J. Soils and Crops 32 (1) 71-75, June 2022

ISSN 0971-2836 (Print)
ISSN 2582-2756 (Online)

# HIGHLIGHTING THE POTENTIALITIES OF FIVE UNDERUTILZED SPICES USED BY THE *KARBI* TRIBE OF ASSAM, INDIA

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## ABSTRACT

**Potentialities of underutilized spices remain mostly unnoticed because of limited reliable research available to support them. Therefore, in this paper we attempt to highlight five underutilized spices used as flavoring and medicinal agents by the *Karbis* of Assam. To validate its potentialities we added a brief note on the botanical descriptions of the spices and investigated the proximate compositions, vitamin contents and mineral contents of the spices. The spices analyzed were *Boesenbergia rotunda* (L.) Mansf., *Kaempferia galanga* (L.), *Lippia alba* (Mill.) N.E. Br. ex Britton and P.Wilson, *Pandanus amaryllifolius* Roxb. and *Zanthoxylum rhetsa* DC. These spices are observed to be grown naturally in nearby forest areas in the region or in home gardens, sometimes cultivated in *juhm* field; these spices are consumed and traded locally in the region. The nutritional compositions analyzed shows varied differences in their nutrient content. The moisture content estimated ranged from 3.96 - 8.38 %, ash 6.96 - 12.5 %, crude protein 2.2 - 5.89 %, total lipid 1.58 - 40.12 %, crude fibre 3.4 - 11.25 %, total carbohydrate 33.11 - 80.3 %, vitamin C 5.0 - 280 mg $100^{-1}$, vitamin A 6.8 - 190 mcg $100^{-1}$, iron 1.2 - 9.4 mg $100^{-1}$, magnesium 31.4 - 314 mg $100^{-1}$ and calcium 50.2 - 731 mg $100^{-1}$ respectively on dry weight basis. The overall analyses results of the investigated spices shows considerable nutrients compositions which is an indicative that these spices could be exploited as potential source for nutritional supplements. Researchers and agricultural scientists have to give more attention to such crops to increase economic security to tribal farmers by giving employment and fetching good returns from their sale in raw form as well as value added products.**

**(Key words: Underutilized, spices, nutrients, potentialities, *Karbi* tribe)**

## INTRODUCTION

The crops which are neither grown commercially on large scale nor traded widely are generally termed as underutilized. Most of them have remained either wild or semi-domesticate (Larrinsangpuii *et al.*, 2016). Some of these crop species may be widely distributed globally, but are restricted to a more local production and consumption system (Ebert, 2014). Underutilized crops are found in numerous agricultural ecosystems and often survive mainly in marginal areas (Williams and Haq, 2002). Underutilized crops have been part and parcel of the food dishes, especially to the ancient rural and peri-urban dwellers. Underutilized crops are often rich in nutrients when compared to more popular staple crops. They often contain high levels of protein, vitamins, phytochemicals and they can have a good macronutrient profile of fat, protein and carbohydrate (Anand *et al.*, 2020). However, researchers and agricultural scientist have given little or no attention to such crops as to what constituents their potential in curbing hidden hunger (Chacha and Laswai, 2020). According to Nandal and Bhardwaj (2014) the underutilized crops have the potential to give economic security to tribal's by giving employment and fetching good returns from their sale in raw form as well as value added products. Underutilized food crops are represented by different categories of grains, pulses, vegetables, fruits and spices, and among all these categories spices though are considered as the major flavoring agents which makes food more palatable are the least researched underutilized crops around the world because of its very small quantity of uses. Even though spices in different forms are observed to be eaten on daily basis by the people around the globe its nutritional properties were least studied, while on the other hand there is explosion of literatures relating to its nutraceutical properties. Generally the leaf of a plant used in cooking may be referred to as a culinary herb, and any other part of the plant, often dried as a spice. Spices can be the buds, bark, roots, berries, aromatic seeds and even the stigma of a flower (Tapsell *et al.*, 2006). For the people throughout the world spices stimulate the appetite, add flavor to food and create visual appeals in meals (Raghavan, 2006; Okonkwo and Ogu, 2014). Many traditional herbal formulations have spices as their base (Borquaye *et al.*,

