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Indian Journal of Hill Farming

June 2017, Volume 30, Issue 1, Page 23-27

Collection and Conservation of Landraces of *Perilla frutescens* (Linn.) Britt. from Northeastern Hill (NEH) Region of India

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ARTICLE INFO

Article history:
Received 17 May 2016
Revision Received 24 September 2016
Accepted 10 October 2016

Key words:
Perilla, exploration, qualitative traits and potentiality.

ABSTRACT

Perilla is one of the underutilized oilseed crop of Northeastern hill (NEH) region of India. In this study a total of 28 *Perilla* accessions, collected from diverse agro-ecological areas of NEH region of India. The qualitative traits and oil yield were assessed. A wide range of variation was observed for traits; early plant vigour, plant shape, leaf colour, seed colour, seed size and oil yield. Accessions namely IC599246, IC599247, IC599233 and IC599258 were recorded more than 48% oil yield. On the basis of Hierachical clustering using Wards method all the accessions were clustered into two major clusters A and B. The utilization of the crop though limited but has got potentiality for cultivation in large scale. Utilization of this oilseed crop by the local tribal people has been discussed.

1. Introduction

Perilla [*Perilla frutescens* (Linn.) Britt., Lamiaceae] is considered to be a commercial oilseed crop in Asia. The major producing countries of this crop are China, India, Japan and Korea. In India, this crop is extending to Northeastern Hill region (Anonymous, 1966). It is generally grown in the courtyards and has wider occurrence in humid sub tropical, subtemperate, and temperate parts of the country (Arora and Pandey, 1996). The primary center of origin for the crop is China (Zeven and de Wet, 1982). The indigenous names of *Perilla* are '*Su-tzu*' (Chinese), '*Bhanjira*' (Hindi), '*Kkaennip*' (Korean), '*Unei*' (Khasi), '*Kenie*' (Naga) *Thoiding* (Manipuri) and *Silam* (Nepali). In Asia, *Perilla frutescens* has three principal varieties. These are *crispa, acuta, and japonica* in addition to another var. proper. Out of this, var. proper and var. *japonica* are usually grown in Northeastern region of India (Palmer, 1989; Nitta et al., 2003). Two distinct varieties are known on the basis of their use: var. *frutescens,* an oil crop and var. *crispa* (Thunb.) Decne, a spicy vegetable or used as medicine. The var. *frutescens* is larger in size and height, with larger soft seeds, whereas var. *crispa* is smaller in habit has more branching, with smaller, hard seeds. Habit wise there are morphological variations among these plants. The tall, bushy, leafy types do occur in NEH region. The leaves are fragrant and variable in size, texture and aroma. Inflorescence length is also variable,

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affecting the seed produce. The seeds vary in size and colour and thus vary in oil quality and quantity (Arora and Pandey, 1996).

Perilla seeds contain 31 to 51% of drying oil similar to tung or linseed oil. According to FAO (1992) the seed has saturated acids (6.7-7.6%), oleic acid (14-23%), Linoleic acid (11-16%), Linolenic acid (50-70%). The seeds also contain moisture (6.30%), protein (23.12%), N free extr. (10.28%), crude fiber (10.28%) and ash (4.64%). Presence of nicotinic acid of 13.98mg/100mg of dry matter and a substance of having antioxidant activity is also reported. *Perilla* oil contains mucilaginous matter and is refined by breaking of coagulation by heating, allowing settling, and finally filtering. The crude oil is deep yellow or greenish in colour, whereas the refined oil is light yellow in colour. The oil has a pleasant smell and resembles linseed oil in appearance, composition, and general behaviour (Anonymous, 1966).

In context of NEH India there is no systematic cultivation practice but confined to certain pockets grown dispersedly and adapted in *jhoom* (shifting) land or in kitchen garden area. Thus the production is very limited. The genotypes, which are available, are mostly semi-wild, semi domesticated types and belong to var. *proper* only. Improvement of existing crop variety is necessary in local condition. Alternatively, suitable improved variety may be introduced to this region after their adaptive trial.

2. Materials and Methods

In the NEH region of India, *Perilla* is mainly grown in Meghalaya, Nagaland, Arunachal Pradesh, Manipur, Mizoram, Sikkim and some hilly areas of Assam. Keeping in view of importance of genetic variability of crops and their collections, a total 28 landraces were collected from different explorations and collection trips, covering all the *Perilla* grown areas of NEH region (Table 1). Random/ selective sampling method was followed as per the crop and the collection was made from farm store, farmer's field and threshing yards. In each collecting site, the necessary standard passport data was filled for each collected accession and assigned a collector number. Altitude, longitude and latitude co-ordinates were determined by a handheld GPS system and recorded for each accession/ location. Most of these collections were made from *jhoom* (shifting cultivation) fields of the tribal dominated pockets. After completion of each exploration trip, one part of the collected germplasm samples were properly dried, cleaned and dispatched to National Gene Bank of ICAR-NBPGR, New Delhi as voucher sample, for ultimate storing in medium term module as well as designating national identity *i.e.* IC (indigenous collection) numbers.

