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

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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 respondents using 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.

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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 remain unutilized 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 Zingiberaceae 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 111 km² 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 possible strategies 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 most 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., Rhynchochetochum ellipticum (Wall. ex D. Dietr.) A. DC., and Sarcochlamys pulcherrima Gaudeich. 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 km² and has total forest cover of 3,754 km² 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 Mongloid 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 50 informants (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 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 (V1 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 (V₂ mL).

Amount of ascorbic acid mg/ 100 g sample = \( \frac{0.5 \text{ mg}}{V_1 \text{ mL}} \times \frac{V_2 \text{ mL}}{5 \text{ mL}} \times \frac{100 \text{ mL}}{W_\text{t of the sample}} \times 100 \)

**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 *Brassaiopsis hainla*, *Gnetum gnemon*, *Pilea scripta*, *Rhynchotechum 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*, *Pilea scripta* 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 markets which 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**

<table>
<thead>
<tr>
<th>Botanical name [Family]; voucher specimens</th>
<th>Local name (Rongmei)</th>
<th>Habit</th>
<th>Ethnobotanical uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brassaiopsis hainla</strong> Seem.[Araliaceae]; RP-66</td>
<td>Lainong</td>
<td>Shrub</td>
<td>Tender leaves cooked as vegetable. i) Boiled leaves and inflorescence are taken against hypertension ii) Leaves decoction is taken against urinary problem</td>
</tr>
<tr>
<td><strong>Gnetum gnemon</strong> L. [Gnetaceae]; RP-01</td>
<td>Ganmakhen</td>
<td>Shrub</td>
<td>Leaves cooked as vegetable. Roasted seed are edible. Boiled leaves are taken for irregular menstrual cycle</td>
</tr>
<tr>
<td><strong>Pilea scripta</strong> (Buch.-Ham. ex D. Don) Wedd.[Urticaceae]; RP-08</td>
<td>Mariumarei/ Turingnong</td>
<td>Shrub</td>
<td>Leaves boiled as vegetable or eaten raw. i) Boiled leaves are taken to relieve general body weakness ii) Fresh leaves are eaten against gastritis.</td>
</tr>
<tr>
<td><strong>Rhynchotechum ellipticum</strong> (Wall. ex D. Dietr.) A. DC. [Gesneriaceae]; RP-18</td>
<td>Gankarek</td>
<td>Herb</td>
<td>Leaves cooked as vegetable or eaten raw with other food. i) Leaves with crushed ginger are massaged over muscle cramp &amp; sprain. ii) Boiled leaves are taken to relieve general body weakness</td>
</tr>
<tr>
<td><strong>Sarcochlamys pulcherrima</strong> Gaudich. Voy. Bonite [Urticaceae]; RP-04</td>
<td>Goibalei</td>
<td>Shrub or small sized tree</td>
<td>Leaves cooked as vegetable; mostly preferred with tubers of <em>Colocasia</em> i) Decoction of leaves along with fruits of gooseberry and mango tree bark are taken for diabetics. ii) Boiled leaves along with <em>Vernonia bicolor</em> leaves also taken for diabetics.</td>
</tr>
</tbody>
</table>
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 Rhynchotetrum ellipticum was reported by Pfoze et al., (2011) from Senapati district of the state. The edible usage of Rhynchotetrum 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% (Rhynchotetrum 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 viridis (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 Brassaiopsis hainla 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 ardens leaves (4%) from Uttarakhand and (Jayanti et al., 2013). The leaves of Brassaiopsis hainla and Gnetum gnemon contained the highest amount of crude fibre (39.44%) and Sarcochlamys pulcherrima (10.51%) had the least which are similar to some wild vegetables like Homalomena aromatica (8.54%), Zanthoxylum rhetsa (9.0%) and Cajanhus 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 Rhynchotetrum 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 Rhynchotetrum ellipticum (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**

<table>
<thead>
<tr>
<th>Species</th>
<th>Local name</th>
<th>Crude Protein (%)</th>
<th>Total carbohydrate (%)</th>
<th>Crude fibre (%)</th>
<th>Vitamin C (mg/100g)</th>
<th>Crude fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassaiopsis hainla</td>
<td>Lai-nong</td>
<td>13.83</td>
<td>16.06</td>
<td>13.25</td>
<td>77.70</td>
<td>1.79</td>
</tr>
<tr>
<td>Pilea scripta</td>
<td>Turingnong</td>
<td>15.31</td>
<td>6.86</td>
<td>13.59</td>
<td>66.67</td>
<td>2.93</td>
</tr>
<tr>
<td>Rhynchotetrum ellipticum</td>
<td>Gankarek</td>
<td>8.93</td>
<td>13.73</td>
<td>39.84</td>
<td>33.33</td>
<td>1.37</td>
</tr>
<tr>
<td>Sarcochlamys pulcherrima</td>
<td>Goibalei</td>
<td>20.30</td>
<td>5.55</td>
<td>10.51</td>
<td>111.11</td>
<td>1.48</td>
</tr>
</tbody>
</table>
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 are 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. 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.

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

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