DOI: 10.21276/ijabpt.2016.7.4.1

INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

www.ijabpt.com ISSN : 0976-4550

Volume-7, Issue-4, Oct-Dec-2016 Coden IJABFP-CAS-USA Copyrights@2016

Received: 15th July 2016 *Revised: 15th Aug 2016* *Accepted: 18th Aug 2016*

DOI: 10.21276/Ijabpt, http://dx.doi.org/10.21276/ijabpt *Research article*

ETHNOBOTANY AND NUTRITIONAL VALUES OF SOME SELECTED WILD EDIBLE PLANTS USED BY *RONGMEI* TRIBE OF MANIPUR NORTHEAST INDIA

Robert Panmei*, P.R. Gajurel and B.Singh

Forest Systematic & Ethnobiology Laboratory,
Department of Forestry, North Eastern Regional Institute of Sciences and Technology Nirjuli-791109 (Arunachal Pradesh)

ABSTRACT: The paper deals with ethnobotanical uses and proximate nutritional analysis of some wild edible plants consumed by *Rongmei* tribe of Manipur, northeast India. Extensive field surveys were carried out in the selected study site during 2013-2015. Ethnobotanical data were collected from 50 respondentsusing semi structured questionnaires. The mostly preferred 5 species having both vegetable and ethnomedicinal values growing in the natural habitat were selected for nutritional analysis. Proximate nutritional values of the 5 species were evaluated in terms of crude protein, total carbohydrate, crude fibre, vitamin C and crude fats adopting standard methods. These species exhibit good content of crude protein, crude fibre and vitamin C with low fat contents indicating their nutritional potential. The outcome of the nutritional analysis suggested that the selected species has high nutritional content and were even superior to some domesticated varieties These species can be promoted for the large scale cultivation and marketing for the benefit of the local tribe and other communities.

Key words: Northeast India, *Rongmei* tribe, ethnobotany, wild edible plants, nutritional value,

*Corresponding author: Robert Panmei, Department of Forestry, North Eastern Regional Institute of Sciences and Technology Nirjuli-791109, India Email: rpanmei4@gmail.com Mobile no. : 8794323273

INTRODUCTION

Wild edible plants provide a substantial contribution to the food habit mostly for the people inhabiting near forest areas. Historically, tribal and rural people identified and collected plants for food and medicine from forests and developed a range of processing methods in accordance with their needs (Dwebe and Mearns, 2011).Wild edibles are endowed with one or more parts that can be used as food if gathered at the appropriate stage of growth and prepared well (Kallas, 2010).Wild edible plants are also an important component of world flora and enumeration of the dietary use of this plant group among different cultures can be useful in the documentation of plant diversity and distribution in an area and the associated traditional knowledge (Termote and Van Damme, 2011; Phangchopi *et al.*, 2014). Some recent studies reveals that, wild edible plants are rich in minerals, vitamins, carbohydrates, proteins, fats and fibre and in addition they are used as remedy for various diseases (Deshmukh and Waghmode, 2011; Jayanti *et al.*, 2013)and their nutritional values are superior to those domesticated varieties (Grivetti and Ogle, 2000; Afolayan and Jimoh 2009; Shad *et al.*, 2013).

