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Ethnobotanical and dietary uses of Bamboo unveiled by the tribes and local inhabitants of Chittoor district, West Godavari and East Godavari districts of Andhra Pradesh

Research Article

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Abstract

Aim and Objective: To unveil and document the folklore claims and dietary recipes of *Bambusa bambos* and *Dendrocalamus strictus*. Materials and methods: The study was intended to examine the tribal individuals like traditional healers, tribal practitioners and elder people on their regular utilization of different species of *Bamboo*. Results: The study explored 13 contemporary folklore claims on *B. bambos* and *D. strictus* species solicited from various tribal pockets of Chittoor District, Andhra Pradesh and dietary recipes from the tribes and local inhabitants of West and East Godavari districts of Andhra Pradesh. Conclusion: With this study, 13 contemporary folklore claims were recorded on *B. bambos* and *D. strictus* for the treatment of different ailments. Besides this, the young shoots of *Bambusa bambos* are noticed as a fabulous dietary source for several minerals and good health.

Key Words: Ethnobotany, Dietary uses, Bamboo, *Bambusa bambos, Dendrocalamus strictus,* Andhra Pradesh.

Introduction

Ethnobotany is an antiquated science with time-tested herbal remedies. It is the only science that unveils the involvement of the men with their surrounding flora. Conversance of ethnomedicine is much earlier than human civilization and is a part of the cultures and customs of a particular neighborhood and is now being acknowledged as an extreme new source of research. At present, probabilities of ethnomedicines are progressing mainly because of revived interests in natural drugs, particularly tribal medicine. The world is enriched with a rich wealth of medicinal plants. These plants have been forming the regional convention with global importance. It is concluded that around 70,000 plant species from lichens to flowering trees have been used for therapeutic purposes.

India is acknowledged as the treasure emporium of medicinal plants. Nearly 70% of the rural population rely on medicinal plants for their well-being. India is a fabulous resource for biodiversity with vast species diversity by standing the tenth position among plant-rich nations of the world and fourth among the Asian countries (1). India is the renowned producer of medicinal plants and is named the "Botanical Garden of World". In India, 45,000 plant species have been classified of them, nearly 15,000-20,000 plants are with great medicinal value. Around 2,500 plant species referring to more than 1,000 genera are employed by conventional healers.

The World Health Organization estimated that 80% of the people in emerging countries of the world depend on conventional medicine for their basic health care requirements and nearly 85% of conventional medicine requires the use of plant extracts. Near about 90% of the people refers to rural areas in India are dependent on plants for their daily needs like food, shelter, fabrics and medicine (2).

In India, Andhra Pradesh state is a rich source for Ethnobotanical studies. Some of the areas from Andhra Pradesh are still untouched for ethnobotanical studies. With this view, we have undertaken an ethnobotanical survey in particular areas of Chittoor (Figure 1,2 and 3), West and East Godavari districts of Andhra Pradesh, where very few studies were initiated (3). During our survey, we have noticed that majority of the tribal

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people from West and East Godavari rely on *B. bambos* shoots as a dietary ingredient. The tribal people in Chittoor district for their day-to-day needs essentially rely on two Bamboo species *B. bambos* (Figure 4) *and D. strictuis* (Figure 5). With this scope, we have enumerated the folklore uses on two Bamboo species *B. bambos and D. strictus.* Bamboo is a grass plant belonging to Poaceae family, spread over 1,250 species under 75 genera in the world. Out of these, about 136 species under 23 genera are available only in India (4). This versatile and evergreen plant is found almost everywhere in the world except the frozen poles.

Bamboo shoots are the new culms that just emerge from the ground and constitute a range of traditional delicacies. Not all species of bamboo shoots available in the world are edible. Out of 136 species available in India, the most commonly edible bamboo species regarding their shoots and grains are *B. bambos, B. pallida*, *B. tulda*, *B. polymorpha*, *B. balcooa*, *D. hamiltonii*, *D. giganteus* and *Melocanna bambusoides* (5).

Depending upon species, bamboo shoots are usually 20–30 cm long and taper to a point. A bamboo shoot at the time of harvest normally weighs more than 1 kg. However, their size and weight depend considerably upon the location, depth, pH and nutrition of the soil, irrigation and drainage conditions, climate, rainfall, temperature and soil type and fertility. Cold tolerance is a limiting factor in the growth of certain bamboo species (6-10).

