Namdung (Perilla ocymoides): A bioculturally rich plant in food and livelihood security of Adi women in Arunachal Pradesh, Eastern Himalaya

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Arunachal Pradesh is considered to be an abode of biocultural diversity in the world. The state is diverse in climates, native cultures and tremendous diversity of plant resources. Looking to the importance of plant resources in food, nutrition and livelihood security, this study was conducted with Adi women on Namdung plant (Perilla ocymoides). Objectives were to explore food, cultural and ethnomedicinal values of Namdung. Data were collected from 180 rural Adi women from 6 villages of East Siang district and secondary sources also. Primary data of study was collected using PRA (participatory rural appraisal) techniques and conventional methods. Study reveals that Namdung has great food, ethnomedicinal and cultural values for Adi women. This is being used from time immemorial and considered to be a medicinal plant, particularly for pregnant ladies. With regards to use and other biocultural value of Namdung plant, knowledge variability was observed among younger and elder Adi women. Namdung plant has been found of great value for promoting livelihoods through generation of micro-enterprises with the help of self help groups (SHGs). Some of the outstanding Adi women, including Mrs Orik Ralen and Mrs Y J Lego played great roles in promoting conservation of Namdung. This could be possible through their efforts in mobilizing other Adi women in order to influence conservation and sustainability of Namdung, and through value addition and linking with local market. There is need for blending traditional methods of conservation and cultivation of this plant with formal agronomic practices so that productivity of Namdung could be enhanced in order to meet the demand of local population and enhance further conservation.

Keywords: Adi women, Namdung plant, Foods and nutrition, Ethnomedicine, Biocultural value, Livelihoods, Conservation, Arunachal Pradesh

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Arunachal Pradesh is spread in an area of over 83,743 sq Km and has a rich biodiversity due to variation in altitude (from 150-6500 m), and unique climatic condition. The original inhabitants of Arunachal Pradesh belong to 26 tribes and 110 ethnic sub-tribes. These tribes have their native culture, food habits and medicines systems of treatment and traditional knowledge acquired through close connection and interaction with nature1-3. The people of the State depend much on forest and related activities for their subsistence and continuance of traditions and culture. Jhum cultivation (slash and burn agriculture) along with some commercial horticultural crops (pineapple, ginger and orange) are basic cultivation systems and major practice for survival of Adi tribe. Mixed farming and mixed cropping (plant based and often multipurpose crops/plants) are basic mainstay to derive their food and nutrition from a large number of wild plant species (so called ethnobotanicals) from their natural habitats, jhum-land and home garden (modified micro-ecosystem)2,3. The culturally important plant species and ethnobotanicals make food habit of local tribes different from rest of India4. These ethnobotanicals are inextricably linked with livelihoods support systems of Adi tribe. Ethnobotanical resources play a major role in meeting the daily nutritional requirement of Adi tribe. A wide variety of plant leaves, flower buds, fruits, roots and tubers are collected from wild, jhum-land and home garden, and consumed in various forms. There are large numbers of ethnobotanicals which have immense potential for contribution to food and livelihood security of not only people of Arunachal Pradesh or northeast region, but the India as a whole, because, the ethnobotanicals found in Arunachal Pradesh are well adapted to biotic and abiotic stress of varying ecosystems1-4.
Namdung (Perilla ocymoides, family Lamiaceae, Fig. 1) is a locally available plant in mountainous subtropical ecosystems of Arunachal Pradesh. It is known with different vernacular name such as perilla, perrila mint and Chinese basil. With erratic annual/perennial growth habit, it can grow up to 0.6 m in height\(^5\). The plant grows well in sandy loam to loam soils which is well drained and retain moisture\(^6\). It can also be grown in acidic soils having pH between 5.5 to 6.0. The plant is not frost hardy and requires temperature above 18°C to grow well. The plant requires short days in order to flower but does not grow well in shade. The flowers are scented and hermaphrodite (have both male and female organs)\(^3\). Many traditional communities of Arunachal Pradesh have domesticated this plant in jhum-land and home garden. Looking to its multipurpose importance, this study was conducted to ascertain the ethnomedicinal, nutritional and livelihood values of Namdung plant consumed in various forms by Adi tribe of Arunachal Pradesh.