The state Manipur located in northeast India falls in the Indo-Burma global biodiversity hotspot (Myers *et al*., 2000) and harbor a rich diversity of flora and fauna with numerous rare and endemic species. The forests serves as a prime habitat for many wild edible plants that fulfill the needs of the communities throughout the year. Many of these inexpensive edible plants are consumed by the local communities yet many still remainsunutilized and the nutritional potential of these species are yet to be studied. Some of the studies recently carried out from the state and the region have substantiated importance of wild edible plants among different communities (Salam *et al*., 2010; Namsa *et al.,* 2011; Yumnam and Tripathi, 2012; Singh *et al.,* 2012; Gangte *et al.,* 2013; Rajkumari *et al*., 2013; Narzary *et al.,* 2013; Singson *et al.,* 2015; Konsam *et al*., 2016). Apart from the studies conducted by Daimei and Kumar (2013) on the ethnobotanical uses of Zingeberaceous plants and Panmei *et al*.,(2014) on non-timber forest products used by *Rongmei* tribe, no remarkable ethnobotanical and related work has been carried out for the tribe of the state. The rich traditional knowledge of the tribe, particularly the forest resource utilization pattern, is yet to be explored. *Rongmeis* have a rich traditional knowledge in selection and utilization of wild plant resources. They rely heavily on wild vegetables (locally known as *Numgaannui-pannui*) to provide dietary nutrition and marginal income from their sale throughout the year and many ethnomedicinal plants are also locally consumed as vegetables and fruits. However with continuous developmental activities and *jhum* practices, the forests in the district have been reducing at a faster pace in the past few years. As per the report of FSI (2015) the district forest cover is reduced by 111km^2 during the past two years and the wild edible plants are no exception to sustain in this heat of degradation. Therefore, there is an urgent need to conserve adopting possiblestrategies and advocate sustainable utilization of these wild edible plants for future generation. At the same time, it is also essential to explore the nutritional content of these wild edible plants so as to validate the scientific basis of consumption of these species. In this context after the ethnobotanical survey was conducted in the district, the proximate nutritional analysis of the 5 mostly preferred wild leafy vegetables was also carried out. The details of the ethnobotanical uses and nutritional values of the five species viz. *Brassaiopsis hainla* Seem., *Gnetum gnemon* L., *Pilea scripta* (Buch.-Ham. ex D. Don) Wedd., *Rhynchotechum ellipticum* (Wall. ex D. Dietr.) A. DC., and *Sarcochlamys pulcherrima* Gaudich. Voy. Bonite have been presented here.

MATERIALS AND METHODS

Study site and people

The study was conducted during 2013-2015 in Tamenglong district located in the western part of Manipur (Fig. 1). This hill district lies between 24°30'N and 25°27'N latitudes and 93°10'E and 94°54'E longitudes at an elevation of 1,290 m above the sea level. Tamenglong district covers a total area of 4,391 km^2 and has total forest cover of 3,754 km^2 which represent 85.49 % of the total district area and the forest are grouped as tropical evergreen forest, sub-tropical forest and bamboo brakes (FSI, 2015). The district has four sub-divisions namely Tamenglong, Nungba, Tamei and Tousem and mainly inhabited by the Zeliangrong Nagas. The name 'Zeliangrong' refers to the combined name of the three Naga kindred tribes *Zeme, Liangmei* and *Rongmei*. This new nomenclature was formed by stitching the first three syllables together out of the three sub-tribes' names i.e. Ze- from *Zeme*, Liang-from *Liangmei* and Rong from *Rongmei* constituting the composite name 'Zeliangrong' in the year 1947 (Makuga, 1994; Rongmei, 2005).Out of the 4 subdivisions, Tamenglong and Nungba are dominantly inhabited by *Rongmei* Naga tribes while the Tamei and Tousem subdivisions are dominated by *Liangmei* and *Zeme* tribes respectively. The present study is emphasized on *Rongmei* tribe where *jhum* cultivation is their main occupation. Ethnically *Rongmeis* are of Mongoloid origin and probably migrated from the western part of Tibet to north eastern India (Deb, 2012).