Methodology

The present study is aimed to document the first-hand information on ethnobotanical and dietary recipes of *B. bambos* and *D. Strictus*.

Preparation of Bamboo curry

Ingredients

1. Grated Bamboo shoot
2. Water Q.S.
3. Deccan hemp or Kenaf (*Hibiscus cannabinus* L.)
4. Red gram (optional)
5. Salt, Chillies, Onions, Turmeric, Garlic and Ginger

Method

Water should be boiled for a period of 15 minutes. Fresh grated shoots of Bamboo obtained by scratching with double edged knife (Figure 6) should be mixed with the above boiled water for another 15 minutes (Figure 7). Later, sliced chillies and onions are added to the above mixture. Now Deccan hemp or Kenaf is added to the above mixture (Figure 8,9). To the above mixture salt, turmeric, garlic and ginger are added and mixed uniformly. This process should take place for another 15 minutes. Final curry is in slight yellowish green in colour with sweet and pungent flavour (Figure 10). Adding of red gram is an optional one in the preparation of this delicious Bamboo recipe.

Taste, usage and claims: without redgram it is little bit spicy, sour and very tasty. With red gram it is less spicy and sour. With red gram also it is very tasty.

The Method for Ethnobotanical Data Collection

The folklore remedies on two plants *B. bambos* and *D. strictus* were acquired through the interview based on queries and discussions in the local Telugu language with nearly 101 informants between the age groups of 35-70 years. The survey allowed to document the data on the local names of the plant, useful plant parts, method of preparation (i.e. paste, powder and juice), mode of administration, dosage, the form of usage (either fresh or dried) and whether the plants used either singly or in combination with other plants, minerals and salts. All the plants were taxonomically identified with the help of flora; "The Flora of Presidency of Madras" by Gamble, (11) and other related works. The method of collection of voucher specimens, preservation, herbaria and technique for the collection of ethnomedicinal information was followed as per Jain and Rao (12).

Quantitative analysis

Use value (UV):

Use value (UV) determines the relative importance of the uses of plant species. It is calculated using the following formula (13).

$$UV_i = \Sigma U_i / N$$

Results

Dietary claims on Bamboo recipe

In each and every tribes house in the studied areas at least once in the season the above mentioned Bamboo recipe is prepared. It is claimed to be a healthy recipe with good nourishment and taking this in a year gives them complete nutrition and provides immunity against the seasonal diseases.

Ethnobotanical claims on Two Bamboo species *Bambusa bambos* and *Dendrocalamus strictus*

This study was commenced in several tribal hamlets of Chittoor District, Andhra Pradesh resided in 12 villages like Narayanavanam, Madanapalli, Nagari, Venkatagirikota, Mamandur, Pakala, Chandragiri, Chintagunta, Bhakarapeta, Rangampet, Parameswara Mangalam, Gudimallam (Figure 3). The survey is aimed to review 101tribal individuals (Table 1). The study revealed 13 contemporary folklore claims on two bamboo species; *Bambusa bambos and Dendrocalamus strictus* for the medication of different diseases like burning micturition swellings, gonorrhoea, diarrhea, edema, oral ulcers, uterine, bladder, or kidney infections, and excessive bleeding after delivery, anthelmintic, cuts and wounds (to heal them), galactagogue and diabetes.

Use value (UV)

Botanical Name	Total number of use reports (ΣUi)	Use value (UV)
B. bambos	**68**	**0.673**
D. strictus	**44**	**0.435**

Table 1. Enumeration of tribal claims on Two Bamboo species *Bambusa bambos* and *Dendrocalamus strictus*

