Chapter-1

Introduction

1. Introduction

Chilli (*Capsicum* species), a popular crop of New World origin, is cultivated for its fruits valued for colour, flavour, spice, vegetable and nutrition that it provides to the several food items (Kumar *et al.*, 2006a). Botanically, chilli plants are dicotyledonous and short-lived perennial herb of *Solanaceae* family and are commercially grown as an annual and as perennial in kitchen gardens. Among the five cultivated species of the genus *Capsicum*, *C. annuum* is most commonly cultivated either for pungent fruited genotype called chilli (synonyms: hot pepper, American pepper, chile, azi, cayenne, paprika etc.) or non-pungent fruited genotype called sweet pepper (synonyms: capsicum, paprika, bell pepper, Shimla mirch). The majority of cultivars grown in Asian, Central and Latin American countries are pungent, while in European countries cultivation of less pungent and non-pungent peppers are more common. Sweet pepper is often called bell pepper because majority of non-pungent cultivars grown worldwide bear bell shaped fruits with four lobes. Consumption of fresh green pungent fruits or non-pungent fruits may perhaps be considered as vegetable uses of the genus *Capsicum*. Similarly, consumption and use of dry fruits in various forms (e.g. intact fruits, grinded powder etc.) and value-added processed products (e.g. capsaicin extracts, oleoresin extracts, processed pickles etc.) may be considered as spice uses of chilli (Kumar *et al.*, 2006a).

The nutritional composition of chilli fruits depends on the genotype and fruit maturity stages. In general, 100 g of green fruits contain 85.7 g moisture, 2.9 g protein, 0.6 g fat, 1.0 g minerals, 6.8 g fibers, 3.0 g carbohydrates, 30 mg calcium, 24 mg magnesium, 0.39 mg riboflavin, 67 mg oxalic acid, 0.9 mg nicotinic acid, 80 mg phosphorus, 1.2 mg iron, 6.5 mg sodium, 217 mg potassium, 1.55 mg copper, 34 mg sulphur, 15 mg chlorine, 0.19 mg thiamine, 292 IU vitamin A, 111 mg vitamin C. Green fruits of chilli and sweet peppers are one of the richest sources of antioxidative vitamins such as Vitamin A, C and E. In fact, vitamin C was first purified from *Capsicum* fruits in 1928 by Hungarian biochemist Albert Szent Gyorgyi, which helped him to receive Nobel Prize of physiology and medicine in 1937.

India, China, Korea, Hungary, Spain, Nigeria, Thailand, Turkey, Kenya, Sudan, Uganda, Japan, Ethiopia, Indonesia, Pakistan, Mexico are the major countries producing chilli. According to FAO estimate (FAO, 2004), globally the percent change in the area and production of chilli is consistently increasing. The world chilli production (green fruits) over the past five years has increased not only due to increase in area under cultivation, but also because of increase in the productivity from 13.2 t/ha in 2000 to 14.5 t/ha during 2004. However, FAO production data of chilli of India is under estimated because of the fact that this data include total production of green fruits only. According to another estimate (NHB, 2003), during the year 2002-2003, India produced 1113.1 thousand tons of dry chilli fruits from the 881.3 thousand hectares with 1.3 t/ha productivity. The major chilli growing states in India are Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu, which together constitute about 75% of the total area. Andhra

Pradesh ranks first in dry chilli fruits production followed by Tamil Nadu, Maharashtra, Orissa and Karnataka.

In the genus *Capsicum*, enormous morphological variability exists for flower morphology, especially corolla, anther colour, fruit colour, size, shape and pungency. Based on fruit size, shape and degree of pungency, a large number of horticultural types are recognized worldwide and at least 20 types are largely cultivated at large scale in one or the other parts of the world. Some of these fruit types such as ancho, bell, jalapeño, pasilla, New Mexican, yellow wax have specific traits for processing, fresh use, flavour and pungency (Bosland and Votava, 2000). The breeding objectives for quality traits of hot pepper and sweet pepper could be described on the basis of five market types (Poulos, 1994). In India also, a number of genotypes with specific fruit size, shape and attributes are commercially cultivated in different regions (Table 1.1). Among the various market types grown in India, paprika type chilli (non-pungent fruits with high oleoresin contents) is being presently cultivated at limited scale in Karnataka and Andhra Pradesh, although there is a great potential for export of natural colouring agents in the international markets.