**Research methodology**

A total of 180 Adi women, 30 each from 6 villages namely Sibut, Yagrung, Poglek and Mirsam (from Pasighat circle), and Mebo and Aying Basti (from Mebo Circle) of East Siang district Arunachal Pradesh were selected randomly. While selecting these women, they were sampled from three age groups, young (20-35 yrs), middle age (36-50 yrs) and old age group (>51 yrs) [thus total 60, ten from each village. Villages those grow the Namdung were selected purposively. Various field tools of participatory rural appraisal (PRA) were applied to collect field data. Transect walk was exercised to learn about the availability pattern and landscape where Namdung is cultivated. Participant observation was used to know about processing methods of traditional products prepared from Namdung. Case history and timeline techniques were applied to understand the changes in use pattern and cultural relativity. Personal interview was employed to quantify some aspects of Namdung. Interview schedule containing open-ended questions was applied to record the data from individual/group of women. Secondary data were also consulted from published sources to verify the primary facts and to compliment primary information. This study is based on 6 years of field experience (2002 to 2008) with rural Adi women in formal and informal manner or both.

The knowledge components of women have been measured with following indicators domestication (A), cultivation (B), management practices (C), seed preservation (D), preparation of due naming (E), preparation of food with local rice (F), medicinal uses of Namdung (G), cultural attachment with Namdung (H), bartering technique of Namdung (I) and marketing and income generation (J). The woman having ‘complete knowledge’ on each selected component of Namdung was assigned a score ‘3’, for ‘moderate knowledge’ a score ‘2’ and for least knowledge a score ‘1’. While, a score ‘0’ was assigned for ‘no knowledge’ to a person who could not explain about a particular component of Namdung.

The intervention points for enhancing conservation of Namdung were explored by using focus group discussion (FGD)- a method of PRA. These interventions were: (A) scientific package of practices for cultivation of Namdung, (B) scientific training to women for cultivation of Namdung (C) marketing channels and infrastructural supports (D) products diversification from Namdung seeds and leaves after identifying medicinal and nutraceutical compounds (E) value addition in Namdung seed products (F) government support and policy to promote cultivation (G), and reward and incentives to outstanding. The prior informed consent (PIC) was obtained from community leaders of respective village in order to use and publish the recorded data on Namdung plant, because most of the knowledge on use of Namdung is in public domain.

**Results and discussion**

**Propagation of Namdung**

For Adi people, Namdung is a most important food and cultural plant. To maintain its continuity and availability, Adi women use to cultivate this, but in a small scale. Adi women prepare the soil. With sufficient moisture level, the seeds of Namdung are sown and covered with a thin layer of soil. Previous studies shows that seed of Namdung germinates best at 20°C, though, it can also germinates at lower temperatures\(^7\). After the germination, proper plant populations are maintained through a careful weeding and thinning of undesired population. Seedlings are prepared and transplanted when they are 4.0 - 5.0 cm in height\(^7,8\). Irrigation is not required so long as sufficient moisture level is maintained by natural showers. The work done by other scholars on Perrila sp. can be used in developing scientific package and
practices to cultivate Namdung\(^7,8\) and prepare functional foods from it\(^9\).

**Traditional uses of Namdung food and nutritional security**

The Adi community has been using seeds of Namdung from time immemorial. Adi community of Upper Siang district has been using seeds of Namdung in the barter system with the same community living in Pasighat ecosystem (plain area) to exchange with rice (local variety called Amkel). The seeds of Namdung are used after mixing with rice and in various other forms-like fermented and chutney also. Eating hot and pungent foods is traditional habit of Adi tribe. Their food and related recipes are selected accordingly. To meet the need for hot and spicy food, chutneys made from herbs along with seeds of Namdung form a major food in the Adi’s diet. For instance, people use dried seeds (Fig. 2) of Namdung in preparing chutney. These are boiled and wrapped in Ekkam leaves (Phrymimum pubenerve), then placed on the Perap (bamboo shelf) near the kitchen fireplace to allow fermentation. After 3-4 days in summer and 6-7 days in winter, the seeds are again wrapped in Ekkam leaves, and are roasted in wood ash for a while. The roasted seeds are crushed and formed into balls, and are then stored after wrapping with Ekkam leaves in bamboo basket. This fermented Namdung paste is used in preparing chutney (Fig. 3) with Sibol chilli (local variety), Ori (local coriander), ginger and salt. This chutney is called Duye namsing. The other study also revealed that seeds of Namdung are used by Adi tribe to enhance taste of curry soup\(^1\).

