



***Perilla frutescens* in Transition: a medicinal and oil yielding plant need instant conservation, a case study from Central Himalaya, India**

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Abstract

Traditional crop varieties and races, which evolved over time through trial and error, not only provide basic nutritional requirements, but also food security. Loss of crop biodiversity has taken place over the years, principally and inadvertently related to changing lifestyle, growing demand of cash crop in the regional market, whose acreage has increased with the concomitant decline in area under traditional crops. Cultivation of *Perilla frutescens*, one of the important oil yielding traditional crops with medicinal value is at the verge of extinction. In this study 50-71% reduction was observed in grain yield of *P. frutescens* per hectare and 52-80% decline in land under cultivation of this crop for last three decades in the region. The present study highlighted the causes and consequences of decline in production and area under cultivation along with agronomy, utilization and future potential of the crop in the region for its conservation and sustaining the agriculture system.

Keywords: Traditional crop, *Perilla frutescens*, Central Himalayan, Conservation, Indigenous knowledge.

Introduction

Agricultural practices are the main stay of the people of Uttarakhand, central Himalaya and a large section of the Himalayan population largely depends upon agricultural based activities for their livelihood. Out of the total population, about 75-90% people are engaged either with the main occupation of agriculture or its allied practices, dominated by traditional subsistence cereal farming (Maikhuri *et al.*, 1997; 2001; Sati, 2005; Negi *et al.*, 2009; Negi *et al.*, 2010a; Chandra *et al.*, 2009; 2011 a,b). The farming of crops is mostly traditional and overall cropping pattern of the mountain region of central Himalaya is typically of an underdeveloped agricultural economy. Environmental, biological, socio-cultural and economic factors prevailing in the Central Himalayan region have resulted in the evolution of diverse agroecosystems along with crop diversity. Agrobiodiversity is an insurance against disease and extreme climatic fluctuations, as a coping mechanism in times of scarcity, as a means to enhance overall productivity of farms, as a source of critical nutrition

and medicine, and as a culturally important resource (Altierie 1995; Maikhuri *et al.*, 2001; Saxena *et al.*, 2005). The huge diversity in Mountain region has been maintained through a variety of crop compositions, indigenous method of maintaining soil fertility, socio-cultural and religious rituals. Research work by various workers (Maikhuri *et al.*, 1996, 1997, 2001; Semwal *et al.*, 2004; Nautiyal *et al.*, 2002-2003; Negi *et al.*, 2009; Farooque and Maikhuri 2009; Chandra *et al.*, 2010) carried out in agriculture system in Himalaya revealed drastic decline in diversity and production of traditional crops during last decades due changing socio-economic condition, promotion of cash crops and change in climatic conditions.

In some areas the traditional crop landraces are facing danger of complete extinction and consequently the ecological security of the traditional farming systems is in dilemma. *P. frutescens*, one of the important oil yielding traditional crops with high medicinal value is at the verge of extinction in the Central Himalaya due to various reasons. It has long been valued for its edible oil, which has played a subsistence role in the economy of Himalayan region for many years. The present study was carried out to understand the causes and consequences of decline in production and area under cultivation along with agronomy, utilization and future potential of the crop in the region for its conservation and sustaining the agriculture system.

Materials and Methods

Present study was carried out in ten prominent villages located in Pinder valley in district Chamoli, Central Himalaya (Uttarakhand) situated between 20^o31'9" to 31^o 26'5" N & 77^o35'5" to 80^o6' E. The Pindar Basin comprising of 1826.0 km² area extends from 30^o N to 30^o 18'N and 79^o 13' E to 80^o E. It represents the eastern part of the Garhwal Himalaya with height ranging from 800 m to 6800 m. River Pindar originates from the 'Pindari Glacier' in Almora District (32 km) and flowing an approximately 124 km with its numerous tributaries, confluences into the Alaknanda River at Karanprayag in Chamoli District (Sati and Rawat 1993; Maikhuri *et al.*, 2001). Agricultural farming is dominated by the cultivation of subsistence cereal farming, which is carried out in the narrow patches of terraced fields and the mode of cultivation is traditional.

A door-to-door survey was conducted in selected households of each village to enumerate total landholding, area under cultivation, crop composition, cropping pattern, commonly cultivated crops and traditional knowledge. Each family was visited 3-4 times during the cropping season so as to collect authentic information. Transactional walk was conducted to survey 60% household of each village through informal discussion with knowledgeable members of the families, particularly with women folk, as they are actively involved in all agricultural activities.