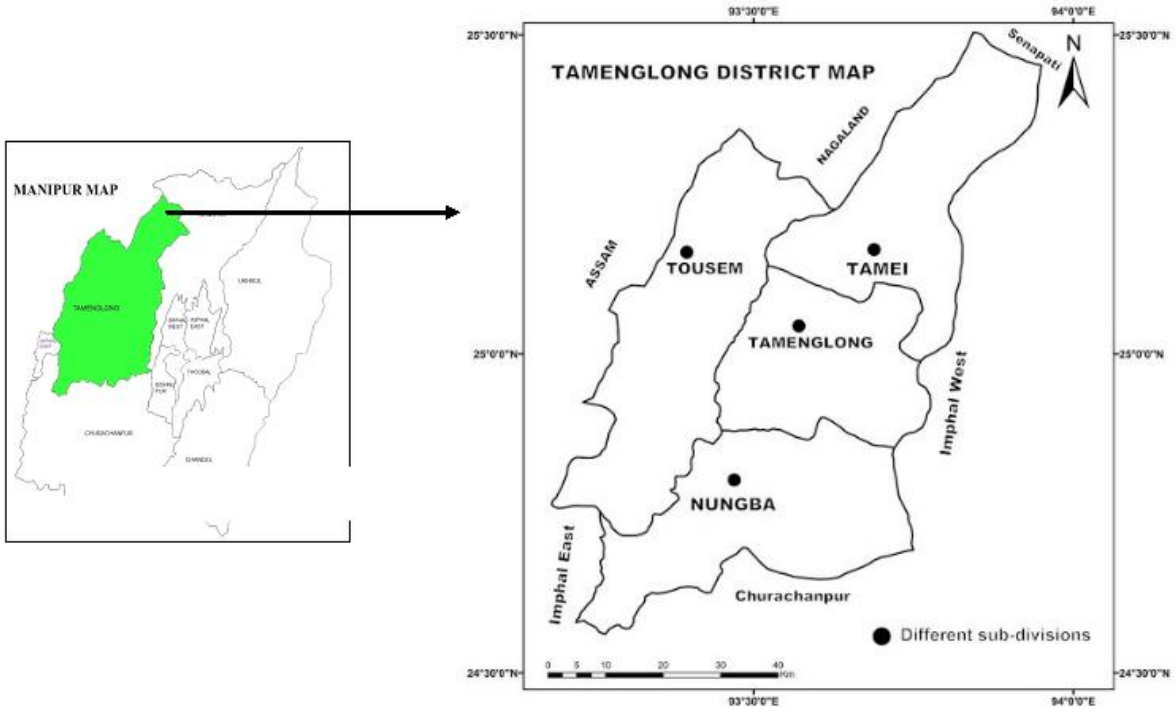

Fig-1: Sample location map

Fig-2: A. *Brassaiopsis hainla* Seem.**B.** *Gnetum gnemon* L.**C.** *Pilea scripta* (Buch.-Ham. ex D. Don) Wedd. **D.** *Rhynchotechum ellipticum* (Wall. ex D. Dietr.) A. DC. **E.** *Sarcochlamys pulcherrima* Gaudich. Voy. Bonite **F.** A local vegetable market in Tamenglong

Data and sample collection

Extensive field surveys were carried out in 10 villages and 4 local market of the district.Every village head was interacted and Informant Consent was taken before interview and the objectives of the study were clearly explained. For the data collection, standard ethnobotanical approach was adopted. Elderly persons including village chief, women folks and vegetable vendors were interviewed using modified semi-structured questionnaires (Jain, 1987; Martin, 1995). A total of 50informants (30 male and 20 female) were interviewed on the traditional uses of wild edible plants (including wild fruits, wild vegetables and spices). Out of the 50 informants, 8 were local medicine practitioners known as '*Maipa'* or '*Maipi'* of which 2 were female and their age ranges between 41-82 years. Detailed ethnomedicinal uses of the species were collected from these practitioners. The selection of plants for nutritional analysis was based on the preferences and recommendation by the local community, market demand and availability in the natural habitat. Plants were collected, photographed (Fig. 2) and herbarium specimens were prepared adopting standard methodology (Jain and Rao, 1977). Collected plants were identified with the help of relevant literature and floras (Sinha, 1996; Singh *et al.*, 2000; Chowdhery *et al.*, 2009). For correct nomenclature and author citation of the collected species, the online database like the International Plant Names Index, The Plant Lists and Tropicos were referred. The Vouchers specimens were deposited in the herbarium of Department of Forestry, NERIST Arunachal Pradesh.

Proximate Nutritional analysis

Sample preparation- The freshly collected healthy leaves were thoroughly washed with tap water to remove soil, dust particle, etc. The washed leaves were dried with blotting paper at room temperature to remove surface water. Then the samples were again oven dried at 60°C except for Vitamin C analysis where fresh leaves were used. The dried plant samples were ground into fine powder in a mixer grinder and these powdered samples were then stored in air tight containers at room temperature.

Estimation of Crude Protein-Crude Protein was determined by micro-Kjeldal method (Sadasivam and Manickan, 2008).Percentage of nitrogen was determined using the following equation

$$\text{Total nitrogen (\%)} = \frac{(V1-V2)\times N\times 1400}{W}$$

Where, V_1= volume of H_2SO_4 (mL); V_2= blank value (mL); N= normality of H_2SO_4; 1400 = constant value and

W= weight of the sample (in mg)

Crude protein (%) = total nitrogen (%) × 6.25

Determination of total carbohydrate: Total carbohydrate was determined by Anthrone method outlined in Sadasivam and Manickan (2008) where the sample were hydrolysed with 2.5 N H_2SO_4 in a boiling water bath. Total carbohydrate was calculated by drawing a standard graph plotting concentration of the standard glucose on the X-axis and absorbance on the Y-axis.

$$\text{Amount of carbohydrate present in 100 mg of the sample} = \frac{\text{mg of the glucose}}{\text{volume of the test sample}}\times 100$$