The Nyshi community of Arunachal Pradesh living in subtropical ecosystem also uses seeds of Namdung in powdered form with the boiled vegetable, and mostly as an additive. Some times, it is being used as an ingredient of chutney in the appetizing foods by the Nyshi community.

Apart from Arunachal Pradesh, in other parts of the world, young leaves and seedlings are reported to be consumed either raw (as salad) or cooked\(^10\). Older leaves are used as a garnish or flavouring. Older leaves are also salted and used as a condiment for tofu (soy paneer) and as a garnish for tempura. Leaves from purple cultivars are used to colour preserved fruits\(^11\). The leaves can also be dried for later use\(^12\). The leaves contain about 3.1% protein, 0.8% fat, 4.1% carbohydrate and 1.1% ash\(^10\). Immature flower clusters are used as a garnish for soups and chilled tofu. Older flower clusters are fried and eaten\(^12\). The seeds are preserved in salt or are used as a spice in pickles, tempura and Miso. The seed can also be cooked and eaten.

The seeds contain about 17.0% protein, 51.0% fat, 11.3% carbohydrate and 4.4% ash\(^10,14\). The oil is rich in n-3 PUFA linolenic acid (56.8%), hence good for heart\(^10,11\). Protein is of good quality and net protein utilization (NPU) is found averaging more than 50 per cent. True digestible protein (TDP) in Namdung is observed to be averaging more than 80 per cent. Cooking and/or dehulling of perilla increases NPU and TDP, whereas roasting exerts a negative effect\(^14,15\). The plant yields an essential oil that is used as food flavouring in candies and sauces\(^12\). It also contains perillartin a mono teropenoid (about 350 times sweeter than sucrose) which is the constituent of slightly sweet volatile oil. Perillartin gives bitter after taste and limits usage\(^16\).

**Ethnomedicinal knowledge on Namdung**

The elder Adi women recommend Namdung seeds to pregnant ladies as chutney and with rice. The nontribal people living in study areas have also become acquainted with the food products (chutney and laddu) prepared from Namdung seeds. It is considered to be beneficial to mother and baby. Eating this herb need to be avoided by pregnant women as reported by Foster\(^17\). The experiences of Adi community women reveal that eating fermented and roasted forms of Namdung seeds does not harm even during the pregnancy also. Results indicated that there was knowledge gap between young, middle aged and elder women of Adi tribe with regards to use and other aspects associated to Namdung (Fig. 8 ‘A’ to ‘J’ components). Elder women were having significantly higher knowledge relating to various dimension of Namdung (‘A’ to ‘J’ components) in comparison to young and middle aged women. This shows that there is knowledge variability across the generation relating to use of Namdung plant, and it takes long to learn upon.

It is reported to be antibacterial; diuretic, anti-inflammatory, antipyretic; antispasmodic; aromatic; carminative; diaphoretic; emollient; expectorant; pectoral; stomachic and remedy for the cough. The leaves, stems and seeds are often used in oriental medicine. It is a pungent, aromatic, warming herb that is antibacterial, antipyretic, antiseptic, antispasmodic, anti-tussive, aromatic, carminative, diaphoretic, emollient, expectorant, pectoral, stomachic and tonic\(^18\). The leaves are used in the treatment of colds,
Physical symptoms include chest stuffiness, vomiting, abdominal pain etc. The seed is anti-asthmatic, anti-tussive, emollient and expectorant. It is used internally in the treatment of asthma, colds and chills, nausea, abdominal pain, food poisoning and allergic reactions (especially from seafood), bronchitis and constipation. The stem is used in Chinese traditional remedy for morning sickness7, 8, 11, 13.