Respondents, particularly the elder persons, were asked to prioritize the probable reasons for change in crop production and decline in yield in their own farm fields in particular and in the village in general. In order to document indigenous knowledge about the crop, a rapid rural appraisal survey was conducted in all the selected villages. Structured and semi-structured questionnaires related to the use of plants for different diseases were developed (Negi *et al.*, 2010b; Negi *et al.*, 2011)

Results and Discussion

Taxonomy, plant description and habitat

P. frutescens belongs to family lamiaceae, is an erect annual herb locally known as Bhangjeera, grown in mixed cropping with pulses and finger millet along the margin of the land in the rainfed agriculture. *Perilla* is a member of the mint family and has the characteristic square stems and four stamens of most species in that family. Within the genus *Perilla*, the taxonomic nomenclature is controversial (Zeevaart, 1969). *P. frutescens*, grow up to 4 feet tall when in bloom, the stems 4-angled, hairy. Leaves ovate–lanceolate, flower white, whorled, Calyx campanulate, Corolla pale white (Gaur, 1999). It is a very aromatic plant, with a strong minty smell. The plant prefers light (sandy) and medium (loamy) soils and requires well-drained moisture-retentive soil but do not need particularly fertile soil. The plant prefers acid, neutral and basic (alkaline) soils. The flowers self-pollinate without insect visits, one of the greatest difficulties in *perilla* cultivation is the limited seed viability in storage. At room temperature, the seeds can die in less than a year. Lowered temperature and lowered humidity improve storage life (Brenner, 1993).

Medicinal value

The species has been used abroad in at least nine ways: seeds are sold as food for birds or human consumption; the seed oil is used as a fuel, a drying oil, or a cooking oil; the leaves are used as a potherb, for medicine, or for food coloring; and the foliage is distilled to produce an essential oil for flavoring (Publications and Information Directorate 1966). The seeds are eaten by people and used as bird seed. The volatile oil of *perilla* is used as a flavoring agent, in which perilla aldehyde is the desirable flavoring compound. One of the aldehyde isomers is 2,000 times as sweet as sugar and four to eight times as sweet as saccharin (Guenther 1949). A *perilla* line from Bangladesh is a potential commercial source of rosefuran, a compound of interest in flavoring and perfumery (Misra and Husain 1987), Asian herbalists prescribe *perilla* for cough and lung afflictions, influenza prevention, restless fetus, seafood poisoning, incorrect energy balance, etc. *Perilla* alcohol prepared from perilla aldehyde, is used in fragrances, and has legal food status in the United States and Europe (Opdyke 1981). Locally the plant is used for various purpose i.e. as a medicine, edible oil, garnish or flavouring agent, as vegetable and other traditional food items (Table 1).

Traditional agronomic practices

The cropping pattern in this region is built up around two seasons viz Rabi (from October to March) and Kharif (from April to October). The crop grown under monocropping practices in some high altitude villages while it is generally cultivated under mixed cropping in almost all the valley of Garhwal region of Uttarakhand. As a mixed crop it is associated with *Amaranthus frumentaceous*, *Elusine coracana* *sesmum indica* and various cultivated legumes crops viz *Macrotyloma uniflorum*, *Vigna radiata*, *V. angularis*, *V. unguiculata*, *Pisum arvense*, *Glycine spp.* etc in mixed cropping practice (Chandra *et.al.*, 2010; 2011 a,b) . Now the cropping practice of this crop has been changed in Uttarakhand as most of the people used to grow *P. frutescens* on the bunds of their crop farm in mixed cropping due to changing socio-

economic condition of the region. This crop is generally sown with wheat (rabi crop), but sowing take place after germination of wheat that is approximately after twenty day along the margin of land. The crop germinates or attains a height of one feet at the time of wheat harvesting, now mixed cropping take place in the same land that include millet, psedomillet, legumes etc but precautions to take to protect seedling of perilla during ploughing. The crop Harvested along with mixed crops (kharif crop) so this crop cycle completed within ten month.