S.No	Tribal Community Name	Name of the Tribe	Number of the Use reports	Area of collection	Part Used	Method of Preparation and Application
1	Chenchu	Venkateswarlu	**20**	Narayanavanam, Chittoor District, Andhra Pradesh State	**Rhizome**	Rhizomes of *Bambusa bambos* are pounded. Oral administration of 5gm root powder daily works as a diuretic and also relieves burning micturition. The same is also claimed to relieve peptic ulcers.
2	Nakkala	Seshulu				
3	Chenchu	Somalingam				
4	Chenchu	Naga Seshulu				
5	Yanadi	Chennaiah				
6	Chenchu	Nomulaiah				
7	Nakkala	Nagulu				
8	Nakkala	Peddaiah				
9	Chenchu	Bhuchaiah				
10	Chenchu	Raghavulu				
11	Yanadi	Somallaih				
12	Yanadi	Tataih				
13	Yanadi	Malaih				
14	Nakkala	Janardan				
15	Chenchu	Balanarasimhulu				
16	Chenchu	Pamulaiah	**11**	MadanapalliChittoor District, Andhra Pradesh State	**Rhizome**	Rhizome of *Bambusa bambos* is grounded into paste and mixed with rock salt. This mixture is applied externally on affected area relieve swellings
17	Chenchu	Sanjeevulu				
18	Yanadi	Maaraiah				
19	Chenchu	Nagigopanna				
20	Chenchu	Venkatarathnaiah				
21	Yanadi	Parameswaram				
22	Nakkala	Subbulu				
23	Chenchu	Gangulasuraiah				
24	Chenchu	Balakondaiah				
25	Yanadi	Narigadu				
26	Yanadi	Pamulakoti				
27	Yanadi	Yenkigopulanna	**9**	Nagari, Chittoor District, Andhra Pradesh State	**Young shoots**	The young shoots and roots of *D. strictus* are charred. The produced ash is mixed with leaf paste and applied on affected area relieves scabies. The use of same preparation internally is claimed to relieve gonorrhoea.
28	Yanadi	Padmiah				
29	Chenchu	Yathnoobulu				
30	Yanadi	Bandlachenchu				
31	Yanadi	Ravanaiah				
32	Chenchu	ThatiRammaiah				
33	Yanadi	Bayanna				
34	Chenchu	Rayappa				
35	Yanadi	Suraiah				
36	Yanadi	Sundaraiah	**9**	Venkatagirikota Chittoor District, Andhra Pradesh State	**Siliceous secretion**	Oral administration of 2-5gm siliceous secretion of *B. bambos* relieves diarrhea.
37	Chenchu	Ankaiah				
38	Nakkala	Peddasomanna				
39	Sugali	Goduguluribujji				
40	Chenchu	Peddaiaih				
41	Chenchu	Miriyalaiah				
42	Chenchu	Tirumalaiah				
43	Yanadi	Yanadisubbaiah				
44	Nakkala	Janardan				
45	Yanadi	Peddasomaiah	**9**	Mamandur Chittoor District, Andhra Pradesh State	**Young stems**	The young stems of *D. strictus* are grounded into paste and oral administration of 5gm relieve edema in ladies.
46	Chenchu	Duggirallasivaiaih				
47	Nakkala	Pallinagaiah				
48	Sugali	Munikantahaih				
49	Yanadi	Peddaveeraiah				
50	Yanadi	Gorlalingaiah				
51	Yanadi	Balachinnaiah				
52	Yanadi	Rosaiah				
53	Chenchu	Ganjalasubbaiah				

