

Hmarchate (*Capsicum frutescens* L.): A less-known underutilized landrace crop of Mizoram (India)

Abstract

Bird's eye chilli (*Capsicum frutescens* L.) is domesticated at various places of the world; one of such centre of domestication is the Lushai hills (Mizoram state) of India where they are found growing in diversified agro-ecological conditions. In Mizoram it is locally known as Hmarchate and it is used for spicy cuisine in, pickle, chutneys, hot sauces and local medicines and has a very high demand in neighboring states like Assam, Tripura, Manipur and countries like China, Thailand, Vietnam, Myanmar and Bangladesh. Due to its complete organic production and unique quality attributes it has got geographical indication status recently. During a recent survey in all the districts of Mizoram a wide variability of fruit shape, size and colour has been documented and efforts are strengthened to conserve these landraces *ex situ* by depositing them at National Bureau of Plant Genetic Resources (NBPGR), New Delhi.

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Introduction

Among the spices produced in India, per capita consumption is highest for chillies. Moreover, India is the largest producer of chillies in the world. Around 30% of the area shared among major spice crops of the country is occupied by chilli.¹ Chilli was introduced to India by Portuguese explorers² and particularly in North Eastern India by Christian missionaries.³ A wide variability in chilli fruit morphology, pungency, bearing habit and crop duration is found throughout India.⁴ The genus *Capsicum* according to Pruthi⁵ comprises five main species: *Capsicum annum* (comprising the NuMex, Jalapeno and Bell varieties), *Capsicum frutescens* (Tabasco variety), *Capsicum chinense* (Habanero and Scotch Bonnet varieties), *Capsicum baccatum* (Aji varieties) and *Capsicum pubescens* (Rocoto and Manzano varieties) and comprises more than 200 varieties. The fruits in this genus vary widely in size, shape, flavor and sensory heat. *C. frutescens* L. is one of the five cultivated species in the genus *Capsicum* (Solanaceae)⁶ and is closely related to *C. chinense* Jacq.⁷ Numerous local land races of *C. frutescens* are cultivated in tropical and subtropical regions of the world.⁸ Bird's eye chilli (*Capsicum frutescens*) came from the Amazon basin in Brazil and the Mexican city of Tabasco, to India and the Far East where they are called Bird pepper.⁹ The north-eastern hill region (NEH), being one of the hot-spots of biodiversity in the Indian gene centre, is also known for its richness in ethnic diversity and traditional culture.¹⁰ Mizoram, comprising of eight districts, is 23rd state of India located at 21°58' to 23°35' N latitude and 92°15' to 93°29' E longitude and altitudes ranging from 21 to 2157 m above the mean sea level with an annual rainfall of 2000-3200 mm. According to Lalramnghinglova,¹¹ Mizoram has the highest proportion of tribal population (94.8%), and is mainly inhabited by *Mizos, Maras, Lais, Pangs, Bawms, Hmars, Paites, Brus, Chakmas, and Mogs*.

Weather condition of Mizoram is very pleasant, where in summer (Monsoon), mean monthly temperature ranges from 14.6°C to 29.6°C, while during winter minimum temperature falls up to 11.8°C. Soils, in general, are sandy loam to loam and loam-clay to clay, rich in humus, acidic (4.5- 6.5pH), and medium in phosphorus and potash content. The total geographical area of Mizoram is about 21087

km², of which net sown area constitutes only 4.4%. *Jhum* cultivation (traditional shifting cultivation) is considered as major source of rural economy and a part of cultural requirement. The ever increasing population pressure has brought down the *jhum* cycle and also soil is less fertile due to degradation of soil and natural resources, heavy rainfall and poor nutrient recycling. The land type of *Lushai* hills is characterized by inaccessibility, marginality, fragility, ethnicity, rich bio-diversity and low crop productivity in general. The agricultural land in Mizoram is comprised of sloppy upland and lowland of valley (settled agriculture). In general, the upland and lowlands are under traditional system of cultivation without any improved input technologies. Among the North eastern states of India, Mizoram is known for presence of considerable diversity of Birds eye chilli with respect to fruit shape, size, colour, pungency, plant type, physiological characteristics, reactions to diseases and pests, adaptability and distribution. In Mizoram Birds eye chilli is locally known as *Hmarchate* or *Vaimarcha* or *Mizoram Bird's eye chilli* which belongs to species *C. frutescens* and is widely grown in the state of Mizoram. Besides being used as spice and vegetable, they are also used as a very good source of ethno-medicines for a number of diseases by the traditional healers. It occupies an area of 100 ha. With a production of 200 tonnes and productivity of 2.0 tonnes/ha.¹² The cultivation of *Hmarchate* is scattered all over the state of Mizoram and some parts of Manipur. Three different varieties/qualities *viz.*, Grade A, Grade B and Grade C of *Hmarchate* are being cultivated in different eight districts of Mizoram. All these varieties are considered to be same with minor difference in quality.¹³ The local Government of Mizoram claimed that Mizoram is the world's native place of a Bird's Eye Chilli known locally as *Hmarchate*. Commercial cultivation of this uniquely aromatic chilli, highly demanded outside the state, was initiated and promoted during the Indian National Congress party rule in the state.¹³

