Namdung (*Perilla ocymoides*): A bioculturally and nutritionally 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. State is diverse in climates, tribal culture and tremendous diversity of plant resources. Looking to the importance of plant resources in food, nutrition and livelihood security, a study was conducted with *Adi* women on *Namdung* plant (*Perilla ocymoides*) to explore its food, cultural and ethnomedicinal values. Data were collected from 180 rural women from six villages of East Siang district and secondary sources also. Data pertaining to study was collected using PRA techniques and conventional methods. Study reveals that *Namdung* has a great food, ethnomedicinal and cultural values for *Adi* women. This is being used from time immemorial and considered to be medicinal for specially the pregnant ladies. Though, with regards to use and other biocultural value of *Namdung* plant, knowledge variability has been recorded in between younger and elder *Adi* women. *Namdung* plant has been found to be of great value for promoting livelihoods through generation of micro-enterprises with the help of self help groups (SHGs). Some of outstanding *Adi* women- including Mrs Orik Ralen and Mrs Y J Lego were studied to be great role players in promoting conservation of *Namdung* and mobilizing other *Adi* women in order to influence conservation and sustainability of *emo*, 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

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 own culture, food habits and medicinal systems of treatment and knowledge acquire through close connection and interaction with nature[1-3]. The people of state depend much on forest and related activities for their survival and continuance of traditions and culture. Jhum cultivation along with some horticultural crops (pineapple and orange) is 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, jhumland and home garden (modified microecosystem)[2,3]. The culturally important plant species and ethnobotanicals make food habit of local tribes different from rest part of India[4]. 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*[2-4]. 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 for Arunachal Pradesh or northeast region of India, but the country as a whole. Because, they are well adapted to biotic and abiotic stress of varying ecosystems[1-4].

Namdung (*Perilla ocymoides*, 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 upto 0.6 meter 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 particularly fertile soil. This plant prefers an acid soil with a pH between 5.0 and 6.0. The plant is not frost hardy and requires temperature above 18°C if it is 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 jhumland and kitchen gardens. Looking to its multipurpose importance, a study was conducted to ascertain the medicinal, nutritional and livelihood values of *Namdung* plant consumed in various forms by *Adi* tribe of Arunachal Pradesh.

Research methodology

A total 180 *Adi* women, 30 from each of six 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 *Adi* women, they were sampled from three age groups young (20-35 yr), middle age (36-

50 yr) and old age group (>51 yr) thus total 60, ten from each village. Villages those grow the *Namdung* were selected purposively. Various field tools of participatory rural appraisal (PRA)- such as transect walk to learn about the availability pattern and landscape where *Namdung* is cultivated, participant observations- to know about processing methods of *Namdnung* products, case history and timeline- to understand the changes in use pattern and cultural relativity, and personal interviews- to quantify some information have been adopted to record the data on various aspects of *Namdung* plant. Survey questionnaire containing open-ended questions was used to record the data from individual/ group of women. Secondary data were also consulted from published sources to verify the primary facts to compliment information of this study. This study is based on 6 years of field experience (2002 to 2008) with rural *Adi* women in formal and informal manner both.

The knowledge components of women has 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* and (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, 'no knowledge' on any component was measured with score 'o'

The intervention points for enhancing conservation of *Namdung* were explored by using focus group discussion (FGD)- a method of PRA). These interventions were named with followings: (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 neutraceutical compounds (E) value addition in *Namdung* seed products (F) government support and policy to promote cultivation, and (G) 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* plant was the part of public domain.

Result 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 at the very small scale. *Adi* women were observed to make a pulverized soil. With sufficient moisture level, the seeds of *namdung* are sown and covered the surface with only a light soil. As other study indicates 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. The other study showed that seedlings are prepared and transplanted when they are of 4.0 - 5.0 cm in height[7,8]. Women don't irrigate this crop, since sufficient amount of moisture is obtained through the frequent rain's 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 the time immemorial. *Adi* community of Upper Siang district has been using its seeds 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 in 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 *Adií*'s diet. For instance, people use dried seeds (Fig. 2) of *Namdung* in preparing chutney. These are boiled and wrapped in *Ekkam* leaves (*Phyrinum 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 in *Ekkam* leaves in bamboo baskets. This fermented *Namdung* paste is used in preparing chutney (Fig. 3), being mixed 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 reported to be 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 time, it is being used as an ingredient of chutney in the appetizing foods by the *Nyshi* community.

