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#### **RESEARCH ARTICLE**

# Traditional consumption and therapeutic beliefs of *Calamus tenuis* Roxb. edible shoots of forest village natives of Dibrugarh district of Assam, India

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#### Abstract

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A proforma based survey was conducted in five forest villages of Dibrugarh, Assam, India. This study explored the use of Calamus tenuis Roxb. shoot in various culinary preparations, consumption, sources, storage, therapeutic and health issues beliefs, history of various diseases and its association with the consumption of the shoots. Consumption practices revealed that shoots are consumed in raw, boiled, fried and roasted forms and also cooked in combination with other edible items like fish, meat, black gram pulses, etc. It is mostly consumed during the period of March to May due to its easy and increased availability. Shoots are obtained from local market, forest or grown in kitchen garden. They are stored on dry floors at room temperature for upto 10 days. Chi square analysis between Socio Economic Status (SES) data and consumption frequency of shoots revealed that subjects who had higher education and better occupation consumed shoots frequently and in more amounts. Subjects belonging to upper class of SES consumed shoots in less amounts. Discussion with the subjects revealed that consumption of shoots improved immunity, purified blood, raw intake killed intestinal worms, etc. and was reported to worsen gastritis and cause stomach problem if taken in empty stomach and at night. This is the first report on Calamus tenuis Roxb. shoots consumption, cooking pattern and therapeutic and health issues beliefs. The findings imply towards therapeutic potential of shoots and encourage for scientific scrutiny for its consumption as functional food.

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# **INTRODUCTION**

#### 1.1. Plants as food and ethnomedicine

Plants have been a nature's gift to mankind and are important sources of food, fodder, fuel and as herbal remedies against various ailments (Prasad et al., 2010). Forest supports the availability of wild edible vegetables which plays an important role as an integral part of life for many indigenous communities serving as alternatives to staple food during scarcity and also contribute as valuable supplement for availing nutritionally balanced diet (Amadi and Duru, 2014; Deshmukh and Rathod, 2013).

Indian subcontinent is being inhabited by over 53.8 million tribal people in 5000 forest dominated villages of tribal community and comprising 15% of the total geographical area of Indian landmasses, representing one of the greatest emporia of ethno-botanical wealth (Ciba Foundation Symposium 185, 1994).

Assam, with diverse ethnic communities and socio-cultural complexities, has maintained one of the oldest and most diverse traditions associated with the use of ethno-medicinal plants. The herbal medicines occupy a distinct place in our life that provides information on the use of plants or plant parts as traditional medicine. The existence and

dependency on a large number of traditional practices can be thought of as an alternative type of medicine, where the cost and side effects is negligible (Borah et al., 2009).

There are some varieties of wild *Calamus sp.* also known as Rattan are edible and used in Ayurveda to treat various diseases like fever, piles, dyspepsia, biliousness, etc. Rattan is commonly known as Jati bet (India), Bet (Bangladesh), Wai nyair (Laos), Kyien dui (Myanmar), Pani bet (Nepal), Wai khom (Thailand), May dang (Vietnam) and is an important ethnomedicinal plant (Henderson, 2009). It grows mostly on lowlands, rainforest, swamps, flooded area along river margins and is also cultivated (Henderson, 2009). Rattan is distributed in hilly and swampy landscape of Bangladesh, Bhutan and some of the South-East Asian countries (Laos, Nepal, Myanmar, Thailand and Vietnam). In India, besides North-Eastern states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura), rattan is found in West Bengal, Bihar, Uttarakhand and Uttar Pradesh. There are over 70 species of rattan reported from India till date (Shaanker et al., 2004). Canes of rattans are harvested for making furniture, cordage, baskets and handicrafts. Edible fruits of many species of rattan are consumed as functional food for their therapeutic potentials (Durst et al., 1994). They have also been found to have antiseptic and anti-bacterial properties (Khare, 2007). Other reports on *Calamus sp.* include anti-diabetic activity (Tag et al., 2012), anthelmintic (Borah et al., 2013), cell growth and cell cycle inhibitory activity against tumor cells (Takashi et al., 2006), anti-inflammatory and cell proliferation inhibition potential (Yu et al., 2008). Tender shoots are consumed either raw or as vegetable by natives of India as well as other South-East Asian countries (Manohara, 2013). Shoots of various species of rattan are also consumed in Philippines (Durst et al., 1994), France, United States, Lao PDR (People's Democratic Republic) and Thailand (Dransfield et al., 2002) due to their rich proteins, carbohydrates, minerals and fibre content. These attributes make rattan a preferred and popular dietary supplement for rural populace in various countries across South-East Asia (Manohara, 2013).