Estimation of Crude fibre: The dried ground samples were treated with sequential hot digestion with H_2SO_4 and NaOH. The materials were filtered through muslin cloth and washed with H_2SO_4, water and alcohol. The washed residue was dried in an oven at 130°C for 2 hours and then cooled in a desiccator and weighed. The residue was scraped into a pre-weighed crucible and ignited for 30 minutes at 600°C in muffle furnace and then cooled in a desiccator and reweighed. The crude fibre is estimated by determining the final weight of the ignited residue in muffle furnace (Sadasivam and Manickan, 2008).

$$\text{\% Crude fibre in ground sample} = \frac{(\text{Weight of the residue})-(\text{Weight of the cooled ash})}{\text{Weight of the sample}}\times 100$$

Estimation of Vitamin C (Ascorbic acid): Ascorbic acid was estimated by volumetric method using 4 % oxalic acid and dye solution which is a mixture of sodium bicarbonate and 2,6- dichloro phenol indophenols (Sadasivam & Manickan 2008). 5 mL of the working standard solution was pipetted out in 100 mL conical flask and 10 mL of 4 % oxalic acid was added and titrated against the dye (V_1 mL). The end point is the appearance of pink colour which persisted for few minutes.

The amount of dye consumed is equivalent to the amount of ascorbic acid present in the test sample. 3 g of freshly collected leaves sample were extracted in 4% oxalic acid and made up to 100 mL and centrifuge for 10 minutes. 5 mL of the supernatant was pipetted out into 10 mL of 4% oxalic acid and titrated against the dye (V_2 mL).

$$\text{Amount of ascorbic acid mg/ 100 g sample} = \frac{0.5\text{ mg}}{V1\text{ mL}} \times \frac{V2\text{ mL}}{5\text{mL}} \times \frac{100\text{ mL}}{\text{Wt. of the sample}} \times 100$$

Determination of Crude Fat: Crude fat in plant samples was determined by extracting a known weight of powdered plant material with petroleum ether using Soxhlet apparatus (Sadasivam and Manickan 2008). The percentage of fat content was calculated using the formula

$$\text{Crude fat (\%)} = \frac{\text{Weight of the fat in the sample (g)}}{\text{Weight of the sample (g)}} \times 100$$

RESULT AND DISCUSSION

Ethnobotany

The result of the ethnobotanical exploration indicated that a wide range of wild plants are used by the locals as leafy vegetables, spices, fruits, etc. About 60 wild edible plants were documented during the field and market surveys.Field data were analyzed and attempt has been made to select the most utilized and preferred species by the community. Accordingly 5 species namely *Brassaiopsishainla*, *Gnetum gnemon, Pilea scripta, Rhyncho techum ellipticum* and *Sarcochlamys pulcherrima* used as vegetables and widely accepted in the tradition and culture of the *Rongmei* have been selected. One species *Gnetum gnemon* belongs to Gymnosperm while the rest are under Dicotyledons of Angiosperms. It has been found that all the 5 species used as vegetable are also used as medicine for curing different health ailments. The ethnomedicinal uses of these species reveals that the species are used for treatment of 7 different ailments. Among the 5 species, three species namely *Brassaiopsis hainla*, *Pileascripta* and *Rhynchotechum ellipticum* are used against two diseases each while *Gnetum gnemon* and *Sarcochlamys pulcherrima* are used to treat one disease each.Because of their common preference, these species are sold commonly in local marketswhich support the marginal income of the poor. The details of the ethnobotanical uses of all the 5 species with their botanical identity is provided (table 1).

