Mn	Cu	Fe	Mg	Zn
A. gomeziana	Soh-ram	Fruits	0.21±0.003	6.16±0.16	2.88±0.11	0.011±0.0001	0.012±0.0001	0.067±0.001	0.733±0.0009	0.212±0.001
B. sapida	Soh-ramdieng	Fruits	0.66±0.005	17.52±0.15	5.71±0.09	0.003±0.0001	0.009±0.0002	0.066±0.001	0.663±0.001	0.099±0.0008
G. cissiformis	Soh-thliem/ Jhur -thliem	Fruits	0.17±0.004	46.33±0.67	7.27±0.10	0.031±0.0005	0.008±0.0002	0.247±0.0008	0.781±0.001	0.228±0.0009
G. cochinensis	Swathang	Fruits	0.49±0.005	57.22±0.84	10.74±0.13	0.047±0.001	0.016±0.0002	0.064±0.001	0.776±0.001	0.155±0.0009
Z. armatum	Jaiur	Fruits	0.23±0.003	27.06±0.12	6.58±0.10	0.076±0.001	0.014±0.0002	0.218±0.001	0.768±0.001	0.310±0.001

Each value in the table was obtained by calculating the average of three experiments (n=3) and data are presented as Mean ± SEM

Table 3—Proximate composition of some common vegetables and fruits

Name of the Plant	Ash (%)	Moisture (%)	Crude fat (%)	Protein (%) (6.25x % of N)	Available Carbohydrate (%)	Crude fibre (%)	Nutritive value (kcal /100g)
Apple	1.2	84.6	0.3	0.2	10.5	3.2	58
Brinjal	1.6	88.7	0.3	1.4	1.7	6.3	24
Broad beans	2.8	82.4	0.1	4.5	1.3	8.9	48
Cabbage	1.6	91.9	0.1	1.8	1.8	2.8	27
Cauliflower	2.2	90.8	0.4	2.6	0.3	3.7	30
Lettuce	1.7	93.4	0.3	2.1	-	-	21
litchi	1.0	84.1	0.2	1.1	-	-	61
Mango ripe	1.1	81.0	0.4	0.6	14.9	2.0	74
Papaya ripe	1.3	90.8	0.1	0.6	4.6	2.6	32
Potato	1.0	74.7	0.1	1.6	20.9	1.7	97
Spinach	2.3	92.1	0.7	2.0	0.4	2.5	26
Wood apple	6.9	64.2	3.7	7.1	18.1	-	134

Table 4—Minerals content in some common vegetables and fruits

Name of the Plant	Minerals present mg/g							
	Na	K	Ca	Mn	Cu	Fe	Cr	Zn
Apple	0.280	0.750	0.100	0.0014	0.0010	0.0066	0.0008	0.0060
Brinjal	0.030	2.000	0.180	0.0013	0.0012	0.0038	0.0007	0.0022
Broad beans	0.435	0.390	0.500	-	0.0017	0.014	-	-
Cabbage	-	-	0.390	0.0018	0.0002	0.008	0.0005	0.003
Cauliflower	0.530	1.380	0.330	0.001	0.0013	0.0123	0.0003	0.0040
Lettuce	0.580	0.330	0.500	-	0.0008	0.024	-	-
Litchi	1.249	1.590	0.100	-	0.003	0.007	-	
Mango ripe	0.260	2.050	0.140	0.0013	0.0011	0.013	0.0006	0.0027
Papaya ripe	0.060	0.690	0.170	-	0.0020	0.005	-	-
Potato	0.110	2.470	0.100	0.0013	0.0016	0.0048	0.0007	0.0053
Spinach	0.585	2.060	0.730	0.0056	0.001	0.0114	0.0005	0.003
Wood apple	-	-	1.300	0.0018	0.0021	0.0048	0.0006	0.0046

potassium (K) content was highest in the fruits of *G. cochinchinense* (57.22±0.84 mg/g) and least in the fruits of *Elaeagnus latifolia* L. (6.16±0.16 mg/g). Na and K take part in ionic balance of the human body and maintain tissue excitability. Na plays an important role in the transport of metabolites and K is important for its diuretic nature. The ratio of K/Na in any food is an important factor in prevention of hypertension and arteriosclerosis, with K depresses and Na enhances blood pressure[14]. The ratio of K/Na were significant in the fruits of *G. cissiformis* (272.52), *Z. armatum* (117.65) and *G. cochinchinense* (116.77) and very much compared with some common fruits (Amla 45, papaya ripe 11.5, tomato 11.31, *Castanea sativa* 56.67, *Punica granatum* 1400.00)[(11)]. The calcium (Ca) content was highest in the fruits of *G. cochinchinense* (10.74±0.13 mg/g) followed by *G. cissiformis* (7.27±0.10 mg/g) and *Z. armatum* (6.58±0.10 mg/g). The Ca levels of some cultivated vegetables and fruits vary between 0.1-1.300 mg/g (Table 4). Calcium constitutes a large proportion of the bone, human blood and extracellular fluid. It is also very much required for the normal functioning of the cardiac muscles, blood coagulation, milk clotting and the regulation of cell permeability[10].

Copper (Cu) is another trace element essential in human body where it exists as an integral part of copper proteins ceruplasmin, the enzyme that catalyzes the oxidation of iron ion[14]. Sufficient amount of Cu was present in *G. cochinchinense* (0.016±0.0002 mg/g), *Z. armatum* (0.014±0.0002 mg/g) and in *A. gomeziana* (0.012±0.0001 mg/g).