The other part of the each sample was retained at ICAR-NBPGR Regional Station, Umiam, Meghalaya for regeneration/ multiplication and subsequent characterization. This was accompanied with relevant passport data sheets. The collected landraces were grown in experimental field of the ICAR-NBPGR Regional Station, Umiam, Meghalaya (25.6 N latitude, 91.9 E longitude and 990 m altitude), in two consecutive years i.e. 2012 and 2013. The experiment was laid out in a Randomized Complete Block Design (RCBD) in three replications with four checks (Jaintia, Shillong, Check III and Check IV). Seeds were sown on first week of May in both the years in rows spaced at 45cm apart. Standard agricultural practices were followed to grow the healthy crops. Subsequently, the crop was thinned out to maintain a plant to plant distance of 20 cm and at the same time gap filling was done. The NBPGR descriptor for agri-horticultural crops (Mahajan *et. al.,* 2000) was used as a guideline for discriminating the variability in the collected germplasm.

Table 1. List of collected *Perilla* accessions along with their place of collection

Sl. No	IC Number	Place of collection		
		Village	District	State
1.	IC599231	Mambrang	South Sikkim	Sikkim
2.	IC599232	Along	West Siang	Arunachal Pradesh
3.	IC599233	Basar	West Siang	Arunachal Pradesh
4.	IC599234	Ziro	Lower Subansiri	Arunachal Pradesh
5.	IC599235	Pyllun II	Ribhoi	Meghalaya
6.	IC599236	Pyllun II	Ribhoi	Meghalaya
7.	IC599237	Chawngtlai	Champhai	Mizoram
8.	IC599238	Bhorimbong	Ribhoi	Meghalaya
9.	IC599239	New Chalrang	Champhai	Mizoram
10.	IC599240	Baktung	Serchhip	Mizoram
11.	IC599241	Venglai	Kolasib	Mizoram
12.	IC599242	Tlangnuam	Aizwal	Mizoram
13.	IC599243	Phanzwal	Lunglei	Mizoram
14.	IC599244	Khanpui	Aizwal	Mizoram
15.	IC599245	Zotlang	Champhai	Mizoram
16.	IC599246	Peducha	Kohima	Nagaland
17.	IC599247	Sajirok	Imphal West	Manipur
18.	IC599248	Laimakhong	Senapati	Manipur
19.	IC599249	Thawai	Ukhrul	Manipur
20.	IC599250	Manmoutissue	Lohit	Arunachal Pradesh
21.	IC599251	Wakro	Lohit	Arunachal Pradesh
22.	IC599252	Namgao	Lohit	Arunachal Pradesh
23.	IC599253	Pankhao	Lohit	Arunachal Pradesh
24.	IC599254	Balek	Lower Dibang Valley	Arunachal Pradesh
25.	IC599255	Balek	Lower Dibang Valley	Arunachal Pradesh
26.	IC599256	Remgeng	Lower Dibang Valley	Arunachal Pradesh
27.	IC599257	Sikatode	East Siang	Arunachal Pradesh
28.	IC599258	Renging	East Siang	Arunachal Pradesh

3. Results and Discussion

In the present study, variability was observed in qualitative characters and oil yield within the genotypes. The frequency distribution for traits which were observed in discrete classes presented in Table 2. These traits are qualitatively inherited and in *Perilla*, few reports on qualitative traits are available. In the germpalsm under study a large variation was observed for studied characters. Earlier workers Sharma and Hore (1994), Pandey and Bhat (2008), Hussain *et al.* (2014) and Bahuguna *et al.* (2014) reported the extent of variability in *Peilla* germplasm, however, these reports are void of qualitative traits. Early plant vigour was recorded at the completion of vegetative stage. The frequency was observed poor (6 accessions), good (6 accessions) and very good (16 accessions) in present study. Only two types of plant shape recorded which is spreading (17 accessions) and erect (11 accessions). Leaf colour was recorded on fully extended leaves at full foliage stage and found greenish white (6 accessions), greenish (13 accessions) and dark green (9 accessions). Inflorescence structure observed compact (14 accessions) and lax (14 accessions) while secondary branches were absent in 19 accessions and present in 9 accessions. Classification of seed colour among the collected accession were as follows; white (6 accessions), gray (13 accessions), light brown (2 accessions), brown (2 accessions) and dark brown (5 accessions). However, seed size were recorded small (<1.5 mm) 12 accessions; medium (1.5 to 2.0 mm) 12 accessions; and bold (<2mm) 04 accessions.

