

Chilli of Manipur: Capsaicin and Its Importance

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Abstract

Chilli is one of the most consumed vegetable crops in the world. There are five domesticated species of chilli. Chilli pepper is best known for its nutraceutical and economic value for its richness in capsaicin and vitamin A and C than tomato. Capsaicin (C₄₀H₅₆O₃) and Capsanthin (C₁₈H₂₇NO₃) are responsible for the pungent principle and red colour of chilli. Capsaicin is exploited for the production of insecticides and several medicinal drugs. Capsaicin and vitamin C content of the chilli pepper determine the quality at the international market. Capsaicinoids, non-volatile alkaloids are responsible for the pungent taste of chilli pepper (*Capsicum annuum* L.). It is also reported to be rich in proteins, lipids, fibers, mineral salts such as Calcium, Phosphorus, Iron and Potassium, vitamins A, vitamins D3, vitamins E, vitamins C, vitamins K, vitamins B2 and vitamins B12 and in capsaicin. Fresh green chilli contains more vitamin C as compared to citrus fruits and fresh red chilli has more vitamin A as compared to vegetable carrots.

Keywords: Chilli, Capsaicin, Capsanthin, Nutraceutical, Domesticated species

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important vegetable crops and also a commercial annual spice crop, belongs to the family Solanaceae. The centre of origin of chilli is considered from South and Central America with the domestication around 7000 BC. Being a crop of tropical and sub-tropical region, it requires a warm humid climate. The genus *Capsicum* includes 30 species, five of which are domesticated viz. *Capsicum annuum* L., *C. frutescens* L., *C. chinense* Jacq., *C. pubescens* R. and *C. baccatum* L. The major chilli growing states are Maharashtra, Andhra Pradesh, Karnataka, Orissa, Tamil Nadu, Madhya Pradesh, West Bengal and Rajasthan. Chilli is considered to be important for its pungency, colour and

aroma as well as its high phytochemical content. Fruits are available in the market throughout the year, since chillies are produced all over the year in one or other part of the country.

India is the only country rich in many varieties of chilli with different quality factors. The fresh and dried fruits of chilli contain phenolic acid compound “capsaicin” in the placenta, which is responsible for the pungency in chilli. The bright red colour at the ripening stage is due to the pigment capsanthin and capsorubin. Chilli is rich source of vitamin A and vitamin C. Deep red colour Chilli fruits without pungency are used as paprika. Capsaicinoids, which are the constituents of chilli are valued for their beneficial therapeutic effects, including antioxidants, anti-inflammatory, anticancer, antimicrobial and positive immunomodulatory effects.



Five domesticated species of chilli are follows:

- ✚ *Capsicum annuum* is a small shrub that reaches 0.3 to 1.2 m (1 to 4 feet) in height and 15 to 30 cm (6 to 12 inches) in width. It has glossy leaves, which is oval in shape with smooth edges up to 7.5 cm (3 inches) long. In some varieties, the leaves turn dark purple or black. Flowers are star or bell-shaped with 4-5 petals, which are white, green, or purple in colour. Its fruit is a true berry that comes in many shapes, sizes, spicy and sweet taste. Depending on the cultivar, the fruit can be green, red, yellow, orange or black, with a variety of colors changing as it ripens.
- ✚ *Capsicum frutescens* is an annual or short-lived perennial plant of the genus *Capsicum*. Flowers are either insect or self-pollinated and are white with a greenish white or greenish yellow corolla. Berries on the bushes are normally upright and ellipsoid-

conical to lanceoloid in shape. They are typically small and pungent, measuring 10-20 mm (0.39-0.79 inches) in length and 3-7 mm (0.12-0.28 inches) in diameter. Fruit is normally pale yellow and turns to a vivid red when mature.

