



Wild Edible Tree Fruits of Sikkim Himalayas

C. P. Suresh¹, K. D. Bhutia, G. Shukla*, K. Pradhan* and S. Chakravarty*

¹North Eastern Hill University (Tura Campus) Tura, Meghalaya; *Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal.

E-mail: sureshcp2112@yahoo.com¹

ABSTRACT

Wild edible tree fruit species are traditional sources of nuts, fruits, edible oil and beverages. In Sikkim, these fruit species are valuable in several other ways pertaining to social, economic and ecological services. Surveys were conducted to document the baseline information on use of wild tree fruits in Sikkim Himalayas. Information on wild tree fruit species were collected during structured and semi-structured interviews with native people. Free listing technique enlisted 21 wild edible tree fruits represented by 15 families and 19 genera. These fruits were generally eaten fresh and raw. Some fruit species are socially and commercially important and also has medicinal value such as *Diploknema butyraceae*, *Terminalia chebula*, *Spondias axillaris* and *Castanopsis hystrix*. These fruits have a great potential to contribute towards nutritional security during food scarcity and can certainly boost the economy of poor people if value addition is encouraged.

Keywords:

conservation, Sikkim Himalayas, wild edible fruits

INTRODUCTION

Many wild edible tree fruit species are found in the Sikkim Himalayas which are cheap and readily available with vibrant taste appeal along with nutritional, medicinal, therapeutic and industrial values (Rai et al. 2005). These species continue to be maintained by cultural preferences and traditional practices but they still remain inadequately characterized and neglected by research and conservation. Exploration and listing of these plants with their ethno-biological values are important for knowing and evaluating their economic potential. The present study documented the wild edible tree fruits of Sikkim Himalayas along with its utilization by the natives.

MATERIALS AND METHODS

Sikkim is a small mountainous state in the

Eastern Himalayan region. Collection and study sites of these fruits covered all four districts of Sikkim. Field surveys were conducted by collecting information during structured and semi-structured interviews with native knowledgeable people. Interview approach following Martin (1995) was used, i.e. asking questions about use of fruit plants for different purposes and making forest visits to identify the species. From four districts of Sikkim, blocks were stratified depending on availability of these fruit trees. Four blocks, one from each district of Sikkim were selected purposively. From four blocks, nine wards were selected purposively based on availability of maximum number of indigenous fruit species. An exhaustive list of people under selected nine wards was prepared to enumerate the sample of

respondents. From this exhaustive list, respondents were randomly selected. A total of 120 respondents were finalized to assess status, utilization aspect of wild edible tree fruits and to identify the most valuable indigenous species from local's perspective. Important wild fruits were selected on the basis of free listing method (Sinha 2003).

RESULTS AND DISCUSSION

Diversity of wild edible tree fruits

Free listing technique enlisted 21 wild edible tree fruit species represented by 15 families and 19 genera (Table 1).

In the Sikkim Himalayas 126 species of fruit and nuts/seeds representing 59 families were identified (Sundriyal and Sundriyal, 2005;

Table 1: Free listed wild edible tree fruit species of Sikkim

Sl. No	Family	Species Name	Local Name	English Name
1	Anacardiaceae	<i>Spondias axillaris</i> Roxb. (Burt & Hill)	<i>Lupsi</i>	Hog Plum
2	Arecaceae	<i>Calamus flagellum</i> var. <i>flagellum</i> Griff	<i>Phyakre, Bet Gainra</i>	-
3	Combretaceae	<i>Terminalia chebula</i> Retz.	<i>Harra</i>	Chebolic Myrobalan
4	Clusiaceae	<i>Garcinia cowa</i> Roxb.	<i>Ban Suntala</i>	Garcinia
5	Ebenaceae	<i>Diospyros virginiana</i>	<i>Halle Beth</i>	Persimmon
6	Elaeocarpaceae	<i>Elaeocarpus sikkimensis</i> Roxb.	<i>Badrasey</i>	
7	Euphorbiaceae	<i>Baccaurea ramiflora</i> Lour	Kusum	Burmese Grape
8	Fagaceae	<i>Castanopsis hystrix</i> Miq.	<i>Kattus</i>	Chestnut
9		<i>Castanopsis tribuloides</i> (Smith) A.DC.	<i>Musure Kattus</i>	Chestnut
10	Flacourtiaceae	<i>Gynocordia odorata</i> R. Br.	<i>Bandarey</i>	
11	Juglandaceae	<i>Juglans regia</i> L.	<i>Okher</i>	Wild Walnut
12	Lauraceae	<i>Machilus edulis</i> King	<i>Pumsi</i>	Wild Avocado
13	Mimosoideae	<i>Entada scandens</i> (L.) Benth.	<i>Pangra</i>	
14	Moraceae	<i>Ficus roxburghii</i> Wall.	<i>Nebaro</i>	Fig
15		<i>Morus alba</i> Wall.	<i>Kimbu</i>	Mulberry
16	Rosaceae	<i>Oreobolus indica</i> Schn. (Wall.) Decaisne	<i>Mehel</i>	Indian Crab Apple
17		<i>Prunus cerasoides</i> D. Don	<i>Painyuu</i>	Himalayan Bird Cherry
18		<i>Prunus persica</i> Batsch	<i>Arru</i>	Peach
19		<i>Pyrus pashia</i> (Buch.-Hamex) Don.	<i>Naspati</i>	Pear
20	Anacardiaceae	<i>Rhus semialata</i> Murr.	<i>Bakimlo</i>	Chinese Sumac
21	Sapotaceae	<i>Diploknema butyraceae</i> Roxb. Lam.	<i>Chuirii</i>	Indian Butter Tree