Table 1 Medicinal and Traditional use of *Perilla frutescens* in Garhwal Himalaya

| Part used | Medicinal and traditional use |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Seeds | The seeds are used as spice and also roasted to prepare a very delicious sauce (chutney), one of the famous traditional dishes of Uttarakhand. Traditionally the plant is useful in the treatment of colds, cough, chest stuffiness, vomiting, abdominal pain, and constipations. |
| Leaves | Edible young leaves cooked as vegetable. Older leaves are used as a garnish or flavouring, the leaves can also be dried for later use. The juice of the leaves is applied to cuts and wounds. |
| Seedlings | Seedlings cooked as vegetable and also added to salads for better taste. |
| Seed oil | Traditionally the seed oil is used as edible oil for centuries by local people and also used by local women of the region for massaging new born infants. |
| Seed by-product | The residue (byproduct) remains after extraction of oil from seeds through traditional way is used to prepared delicious vegetable in Uttarakhand since time immemorial. |

Yield and consumption pattern

Once a time when this crop solely fulfilled the need of oil in the Garhwal Himalaya but due to market availability and alternative source, consumption of its oil is decreased at higher level, which subsequently consequences into the decreased land under this crop. Figure 1 presented land under *P. frutescens* cultivation between two points of time (1980 and 2010), which reveals that there is a huge decline in land under cultivation of this crop within a time period of three decade. The present study raveled 50-71% reduction in grain yield of *P. frutescens* per hectare (Table 2) and 52-80% decline in land under cultivation of this crop for last three decades in the region due to various reasons (Table 2). On-farm conservation is considered to be the sustainable management of genetic diversity of locally developed traditional agriculture system. There is 90% replacement of area under cultivation of this crop during past three decades by different cash crops like soyabean, potato, pea, brassica etc (Maikhuri *et al.*, 1997; Negi *et al.*, 2009; Chandra *et al* 2010).

Figure 1. Land under (ha/ village) *Perilla frutescens* cultivation between two points of time (1980 to 2010)

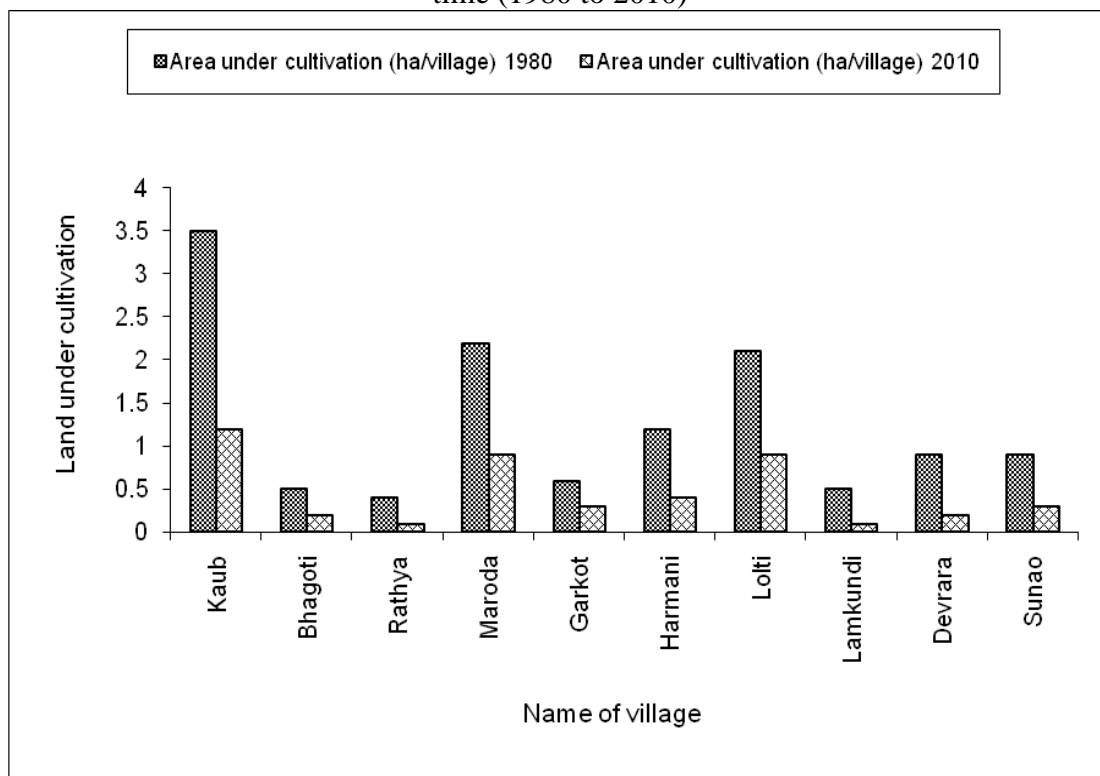


Table 2. Grain yield (kg/ha±SE) (n=200) of *Perilla frutescens* at two points of time (1980-2010)