#### 1.2. Calamus tenuis Roxb.

*Calamus tenuis* Roxb. (fam. Arecaceae) is one such edible variety of rattan which is found in Dibrugarh district of Assam, India. Its fruits are known to have antioxidant and cytotoxic potentials (Ahmed et al., 2014); analgesic and CNS depressant activities (Hossain, 2013). Shoots are consumed as vegetables and its occasional consumption is traditionally known to have therapeutic potential against stomach disorder and intestinal worms (Saikia and Khan, 2011). However, there was no documentation found on consumption pattern, traditional therapeutic beliefs and practices and health issues due to consumption of the shoot; among the inhabitants of forest villages of Dibrugarh district of Assam, India and hence it was thought pertinent to do the survey for the same.

#### 1.3. Description of the study area

The Dibrugarh district of Assam, India extends from  $27^{\circ}$  5' 38" N to  $27^{\circ}$  42' 30" N latitude and 94° 33' 46" E to 95° 29'8" E longitude. It is bounded by Dhemaji district on the north, Tinsukia district on the east, Tirap district of Arunachal Pradesh on the south east and Sibsagar district on the north and south west. The area stretches from the north bank of the mighty river Brahmaputra, which flows upto a length of 95 km through the northern margin of the district, to the Patkai foothills on the south (Geography of Dibrugarh district, 2015) (Figure 1). The district occupies an area of 3381 Sq Km (Dibrugarh district, 2015). The total population recorded is 11,85,072. Among which rural population comprises of 9,56,634 and urban of 2,28,438 number of people. There are 1362 total villages in Dibrugarh district among which 27 are forest villages (Dibrugarh district census, 2001).

The main communities inhabiting the district includes Tea tribes (Adivasi), Ahoms, Sutiya, Sonowal Kacharis, Muttock, Moran people, Deori, Bengali etc. There are also some Tai speaking Buddhist communities like Tai Phake, Khamti and Khamyang. Languages commonly used in the district are Assamese, English, Hindi and Bengali.



Figure 1: Dibrugarh district of Assam, India

# 2. Materials and methods

#### 2.1. Ethical approval

The study protocol was approved by the Medical Ethical Committee of the Foods and Nutrition department of The Maharaja Sayajirao University of Baroda, Vadodara in compliance with the guidelines issued by Indian Council of Medical Research with the Medical ethics approval number- IECHR/2014/21.

#### 2.2. Plant identification

The plant was identified and authenticated by Dr. A. A. Mao, Botanical Survey of India, Eastern Regional Centre, Shillong and a voucher specimen (Specimen no. MSU/PKT/2013/11, Reference no. BSI/ERC/2013/Tech/Plant identification/669) was deposited in BARO herbarium, Department of Botany, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat for future references.

#### 2.3. Description of Study population

The major inhabitants of the selected forest villages for the study were Ahoms, Sonowal Kacharis, Deori, Muttock and Moran people. Most of the family types were joint or nuclear. Most of them could speak, read and write their native language Assamese and some of them could speak Hindi and English as well.

#### 2.4. Sample size

Five forest villages viz. Tingkhong Village, Hati Gandhori Village, Telpani Village, Modhupur Deori Village and Kaliyoni Village were conveniently selected for the study and 70 households from each village were purposively selected. Head of the family or its substitute were selected from each household who gave his/her written consent to participate in the survey. A total of 350 adult subjects were selected for the study.

#### 2.5. Tool

A structured and pretested proforma was used to elucidate the information on various aspects including: (1) general information and socio-economic status (Patro et al., 2012), (2) use of the shoot in various culinary preparations, (3) frequency and reason of consumption of the shoot, (4) sources of the shoot and its storage practices, (5) beliefs about uses of shoot for healing various diseases, (6) known health issues related to shoot consumption and (7) history of various diseases and its association with the consumption of the shoots. These objectives provided a background to the use of Calamus *tenuis* Roxb. shoots as edible in various forms of consumption pattern and culinary preparations, source and storage practices, traditional therapeutic and health issues beliefs due to consumption and its association with consumption of the shoots.