Utilization (culinary, nutritional and medicinal)

C. frutescens fruits are used as pungent (50,000 -100,000 scoville units)¹⁴ spices for domestic culinary purposes and by food manufacturing industries for seasoning of processed foods in the preparation of curry powder, hot sauce and in pickling.¹⁵ Pungency is a key characteristic

associated with members of the genus *Capsicum* which is also an important fruit quality contributing attribute. The degree of pungency in *Capsicum* fruit is proportional to the combined concentrations of the various vanillyl amides that represent capsaicinoids.¹⁶ Although capsaicin is the predominant capsaicinoid in hot peppers, the ratio of capsaicin to dihydrocapsaicin can vary substantially within and among species.¹⁷ *Capsicum* species are also rich in Vitamin A, which is responsible for red colour in mature fruit. *C. frutescens* forms an important part of diet supplying some of the nutrients lacking in other food materials.^{18,19} *C. frutescens* is also a source of saponin and other compounds that are being evaluated as natural fungicides.²⁰ Capsaicin of pungent *Capsicum* fruit shows various bioactive properties in humans. For instance, capsaicin is used to relieve the pain of peripheral neuropathy,²¹ and can inhibit a variety of cancer.^{22,23} It also possesses anti-inflammatory and antioxidant activities.^{23,24} Capsaicin inhibits obesity by decreasing energy intake,²⁵ adipose tissue weight and serum triglyceride through stimulation of lipid mobilization.²⁶ In addition, capsaicin prevents adipogenesis and obesity by activation of TRPV1 channels.²⁷ Recently, capsaicinoids came into focus because of their broad range of medical benefits including alleviation of pain,²⁸ blood pressure regulation,²⁹ fat distribution³⁰ and cancer prevention.²⁴ Additionally, there is a report that capsaicin has anti-bacterial activity that is sufficient for providing an antifouling coating for foods.³¹

In Mizoram, *Hmarchate* is used for spicy cuisine in, pickle, chutneys and hot sauces to be served with noodles and has a very high demand in neighbouring states and countries like China, Thailand, Vietnam, Myanmar and Bangladesh and therefore, the major share of the produce are exported outside the state.¹³ The people of Mizoram are fond of eating boil (*Mizo bai*) and this Bird's eye chilli plays an important role in making up the taste. Mixing of *Hmarchate*, onion, garlic and ginger also serves as good chutney for the Mizo people. Ethno-veterinary use includes dry Bird's eye chill and spider after grinding are fed to poultry chicks to minimize swelling of body.³²

Ecology, biology and cultivation

Numerous local landraces of *C. frutescens* are cultivated in tropical and subtropical regions of the world.⁸ In India, *Hmarchate* (*C. frutescens*) is exclusively grown in the state of Mizoram and some parts of Manipur. The geographical boundaries of the production area of *Hmarchate* lies between 21° 58' North to 24° 35' North Latitude and 92° 15' East to 93° 29' East Longitude. Interestingly, *Hmarchate*

can be found growing in the low-lying areas of Chongte (western part of Mizoram) and also in the high elevated areas like the *Blue Mountain*, situated in the south-eastern part of the state (highest peak in Mizoram at 2,210 metres above sea level). In a collection drive of all the districts of Mizoram (Kolasib, Aizawl, Serrchhip, Lunglei, Lawngtlai, Champhai, Mamit and Saiha), 70 landraces were collected from *jhum* lands (slash and burn), farmers backyards and village markets. Collected germplasm is under mass multiplication, and will be deposited in the National Bureau of Plant genetic Resources (NBPGR), for a long-term conservation. The plants of *C. frutescens* are typically upright with one or sometimes two flowers per node, with green or greenish white corollas. Calyx teeth and a calyx constriction are lacking in *C. frutescens*. Fruit are typically upright, soft, and deciduous.³³ The species has 2n=24 chromosomes.³⁴ *Hmarchate* is characterized by a bushy type of plant growing up to 120 cm and the leaves are smooth, oval shaped up to 6.35 cm in size. Flowering in *Hmarchate* starts three months after planting and fruits continuously thereafter. A wide diversity was recorded in fruit morphological traits of the collected landraces which are shown in Figure 1. The size of the *Hmarchate* ranges from 2.0 to 4.0cm in length and about 1.00cm in diameter. Three different colours of fruit at mature stage were orange, light red and red. Fruit are small sized and highly pungent and the color of the mature fruit is dark red. The distinctive red color of the *Hmarchate* is believed to be responsible for high availability of potash in the *Jhum* lands. According to the Spice Board of India, the capsaicin content of Mizoram *Hmarchate* is 0.59 %. There are three popular grades of differentiations in *Hmarchate* which are given below.¹³

- I. **Grade A:** The variety of *Hmarchate* Grade 'A' is the smallest, thin and most pungent among all the other variety. It is considered to be of the best quality and fetches the highest demand in the market. The chilli powder of this variety can be identified because of the slight difference of color. Its color is more shiny red in comparison of other two varieties.
- II. **Grade B:** It is slightly thicker than Grade 'A' and marginal longer in size. The color of dried red chilli changes to dark red and pungency is slightly less.
- III. **Grade C:** The properties of Grade 'C' is almost similar to Grade 'B' but the size are a bit longer than other varieties of this segment. The buyer preference is towards Grade A but there is not much difference in prices of the all three types of *Hmarchate*.