An appreciable quantity of Zinc (Zn) was found to be present ranging from 0.099±0.0008 mg/g (*B. sapida*) to 0.310±0.001 mg/g (*Z. armatum*). Zn is an essential element in the nutrition of human being where it functions as an integral part of numerous enzymes including some enzymes which play a central role in nucleic acid metabolism. In addition, Zn is a membrane stabilizer and a stimulator of the immune response. Its deficiency leads to growth failure and poor development of gonadal function[15] .

The Manganese (Mn) concentrations of the plants studied varied between 0.003±0.0001 to 0.076±0.001 mg/g. The highest Mn value was found in the fruits of *Z. armatum* (0.076±0.001 mg/g) and appreciable amount of this element were observed in all other plants and our results were in the limits. This element is very much essential for haemoglobin formation[10]. Mn is one of the most important minerals for human physiology and daily requirement for healthy person is 4.50 mg[16]. High concentration of Iron (Fe) was present in the fruits of *G. cissiformis* (0.247±0.0008 mg/g) and *Z. armatum* (0.218±0.001 mg/g). This high Fe levels in some wild edible plants studied could be clarified with different soil characteristics of the growing area. A daily Fe requirement of human body is 15 mg and the deficiency causes illness like anemia. Wild edible plants studied had sufficient and high Fe levels for human health[16].

The Magnesium (Mg) concentrations of the plants studied varied between 0.663±0.001 to

0.781±0.001 mg/g. The highest Mg value was found in the fruits of *G. cissiformis* (0.781±0.001 mg/g). A very good amount of Mg was also present in the fruits of *G. cochinchinense (*0.776±0.001 mg/g) and *Z. armatum* (0.768±0.001 mg/g). So the mineral findings of all these plants obtained from present study were similar and comparable to the commercial vegetables and fruits.

Conclusion

The study showed that the wild edible fruits collected from Meghalaya State in India were rich in protein, available carbohydrate, total dietary fibre and minerals investigated and we believe that these plants could be used for nutritional purpose of human being due to their good nutritional qualities and adequate protection may be obtained against diseases arising from malnutrition.

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References

1 Mao A A, Hynniewta T M and Sanjappa M, Plant wealth of Northeast India with reference to ethnobotany, *Indian J Trad Knowledge*, 2009, **8**(1), 96-103.

2 Kayang H, Tribal knowledge on wild edible plants of Meghalaya, Northeast India, *Indian J Trad Knowledge*, 2007, **6**(1), 177-181.

3 Jain S K and Dam N, Some Ethnobotanical notes from North-eastern India, *Econ Bot*, 1979, **33**(1), 52-56.

4 Akubugwo I E, Obasi A N and Ginika S C, Nutritional potential of the leaves and seeds of black nightshade-*Solanum nigrum* L. var *virginicum* from Afikpo-Nigeria, *Pak J Nutr*, 2007, **6**(4), 323-326.

5 Singh T P and Singh O M, Phytochemical and pharmacological profile of *Zanthoxylum armatum* DC.—An Overview, *Indian J Nat Prod Resour*, 2011, **2**(3), 275-285.

6 Pfoze N L, Kumar Y and Myrboh B, Survey and assessment of ethnomedicinal plants used in Senapati District of Manipur State, Northeast India, *Phytopharmacology*, 2012, **2**(2), 285-311.

7 Sundriyal M and Sundriyal R C, Underutilized edible plants of the Sikkim Himalaya: Need for domestication, *Curr Sci*, 2003, **85**(6), 731-736.

8 AOAC, 2000, Official methods of analysis, 17th edition, Association of Official Analytical Chemists, Washington DC, Arlington, Virginia, USA

9 Guil-Guerrero J L, Gimenez-Gimenez A, Rodriguez-Garcia I and Torija-Isasa M E, Nutritional composition of *Sonchus* Species (*S. asper* L., *S. oleraceus* L. and *S. tenerrimus* L.), *J Sci Food Agric*, 1998, **76**(4), 628-632.

10 Indrayan A K, Sharma S, Durgapal D, Kumar N and Kumar M, Determination of nutritive value and analysis of mineral elements for some medicinally valued plants from Uttaranchal, *Curr Sci*, 2005, **89**(7), 1252-1255.

11 Sundriyal M and Sundriyal R C, Wild edible plants of the Sikkim Himalaya: Nutritive values of selected species, *Econ Bot*, 2004, **58**(2), 286-299.

12 Gopalan C, Rama Sastri B V and Balasubramanian S C, Nutritive value of Indian foods, printed by National Institute of Nutrition, Indian Council of Medical Research, Hyderabad-500 007, India, , pp. 2-58, 2004.

13 Seal T, Nutritional composition of wild edible fruits in Meghalaya state of India and their Ethno-botanical importance, *Res J Bot,* 2011, **6**(2), 58-67.

14 Saupi N, Zakaria M H and Bujang J S, Analytic chemical composition and mineral content of yellow velvet leaf (*Limnocharis flava* L. Buchenau)'s edible parts, *J Applied Sci*, 2009, **9**(16), 2969-2974.

15 Ihedioha J N and Okoye C O B, Nutritional evaluation of *Mucuna flagellipes* leaves: An underutilized legume in Eastern Nigeria, *Amer J Plant Nutr Fertil Technol*, 2011, **1**(1), 55-63.

16 Sekeroglu N, Ozkutlu F, Deveci M, Dede O and Yilmaz N, Evaluation of some wild plants aspect of their nutritional values used as vegetable in Eastern Black sea region of Turkey, *Asian J Plant Sci*, 2006, **5**(2), 185-189.