Table-1: Ethnobotanical uses of wild edible plants

Botanical name [Family]; voucher specimens	**Local name** (*Rongmei*)	**Habit**	**Ethnobotanical uses**	
			As vegetable	As medicine
Brassaiopsis hainla Seem.[Araliaceae]; *RP-66*	*Lainong*	Shrub	Tender leaves cooked as vegetable.	i) Boiled leaves and inflorescence are taken against hypertension ii) Leaves decoction is taken against urinary problem
Gnetum gnemon L. [Gnetaceae]; *RP-01*	*Ganmakhen*	Shrub	Leaves cooked as vegetable. Roasted seed are edible.	Boiled leaves are taken for irregular menstrual cycle
Pilea scripta (Buch.-Ham. ex D. Don) Wedd.[Urticaceae]; *RP-08*	*Mariu-marei/ Turingnong*	Shrub	Leaves boiled as vegetable or eaten raw.	i) Boiled leaves are taken to relieve general body weakness ii) Fresh leaves are eaten against gastritis.
Rhynchotechum ellipticum (Wall. ex D. Dietr.) A. DC. [Gesneriaceae]; *RP-18*	*Gankarek*	Herb	Leaves cooked as vegetable or eaten raw with other food.	i) Leaves with crushed ginger are massaged over muscle cramp & sprain. ii) Boiled leaves are taken to relieve general body weakness
Sarcochlamys pulcherrima Gaudich. Voy. Bonite [Urticaceae]; *RP-04*	*Goibalei*	Shrub or small sized tree	Leaves cooked as vegetable; mostly preferred with tubers of *Colocasiasp*	i) Decoction of leaves along with fruits of gooseberry and mango tree bark are taken for diabetics. ii) Boiled leaves along with *Vernonia bicolor* leaves also taken for diabetics.

Ethnobotanical uses of these 5 species are very rarely reported from the region. The recent ethnobotanical works from the state (Salam *et al.,* 2010; Yumnam and Tripathi, 2012; Gangte *et al.,* 2013; Rajkumari *et al.,* 2013; Devi *et al.,* 2010; Singson *et al.,* 2015; Konsam *et al.,* 2016)do not cite the 5 species signifying the importance of the present report. However, the edible usage of *Rhynchotechum ellipticum* was reported by Pfoze *et al.,* (2011) from Senapati district of the state. The edible usage of *Rhynchotechum ellipticum*, *Sarcochlamys pulcherrima* and *Gnetum gnemon* by some tribes of Assam have also been reported (Sharma and Pegu, 2011; Terangpi *et al*., 2013; Medhi *et al.,* 2014).

Proximate nutritional composition

The proximate nutritional composition of the five plants is presented in table 2. The crude protein content of the five plant samples ranges from 8.93% (*Rhynchotechum ellipticum*) to 20.30% (*Sarcochlamys pulcherrima*). The present recorded range of the crude protein is found similar with some other wild vegetable plants preferred and consumed in different parts of India like *Amaranthus virdis* (7.95%), *Achyranthus aspera* (8.22%) and *Cissus quadrangularia* (12.16 %) (Vishwakarma and Dubey, 2011); *Oxalis corniculata* (22.28%), *Cassia obtusifolia* (20.25%), *Boerhavia diffusa* (16.7%) (Jain and Tiwari, 2012) and adjacent country like Bangladesh *Dryopterisfilixmas* (20.76 %) and *Enhydra fluctuans* (16.69%) (Satter *et al.,* 2016). On the other hand the recorded values are much higher than those found in some other wild leafy vegetables consumed in the region (Seal and Chaudhuri, 2015)as well as some commercial vegetables like spinach (2%), lettuce (2.1%), cabbage (1.8%), susni sag (3.7%), etc. (Gopalan *et al.,* 2004). These indicate that the wild leafy vegetables are also very good sources of protein. Maximum total carbohydrate content (16.06%) was obtained from *Brassaiopsishainla* and minimum in *Sarcochlamys pulcherrima* (5.55%). The present report is comparable to those species eaten by the tribes of the state Arunachal Pradesh like *Phoebe lanceolata* fruit (8.18%), *Pleurotus sajor-caju* fruiting body (13.62%), *Persearobusta* (12.24%), etc. (Saha *et al.*,2014)and *Urtica ardence* leaves (4%) from Uttarakh and (Jayanti *et al*., 2013).The leaves of *Brassaiopsis hainla* and *Gnetum gnemon* contained the highest amount of crude fibre (39.44%) and *Sarcochlamyspulcherrima* (10.51 %)had the least which are similar to some wild vegetables like *Homalomena aromatica* (8.54%), *Zanthoxylum rhetsa* (9.0%) and *Cajanus indicus* (9.65%) consumed in Meghalaya (Seal and Chaudhuri, 2015).The crude fibre content of these leafy vegetable is close to those reported in some wild edible food plants used in Pakistan and Arunachal Pradesh state of India (Shad *et al.,* 2013; Kalita *et al.,* 2013). The crude fibre content of the present study is higher than those in some commercial vegetables like broad beans (8.9%), cabbage (2.8%) and spinach (2.5%) as reported by Gopalan *et al.*,(2004).The vitamin C content was found maximum in *Sarcochlamys pulcherrima* (111.11mg/100g) and least in *Rhynchotechum ellipticum* (33.33mg/100g).These values are much higher than those found in domesticated vegetables like celery (9mg/100g), lettuce (18 mg/100g), green onions (32 mg/100g), tomatoes (23 mg/100g), etc. (Zennie and Ogzewalla 1977).Maximum amount of ether-extracted fat was found in leaves of *Pilea scripta* (2.93%) and least in the leaves of *Rhynchotechum elliptecum* (1.37%). The result was close to that found in some leaves of wild edible plants consumed by *Bodo* tribe of Assam (Brahma *et al.,* 2014). Similar range of crude fat content in dry weight (1.45 % to 4.76%) was also reported by Satter *et al.,* (2016) in leaves of some wild edible plants consumed in Bangladesh. Low fat content in the vegetable can be recommended to individuals suffering from overweight or obesity.