Oil yield were also showed the good variation, maximum for IC599246 (50.0%) while minimum for IC599232 and IC599235 (41.0%) with a mean value of 45.0%. The CV% of oil yield was recorded 5.0. Out of 28 accessions, 15 accessions were recorded more than 45% oil percentage. Hierachical clustering using Wards method assembled accession from the NEH India into two major clusters which are designated cluster-A and cluster-B based on qualitative traits and oil% (Figure 1.). Cluster-A include a total of 11 accessions (Mizoram 5; Arunachal Pradesh 4; Sikkim 1 and Manipur 1) and check (Shillong local). While the cluster-B include a total of 17 accessions (Mizoram 3; Arunachal Pradesh 8; Manipur 2; Meghalaya 3 and Nagaland 1) and three checks (Jaintia, Local III and local IV). Accession IC599246 recorded highest oil yield and clustered separately, while the accessions recorded more than 45% oil yield also grouped in cluster-B. Though cluster analysis grouped together accessions with greater genetic similarity. The clusters did not necessarily include all the accessions from same origin. Hussain *et al.* (2014), Sa *et al.* (2013), Verma *et al.* (2008) and Pandey and Bhat (2008) also reported lack of association between agronomic traits and origin.

Earlier authors were considered morphological characterization as an important first step in description and classification of germplasm because any breeding programme is mainly depends upon the magnitude of genetic variability. Many qualitative characters showed a considerable high level of variability, in case of early plant vigour, plant shape, leaf colour, seed colour and seed size. However, for inflorescence structure and secondary branches variation there was low level of variability *i.e.* only two types compact/ lax and absent/ present, respectively. While anthocynin coloration of leaves, flower colour and leaf trichomes were not shown any variation within the population. Importance of qualitative characters for plant description and are influenced by consumer's preference, socio-economic condition and natural selection as is explained by Kurlovich (1989). Nakayama *et al.* (1998) in foxtail millet landraces with a low amylase allele were distributed only in Southeast Asia mainly because of local preferences. In the same manner erect plant shape type plants in *Perilla* can be preferred for planting as it takes less space in the field so that more plant can be accommodate in the field. Compact inflorescence structure is giving more number of seeds which will enhance the yield. Seed coat colour and size is also a very important criterion of selection by the consumers, and it was observed during the survey and collection of germplasm, white and bold seeds are preferred by the farmers. Pandey and Bhat, (2008) was also reported the bold seeds are mainly used for oil in Northeastern region. In this region, the spreading type of plant shape accessions is important as it facilitate moisture conservation, because this region is mainly under the rainfed cropping based. Therefore, these characters may be of utmost important for successful and effective breeding programme in *Perilla* crop.