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2017). This paper deals with five underutilized spices used by the *Karbis* for different culinary and ethno medicinal preparations. The *Karbis* have been using these spices from centuries as flavoring agents in their varieties of exotic culinary preparations but presently it was observed that these spices are highly neglected as more palatable, productive, and profitable spices are introduce by the present day agricultural and trade systems. The use of these spices today has been observed only in rural areas where market supplies are not organized or limited and forest resources are rich. It is also observed that these spices once a regular major ingredient in the local diets are now known only as ethno medicines because of its uses in ethno medicinal formulation more than as culinary spices resulting in drastic degradation of traditional knowledge of these spices. Therefore, there is an urgent need to promote these traditional spices used by the *Karbi* tribe to address food and nutritional security issues of the present day by helping these local spices from vanishing and introducing them along with the mainstream spices. It was also observed that during the previous studies by different researchers these traditional spices were never fully investigated and therefore, this work will be a small contribution to the scanty of literatures available from the region pertaining to the reported underutilized spices.

# MATERIALS AND METHODS

**Data collection**

The study was carried out in *Karbi* Anglong district of Assam, India. It is the largest district of Assam with an area of 10.434 square kilometer. The region is a home to many indigenous tribes of Assam. The *Karbis* are the original tribe inhabiting in majority in the region. Besides the original *Karbi* tribe the *Bodos, Dimasas, Kukis, Tiwas, Garos, Man-tai, Khasi, Chakmas* and *Rengma nagas* are the other tribal communities observed to be inhabited in the district. Extensive field survey was undertaken to collect the ethno botanical data during the year 2016 to 2018. The information on traditional spice plants used in culinary preparation by the *Karbi* tribe was collected through observation and interview with the local indigenes particularly the women group for their knowledge and role in collecting and cooking of local cuisines using underutilized wild vegetables and spices are more than the other groups of the studied tribe. The spice plant was then collected from the field in extensive quantity and brought to the department of Life Science and Bioinformatics, Assam University Diphu Campus for identification and for further analysis.

**Sample preparation**

Spices samples in the form of leaves and rhizomes were collected from the field from different areas of Karbi Anglong according to their availability. Those were then washed thoroughly under running water to remove the foreign materials and kept in a clean *beleng* (a plate like traditional hand crafted tool made of bamboo, used by the locals for drying veggies and fishes). All the plant materials were then dried under sunlight for one hour and shade dried for some days. The dried material was then pounded with a mortar and pestle into coarse powder and stored in air-tight containers for chemical analyses. All the chemical analyses were performed at Assam University, Diphu Campus, Diphu.

**Nutritional analyses**

The moisture, ash, crude protein, crude fats, and crude fibre content were determined according to procedures established by Helrich, (1990). The moisture content (%) was determined by oven drying at 100±5ÚC to constant weight, ash content (%) by incineration in muffle furnance at 580ÚC for 4 hours, crude protein (%) by Macro Kjeldahl method, crude fats (%) by soxhlet extraction with petroleum ether, and crude fibre by non- enzymatic gravimetric. Total carbohydrate was estimated by using phenol-sulphuric acid methods described by Deb and Khruomo, (2021). Vitamin A was determined by spectrophotometric method and vitamin C by iodometric titration method described by Oteng *et al.* (2020). Estimation of essential elements calcium (Ca), magnesium (Mg) and iron (Fe) was done by the Atomic Absorption Spectrophotometric method adopted by Seal *et al.* (2016).

# RESULTS AND DISCUSSION

**Botanical descriptions and culinary uses**

*Boesenbergia rotunda* (L.) Mansf.: *B. rotunda* is perennial herb with short stem that is replaced by pseudo stems, formed by leaf sheaths growing up to 15-45 cm in height. There are 3-5 leaves which are 7-11 cm in width and 10-20 cm in length which are not divided, oval or elongate shape. The surface of rhizome is light brown and yellow inside, ovoid-globose and strongly aromatic. Its rhizome looks like fingers which are growing from a central part (Eng-Chong *et al.*, 2012; Ongwisespaiboon and Jiraungkoorskul, 2017). The rhizomes are used as flavoring agents and as condiments in many traditional non-vegetarian cuisines of the *Karbis* (Figure 1A).