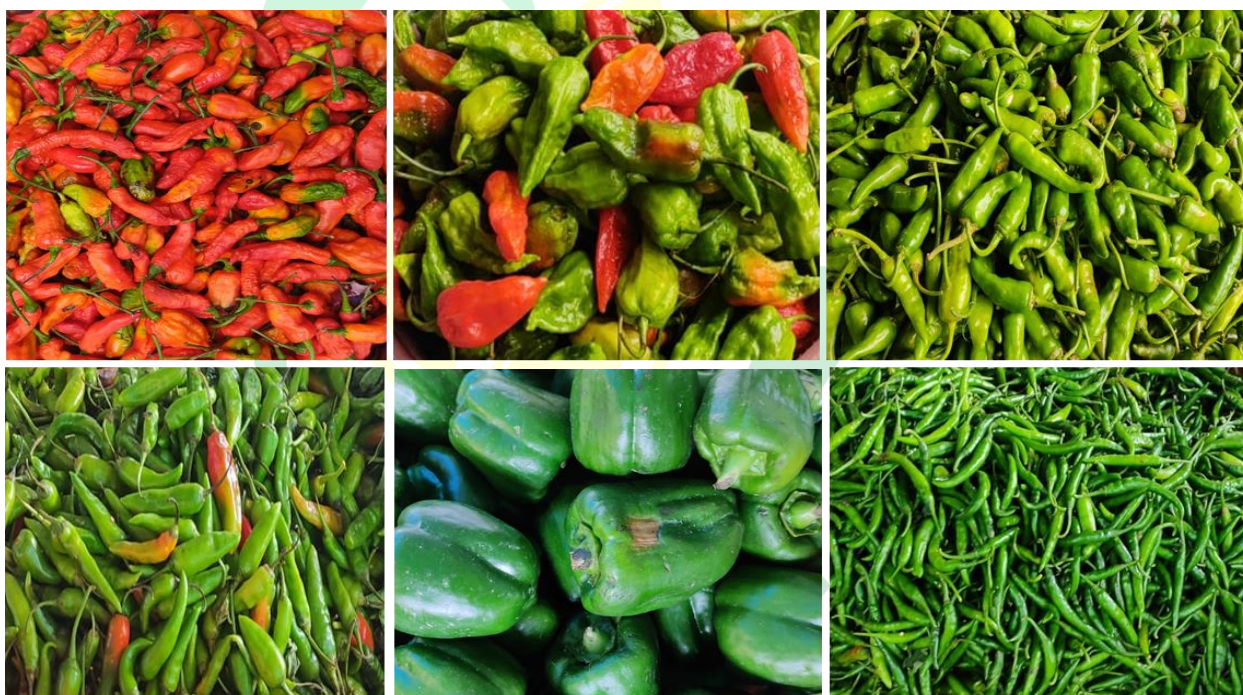
- ✚ ***Capsicum baccatum*** is extremely pungent with a Scoville heat unit rating of 30,000 to 50,000. Flowers are white or cream in colour with a green or gold corolla. They are either insect or self-pollinated. Unlike other *Capsicum* species, the fruit pods of the *baccatum* species have been developed into a wide range of forms and sizes. Erect or scrambling, often much branched, perennial herb to sappy shrub, up to 4.5 m (but often less). Leaves are usually solitary, rarely 2 appearing together; petiole 0.3-3 cm long.
- ✚ ***Capsicum pubescens*** is a member of the genus *Capsicum*. The species name "*pubescens*" refers to the hairy leaves of this pepper. The hairiness of the leaves, along with the black seeds, makes *Capsicum pubescens* distinguishable from other *Capsicum* species. *Capsicum pubescens* has pungent yellow, orange, red, green or brown fruits. The leaves have petioles 5-12 mm long and oval blades 5-12 cm long, 2.5-4 cm wide, tapering at the apex and wedge-shaped base. Another feature that differs from other cultivated species of the genus *Capsicum* is that the petals are bluish-violet, brighter in the center. The anther is partly purple, partly white.
- ✚ ***Capsicum chinense***, commonly known as a "King Chilli" is well known for its unique flavour and exceptional heat. The hottest peppers in the world are members of this species, with Scoville Heat Unit scores of over 2 million. It grows into compact perennial shrubs about 0.5 m (1 ft 8 in) tall. The flowers are small and white with five petals and blue anthers. Fruits are light green, which changes into red colour when mature. The fruit of *Capsicum chinense* is considered as a berry possessing 4-5 locules and bears wrinkled seeds.

Different types of Chilli available in Manipur

In Manipur, there are six different indigenous varieties of chili peppers belonging to the three species of *Capsicum* viz. *Capsicum annuum* L. (cvs. 'Meiteimorok' and 'Haomorok'), *Capsicum frutescens* L. (cvs. 'Uchithi' and 'Mashingkha') and *Capsicum chinense* Jacq. (cvs. 'Umorok' and 'Chiengpi') are important food crops in the region. *Capsicum chinense* Jacq. cv 'Umorok' is a very spicy chili with a unique flavor and aroma and is used in hot sauces. This 'Umorok' variety (also known as 'Naga jolokia' or 'Bhut jolokia') is one of the

hottest peppers in the world. This chili is native to the Northeastern region of India. Nagaland has got the Geographical Indication (GI) label for this chilli. King Chilli was recorded as the hottest chili in the world in 2006 with a Scoville Heat Unit (SHU) of 1,001,304. Currently, it holds the 6th position among the hottest peppers in the world.

