CHAPTER-I
INTRODUCTION

India is the second largest producer of vegetables in the world, next to China with a total production of 155.52 million tonnes (NHB, 2015). The total cultivation occupying 9.2 million hectare (mha) area, accounts 6.12 per cent of the total cultivated area (145 mha) in our country (NHB, 2015). In India, average productivity of vegetables is 17.3 tonnes/ha, which is lower than the average productivity of China (22.5 tonnes/ha) and the USA (32.4 tonnes/ha) (FAO, 2014). The per capita availability of vegetables is (285 g/person/day) less than the daily recommended quantity of 385g/person/day for the balanced diet.

Vegetable kingdom comprises a large number of plant species most of them being annuals. Their parts like stems, flowers buds, flowers, fruits, roots etc. are consumed in different ways. Vegetables provide the all nutrient components; viz. carbohydrates, protein, fat, vitamins, minerals, and roughage which are essential constituents of balance diet for human being. They also contain ample amount of vitamins and minerals, Rightly know as protective foods. Among vegetables, leguminous ones provide proteins. Most of the vegetables contain low amount of fat, (lesser than the 0.1%). Major minerals obtained from vegetables are calcium, iron and phosphorus. The vegetable also play an important role in neutralizing the acids produced during digestion of
protein and fatty acid. They also provide roughages in the form of dietary fibres which help in digestion and bowel movement.

Among vegetables, cucurbitaceae is the largest family consisting of maximum number of edible types of species. The crops belonging to the cucurbitaceae family are commonly called cucurbits. The family consists of 130 genera and 900 species, that includes cucumber, bitter gourd, squash, bottle gourds, ridge gourd and snake gourd etc. Most of the cucurbit species have an African origin. The genus Cucumis contains nearly 40 species, including three important cultivated ones [C. anguria L. (West Indian gherkin), C. sativus (cucumber) and C. melo L., (cantaloupe)].

The cucumber (Cucumis Sativus) (2n =14), belonging to the family Cucurbitaceae is believed to have originated from India. There is a large variation in cucumber of different parts of India. It has been cultivated for at least 3,000 years in the western Asia, it was probably introduced to other parts of Europe by the Romans. Cucumber continued to grow in the wild form through many other nations in the South -East region of Asia, and was probably introduced to other parts of Europe by the Romans.

The cucumber belong to the genus Cucumis consisting of 20 to 25 species found in Asia and Africa. The cucumber is a creeping vine that roots in the ground and grows up trellises or other supporting frames, wrapping around ribbing with thin, spiralling tendrils. It plants have large leaves that form a canopy over the fruits. The fruit is roughly cylindrical, elongated, with tapered
ends, and may be as large as 60 cm long and 10 cm in diameter. Cucumber is grown to be eaten as fresh (called slicers) and those intended for pickling (called piklers) are similar. Cucumber is mainly eaten in the unripe green form. The ripe yellow form normally becomes too bitter and sour. It has usually over 90% water. Having an enclosed seed and developing form a flower, botanically, cucumber is classified as fruit. However, much likes tomatoes and squash they are usually perceived, prepared and eaten as vegetables. A few varieties of cucumber are parthenocarpic, the blossoms create seedless fruits without pollination. Pollination in these varieties degrades the quality. In the US, these are usually grown in green houses, where bees are excluded.

Most of the cucumber varieties, however, are seeded and require pollination. Thousands of hives of honey bees are annually carried to cucumber fields just before bloom for this purpose. Cucumber may also be pollinated by bumblebees and several other species. Cucumber is wonderful as a digestive aid, and has a purifying effect on the bowel. It is not necessary to soak them in salt water. Serve them thinly sliced, raw, in soar cream, lemon or yogurt for a delightful summer dish. They have a marvellous effect on the skin, and the old saying “keeping cool as cucumber” is literally true because of its cooling effect on blood. Cucumber seeds have a number of Ayurveda uses.