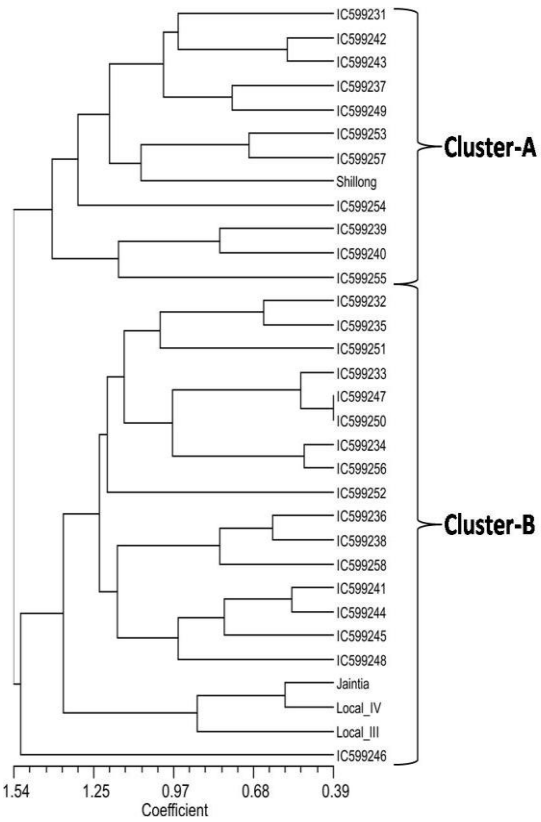
3.1 Utilization in NEH region

It is cultivated sporadically in Northeastern parts of India for the seed, which are used as condiments. The leaves are cooked as vegetable in Nagaland and Manipur. Being the rich source of oil and protein, the seeds are much relished by the hill people in the form of '*Chutney*' (Sauce). The tribes of Meghalaya enjoy its '*Chutney*' with '*Soh-phlang'* (*Moghania vestita*) tubers (Sharma *et al*., 1989). The common recipes prepared from this oilseed are mainly in two ways; firstly the fried seeds, pounded and mixed with small pieces of banana inflorescence together with pieces of onion, chilli and ginger, it is used as '*Chutney*' (sauce). Secondly the, pounded seeds smashed with reddish to form another kind of '*Chutney*' (sauce). Sometimes dried seeds are thrashed simply and eaten with cooked rice. The tribal people of Meghalaya use to grow *Perilla* plants mainly in the boundaries of crop fields, according to their experience the *Perilla* plant has got the insect repellant characteristics.

Table 2. Frequency distribution based on qualitative traits of *Perilla* germplasm

Traits	Observations	Frequency
Early plant vigour	Poor	6
	Good	6
	Very Good	16
Plant shape	Spreading	17
	Erect	11
Leaf colour	Greenish white	6
	Greenish	13
	Dark Green	9
Inflorescence structure	Compact	14
	Lax	14
Secondary branches	Absent	19
	Present	9
Seed colour	White	6
	Gray	13
	Light Brown	2
	Brown	2
	Dark Brown	5
Seed size	Small	12
	Medium	12
	Bold	4

Figure 1. Grouping of the *Perilla* accessions on the basis of standardized squared Euclidean distance applied to Wards Hierarchical analysis



References

Anonymous 1966. The wealth of India, Council of Scientific and Industrial Research, New Delhi. 7: 311-313

Arora RK, Pandey A (1996). Wild edible plants of India. National Bureau of Plant Genetic Resources, New Delhi, pp. 178-179

Bahuguna A, Prasad B (2014). Plant development and yield as prejudiced by Perilla germplasm lines in India hill condition. Res J Med Plants 8(3): 121-125

FAO (1992). Minor Oil Crops. Agricultural Services Bulletin 94: 107

Hussain S, Changkija S, Hore DK (2014). Genetic divergence analysis in Perilla [Perilla frutescens (L.) Britton]. Indian J Hill Farming 27(2): 10-15

Palmer J (1989). Lesser known crop plants of the South Pacific: an annotated bibliography. Crop Research Division, New Zealand, Pp 74

Kurlovich BS (1998). Species and intraspecific diversity of white, blue and yellow lupins. Plant Genetic Resources News Letter 115: 23-32

Mahajan RK, Sapra RL, Srivastava U, Singh M, Sharma GD (2000). Minimal descriptors of agri-horticultural crops, Part-I. NBPGR, New Delhi

Nakayama H, Afzal M, Okuno K (1998). Intraspecific differentiation and geographical distribution of Wx alleles for low amylase contents in endosperm of foxtail millet, Setaria italic (L.) Beauv. Euphytica 102: 289-293

Nitta M, Lee JK, Ohnishi O (2003). Asia Perilla crops and their weedy forms: Their cultivation, utilization and genetic relationships. Economic Botany 57(2): 245-253

Sharma BD, Hore DK, Mandal S (1989). Perilla: An oil and protein rich underexploited crop of Northeastern Hills. J Oilseeds Res 6: 386-389

Pandey A, Bhat KC (2008). Diversity distribution and collection of genetic resources of cultivated and weedy type in Perilla frutescens (L.) Britton var. frutescens and their uses in Indian Himalaya. Genetic Resources and Crop Evolution 55: 883-892

Verma N, Bisht IS, Negi KS, Hore DK (2008). Morphological diversity in Perilla frutescens (L.) Britton landraces from the Indian Himalayas. Pusa AgriSci 31: 15-24

Sa KJ, Choi SH, Ueno M, Park KC, Park YJ, Ma KH and Lee JK (2013). Identification of genetic variations of cultivated and weedy types of Perilla species in Korea and Japan using morphological and SSR markers. Genes Genome 35: 649–6

Sharma BD, Hore DK (1994). Perilla: untapped oilseed crop of hills. J North Eastern Council 14(3): 14-15

Zeven AC, Wet JMJ de (1982). Dictionary of cultivated plants and their regions of diversity. Centre for Agricultural Publishing and Documentation, Wageningen, pp 40