54	Yanadi	Obulaiah	**7**	Pakala, Chittoor District, Andhra Pradesh State	**Grains**	Consuming of boiled bamboo rice from *B. bambos* is claimed to relieve oral ulcers.
55	Chenchu	Alluraiah				
56	Yanadi	TirumalaNarayana				
57	Yanadi	TirumalaKondaiah				
58	Chenchu	Peddanarasaiah				
59	Nakkala	Kotesu				
60	Chenchu	Duggiramaiah				
61	Yanadi	Tyagaiah	**3**	Chandragiri, Chittoor District, Andhra Pradesh State	**Grains**	Boiled bamboo rice of *D. strictus* is given to mother to relieve Postpartum infections, including uterine, bladder or kidney infections and excessive bleeding after delivery.
62	Yanadi	Yerukalaih				
63	Chenchu	Somaiah				
64	Yanadi	EEswaraiah	**7**	Chintagunta, Chittoor District, Andhra Pradesh State	**Siliceous secretion**	Consuming of siliceous secretion of *B. bambos* is claimed as anthelmintic.
65	Chenchu	Nomulanna				
66	Yanadi	YanadhiGuravaiah				
67	Yanadi	Dhanunjayalu				
68	Chenchu	Buraiah				
69	Yanadi	Seshulu				
70	Chenchu	Somallaih				
71	Chenchu	ChenchuNomulu	**9**	Bhakarapeta, Chittoor District, Andhra Pradesh State	**Leaves and young shoots**	Leaves and young shoots of *D. strictus* are grounded into paste. About 5 kg of paste is boiled in 7 liters sesame oil for 6 hours. This mixture is squeezed with white cotton cloth. The produced oil is applied externally on cuts and wounds to heal them.
72	Chenchu	ChinnaSomulu				
73	Chenchu	Gopparupullaiah				
74	Chenchu	Tallapallisubbaiah				
75	Yanadi	Tirupataiah				
76	Yanadi	Ramadevaiah				
77	Chenchu	Peddaguravaih				
78	Chenchu	Boyinaiah				
79	Yanadi	Peddapichaiah				
80	Yanadi	Munikanthiah	**8**	Rangampet,Chittoor District, Andhra Pradesh State	**Grains**	Bamboo rice of *D. strictus* and jaggery are taken in 3:1 ratio and boiled to prepare jaggery rice. Consuming of this works as a galactogouge.
81	Chenchu	Duggichenchulu				
82	Chenchu	PeddaNagaiah				
83	Yanadi	Chinnagovindaiah				
84	Chenchu	Reddaiah				
85	Chenchu	Suraiah				
86	Chenchu	Subbulaiah				
87	Yanadi	Seenu				
88	Chenchu	Subbi	**8**	ParameswaraMangalam, Chittoor District, Andhra Pradesh State	**Grains**	Bamboo rice of *B. bambos* is given as alternative source for diabetic patients rather than rice.
89	Nakkala	Mangalam				
90	Sugali	Somulu				
91	Chenchu	Bheemaiah				
92	Yanadi	Malakondaiah				
93	Chenchu	Venkatarathnam				
94	Yanadi	Samulu				
95	Chenchu	Varahalaiah				
96	Chenchu	Somaiah	**6**	**Gudimallam**	**Stem and leaves**	Baskets are prepared with bamboo stems from both plants *B. bambos* and *D. strictus*. In this baskets boiled food is stored and covered. The food is preserved for a long time.
97	Chenchu	Eddasubbaih				
98	Chenchu	Tirnalaiah				
99	Chenchu	Obulesulu				
100	Chenchu	Chinnakondaiah				
101	Yanadi	Yerukalaih				

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Figure 1. India Map

Figure 2. Andhra Pradesh Map

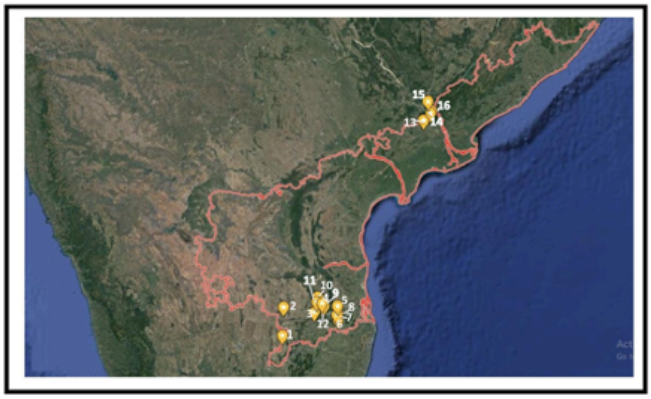


Figure 3. Map with Surveyed areas

Areas Surveyed from Chittoor District:

1.Venkatagiri Kota; 2. Madanapalle; 3. Pakala; 4. Chandragiri; 5. Gudimallam; 6. Nagari; 7. Narayanavanam; 8. Parameswara mangalam; 9. Mamandur; 10. Rangampeta; 11. Chinthalagunta; 12. Bhakarapet.

Areas Surveyed from West Godavari and East Godavari Districts:

13. Jangareddigudem; 14. Gogumilli; 15. Upparilli; 16. Chintapalle.

Figure 4: ***Dendrocalamus strictus***

Figure 5: ***Bambusa bambos***

Figure 6: Grating bamboo shoots with double edged knife

Figure 7: Boiling of grated bamboo shoots

Figure 8: Sliced chillies and onions added to grated bamboo

Figure 9: Cutting the deccanhamp

Discussion

Tribal pockets of West and East Godavari districts especially belonging to Gogumilli, Chintapalli, Upparilla and several other surrounding villages are surrounded by thick forests with dense bamboo thickets (Figure 10). They use bamboo to fence the house and to make cot or sitting bench etc. (Figure 11, 12, 13). People of this area are very fond of taking Bamboo curry daily as a primary recipe in the particular season to satisfy their taste receptors. It is one of the prime reasons for the good health of tribal people and this is attributed to the nutritive potential of Bamboo shoots.