Apart from the 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, 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*. They are one of the ingredients in 'S*shichimi*' or 'seven spice' mixture. The seed can also be eaten cooked.

The seed contains about 17.0% protein, 51.0% fat, 11.3% carbohydrate, 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 to be averaging more than 50%, and true digestible protein (TDP) is recorded to be averaging more than 80 per cent. Cooking and/or dehuling of perilla increases NPU and TDP, whereas roasting exerts a negative effect[14-15]. The plant yields an essential oil which 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 for using *Namdung* seeds to pregnant ladies as chutney and with rice food. It is considered to be beneficial to mother and baby both. While, eating this herb should be avoided by pregnant women as reported by Foster[17], while the experiences of *Adi* community women reveals that eating fermented and roasted forms of *Namdung* seeds does not harm even during the pregnancy also. Results indicated that

there was knowledge gap in between young, middle aged and elder women of *Adi* tribe with regards to use and other aspects associated to *Namdung* (Fig. 4 A to J components). Elder women were having higher and significant 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 in between the younger and elder generation relating to use of *Namdung* plant, and it takes long to learn upon.

It is reported to be antibacterial; diuretic, 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, antitussive, aromatic, carminative, diaphoretic, emollient, expectorant, pectoral, stomachic and tonic[18]. The leaves are used in the treatment of colds, chest stuffiness, vomiting, abdominal pain etc. The seed is antiasthmatic, antitussive, 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 stems are a traditional Chinese remedy for morning sickness[7,8.11,13].

Other uses of *Namdung*

The *Adi* people use it as an alternative of mustard oil and are 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 etc[3,5,9,15]. It is used as a food flavouring and in dental products[7,9,13,19]. The plant yields 0.3 - 1.3% essential oil, which contains 20% citral[9]. It contains volatile oil, used as spicy (among *Adi* and *Nyshi* communities of Arunachal Pradesh also), perfumery and oil coloring[20]. Its anthocyanine is used for coloring pickled fruits[20].

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

To promote the conservation through use and cultivation of *Namdung*, two villages are 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

products to increase income and promote conservation of *Namdung*. In such initiative, the following two products were prepared and standardized through training (Fig. 5):

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 of 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 cello-phin polythine. 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 both 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 of dark 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* chilli, salt, *Dilap* (local onion) and *Ori* (local coriander). Mix all the ingredient, grind it with small amount of water. 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 in relation to required intervention points indicated that they are willing to enhance conservation of *Namdung* with various degree of interventions through 'A' to 'G' (Table 1). Though, in this aspect, elder *Adi* women were in higher percentage of opinion than the young and middle aged *Adi* women. The experiences gained through various village workshops and meeting held with *Adi* women indicated that conservation of *Namdung* can be accelerated through promoting outstanding grassroots conservators as key community leaders[21]. Such community women leaders were found to be catalytic agents for other *Adi* women who could influence conservation and uses of *Namdung* plant.

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 who promotes conservation of indigenous plant biodiversity. She spreads awareness among younger generation about domestication of forest plant species. Her efforts have led to conserving 23 local varieties of various crops and 36 local forest species including *Namdung*. She explores plants from the community forest (*Morang*) and adds cultural-specific values to them- such as making pickle, using them as ethnomedicines, as foods and for many cultural and spiritual purposes. She has mobilized the *Adi* women of Sibut village to undergo training in value addition in *Namdung* and its marketing to enhance community-based plant conservation. For this, she has formed a self-help group (SHG) of 10 women[21].

She is aware of the eroding knowledge among the young members of the community and teaches children and women about medicinal and cultural value of *Namdung* plant. 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-based products. Developing food products from seeds of *Namdungs* (*Perilla ocymoides*) to promote livelihoods of *Adi* women; and to influence conservation of *Namdung* in jhumland is the sole efforts of Rallen. For this contribution, she has been awarded at SRISTI, Ahmedabad as '*Champion of Biodiversity Conservation*'[21] (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 the income generation. Though, to promote this she has established network from mountain ecosystem to plain ecosystems, since *Namdung* is a crop which is compatible in undulating and gravelly lands than the plain land clay soil. 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 conservation efforts made by Mrs

Lego, she has also been awarded at SRISTI, Ahmedabad as '*Champion of Biodiversity Conservation*'[17] (Fig.7).