#### 2.6. Statistical Analysis

The obtained data was entered in a Microsoft excel (2007) spreadsheet. It was cleaned and verified for appropriate statistical analysis. Number and percent calculation was done by using Microsoft excel (2007) and Chi Square was calculated for obtaining association between consumption pattern and other parameters by using Epi Info (7.0).

| Parameters     |                              | Ν   | %     |
|----------------|------------------------------|-----|-------|
| Education      | Illiterate                   | 24  | 6.86  |
|                | Primary School               | 57  | 16.29 |
|                | Middle School                | 66  | 18.86 |
|                | High School                  | 82  | 23.43 |
|                | Intermediate                 | 99  | 28.29 |
|                | Graduate and above           | 22  | 6.29  |
| Occupation     | Unemployed                   | 5   | 1.44  |
|                | Unskilled worker             | 27  | 7.71  |
|                | Semi-skilled worker          | 32  | 9.14  |
|                | Skilled worker               | 25  | 7.14  |
|                | Clerical, shop-owner, farmer | 247 | 70.57 |
|                | Professional                 | 14  | 4.00  |
| Total monthly  | Upto 4203                    | 56  | 16.00 |
| income (Rs)    | 4204-7015                    | 128 | 36.57 |
|                | 7016-10532                   | 123 | 35.14 |
|                | 10533-14049                  | 29  | 8.29  |
|                | 14050-23113                  | 10  | 2.86  |
|                | ≥28114                       | 4   | 1.14  |
| Socio economic | Class I                      | 4   | 1.14  |
| status (SES)   | Class II                     | 32  | 9.14  |
|                | Class III                    | 200 | 57.1  |
|                | Class IV                     | 114 | 32.6  |

### 3. Results

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The Mean  $\pm$  SD age of the subjects interviewed was  $39.42 \pm 11.27$  years. As seen in Table 1, most subjects (86.87%) were educated upto secondary level and only 6.86% were illiterate and a very few (6.29%) were graduates and postgraduates. 94.56% subjects were engaged as unskilled worker, clericals, shop owners and in farming. Only

4% had high professions and very few (1.44%) were found to be unemployed. Total monthly income of most subjects (71.17%) was in the range of Rs. 4204-10532 and a majority of the subjects surveyed belonged to SES class III and IV.

| Parameters                 |                                      | Ν   | %      |
|----------------------------|--------------------------------------|-----|--------|
| Cooking pattern            | Boiled                               | 218 | 62.29  |
|                            | Roasted                              | 271 | 77.43  |
|                            | Fried                                | 350 | 100.00 |
|                            | Pickled                              | 0   | 0.00   |
|                            | Raw                                  | 56  | 16.00  |
|                            | In combination with other food items | 115 | 32.87  |
| Intake frequency           | Occasionally                         | 188 | 53.71  |
|                            | Monthly                              | 122 | 34.86  |
|                            | Weekly                               | 26  | 7.43   |
|                            | Seasonally                           | 13  | 3.71   |
|                            | Occass. / Season.                    | 1   | 0.29   |
| Period of max. consumption | March-May                            | 101 | 28.86  |
| round the year             | Apl-May                              | 139 | 39.71  |
|                            | March-Apl                            | 95  | 27.14  |
|                            | Apl-June                             | 3   | 0.86   |
|                            | Apl                                  | 9   | 2.57   |
|                            | March-June                           | 3   | 0.86   |

| Table 2:  | Consumption | and cooking n | attern of <i>Calan</i> | <i>nus tenuis</i> Roxb | , shoots |
|-----------|-------------|---------------|------------------------|------------------------|----------|
| I able 2. | Consumption | and cooming p | attern or Camin        | ins icinis hori        | · snoots |

According to Table 2, cooking pattern of *Calamus tenuis* Roxb. shoots revealed that most subjects followed frying, roasting and boiling as most preferred methods. Some subjects (32.87%) also practiced cooking the shoots in combination with other food items like fish, meat, red ant eggs, elephant apple, mustard flakes, wrapped in edible leaves and with black gram pulses. Few consumed in raw form. Most subjects resorted to occasional or monthly consumption of the shoot round the year. Highest consumption of the shoot was observed during the period of March to May as compared to other months of the year.