In India, very limited work has been done on the development of improved chilli varieties/hybrids for paprika production. In past, from Spain, three paprika genotypes, viz., Kt-Pl-8, Kt-Pl-18 and Kt-Pl-19 were introduced at Indian Agricultural Research Institute (IARI), Regional Station, Katrain. These genotypes were evaluated for adaptability and desirable horticultural characters under various agro-climatic conditions of India and Kt-Pl-19 was found to be more suitable for commercial cultivation. The Indian Institute of Horticultural Research (IIHR), Bangalore has also

Table 1.1. Commercial cultivation of pepper in India: fruits of various market types

Stage of harvesting	Consumption pattern	Cultivar type	Species	Preferred fruit type/size	Degree of pungency
Red ripe fruits	Spice (intact fruits or powder)	Landraces, improved populations and hybrids	*C. annuum*, *C. chinense*[2] *C. frutescens*[2]	Cayenne (10-12 x 2-3 cm)	Highly pungent with more colour retention
Green/mature fruits	Vegetable	Improved populations and hybrids	*C. annuum*	Bell (6-8 x 4-5 cm)	Non-pungent
Green fruits	Intact fruits or sauce preparation	Landraces, improved populations and hybrids	*C. annuum* *C. chinense*[2] *C. frutescens*[2]	Cayenne (6-8 x 2-3 cm)	Mild to highly pungent
Red ripe fruits (Paprika)[1]	Oleoresin extraction	Landraces (*e. g.*, Tomato Chilli, variants of Bayadagi chilli)	*C. annuum*	Cayenne with very less capsaicin and high oleoresin	High oleoresin with no pungency
Red ripe fruits	Pickle preparation	Landraces	*C. annuum*	Jalapeno, but with thin pericarp	Mild to non-pungent
Red ripe fruits	Specific flavour	Landraces (*e. g.*, Dello of NEH region)	*C. baccatum*[2]	Bell shaped with distinct flavour	Regional preferences

[1]In international trade, paprika refers to pepper lines suitable for non-pungent oleoresin extraction, however in Hungary and several central European countries, paprika is synonym of pepper and invariably used for both hot and sweet peppers.

[2]Only landraces with variable fruit sizes and shapes are cultivated at limited scale.

developed a improved variety (Arka Abhir) from the local landrace (Byadagi Dabbi) widely grown in Karnataka. At IIVR, Varanasi, paprika populations have been collected from Asian Vegetable Research and Development Center (AVRDC), Taiwan and many other countries such as Hungary and Australia, which are being maintained as active collections. At the University of Agricultural Sciences (UAS), Dharwad a number of landraces are available. Hitherto two landraces cover most of the area under paprika cultivation. In Karnatka, Byadagi and their variants and in Warangal area of Andhra Pradesh, Tomato Chillies are being widely cultivated by the farmers to meet the demand of paprika industries (Kumar and Rai, 2005). In North Karnataka, several landraces have been identified within Byadagi chilli. Some of these include: Byadagi Kaddi, Byadagi Dabbi, Dyavanur Kaddi, Delux, Anthur Benthur Local. Although these are the highly variable germplasm lines available with the Indian breeders, systematic breeding work on the development of genotypes for oleoresin extraction has not been initiated in past.

Therefore, this investigation was undertaken with following major objectives:

(i) To screen chilli (hot pepper) and sweet pepper germplasm lines including improved populations, inbred, gms and cms lines for capsaicin and oleoresin contents and identification of populations with low pungency and high colour value (low capsaicin and high oleoresin contents).

(ii) To develop and evaluate chilli hybrids and inbred lines with respect to yield, capsaicin and oleoresin contents.

(iii) To develop and evaluate cms based hybrids for fertility restoration and assign restorer and maintainer genes to the inbred lines.

(iv) To evaluate chilli germplasm for selected nutritional quality in order to suggest future quality breeding objectives.

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