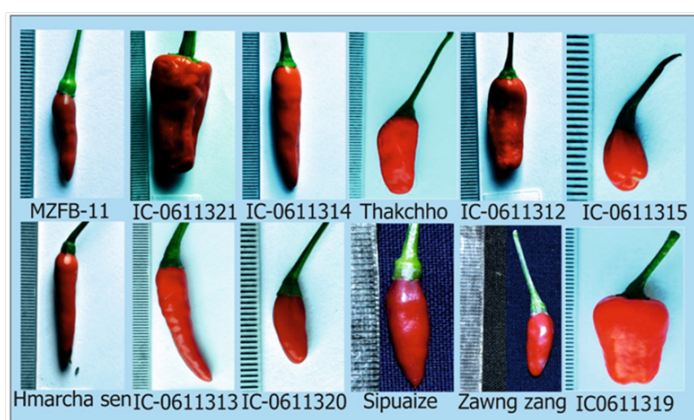


Figure 1 Morphological diversity of Mizoram's Bird's eye chili (*Hmarchate*) (Local code name MZBEC: Mizoram Bird's Eye Chili).

Hmarchate can grow on soils of all textures but moist, well-drained conditions and loose structure is best for rapid growth. Soil pH of 4.3 to 9.7 is better tolerated by this species. The species is intolerant of shade and frost, and fruits best in full sun and temperature above 7°C. These can be cultivated in areas that receive from 30 to 430cm of annual precipitation at elevations from near sea level to more than 2,000 meters.³⁵ In Mizoram, *Hmarchate* is cultivated on hill slopes under shifting cultivation system or *jhuming* system. In this type of system, large tracts of hills are cleared by burning and land occupancy of short periods is done by crops alternating with long fallow periods. One meter width raised beds also known as bum are made along the slopes and again covered with farm wastes, dried leaves etc. which are burnt before sowing of the seeds. This burning helps in checking the growth of weeds, soft rot diseases incidence and increase the availability of certain plant nutrients particularly potash.¹³

Hmarchate is not grown as single crop in Mizoram by the farmers. They are intercropped with paddy to generate some extra revenue because the yield is very low and there is high price fluctuation in the market. Seeds are sown between paddy crops in the month of April before the onset of monsoon by broadcasting and dibbling method. *Hmarchate* are grown as rainfed in the state due to the occurrence of high rainfall spread over a period of six to eight months that helps the farmers to grow paddy and chilli without irrigation. Harvesting season for *Hmarchate* starts from October and ends till December. The yield of *Hmarchate* is normally low compared to other big size chilli varieties, which is about 1.36 MT/ha.¹³

Market potential and industrial use

Hmarchate is found throughout the year in almost all the roadside markets of Mizoram. Majority of the produce comes from traditional *Jhum* lands and farmers kitchen gardens. There are few commercial growers having extensive area under Bird's eye chilli. Mature red and green *Hmarchate* is sold in the form of bunches (carrying 100-200 berries) and loose in small cups. Both dry and green chillies are sold in the market. Price of dry chillies are relatively higher than the green ones and the dried ones can be stored for longer duration. The present retail price of *Hmarchate* is about Rs. 20 /cup (around 100 grams) in the local market. It is mostly marketed in dried form and therefore, it is non-bulky and has long shelf life which makes it easy to transport. It is grown completely organically in the *jhum* lands. Use of chemical fertilizers and pesticides is very rare in the state and because most of this chilli is grown on *jhum* land which is already very fertile, farmers don't ever use any chemical fertilizers. This feature clearly differentiates it from other Bird's Eye Chilli grown elsewhere in the world. *Hmarchate* is completely free (Below Limit of Qualification) from any pesticide residues which is the unique characteristics of *Hmarchate*. *Hmarchate* which is exclusively grown in Mizoram is distinctly different from other chilli varieties grown in different parts of the country.¹³

Hmarchate is an important cash crop which supports the livelihood and generates income for the farmers. It is an integral part of *Mizo* dish where it is used for spicy cuisine in, pickle, chutnies and hot sauces to be served with noodles and has a very high demand in neighboring states and countries like China, Thailand, Vietnam, Myanmar and Bangladesh and therefore, there is good export potential outside the state. Mizoram has enormous potential for large quantity production with proper market linkage and not less than 2000 tons is sold though un-authorized traders every year to Bangladesh and neighboring states.¹³

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Conflicts of interest

The author declares there is no conflict of interest.

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