The analysis of data with respect to number of the claims claimed by tribal people of Chittoor District, Andhra Pradesh, on particular disease, major number of the claims were recorded on burning micturition (16) peptic ulcers (16), followed by swellings (11), gonorrhea (09), diarrhea (09), edema (09), cuts and wounds (to heal them) (09), as galactagogue (08) and in diabetes (08), oral ulcers (07), as anthelmintic (07), in uterine bladder or kidney infections (03) and excessive bleeding after delivery (03) (Figure 14). With the scope of various plant parts employed for the treatment of different diseases, the grains are the most important and frequently employed part and it is accompanied by the young shoots, rhizome, siliceous secretions, and leaves. Use value was calculated for *B. bambos* as **0.673** and for *D. strictus* is 0.435.

The data obtained while the study has also been correlated with some current and past available literature (14-18). It has been noticed that majority of the claims are new for the scientific entity in the present study and their method of employment, components and parts used are entirely different from the earlier published reports.

Bamboo shoots are the major source for acids, proteins, carbohydrates, starch, fat, dietary fiber, vitamins and minerals have been systematically analyzed and reported by various authors (19-26). Although bamboo shoots are found during the monsoons, there are normally two types of bamboo shoots available in a year; winter shoots and spring shoots depending on the seasons of a year. The spring shoots are normally larger, tougher and more superior compared to the winter shoots.

Bamboo shoot is a good source of potassium, Vitamin E (α-Tocopherol), Vitamin C, Vitamin B6, thiamin, riboflavin, niacin, iron, phosphorus and dietary fibers like hemicelluloses, cellulose, pectin and lignin. With 17 different types of amino acids, bamboo shoots contain about ten types of minerals like Cr, Zn, Mn, Mg, Ni, Co, Cu, etc. and lysine(one of the limited amino acids, which is helpful for growth and development of children) is found in bamboo shoots (23-33). Ash of bamboo shoots has been reported in Ayurveda as medicines (26).

Conclusion

The study reveals that various parts of *B. bambos* and *D. strictus* have been widely used as a traditional ethnomedicine to treat various diseases by local tribes and traditional healers from Chittoor district of Andhra Pradesh. Accompanying this, the young shoots of *B.bambos* have been adopted as a traditional healthy dietary dish by the tribes of West and East Godavari districts for the past several ages. Ayurveda has also validated this fact owing to its therapeutic properties. By all its nutritive potential it can be concluded that, the utilization of bamboo not only the good for the taste receptors but also a potential source of ethnomedicine.

Figure 10: Bamboo forest near munjuluru village of Jangareddy gudem

Figure 11: Use of Bamboo sticks as fencing

Figure 12: Use of Bamboo sticks as a cot

Figure 13: Use of Bamboo sticks as a sitting bench

Figure 14: Percentage of plant parts usage by the local communities in the study area