Table-2: Proximate nutritional composition of the wild edible plants

Species	Local name	Crude Protein (%)	Total carbohydrate (%)	Crude fibre (%)	Vitamin C (mg/100g)	Crude fat (%)
Brassaiopsis hainla	*Lai-nong*	13.83	16.06	13.25	77.70	1.79
Gnetum gnemon.	*Ganmakhen*	20.13	7.12	39.84	66.67	2.13
Pilea scripta	*Turingnong*	15.31	6.86	13.59	66.67	2.93
Rhynchotechum ellipticum	*Gankarek*	8.93	13.73	39.84	33.33	1.37
Sarcochlamys pulcherrima	*Goibalei*	20.30	5.55	10.51	111.11	1.48

CONCLUSIONS

Wild edible plants play an important role in daily life of the local people considering in terms of dietary nutrition, marginal income and even local health care. The *Rongmei* tribe of Manipur depends largely on wild plant resources for their livelihood and possesses rich traditional knowledge system. The 5 selected species that are mostly used by the *Rongmei* tribe for vegetables and medicine are also found with rich nutritional potential and areeven superior to some domesticated varieties. These species can be promoted for the large scale cultivation and marketing for the benefit of the local tribe and other communities.Domestication of such wild edible plants should be encouraged with proper conservative measures,sustainable utilization and harvesting of the resources to preserve the local gene pool.

ACKNOWLEDGEMENTS

The authors are grateful to the *Rongmei* people of Tamenglong district for their valuable information and co-operation during the field studies. The author also thank DST, New Delhi for providing financial assistance through INSPIRE fellowship sanctioned order no. DST/INSPIRE Fellowship/2013/685. The authors express their gratitude to Dr. C. Tamuly, Scientist & In-Charge, Council of Scientific and Industrial Research - North East Institute of Sciences and Technology (CSIR-NEIST) Branch Laboratory, Itanagar for extending all possible help and support during the nutritional analysis of the samples and Head of Department Forestry, NERIST for all facilities and encouragements.

Conflict of Interest: We declare that there is no conflict of interest in the present work.

REFERENCES

Afolayan, A.J. and Jimoh, F.O. (2009). Nutritional quality of some wild leafy vegetables in South Africa. Int J Food SciNutr.:Vol.60, 5, 424-431.

Brahma, J., Singh, B.,Rethy, P. and Gajurel, P.R.(2014). Nutritional analysis of some selected wild edible species consumed by the Bodo tribes of Kokrajar district, BTC, Assam.Asian J Pharm Clin Res.: Vol. 7, 3, 34-37.

Chowdhery, H.J., Giri, G.S. and Pramanik, A. (2009). Materials for the Flora of Arunachal Pradesh. Vol.3. Botanical Survey of India, Kolkata.

Daimei, P. and Kumar, Y. (2013). Ethnobotanical uses of gingers in Tamenglong district, Manipur, Northeast India.Genet Resour Crop Evol.:Vol. 61, 273-285. doi: 10.1007/s10722-013-0054-5

Deb, D. (2012). Meaning in Rongmei. Int Journal of Linguist.: Vol.4, 4, 24-35.

Deshmukh, B.S. and Waghmode, A. (2011). Role of wild edible fruits as a food resources: Traditional knowledge.Int J Pharm Life Sci.: Vol. 2,7, 919-924.

Devi, O.S.,Komor, P. and Das, D. (2010). A checklist of traditional edible bio-resources from Ima markets of Imphal Valley, Manipur.Indian J Threat Taxa.: Vol. 2, 11, 1291-1296.