*Kaempferia galanga* (L) : *K. galanga* is a perennial aromatic herb with very fragrant underground parts. Leaves two or more, spreading flat on the ground, round ovate, thin deep green, petioles very short, channeled; flowers white with purplish spots in the axillary fascicles; the underground rhizome has one or more prominent, vertically oriented tuberous root stock and many small secondary tubers and roots, their tips becoming tuberous (Preetha *et al.*, 2016; Shetu *et al.*, 2018). The leaves and rhizomes are used for flavoring non-vegetarian cuisines by the *Karbis* (Figure 1B).

*Lippia alba* (Mill.) N.E. Br. Ex Britton and P. Wilson: *L. alba* is straggling shrubs with a quadrangular branch reaching 1.7 m in height. Young branches are velvet-hairy, hairless when matured. The leaves are petiolate, pubescent,

opposite or ternate, sparsely velvet-hairy above and silvery velvet-hairy beneath. The flowers are 3-5 mm, pinkish white (Or-Rashid *et al*., 2013). The young leaves are used as spice. Young leaves are mostly used in preparing chutney along with dry fish, garlic and green chilies (Figure C).

*Pandanus amaryllifolius* Roxb.: *P. amaryllifolius* are vertical green plants with fan-shaped sprays of long, narrow, blade-like leaves reaching a maximum height of 4.5 m. The stems are slender about 2.5 cm thick, decumbent and ascending reaching 1.0 - 1.6 m tall. The leaves are middle to pale green, somewhat flaccid, more or less glaucous beneath and the apex with a very few prickles less than 1 mm long. The blades are commonly 25 - 75 cm in length and 2 - 5 cm in width. Aerial roots are distinct (Wakte *et al*., 2009; Sonowal and Bhuyan, 2012). The leaves are used for flavoring rice by the *Karbis*. They also cherished an herbal red tea flavored with leaves of *P. amaryllifolius* (Figure 1D).

*Zanthoxylum rhetsa* DC.: *Z. rhetsa* is flowering shrub or tree that sometimes grows to a height of 26 m. The plant is sometimes deciduous and has stems with thick cone-shaped spines on the older stems. The leaves are 140 - 230 mm long and pinnate with 9 - 23 egg shaped to elliptical leaflets. The flowers are arranged on the end of branch lets, sometimes also in leaf axils, in panicles up to 150 mm long (Maduka and Ikpa, 2021). The young leaves are used by the *Karbis* as condiment for fish curry to remove the fishy smell and give a lemon like flavor (Figure 1E).