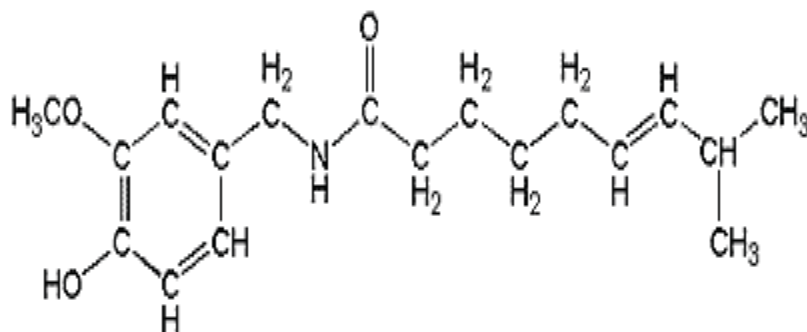
Hathei chilli has also been reported to be found in Manipur. It thrives only in the Mahadev hills that surround the remote Tangkhul Naga-inhabited village of Sirarakhong in Ukhrul district. Locals say that an old man in the village found this variety of chilli growing in the wild while hunting and brought it home, not realizing it was a chilli. The plant flowered after some time and the villagers tasted the brightly coloured chilli and found it bitter and very hot. Since bitter is called "Ha" in the Tangkhul dialect, the chilli was known as Hathei. Hathei chilli received a geographical indication (GI) in 2021.



Capsaicin and its components

Capsaicinoids, a secondary group of metabolites, are found mainly in the fruits of members of the *Capsicum* genus. Capsaicinoids are derivatives of benzylamine. Capsaicin is the condensation product of 3-hydroxy-4-methoxybenzylamine and decylenic acid. Capsaicin and hydroxycapsaicin, the main components of capsaicin, are highly desirable and indispensable for spice, food, pharmaceutical and industrial purposes. Capsaicin, a homovanillic acid derivative (N-vanillyl-8-methyl-6-E-noneamide), is an active component of

the red pepper. Capsaicin is also the active ingredient responsible for the pungency of chilli and has medicinal properties that are useful as an anti-irritant, anti-arthritic, pain reliever, antioxidant and anti-cancer agent. The amount of capsaicin in a given variety can vary depending on the light intensity and temperature in which the plant grows, the age of the fruit and the location of the fruit on the plant.



Structural formula of Capsaicin

Importance and Uses of Chilli

Chilli pepper is also suitable for the diets of the obese and is useful in the control of cancer of the stomach and colon. Chilli pepper fruits are low in sodium and free from cholesterol and are used in sauces, soups, stews, etc. and generally as a flavoring agent. Since ancient times, Capsaicin-containing products have mostly been used to repel insects. A review of the literature found that capsaicin has fatal and antifeedant effects on many invertebrates, which is another reason why organic farming is geared towards the manufacture of bio-pesticides. It is an incredibly versatile substance, with applications ranging from medicine and nutrition to chemical weaponry to shark repellence.

Nutrient values of Chilli

Based on USDA National Nutrient data base, important nutrient component in red & raw chilli per 100 g are 40 Kcal Energy (2% RDA), 8.81 g carbohydrates (7% RDA), 1.87 g protein (3% RDA), 0.44 g total fat (2% RDA), 1.5 g dietary fiber (3% RDA). In 100g of red & raw chilli, vitamins such as 23 µg folates (6% RDA), 1.244 mg Niacin (8% RDA), 0.201 mg pantothenic acid (4%), 0.506 mg pyridoxine (39% RDA), 0.086 mg Riboflavin (6.5% RDA), 0.72 mg Thiamin (6% RDA), 952 IU vitamin A (32% RDA), 143.7 mg vitamin C (240% RDA), 0.69 mg vitamin E (4.5% RDA), 14 µg vitamin K (11.5% RDA) are present. In 100g of red & raw chilli, phyto-nutrients such as Carotene-β (534 µg), Carotene-α (36 µg), Cryptoxanthin-β (40 µg) and Lutein-zeaxanthin (709 µg) are available.

Conclusion

Capsicum spp. contain several bioactive compounds which have nutritional and pharmaceutical importance and these varies between types of pepper. The different varieties of *Capsicum spp.* contain important micro- and macro-elements and antioxidative vitamins, in different quantities. The presence of the different bioactive compounds can provide significant proportions of the recommended daily allowance and enhance overall health of humans.