Dwebe, T.P. and Mearns, M.A. (2011). Conserving indigenous knowledge as the key to the current and future use of traditional vegetables.Int J Inform Manage.:Vol.31, 6, 564-571.

FSI. (2015). India state of Forest Report.Ministry of Environment & Forest. P. 195.

http://fsi.nic.in/isfr-2015/isfr-2015-forest-and-tree-resources-in-states-and-union-territories.pdf(Accessed 24 Feb. 2016)

Gangte, H.E., Thoudam, N.S. and Zomi, G.T. (2013). Wild edible plants used by Zou tribe in Manipur, India.Int J Sci Res Publ.: Vol. 3,5, 1-8.

Gopalan, C., Rama, Sastri, B.V. and Balasubramanian, S.C.(2004). Nutritive Value of Indian Foods. National Institute of Nutrition, ICMR, Hyderabad.

Grivetti, L.E. and Ogle, B.M. (2000). Value of traditional foods in meeting macro- and micronutrient needs: the wild plant connection. Nutr Res Rev.: Vol. 13, 31-46.

Jain, A.K. and Tiwari, P. (2012). Nutritional value of some traditional edible plants used by tribal communities during emergency with reference to Central India. Indian J Tradit Know.:Vol. 11, 1, 51-57.

Jain, S.K. and Rao, R.R. (1977). A hand book of field and herbarium methods. Today's and Tomorrows Printers and publishers, New Delhi.

Jain, S.K. (1987). A Manual of Ethnobotany. Scientific Publisher, Jodhpur, India.

Jayanti, Agarwal, K. andSaini, P.(2013).Nutritional Assessment of Leaves of Wild edible plant *Urticaardence*. Indian J Pharm Biol Res.:Vol. 1, 2, 53-59.

Kalita, P., Tag, H.,Sarma, H.N. and Das, A.K. (2013). Evaluation of nutritional potential of five unexplored wild edible food plants from Eastern Himalayan Biodiversity Hotspot Region (India).Int J Biochem Biomol Agri Food Biotech Eng.:Vol. 8, 3, 215-218.

Kallas, J. (2010). Edible wild plants. Wild foods from dirt to plate. Gibbs Smith, Layton, Utah.

Konsam, S., Thongam, B. and Handique, A.K. (2016).Assessment of wild leafy vegetables traditionally consumed by the ethnic communities of Manipur, northeast India.J Ethnobiol Ethnomed.:Vol. 12, 9. doi: 10.1186/s13002-016-0080-4.

Makuga, G. (1994). Introduction to the Rongmei Nagas. Mr. & Mrs. Makuga, Imphal,

Martin, G.J. (1995). Ethnobotany. A Methods Manual. Chapman and Hall, London.

Medhi, P., Sarma, A. and Borthakur, S.K. (2014).Wild edible plants from the DimaHasao district of Assam, India. Pleione: Vol. 8,1, 133-148.

Myers, N., Mittermeier, R.A.,Mittermeier, C.G., da Fonseca, G.A. and Kent, J.(2000). Biodiversity hotspots for conservation priorities. Nature:Vol. 403, 853-856.

Namsa, N. D., Mandal, M., Tangjang, S. andMandal, S.C. (2011). Ethnobotany of the Monpa ethnic group at Arunachal Pradesh, India. J Ethnobiol Ethnomed.: Vol. 7, 31.doi:10.1186/1746-4269-7-31.

Narzary, H.M., Brahma, S. and Basumatary, S.(2013). Wild Edible vegetable consumed by Bodo tribe of Kokrajhar district (Assam), North-East India. Arch Appl Sci Res.:Vol. 5, 5, 182-190.

Panmei, R., Gajurel, P.R., Singh, B. and Rethy, P. (2014).Utilization pattern of non-timber forest products by Rongmei tribe of Manipur, northeast India.J Non-Timber Forest Prods.: Vol. 21,1, 9-20.

Pfoze, N.L., Kumar, Y. and Myrboh, B. (2011). Survey and assessment of floral diversity on wild edible plants from Senapati district of Manipur, Northeast India, J Biodivers Environ Sci.: Vol. 1, 6, 50-62.

Phangchopi, U., Tamuli, A.K. and Teron, R. (2014). Inventory of wild food plants in Marat Longri wildlife sanctuary in Assam, India.Pleione: Vol. 8, 2, 331-343.