**Nutritional compositions of spices**

The results of the nutrients estimated are summarized in Table 1. In our study it was observed that the nutritional compositions of the studied underutilized spices showed varied differences because of differences in their stages of harvesting and different in parts used as spices. The moisture content was observed to be ranged from 3.96 - 8.38 % in dry weight. The lowest was observed in *Pandanus amaryllifolius* (3.96 %) and highest in *Lippia alba* (8.38 %). The low ranged of moisture content in these spices is an indicative that the shelf-life of these spices is long and microbial deterioration of these spices is limited. The ash content of the spices ranged from 6.96 - 12.5 % in dry weight. The lowest was estimated in *Zanthoxylum rhetsa* (6.96 %) and highest in *Lippia alba* (12.5 %). The high range of ash content reflects the presence of rich mineral concentrations in these spices. Crude protein content of studied spices ranged from 2.2 - 5.89 % on dry weight basis. Lowest recorded in *Pandanus amaryllifolius* (2.2 %) and *Boesenbergia rotunda* (2.61 %) and highest in *Lippia alba* (5.89 %) and *Kaempferia galanga* (5.8 %). Proteins are the basic essential components required in daily diets of consumers. The presence of crude protein contents in these spices represents that plants are the richest and cheapest sources of proteins on this earth. Crude fats ranged from 1.58 - 40.12 % on dry weight basis. Lowest observed in *Kaempferia galanga* (1.58 %) and highest in *Lippia alba* (40.12 %). Adequate fats content in spices indicates that these spices can be recommended as low-fat diet for human consumption. Crude fibre content estimated ranged from 3.4 - 11.25 % on dry weight basis. Lowest in *Pandanus amaryllifolius* (3.4 %) and highest in *Boesenbergia rotunda* (11.25 %). Crude fibre though doesn't contribute in nutritive value of food but it's always recommended for proper digestion of food. Total carbohydrate of the spices ranged from 33.11 – 80.3 %. It was recorded highest in *Pandanus amaryllifolius* (80.3 %) and lowest in *Lippia alba* (33.11 %). High carbohydrate content in spices indicates that these spices have high energy content. Vitamin C was estimated highest in *Zanthoxylum rhetsa* (280 mg $100^{-1}$) and lowest and similar in *Pandanus amaryllifolius*, *Kaempferia galanga* and *Boesenbergia rotunda* with a value of 5.0±1 mg $100^{-1}$ each. Vitamin C, one of the most essential vitamins which play a hefty role in hundreds of body functions. Vitamin A was highest in *Pandanus amaryllifolius* (190 mcg $100^{-1}$) and lowest in *Boesenbergia rotunda* (6.8 mcg $100^{-1}$), whereas it was absent in *Zanthoxylum rhetsa.* A small quantity of vitamin A is always required for the proper functioning of the body such as vision, reproduction growth and development and boosting immunity. The three essential elements estimated were Iron (Fe), calcium (Ca) and magnesium (Mg). Iron content was observed highest in *Zanthoxylum rhetsa* (9.4 mg $100^{-1}$) and lowest in *Boesenbergia rotunda* (1.2 mg $100^{-1}$) and *Kaemperia galanga* (1.8 mg $100^{-1}$). Iron is the most vital elements required for proper functioning of human health. It helps in boosting hemoglobin and treats anemia. Calcium content was estimated highest in *Zanthoxylum rhetsa* (731 mg $100^{-1}$) and lowest in *Kaempferia galanga* (50.2 mg $100^{-1}$). Calcium helps in maintaining proper bone and teeth health. It is the most abundant element found in human body. Magnesium was highest in *Zanthoxylum rhetsa* (314 mg $100^{-1}$) and lowest in *Kaempferia galanga* (31.4 mg $100^{-1}$). Magnesium helps with muscle and nerve function, regulates blood pressure and supports the immune system in human body.

The present study was an attempted to untapped the potentialities of five underutilized spices used in *Karbi* cuisines. From our data estimated for the five spices we observed that these spices have a remarkable amount of nutrient present in them in addition to their role as flavoring agents. In rural areas these spices serves as a nutritional source and is available throughout the year. In our interaction with the local indigenes we were told that the traditional knowledge relating to these spices are decreasing from the region. Therefore, there is an urgent need for further research regarding these spices and introduced these spices to the mainstream spices category as today demand for more natural food ingredients is increasing for a healthy life.

**Table 1. Nutritional compositions of spices**

| Nutrients | Name of spices | | | | | Units |
|---|---|---|---|---|---|---|
| | *Boesenbergia rotunda* | *Kaempferia galanga* | *Lippia alba* | *Pandanus amaryllifolius* | *Zanthoxylum rhetsa* | |
| **Moisture** | 6.73 | 7.95 | 8.38 | 3.96 | 6.2 | % |
| **Ash** | 9.35 | 11.76 | 12.50 | 9.95 | 6.96 | % |
| **CrudeProtein** | 2.61 | 5.80 | 5.89 | 2.20 | 3.80 | % |
| **Crude fats** | 1.65 | 1.58 | 40.12 | 3.59 | 3.51 | % |
| **Crude fibre** | 11.25 | 7.9 | 5.69 | 3.40 | 6.20 | % |
| **Total carbohydrate** | 59.39 | 72.91 | 33.11 | 80.3 | 79.53 | % |
| **Vitamin C** | 5.10 | 5.000 | 20.00 | 5.0 | 280.00 | mg |
| **Vitamin A** | 6.80 | 7.45 | 12.60 | 190.00 | AB | mcg |
| **Iron** | 1.20 | 1.80 | 8.52 | 5.50 | 9.40 | mg |
| **Magnesium** | 48.00 | 31.40 | 220.00 | 261.00 | 314.00 | mg |
| **Calcium** | 150.00 | 50.20 | 248.00 | 136.00 | 731.00 | mg |

AB: absent

**Figure 1. List of spices used by the *Karbis***

*A. Boesenbergia rotunda*

*B. Kaempferia galanga*

*C. Lippia alba*

*D. Pandanus am aryllifolius*

*E. Zanthoxy lum rhetsa*

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**Rec. on 24.11.2021 & Acc. on 28.11.2021**