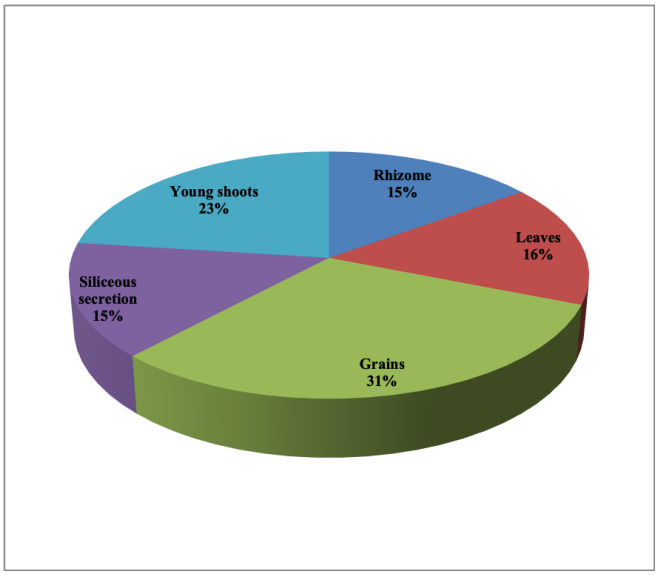
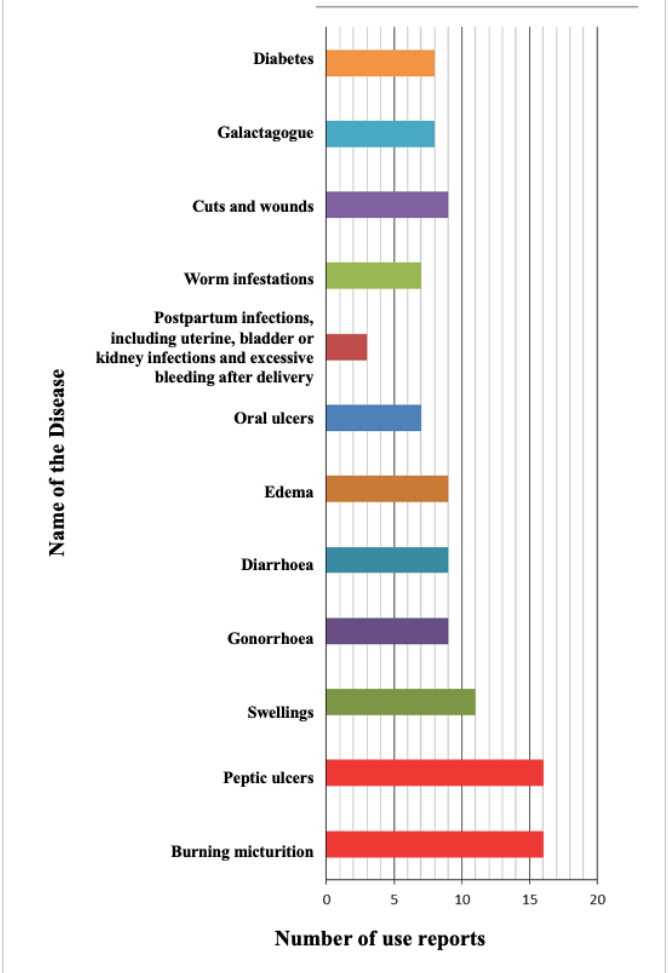


Figure 15: Number of the use reports for disease conditions



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References

1. Pratap G P, Husain M K, Kazmi M H, Sudarshsanam G, Prasad G.P. Ethno-medico documentation of medicinal plants in Madanapalle mandal of Chittoor District, Andra Pradesh. Indian J Ayurveda Res, 2018;1:11-18.
2. Sudarsanam G. Pratap GP, Ramesh C, Husain MK, Kazmi MH, Prasad GP. Ethno-veterinary herbal claims collected from rural people of Rapur Mandal, Nellore District, Andhra Pradesh, India. Int. J. Res. Ayurveda Pharm., 2017;8(Suppl 3):211-216.
3. Sudarsanam G, Pratap GP, Nagaraju V. Ethnobotany of Kuppam, 1st Edition, New Delhi, AkiNik Publications; 2019. 3-7p.
4. Sharma YML . Bamboos in the Asia-Pacific region. In: Lessard G, Chouinard A (ed) Bamboo research in Asia. Proceedings of a workshop held in Singapore. International Development Research Centre, Ottawa, Canada, 1980, 99–120 p.
5. Dollo M, Samal PK, Sundriyal RC, Kumar K. Environmentally sustainable traditional natural resource management and conservation in Ziro Valley, Arunachal Himalaya, India. J Am Sci., 2009; 5(5):41–52.
6. Gangwar AK, Ramakrishnan PS. Cropping and yield patterns under different land use systems of the *Khasis* at higher elevations of Meghalaya in North-Eastern India. Int J Ecol Environ Sci.,1987;13:73–86.
7. Maikhuri RK. Eco-Energetic analysis of village ecosystem of different traditional societies of Northeast India. Energy, 1996; 21(12):1287–1297. doi: 10.1016/0360-5442(96)00032-1.
8. Anderson JM, Ingram JSI. Tropical soil biology and fertility: a handbook methods. UK: CAB International, 1993. 218 p.
9. Kigomo, B . Guidelines for growing bamboo. KFRI Guideline Series: No 4, Kenya Forestry Research Institute, Nairobi, Kenya; 2007.
10. Bhatt BP, Singh K, Singh A. Nutritional values of some commercial edible bamboo species of the North Eastern Himalayan region, India. J Bamboo Rattan., 2005;4(2):111–124. doi: 10.1163/1569159054699317.
11. Gamble JS. Flora of the Presidency of Madras. Calcutta, Botanical Survey of India. 1936, Vol. 3; 1857-1859 p.
12. Jain SK, Rao RR. A Handbook of Field and Herbarium Methods. Today & Tomorrow's Printers and Publishers, New Delhi,1977.
13. Phillips O, Gentry AH. The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. Economic Botany, 1993; 47: 15-32.
14. Pratap GP, Prasad, GP, Sudarsanam G. Ethno-medical studies in Kailasagirikona forest range of