| Parameters |                        | Ν   | %     |
|------------|------------------------|-----|-------|
| Sources    | Only Forest            | 68  | 19.43 |
|            | Forest, Garden         | 84  | 24.00 |
|            | Forest, Garden, Market | 23  | 6.57  |
|            | Forest, Market         | 88  | 25.14 |
|            | Garden, Market         | 9   | 2.57  |
|            | Only Market            | 78  | 22.29 |
| Storage    | About 5 to 7           | 14  | 3.99  |
|            | About 7 to 10          | 335 | 95.72 |
|            | No idea                | 1   | 0.29  |

 Table 3: Sources and storage of Calamus tenuis Roxb. shoots

As seen in Table 3, the source of *Calamus tenuis* Roxb. shoots for most subjects was forest followed by local market and some grew shoots in their kitchen garden. Most of the people mentioned that the shoot can be stored on cold and dry floor at room temperature for about 7 to 10 days, while some other said that it could be stored for about 5-7 days only.

| Parameters             |               | Ν   | %     |
|------------------------|---------------|-----|-------|
| Therapeutic beliefs    | Believers     | 101 | 28.86 |
|                        | Non-believers | 249 | 71.14 |
| Health issue beliefs   | Believers     | 66  | 18.86 |
|                        | Non-believers | 284 | 81.14 |
| Subjects' medical      | Reported      | 110 | 31.43 |
| condition *            | Not-reported  | 240 | 68.57 |
| Family medical history | Reported      | 31  | 8.86  |
|                        | Not-reported  | 319 | 91.14 |

 Table 4: Therapeutic and health issue beliefs due to consumption of Calamus tenuis Roxb. shoots, subjects' medical condition and family medical history of the subjects

\*Prevalence of cardio vascular disease, diabetes mellitus, gastro intestinal disorder, skin disease, kidney stone, dental disorder, eye disorder, body pain, etc.

As seen in Table 4, most of the subjects did not believed that the consumption of *Calamus tenuis* Roxb. shoots treat illness (71.14%) or cause side effect (81.14%). Majority of them did not report their medical condition (68.57%) and family medical history (91.14%).

# Table 5: Association of consumption of Calamus tenuis Roxb. shoots with education, occupation, income, socio economic status (SES), therapeutic beliefs, health issue beliefs, subjects' medical condition, family medical history and sources of the shoots.

| Parameters            |                                  | Consumption (< 80) | Consumption ( $\geq$ 80) | Chi sq.            |
|-----------------------|----------------------------------|--------------------|--------------------------|--------------------|
|                       |                                  | N (%)              | N (%)                    | $(\mathbb{P}^2)$   |
| Education             | Upto Primary                     | 30 (37.04)         | 51 (62.96)               | 54.72***           |
|                       | Middle – High school             | 86 (58.10)         | 62 (41.90)               |                    |
|                       | Intermediate and above           | 89 (73.55)         | 32 (26.45)               |                    |
| Occupation            | Unemployed – Unskilled<br>worker | 13 (40.62)         | 19 (59.38)               | 19.04***           |
|                       | Semi skilled – Skilled<br>worker | 36 (63.16)         | 21 (36.84)               |                    |
|                       | Clerical – Professional          | 156 (59.77)        | 105 (40.23)              |                    |
| Income (Rs)           | ≤1406 - 4203                     | 12 (21.43)         | 44 (78.57)               | 39.50***           |
|                       | 4204 - 10532                     | 161 (64.14)        | 90 (35.86)               |                    |
|                       | 10533 - ≥28114                   | 32 (74.42)         | 11 (25.58)               |                    |
| Socio Economic        | СІ                               | 2 (50.00)          | 2 (50.00)                | 46.72***           |
| Status (SES)          | CII                              | 24 (75.00)         | 8 (25.00)                |                    |
|                       | CIII                             | 141 (70.50)        | 59 (29.50)               |                    |
|                       | CIV                              | 38 (33.34)         | 76 (66.66)               |                    |
| Therapeutic beliefs   | Believers                        | 54 (53.47)         | 47 (46.53)               | 1.52 <sup>NS</sup> |
|                       | Non-believers                    | 151 (60.64)        | 98 (39.36)               |                    |
| Health issues beliefs | Believers                        | 39 (59.09)         | 27 (40.91)               | 0.01 <sup>NS</sup> |
|                       | Non-believers                    | 166 (58.45)        | 118 (41.55)              |                    |
| Subjects' Medical     | Reported                         | 66 (60.00)         | 44 (40.00)               | 0.13 <sup>NS</sup> |
| Condition             | Not reported                     | 139 (57.92)        | 101 (42.08)              |                    |
| Family Medical        | Reported                         | 18 (58.06)         | 13 (41.94)               | 0.00 <sup>NS</sup> |
| History               | Not reported                     | 187 (58.62)        | 132 (41.38)              |                    |
| Calamus tenuis        | Only Forest                      | 22 (32.35)         | 46 (67.65)               | 46.12***           |
| Roxb. Shoot sources   | Forest, Garden                   | 44 (52.38)         | 40 (47.62)               |                    |
|                       | Forest, Garden, Market           | 9 (39.13)          | 14 (60.87)               |                    |
|                       | Forest, Market                   | 61 (69.32)         | 27 (30.68)               |                    |
|                       | Garden, Market                   | 5 (55.56)          | 4 (44.44)                |                    |
|                       | Only Market                      | 64 (82.05)         | 14 (17.95)               |                    |