To have the self reliance and sustainability in promotion of *Namdung* products and conservation of this crop, a village workshop was conducted (Fig. 8) and self help groups were made. Every member of this SHG was given a particular responsibility to process and promote the *Namdung* based products. It is interesting to report that, recently the traditional *Adi* women have formed self help groups and developed *Siang nutri* in which adding mixture of *Namdung* is most important ingredient.

Conclusions

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 of *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 *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 folk 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. 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 folk 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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Table 1. Intervention to enhance conservation of *namdung*

Nos	Interventions	Opinion percentage of studied women		
		Different age group of *Adi* women		
		Young	Middle	Old
A	Scientific package of practices for cultivation of *namdung*	12.4	34.6	64.7
B	Scientific training to women for cultivation of *namdung*	18.9	30.2	70.5
C	Marketing channels and infrastructural supports	15.2	24.5	78.8
D	Products diversification from *namdung* seeds and leaves after identifying medicinal and neutraceutical compounds	18.9	29.8	68.9
E	Value addition in *namdung* seed products	14.6	22.8	72.9
F	Government support and policy to promote cultivation	19.5	29.7	65.4
G	Reward and incentives to outstanding	18.3	30.4	85.9

Fig. 1 *Namdung* (*Perrila ocimodes*) plant

Fig. 2 Inflorescence and seeds of *Namduna*

Fig. 3 *Namdung* seeds' chutney

Fig. 5 Rural *Adi* women of *Sibut* village, Pasighat engaged in processing of *namdung laddu*

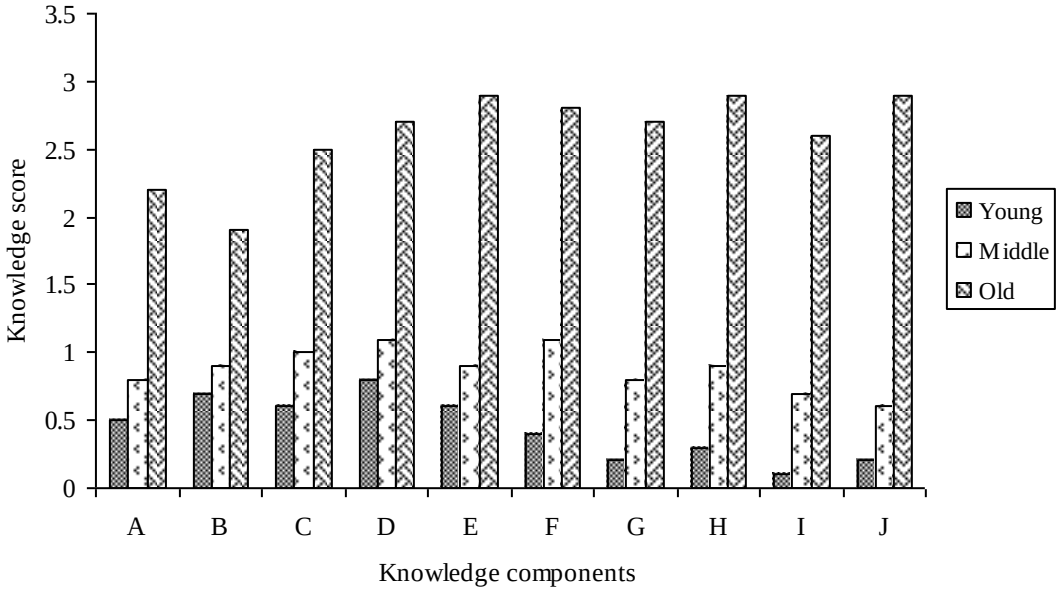

Fig. 4 Knowledge variability among different age groups

Abbreviation

A= Domestication, B= Cultivation, C= Management practices, D= Seed preservation, E=Preparation of *due naming*, F= Preparation of food with local rice, G= Medicinal uses of *namdung*, H= Cultural attachment with *namdung*, I= Bartering technique of *namdung*, J= Marketing and income generation

Fig. 6 Mrs Orik Ralen

Fig. 7 Mrs Y J Lego

Fig. 8 Village workshop in Sibut village (East Siang district) on *namdung* crop conservation and through value addition & products development