Sundriyal et al. 1998, 2003). *Diploknema butyracea*, *Eriolobus indica*, *Spondias axillaris* and *Machilus edulis* were found to have higher demands by the locals and thus bear maximum pressure on their natural habitats as was also reported by Sundriyal and Sundriyal (2005). In some areas people have cultivated and preserved some of the wild tree fruit plant species in their private land. Some of these species were domesticated while some grew naturally. Most of the localities were planted with *Machilus edulis* and *Juglans regia* in their home gardens.

Traditional use of wild edible tree fruits

Ten tree fruit species were identified as most valuable by the respondents based on their food, medicinal and other values. The various uses of these species are summarized in table 2. The traditional methods of fruit collection are picking, shaking stems and throwing objects to dislodge the fruits or even destructive harvesting as branches were lopped to harvest fruit in a short time. Most of the wild edible tree fruits in Sikkim were eaten fresh and raw. Wild edible tree fruits play a vital role in subsistence economy and livelihood of people in this small Himalayan state. A variety of these fruits with enormous economic potential can be seen grown in the valley regions, mid-slopes, and the highlands of the basin. These fruits are used for food traditionally by native people as nutritional diet.

Some fruit species are commercially important and also have medicinal value such as *Diploknema butyraceae* and *Terminalia chebula*. *Spondias axillaris* and many others were used for spices and pickle purpose along with medicinal and other uses. These species are free and accessible to the local communities. Some of these food plants are supplementary and nutritionally important especially prior to the harvest of staple foods to the locals as also reported from Nepal (Shrestha et al. 2005). Some of these fruits were home processed as boiled, roasted and fermented. Most of these fruits were eaten fresh and raw as snacks or sometimes as potion. Fruits of *Ficus* species were eaten either fresh or in dehydrated form while *Castanopsis hystrix* fruits were consumed dried after roasting and even processed into flour for

baking purpose. These wild fruits were available year round and have a great potential to contribute towards food and nutritional security during food scarcity. Although, the current level of consumption is very low and the fruits had insignificant role in the diets of the natives. The low consumption of fruits is partly attributed to ignorance of their nutritional value and method of preparation, need for cash and more importantly dietary custom of people. It was also found out that people in the study areas do not explicitly recognize nutritional contribution of the wild fruits rather they value them as snack. Moreover, many fruit species were also exploited for various non-fruit utilities (Table 2). Almost all the wild edible fruit tree species are utilized for charcoal purpose. Fuel wood, construction and fence are the other major non-food use categories, while *Machilus edulis*, *Juglans regia* and *Castanopsis hystrix* were multiple used species. The harvesting of these multiple use species can put them under threat (Dhillion and Shrestha 2005) but can also lead to better chances for their conservation (Etkin 2002). Over utilization of these fruit trees may have detrimental effects on landslide in hilly region.

These fruit trees have the potential for commercialization. Lack of a developed market for these fruits can be explained in part by the fact that many people have free access to wild fruits and do not perceive them as having market potential. The other reason for lack of a developed market for these fruits could be related to consumers taste and preference for commercial fruits like apples, citrus, mangoes, guava and banana. Many urban consumers relate wild edible fruits as food for the poor. This perception of these fruits affects their market demand and consumption, a problem that needs to be overcome if these fruit trees are to be domesticated and commercialized to improve household food security and nutrition (Hoe and Siong 1999; Deshmukh and Waghmode 2011). Some fruits were commonly available and had a processing potential but mostly the products were either used in household or sold locally especially as butter, dried form and wine (Table 3).