Other uses of Namdung

The Adi people use Namdung as an alternative to mustard oil. Oil of Namdung is considered comparatively better than any other oil from health point of view. According to previous studies, drying oil obtained from the seed is used in making paints, varnishes, water proofing, etc3, 5, 9, 15. It is used as a food flavouring and in dental products7, 9, 13, 19. The plant yields 0.3 - 1.3% essential oil, which contains 20% citral9. It contains volatile oil, used as spice (among Adi and Nyshi communities of Arunachal Pradesh also), perfumery and oil coloring20. Its anthocyanine is used for coloring pickled fruits20.

Capacity building of Adi women for promoting livelihood and cultivation of namdung

To promote the conservation through use and cultivation of Namdung, two villages were selected, viz. Sibut and Yagrung where Adi women have been given training exposure on various aspects of Namdung. It included the cultivation and development of food products to increase income and promote conservation of Namdung. In such initiative, the following two products were prepared and standardized through training (Fig. 4):

Preparation of Laddu(sweet) from Namdung seeds

Roast the seeds of Namdung on low flame in a Kadahi (pan) for 8-10 minutes. When Namdung seeds appear dark in colour, remove the pan from flame. Make the powder of Namdung seeds and sugar with the help of grinder. Mix all the ingredients in a big pot; add dry fruits and ghee (fat obtained from cow milk) for binding of laddus. It may be stored in the polythene bags for about 10-15 days on normal room temperature. It may be transported in the plastic tray to market without any loss. This product could be of great demand among the tribal and non-tribal communities.

Making chutney from Namdung seeds

Roast the seeds of Namdung on low flame in a Kadahi or pan for 8-10 minutes. When Namdung seeds appear in colour, remove the pan from flame. Make the powder of Namdung seeds with the help of grinder. Add dry mango or bamboo shoot powder, Sibol (indigenous variety of chilli), salt, Dilap (indigenous variety of onion) and Ori (indigenous variety of coriander). Mix all the ingredients together, grind it well with small amount of water. Now chutney is ready serve. This product will be greatly appreciated and consumed by diverse population and could generate demand in local restaurants and hotels.

Interventions to enhance conservation of Namdung

The opinion percentage of Adi women indicated that they are willing to enhance conservation of Namdung with various degrees of conservation interventions through ‘A’ to ‘G’ (Table 1). Though, in this aspect, elder Adi women were in higher percentage of opinion than those of young and middle aged. The experiences gained through various village workshops and meetings held with Adi women indicated that conservation of Namdung can be accelerated through promoting outstanding grassroot conservators as key community leaders21. Such community women leaders were found as catalytic agents for other Adi women who could influence conservation and uses of Namdung plant.

<table>
<thead>
<tr>
<th>Nos</th>
<th>Interventions</th>
<th>Opinion % of studied women</th>
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<tbody>
<tr>
<td>A</td>
<td>Scientific package of practices for cultivation of Namdung</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Young</td>
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<td></td>
<td>12.4</td>
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<tr>
<td>B</td>
<td>Scientific training to women for cultivation of Namdung</td>
<td>18.9</td>
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<tr>
<td>C</td>
<td>Marketing channels and infrastructural supports</td>
<td>15.2</td>
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<td>D</td>
<td>Products diversification from Namdung seeds and leaves after identifying medicinal and nutraceutical compounds</td>
<td>18.9</td>
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<tr>
<td>E</td>
<td>Value addition in Namdung seed products</td>
<td>14.6</td>
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<tr>
<td>F</td>
<td>Government support and policy to promote cultivation</td>
<td>19.5</td>
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<tr>
<td>G</td>
<td>Reward and incentives to outstanding</td>
<td>18.3</td>
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Table 1—Intervention to enhance conservation of Namdung
Formation of self help group (SHGs), promotion of namdung products and conservation of species

