CHAPTER – 1
INTRODUCTION

*Capsicum annuum* L., commonly called as peppers, belongs to botanical family Solanaceae. It is grown all over of the world and is believed to be the native of Tropical South America (Shoemaker and Teskey, 1995). The domesticated peppers could be broadly classified into two groups viz. sweet and hot type on the basis of pungency content. The bell pepper (*Capsicum annuum* L. var. *grossum* Sendt.) is commonly known as sweet pepper, capsicum or green pepper. It is well adopted to temperate part of American and European countries while tropical or sub-tropical parts of Asian countries. It is a high productivity crop and has high remunerative value.

Global vegetable production amounted to a total of 956 million tonnes and had grown up by 56% in the last decade. India is the second largest producers of vegetables in the world next to China with an estimated production of about 126.58 million tonnes from an area of 8.51 million hectares with an average yield of 14.87 tonnes per hectares (Anonymous 2017). India shares about 15% of the world output of vegetables from about 4% of cropped area in the country (Anonymous 2014). Capsicum was grown on an area of 46 thousand hectare with annual production of 288 thousand MT in India. In Punjab it was grown on an area of 0.31 thousand hectare with annual production of 4.81 thousand MT during the year 2015-16 (Anonymous 2017). However, in India per capita consumption of vegetables is 210 g/day, which is very low against WHO standards of per capita requirement of 300 g/day vegetables as recommended by FAO (Dhaliwal, 2014).

Nutritionally 100 g of capsicum provides 8493 IU of Vitamin A, 283mg of Vitamin C, 13.4 mg of Ca, 14.9 mg of Mg, 28.3 mg of P, 263.7 mg of K, 24 Kcal of energy, 1.3 g of protein, 4.3 g of carbohydrate and 0.3 g of fat (Yellavva, 2008). It is widely used as vegetables, cooked or preparation of pizza or burger in growing fast food chain. Its high consumer demand is attributed with high market price.

Capsicum can be successfully grown under open field conditions and in protected structures, i.e., net house, polyhouse, walk-in-tunnels, plastic low tunnels, etc. (Singh and Sirohi 2006) but its cultivation under open condition is not successful
which might be due to poor adoptability under fluctuating atmosphere and produced poor quality food under erratic biotic and abiotic factors (Yoon et al. 1989; Kanwar et al. 2014). The cultivation of capsicum under different protected structures like polyhouse, net house, walk-in-tunnels, plastic low tunnels are the most suitable solutions to the challenging environmental factors as it prevents spreading of insect, pest, and viral diseases, hence plays a key role in integrated pest management.

Worldwide total greenhouse area is the maximum in China at 2760 thousand hectare followed by Korea 57.4 thousand hectare (Anonymous, 2018). In India, the area under all forms of protected cultivation is nearly 25 thousand hectare however significant efforts are being made under National Horticulture Mission, Ministry of Agriculture, Government of India to increase area under protected cultivation (Anonymous, 2012). In Punjab upto 2016-17, total number of 1151 protected structure units (all types) were established which covered an area of 224 hectare under protected cultivation (Anonymous, 2018).

The growing trend of protected cultivation is associated with high yield, good quality, improved shelf life and year around availability of pepper fruit (Rai et al. 2004). Greenhouse technology can be utilized for controlling the environmental parameters such as temperature, relative humidity, light intensity and duration, CO₂ level, Irrigation & nutrient supply, spacing, growing medium and root development (Baghel et al. 2003; Wani et al. 2011). Choudhary (2016) reported a manifold increase in the resource-use efficiency through crop cultivation under protected structures as compared to the open-field conditions. The high-value cash crops and vegetables are grown and managed under the controlled environmental conditions with higher productivity/unit of area and economic profitability.

Among the various protected structures, polyhouse production had been proven as more profitable protected technique for capsicum cultivation (Aruna and Sudagar 2010). Polyhouse/greenhouse production of capsicum emphasizes appropriate planting densities to boost-up the total production per unit area by utilizing the space available and nutrient applied.

Now-a-days, decreasing land holding for crop cultivation hinders the availability of land under vegetable crops, further year around availability of good quality capsicum endorses the cultivation of capsicum under protected environmental
conditions such as greenhouse or polyhouse. Protected cultivation also ensures the availability of produce in the market during off season, when it is in great demand.

The northern plains of India had very fertile soil, enriched with natural macro and micro nutrients essential for crop cultivation. But the vegetable cultivation is confined to region specific and season specific due to varied climatic conditions. The extremes of temperature range from 0°C to 48°C prevails in northern plains, which restrict year-round production of capsicum to meet the daily requirement. Thus, protected cultivation delimits the vagaries of extreme of adverse climatic conditions. It is well known fact that protected cultivations has so many advantages like early fruit yield, high yield per unit area, excellent marketable quality of produce on demand, year round production of capsicum, better utilization of land and space, minimum use of ground water by using drip irrigation system, controlled environmental conditions like temperature, humidity and light, eco-friendly use of inorganic chemical like fertilizers and pesticide, management of biotic and abiotic stresses, more scope to adopt bio-solutions to control biotic and abiotic stress etc.

Although some capsicum cultivars like Orobelle, Indra, Bomby had been tested for protected cultivation in net house or shadenet etc., but many other good cultivars are now available, which need to be tested for their cultivation in Punjab state under different types of protected structures such as naturally ventilated polyhouse (NVPH), walk-in-tunnel (WIT), Nethouse etc. Thus a study was planned with the following objectives in view:

- To evaluate capsicum cultivars under different protected structures.
- To study the effect and economics of different protected structures on capsicum cultivation.
- To work out technology for year-round production of capsicum.