The most common and popular value added product was the fat/butter extracted from the

Table 2: Traditional/Indigenous uses of wild edible tree fruit species

Botanical Name	Indigenous uses
<i>C. hystrix</i>	Fruits edible, fuel wood, leaves are good ingredients for composts. It is highly valued for furniture, agricultural implements etc
<i>D. butyraceae</i>	Fruits are edible. Pulp of the fruits are sweet and juicy but cannot be stored for a longer time due to its low keeping quality. The seeds are used to make a special type of butter for burning lamps and culinary purpose as well. Oil though edible is mostly used for burning lamps due to its strong odour. Butter extracted from the fruits is used in treating rheumatism. Also used as live fence and fodder.
<i>E. indica</i>	Fruit extracts used for curing blood dysentery and bark used for piles.
<i>E. sikkimensis</i>	Fruits edible, the fruit is used to make pickles and chutney.
<i>F. roxburghii</i>	Fruits edible, leaves are good fodder. Gum is extracted from the fruit and used locally. It is believed to have medicinal properties and prevents constipation.
<i>M. alba</i>	Fruits edible, locally they are made into wine and also it makes an excellent dried fruit. In traditional and folk medicine, the fruit is believed to have medicinal properties anti-inflammatory and moisturizing properties. It is highly valued for furniture, agricultural implements etc.
<i>M. edulis</i>	Fruits edible, leaves are good fodder. Butter/ ghee is extracted from the fruits and used as additive in vegetable ghee.
<i>P. cerasoides</i>	Fruits edible, fairly good fodder and fuel wood, The fruits and the leaves give a dark green dye, bark of the tree is used medicinally for fracture and burns.
<i>S. axillaris</i>	Fruits are edible, nutritious and highly valued as a source of traditional medicine. Medicine is prepared from bark against diarrhoea, vomit. The finer bark is chewed by local people as a substitute for betel nut. The fruits (ripe or unripe) are traditionally eaten by local peoples as raw with salt and used for making chutney, pickles and various candies. The processed product has a considerably long shelf-life even up to 5 years. Processed products of the fruits are popular among the natives.
<i>T. chebula</i>	Fruits edible. Traditionally it is used for the removal of Kidney Stones and treatment of diabetes, raw fruits used for curing diabetes and dry fruits for cough and cold. The paste of its fruits is applied on the eyelids in conjunctivitis.

Table 3: Value added products and their processing of some wild edible tree fruits

Fruit	Value added products	Process
<i>C. hystrix</i>	Flour	Candies: Fruits were boiled, peeled, mixed with sugar syrup and boiled again till it thickens. The thickened product was cooled and cut as candies. Salt/Sugar/chili powder was added according to taste.
<i>D. butyraceae</i>	Fat/butter	
<i>E. indica</i>	Pickle	Pickle: Fruits were washed, cut into pieces, sun dried, mixed with oil along with required spices and then seasoned under sun.
<i>F. roxburghii</i>	Dry fruits	
<i>M. edulis</i>	Fat/butter	Fruit wine: Fruits were sliced, added with few slices of potato and sugar (half kg sugar/1 kg fruits) and the mix are stored in an air tight container for fermentation (during summer for 20 -25 days and winter 45 -60 days). After fermentation, the product was squeezed in a muslin cloth. Water can be added according to taste. Butter: Fruits were crushed to extract the seeds. The seeds kept in a bamboo basket were dried in a fire place for 4 -5 days. The dried seeds were crushed and steamed to extract oil.
<i>S. axillaris</i>	Candies, pickle	
<i>T. chebula</i>	Dried with honey or jaggery	

Table 4: Ethnomedicinal uses of wild edible tree fruits and their formulation

Species used	Ailment	Formulation
<i>P. cerasoides</i>	Burns	Paste mixture of stem and root bark of the two plant species is applied on the burn and left till it loosens
<i>T. chebula</i> , <i>P. cerasoides</i>	Bone fractures	Bark of the either species is powdered and mixed with milk. A glass of the mixture is taken orally twice a day.
<i>E. indica</i>	Piles, Dysentery	Bark of <i>E. indica</i> and root of <i>R. ellipticus</i> are grounded and one teaspoon of the mixture is taken twice a day with hot glass of water.
<i>S. axillaris</i>	Diarrhoea, Vomiting	Tree bark is powdered and taken with water. One cup for adult and half a cup for children.
<i>T. chebula</i>	Piles, Dysentery	Small bark pieces of <i>T. chebula</i> are chewed anytime in a day.
	Gastritis	Fruits are dried, powdered and boiled in water. One teaspoon taken orally twice a day.
	Diabetes	Fruits are dried; powdered and 10 g powder is taken twice a day.
	Kidney stones	Three dry fruits are dipped in a glass of water for 4 hours and then given to the patient to drink.

fruits of *Machilus edulis* and *Diploknema butyraceae*. Raw fruits of *Spondias axillaris* were processed as pickle. Processing these fruits would enhance their utilization by reducing wastage and improve their marketing prospects. This will further increase their contribution to household food security and nutrition. In turn, this would lead to better value recognition of these fruit species and thus promote their conservation. Also, household processing of these fruits as drying and canning could increase their market value and ensures a year-round supply (Marsh 1998).