Rajkumari, R., Singh, P.K., Das, A.K. and Dutta, B.K. (2013). Ethnobotanical investigation of wild Edible and medicinal plants used by the Chiru tribe of Manipur, India.Pleione: Vol.7, 1, 167-174.

Rongmei, K.S. and Kapoor, S. (2005). Zeliangrong Today: A Naga Tribe of Manipur.Stud Tribes Tribals: Vol. 3, 2, 105-116.

Sadasivam, S and Manickan, A. (2008). Biochemical methods. H. S. Polai, New Age International Delhi.

Saha, D., Sundriyal, M. and Sundriyal, R.C. (2014). Diversity of food composition and nutritive analysis of edible wild plants in a multi-ethnic tribal land, Northeast India: an important facet for food supply.Indian J Tradit Know.: Vol. 13, 4, 698-705.

Salam, S., Kumar, P.K. and Jamir, N.S. (2010). Wild edible plants used by the Tangkhul Naga tribe of Ukhrul district in Manipur. Pleione: Vol. 4, 2, 284-287.

Satter, M.M.A., Khan, M.M.R.L., Jabin, S.A., Abedin, N., Islam, M.F. and Shaha, B. (2016). Nutritional quality and safety aspects of wild vegetables consume in Bangladesh. Asian Pac J Trop Biomed.: Vol. 6, 2, 125-131.

Seal, T. and Chaudhuri, K. (2015). Ethnobotanical importance and nutritional potential of wild leafy vegetables of Meghalaya state in India. Int J ApplBiol Pharm.: Vol. 6, 1, 80-85.

Shad, A.A. Shah, H.U.and Bakht, J. (2013). Ethnobotanical assessment and nutritive potential of wild food plants. J Anim Plant Sci.: Vol. 23, 1, 92-97.

Sharma, U.K. and Pegu, S. (2011). Ethnobotany of religious and supernatural beliefs of the Mising tribes of Assam with special reference to the 'DoburUie'. J Ethnobiol Ethnomed.: Vol. 7, 16. doi:10.1186/1746-4269-7-16

Singh, B., Sinha, B.K., Phukan, S.J., Borthakur, S.K. and Singh, V.N. (2012). Wild edible plants used by Garo tribes of Nokrek Biosphere Reserve in Meghalaya, India. Indian J Tradit Know.: Vol. 11, 1, 166-171.

Singh, N.P., Chauhan, A.S. and Mondal, M.S. (2000). Flora of Manipur, series 2. Botanical Survey of India, Kolkata.

Singson, N., Deshworjit, S.N., Nanda, Y. and Rao, A.N. (2015).Wild edible plants associated with the Thadou-Kuki tribe of Manipur, India.Indian J Appl Res.: Vol.5, 6, 661-664.

Sinha, S.C. (1996). Medicinal Plants of Manipur. Manipur Association for Science and Society, Imphal,

Terangpi, R., Engtipi, U. and Teron, R. (2013). Utilization of less known plants, *Gnetumgnemon* L. and *Rhynchotechumellipticum*(Dietr.)A. DC. among the Karbis, Northeast India.J SciInno Res.: Vol. 2, 5, 943- 949.

Termote, C. and Van Damme, P. (2011). Eating from the wild: Turumbu, Mbole and Bali traditional knowledge on non-cultivated edible plants, District Tshopo, DRCongo. Genet Resour Crop Evol.: Vol.58, 585-618. doi: 10.1007/s10722-010-9602-4

The International Plant Names Index. (2012). www.ipni.org (Accessed 07 Dec 2015)

The Plant List. Version 1.1. 2013 www.theplantlist.org (Accessed 07. Dec 2015)

Tropicos.org. Missouri Botanical Garden. www.tropicos.org(Accessed 07 Dec 2015)

Vishwakarma, K.L. and Dubey, V.(2011). Nutritional analysis of indigenous wild edible herbs used in eastern Chhattisgarh, India. Emir. J Food Agric.: Vol. 23,6, 554-560.

Yumnam, J.Y. and Tripathi, O.P. (2012). Traditional knowledge of eating raw plants by the Meitei of Manipuri as medicine/ nutrient in their diet. Indian J Tradit Know.: Vol. 11, 1, 45-50.

Zennie, T.M. and Ogzewalla, C.D. (1977). Ascorbic Acid and Vitamin A content of edible wild plants of Ohio and Kentucky.Econ Bot.: 31, 76-79.

ISSN : 0976-4550

INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

Email : ijabpt@gmail.com

Website: www.ijabpt.com