| Village | Grain yield (kg/ha) 1980 | Grain yield (kg/ha) 2010 | % Decline in yield | Reasons for Decline/increase |
|----------|--------------------------|--------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kaub | 250±5.77 | 100±5.06 | 60 | 1. Preference towards refined oil easily available in the market 2. Due to rapid socio-economic and change in food habit reduce its consumption in spices, vegetable and as edible oil. 3. Shift from traditional crops to cash crops like Soyabean, Potato, Rajma etc |
| Bhagoti | 225±4.40 | 65±3.60 | 71 | |
| Rathya | 240±8.80 | 100±4.87 | 58 | |
| Maroda | 275±6.40 | 140±4.31 | 50 | |
| Garkot | 240±7.12 | 93±3.09 | 61 | |
| Harmani | 250±5.91 | 120±5.14 | 52 | |
| Lolti | 198±7.15 | 96±4.19 | 52 | |
| Lamkundi | 186±4.95 | 79±3.45 | 58 | |
| Devrara | 260±8.27 | 87±3.65 | 67 | |
| Sunao | 210±5.64 | 72±4.01 | 65 | |

* SE - Standard error



Figure 2 A: Mixcropping of *P. frutescens* along the bund of agriculture farm, B: Monocropping of *P. frutescens*, C: Manual threshing of *P. frutescens*, D: Sauce (chutney) of roasted seeds, one of the famous traditional dishes of Uttarakhand.

People prefer to refined oil which is easily available in the market due to rapid changing socio-economic conditions, cultural changes, food habit and lack of incentives for marketing of traditional crops. Though, a few farmers' especially poor ones as they can't afford the price of market are still cultivating the crop in monocropping but a rather small quantity, most of the farmers cultivating this crop on the bunds of their crop field in mixed cropping. Since this plant required least input for cultivation and provide viable economic return and therefore its cultivation in monocropping, abandon agricultural land/ degraded site needs to be promoted. It provides, three times higher yield when maintained by the farmers as a pure crop compared to yield obtained in mixed cropping conditions. This will require awareness among the people about the potential and value of this crop since it has great potential for cottage industry (Figure 2). Since hill economy and agriculture is women folk based, the action to empower them through training in technical, leadership and organization skills can led to successful outcomes from implemented strategies, individual household food security and conserving agriculture diversity (Maikhuri *et al.*, 1996; Nautiyal *et al.*, 2005; Negi and Rawat 2010).

The change from traditional subsistence agriculture to cash-crop-based agriculture has been advancing in the last three decade. Many traditional crops thus totally vanished; some others are at the brink of extinction and subsequently decreased the area under traditional crop while these entire crops are good source of

nutrients and full of medicinal properties (Maikhuri *et al.*, 1996; 1997; 2001; Negi *et al.*, 2009). Consequently, the ecological and economic security of the traditional agroecosystems of this area appears to be in jeopardy, as studied in other parts of the Central Himalaya by various authors (Maikhuri, 1996, 2001; Nautiyal *et al.*, 2005). Negative trends in agro-ecosystem such as decline in crop yield, expansion of agriculture on marginal land (Eckholm, 1975; Singh *et al.*, 1984) declining carrying capacity of the rangeland (Negi, 1990; Joshi, 1991) loss of crop genetic diversity (Maikhuri *et al.*, 1997, 2001; Singh, 1997) dominates the debate on sustainable agriculture in Himalaya as when any species or cultivar is lost, the centuries old traditional knowledge about the same also disappears (Maikhuri *et al.*, 2001).

Conclusion

Sustainable agricultural development will involve the strengthening and improvement of some of these traditional systems rather than their replacement with alternative high input farming system. In outlook of the distinctive and precious properties of *P. frutescens* and its decreasing cultivation in central Himalaya, due to lack of promotion to marketing and awareness among the policy maker, there is an urgent need to endorse the cultivation and marketing of this indigenous and traditional crop for its conservation in Uttarakhand. Farmers indicated that special incentives and ecological compensation are necessary to promote profitable conservation of local and traditional crop varieties. Therefore, agriculture specific development policies might be beneficial to maintain traditional agriculture and livelihood of the people in the region.

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