Chittoor district, A.P. Ancient Science of Life, 2009,29(2): 40-45.
15. Pratap GP, Prasad, GP, Sudarsanam G. Ethno medical studies in Talakona forest range of Chittoor district, A.P. Ancient Science of Life, 2009; 28 (3):42-49.
16. Sekhar J, Pratap GP, Sudarsanam G, Prasad GP. Data on herbal remedies from the tribes of Chittoor district, Andhra Pradesh in India, Life sciences Leaflets. 2011; 17:621 –63.
17. Neelima M, Prasad GP, Sudarsanam G, Pratap GP, Jyothi, B. Ethnobotanical studies in Rapur forest division of Nellore district in Andhra Pradesh. Life Sciences Leaflets, 2011; 11:333-345.
18. Pratap GP, Sudarsanam G, Jyothi B, Prasad GP. Ethnic practices on Urinary Disorders and Jaundice from the Tribes of Nellore District Andhra Pradesh, India, Ethnobotanical Leaflets, 2010; 14: 976-985.
19. Young RA. Flavor qualities of some edible oriential bamboos. Econ Bot., 1954;8:377–386. doi: 10.1007/BF02908612.
20. Lee, Y.P. and Takahashi T. An improved colorimetric determination of amino acids with the use of ninhydrin. Analytical Biochemistry Volume 14, Issue 1, January 1966, 71-77p.
21. Bradford MM. A rapid and sensitive method for the quantization of micrograms quantities of protein utilizing the principle of protein-dye binding. Anal Biochem, 1976;72:248–254. doi: 10.1016/0003-2697(76)90527-3.
22. Mecreddy RM, Guggolz J, Silviera V, Owens HS. Determination of starch and amylase in vegetables. Anal Chem., 1958;22:1156.
23. Shimada M. Biochemical studies on bamboo lignin and methoxylation in hardwood and softwood lignin. Wood Research: Bulletin of the Wood Research Institute Kyoto University, 1972; 53:19–65
24. Goering HK, Van Soest PJ. Forage fiber analysis. Agric. Handbook No. 379, ARS, USDA, Washington, DC, 1970. 20 p.
25. Baker H, Frank O, De Angelis B, Feingold S. Plasma tocopherol in man at various times after ingesting free or acetylated tocopherol. Nutr Rep Int., 1980;21:531–536.
26. Nirmala C, David E, Sharma ML. Changes in nutrient components during ageing of emerging juvenile bamboo shoots. Int J Food Sci Nutr. 2007;58(8):612–618.
27. Reiss C . Measuring the amount of ascorbic acid in cabbage. In: Goldman CA, Hauta PL (ed). Tested studies for laboratory teaching. 1993. Vol. 7/8. Proceedings of the 7th and 8th Workshop/ Conference of the Association for Biology Laboratory Education (ABLE). 85–96 p.
28. Tripathi YC. Food and nutrition potential of bamboo. MFP News, 1998; 8(1): 10-11.
29. Park E, John D. Effects of bamboo shoot consumption on lipid profiles and bowel function in healthy young women. Nutri, 2009; 25(7–8):723–728.
30. Sue T. Bamboo shoots = good food. Temp. Bamboo Q. 1995; 2(1):1–2.
31. Fu S, Yoon Y, Bazemore R. Aroma-active components in fermented bamboo shoots. J Agric Food Chem., 2002;50(3):549–554.
32. Bhatt BP, Singha LB, Singh K, Sachan MS. Commercial edible bamboo species of the north eastern Himalayan region, India. Part II. Fermented, roasted and boiled bamboo shoots. J Bamboo Rattan, 2005;4(1):13–31.
33. Puri HS. Rasayana ayurvedic herbs for longevity and rejuvenation. London: Taylor and Francis, 2003. 71–73 p.

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