Ethnomedicinal uses of wild edible tree fruits

Out of 10 selected wild edible tree fruit species, only four species were documented to have medicinal properties for curing different ailments and diseases (Table 4). The plant products are consumed raw or in the form of a decoction, juice (mix with water or milk), capsule, curry/spices or an infusion for oral treatment and as burnt product, ointments or raw paste when applied externally. Majority of the plants parts were prepared in the form of juice followed by paste and powder. Internal administration is predominating over external. For current use, administration of

formulation was direct in form of paste or ointment. Mode of preparation is based upon nature of the ailments. There is no set and precise formula for determining the quantity of application used. It was evident from the study that these wild edible fruit species are important sources of medicine to the households. The households interviewed were aware of these species and self-medicate a range of minor ailments.

CONCLUSION

Wild edible tree fruits are limited to subsistence purposes only. Collection of these fruits plays a role in the livelihood of poor people as they sell these fruits to the nearby markets. The population of wild edible fruit trees in Sikkim is declining primarily due to human and livestock population pressure resulting to their over extraction, severe forest degradation and concomitant agricultural expansion. Poor socio-economic condition of the people is directly causing loss of these valuable resources. A growing rivalry in land use between fruits and other cash generating crops (mainly ginger, mandarin and large cardamom) presents another major difficulty. For the perceived high benefits, farmers gave

precedence to the latter crops rather than these wild edible fruit species which have a long gestation period and currently fetch low price. Creation of an enabling environment through policy reforms and market development will be essential to achieve socio-economic empowerment of the resource poor people in the state through domestication, utilization and commercialization of fruits and products. There is need for product development research, private sector involvement and strong policy support in order to have tangible impact. Interview with villagers revealed that they were willing to raise the selected species especially *Diploknema butyracea*, *Eriolobus indica*, *Spondias axillaris* and *Machilus edulis* in their farms. Sikkim has great potential in development of enterprises based on these fruits that can be linked with conservation and economic development. Wild edible tree fruits have thus crucial contribution towards subsistence economy and livelihood of Sikkim. Further, such documentation will benefit the community through the use of locally and freely available health giving foods which will also help preserve their cultural pride. In order for wild edible tree fruit species to be better appreciated, more work should be undertaken to determine their nutritional and biochemical characterization so that they can be compared with widely cultivated major fruit crops. Nutritional value of these fruits and their value added products needs further study so as to determine how they compare nutritionally with the modern diet. Further research should address the issue of marketing and pricing of wild edible fruits and their products.

REFERENCES

- Deshmukh BS and Waghmode A 2011 Role of wild edible fruits as a food resource: Traditional knowledge. *International Journal of Pharmacy and Sciences* **2**: 919-924.
- Dhillion SS and Shrestha PM 2005 Conservation needs and regulations for locally managed forests in the Highlands of Dolakha District, Nepal. In: Salleh, H. and Aziz, S. (Eds.) *Environmental and Development Aspects of Natural Resource Management in Mountains*. Pelanduk Press, Singapore.
- Etkin N L 2002 Local knowledge of biotic diversity and its conservation in rural Hausaland, Northern Nigeria. *Economic Botany* **56**: 73-88.
- Hoe V B and Siong KH 1999 The nutritional value of indigenous fruits and vegetables in Sarawak. *Asia Pacific Journal of Clinical Nutrition* **8**: 24-31.
- Marsh R 1998 Building on traditional gardening to improve household food security. *Food, Nutrition and Agriculture* **22**: 4-14.
- Martin G J 1995 *Ethnobotany, A People and Plants Conservation Manual*. Chapman and Hall London, New York, Tokyo.
- Rai AK, Sharma RM and Tamang JP 2005 Food value of common edible wild plants of Sikkim. *Journal of Hill Research* **18**: 99-103.
- Shrestha DP, Margate DE, Meer FVD and Anh HV 2005 Analysis and classification of hyperspectral data for mapping land degradation: An application in southern Spain. *International Journal of Applied Earth Observation and Geoinformation* **7**: 85-96.
- Sinha R 2003 *Beyond card sorting: Free-listing Methods to Explore User Categorizations*. Technical report. Boxes and Arrows. www.boxesandarrows.com/view/beyondcard_sorting_free_listing_methods_to_explore_user_categorizations.
- Sundriyal M and Sundriyal RC 2005 Seedling growth and survival of selected wild edible fruit species of Sikkim Himalayas, India. *Acta Oecologica* **28**: 11-21.
- Sundriyal M, Sundriyal RC and Sharma E 2003 Dietary use of wild plant resources in the Sikkim Himalaya, India. *Economic Botany* **58**: 626-638.
- Sundriyal M, Sundriyal RC, Sharma E and Purohit AN 1998 Wild edibles and other useful plants of Sikkim Himalayas, India. *Oecologia Montana* **7**: 43-54.