\*\*\*- Significant at p<0.001 NS- Non Significant

Figures in parenthesis indicates percentage

According to table 5, the subjects who had education upto primary level, consumed more shoots as compared to others. A significant association of consumption pattern of the shoots with occupation of the subjects was found. The unemployed and unskilled workers consumed shoot more as compared to others. The income of subjects had high impact on amount of consumption. The people who had low income, consumed shoot more than those of other income groups. A significant association was seen between consumption of the shoots and socio economic status of the subjects. The people belonging to upper class of SES consumed shoots in less amounts while lower SES group consumed in more quantity. No association was found between consumption of *Calamus tenuis* Roxb. shoot and therapeutic beliefs, health issues beliefs, subjects' medical condition and family medical history of people. The preference of sources of the shoot had significant impact on consumption of shoots. The people, who chose forest as a source of shoots, consumed more.

#### 4. Discussion

The present survey has highlighted some important insights into the current consumption pattern of *Calamus tenuis* Roxb. shoots by the forest villagers of Dibrugarh district of Assam. In the earlier days, in absence of modern medicine people were dependant on indigenous plant for their therapeutic benefits (Payyappallimana, 2006)) which may have proved to be beneficial for curing illnesses. However, by the discovery and adoption of modern medicine, consumption of these plants has reduced (Kong et al., 2003; Shrestha and Dhillion, 2003). The present study has shown a significant negative association between consumption of the *Calamus tenuis* Roxb. shoots and education, occupation, income, socio economic status (SES) and sources of the shoot. Patel (2014) also found highest use of traditional plant among the people who had education upto primary level. Consumption of medicinal plant also varies with factors such as income and access to public health facilities (Kayombo et al., 2012; Adera, 2013), ethnicity (Lim et al., 2005) and ethnobotanical knowledge (Wehi and Wehi, 2010). Forest was found to be the most preferable source of the shoots and forest dependant subjects consumed shoots in more quantity than those who depended on other sources like market and garden; which may be due to its availability, easy access and cost effectiveness. Payyappallimana (2006) also mentioned that plants which are locally available, easily accessible and cost effective are primarily used by communities.

Although toxicity studies on *Calamus tenuis* Roxb. shoots have not been carried out for its safety and dosage, some of the subjects reported to experience gastritis and stomach disorder specifically when consumed at night and on empty stomach. Researchers have also reported that some vegetable species are potentially toxic to humans and animals when consumed in high amount (Kofi-Tsekpo, 1997; Pfander, 1984). Therefore, indigenous edible plants like *Calamus tenuis* Roxb. need to be proved for its therapeutic value, safety and dosage.

Hence, *Calamus tenuis* Roxb. shoots remains the food of those who are poor belonging to low socio economic group and are consumed by the local people living by the forest villages were mostly unemployed or unskilled workers. This shoot seem to be primarily consumed for food purpose by most of the village dwellers rather than for therapeutic purpose as there was no statistical significance difference observed between the subject who believed in its therapeutic values as compared to those who did not believe. Also, beliefs about the healing properties of the shoot did not show any significant association with various medical condition suffered by them. *Calamus tenuis* Roxb. by and large still remains as a forest crop and is not freely available in the market and confined to traditional delicacy of the region.

#### 5. Conclusion

This inventory is the first report on *Calamus tenuis* Roxb. shoots consumption, cooking pattern and therapeutic and health issues beliefs. The findings imply towards therapeutic potential and safety of the shoots and encourage for scientific scrutiny for its consumption as a functional food.

#### **6.** Conflict of interest

The authors declare no conflict of interest.

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