Mrs Orik Rallen, an Adi woman of Sibut village, East Siang district of Arunachal Pradesh is a traditional medical practitioner and community mobilizer. She promotes conservation of indigenous plant biodiversity, and spreads awareness among younger generation about domestication of forest plant species. She has conserved 18 local varieties of various crops and 26 local forest species including Namdung. She explores plants from the Morang community forest and adds cultural values to them, such as making pickle, using them in ethnomedicines, as foods and for many cultural and spiritual purposes. She has mobilized the Adi women of Sibut village to undergo training on value addition to various traditional products prepared from Namdung, and their marketing to enhance community-based plant conservation. For this contribution, she has formed a self-help group (SHG) of 10 Adi women.

She is aware of traditional knowledge erosion among young members of her community. She teaches children and women about ethnomedicinal and cultural value of Namdung. With the help of her SHG, she promotes local plant species-based micro-enterprises in coordination with R&D institutions in order to improve the scientific value of local products. Developing food products from seeds of Namdung to promote livelihoods of Adi women; and to influence conservation of Namdung in jhum-land is the sole efforts of Rallen. For this contribution, she has been awarded at SRISTI, Ahmedabad as ‘Champion of Biodiversity Conservation’ (Fig. 6).

Mrs Y J Lego (52) was another woman who took interest in using Namdung to prepare local products including medicinal food, local chutney and sweets. She has started making network and group of Adi women who were interested to cultivate Namdung and sell it in local market for income generation. To promote this she has established network from mountain ecosystem to plain ecosystems, since Namdung is a crop that is compatible to cultivate in undulating and gravelly lands than the clay soil in plain land. Therefore, she tried to exchange the products such as local rice and chilies products from Pasighat (plain ecosystem) with the women living in upper region of mountain. This network has influenced to encourage women of mountain region for increasing area under Namdung plants. Looking to this effort on conservation, Mrs Lego has also been

Fig. 1-7—Namdung (Perrila ocimodes) plant; 2—Inflorescence and seeds of Namdung; 3—Namdung seeds’ chutney; 4—Rural Adi women of Sibut village, Pasighat engaged in processing of Namdung’s laddu; 5—Village workshop in Sibut village (East Siang district) on conservation of Namdung through value addition & products development; 6—Mrs Orik Ralen of Sibut village, East Siang district; 7—Mrs Y J Lego of GTC Colony, East Siang district
A=Domestication, B=Cultivation, C=Management practices, have been receiving the seeds of conservation and use. The people of Pasighat valley has got a special attention for its Namdung food compatibility of tribal communities, the plant. Arunachal Pradesh is rich in many aspects of nutrition and could be blended with formal knowledge. The methods of cultivation is studied in scientific manner cultivations is promoted, provided the traditional cash crop to the subsistent cultivation. The now the women of some of villages have started its Pangin, Renging people of villages namely: Conclusion and policy implications

We could conclude that Namdung species found in Arunachal Pradesh is rich in many aspects of nutrition and medicinal properties. On account of its taste and food compatibility of tribal communities, the plant Namdung has got a special attention for its conservation and use. The people of Pasighat valley have been receiving the seeds of Namdung with the people of villages namely: Mebo, Boleng, Borguli, Pangin, Renging and other neighboring areas with other food stuff and bioresources of forest and jhumland. Looking to biocultural values of Namdung, now the women of some of villages have started its subsistent cultivation. The Namdung can become a cash crop to the Adi people, if its scientific package of cultivations is promoted, provided the traditional methods of cultivation is studied in scientific manner and could be blended with formal knowledge. The practices of cultivation of Namdung where the refinement and validation is required, need to be prioritized. This is an opportunity for agronomists and other agricultural scientists. The other scholars from food and nutrition subjects have done remarkable work on Perrila sp.15,16 For further conservation and promotion of this species, several other food products can also be made with the proper value addition in order to generate more demand of seeds. This approach can accelerate the conservation process of Namdung species and may also help in boosting economy of Adi and other tribal women of Arunachal Pradesh. For this, rural women can be trained regarding the scientific cultivation, but before that its nutritional and medicinal values are to be popularized by the local media and other agencies.

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