The cucumber is an annual and day neutral species. Basically, it is monococism trilling, or climbing vine with angled, hirsute or rough stem, leaves are triangular – ovate, some –what three loved with mostly acute curves. The staminate flowers have three stamens. The two stamens have two locules each
and third are unilocular. The pistil consists of five (but usually three) carpels which in turn, produce ovaries with a corresponding number of locules. The pistillate flower contain up to five stigmas. The main stem of monoecism cucumber is usually characterized by three phases of sex expressions. Only staminate flower are produced in the first phase, followed by a phase of irregular alternating female, male or mixed nodes and finally a phase of only pistilate flowers. For crossing purpose, pistilate flower are closed with a rubber band/ wrapped with cotton pad to protect against unwanted pollen grain about to 2 days prior to opening. Anthesis takes place around 5:30 – 7:00 AM. Dehiscence occurs around 4:30 – 5.00 AM. Pollen is up to 14 hr. Similarly male flowers are also protected. For seed purpose the fruits are harvested at fully ripe stages, the colour of fruits turn to yellow.

The cucumber most likely originated in India (foot hills of the Himalayas), where closely related wild species C. hardwickii Royle still exists in India. It has been in cultivation for at least, 3000 years. The Romans used highly artificial methods of growing cucumber when necessary to have it for the Emperor Tiberius out of season.

The cucurbits are distributed primarily in warmer areas of the world, especially in the tropics and Subtropics. They are less frequently encountered in temperate regions because of their frost sensitivity. The cucumber is being grown for fresh market in India and elsewhere in the world. In india, it is cultivated extensively in Karnataka, Tamil Nadu, Uttar Pradesh, Andhra Pradesh Kerala and Maharashtra. The world cucumber and gherkin are
cultivated in the area of 21.10 lakh ha with a total production of 64.21 million tonnes and average productivity of 30,254 kg/ha (FAO, 2015). In India, it is cultivated in 26140 ha with the total production of 1.95 lakh tonnes and an average productivity of 6,385 kg/ha (FAO, 2015). Its fruits are highly nutritive and have very high water content. This cucumber is a diuretic and has a cleansing action within our body by removing accumulated pockets of old waste material and chemical toxins and very low calories. Its fruit is used as a vegetable or salad. It is rich in minerals, thiamine, niacin and vitamin C. (0.38 g, 0.3 mg, 0.2 mg and 78 mg, respectively per 100 g of edible fruit). Fruits consist about 80 % edible portions which contain 95% water, 0.7% protein, 0.1% fat, 3.4% carbohydrates, 0.4% fiber and 0.4% ash (Aykroyd, 1963). It is fiber-rich in high levels of potassium and magnesium helps regulate blood pressure and help promote nutrient functions. The magnesium content in cucumbers also relaxes nerves and muscles and keeps blood circulating smoothly.

There are different ways and means to achieve higher production, e.g., bringing additional area under vegetable crops, using hybrid seeds and use of improved agro-techniques. Another potential approach is perfection and promotion of protected cultivation technology of vegetables (Singh, 1998). A successful vegetable production is very dependent upon a sustainable supply of quality seed. With the use of F$_1$ hybrids, its productivity can be increased manifold within a short period. Besides, hybrid cultivars have other useful attributes too, like resistance to disease, earliness, better keeping quality,
transportability and also provide quick and convenient way of combining desirable characters. Hybrid cultivars require better production technology than common and open pollinated cultivars, which is necessary for exploitation of their maximum potential. Undoubtedly, seeds of hybrid cultivars are expensive, but provide at least 2-3 times higher economic returns with better quality as compared to open pollinated cultivars. By adopting improved methods of seedling rising often under protected environment, it has been possible to drastically reduce the seed rate per acre but, high germinability and genetic purity are essentially required.

The exploitation of heterosis has led to the development of hybrids. Cucumber hybrid Pant Shankar Khira-1 is a new and promising one for cultivation in northern Indian plains. Its seeds are great in demand and production of hybrid seed needs to be standardized to increase the seed yield with better quality fruits so that the cost of seed can be reduced. In the absence of suitable male sterile cytoplasm, hybrid seed production on commercial scale in cucumber is being done by hand emasculation and pollination is performed manually. The most productive and desirable hybrid seed can be obtained from the female parent when there is a perfect coincidence of stigma receptiveness and pollen viability. Thus, time of pollination plays a crucial role in hybrid seed production of cucumber. The pollination is done usually on the day of flower opening itself the stigma is receptive till noon of the day but most receptive in early morning. But, there is a lack of information on the time of
pollination for cucumber seed crop grown under naturally ventilated poly house and insect-proof net house.

Seed crop grown in open field especially in kharif season is severely infested with cucumber mosaic virus and other insect pests; against which no reliable management measures are still available. Secondly, with changing climatic conditions like continuous unseasonable rains during April-June, increased temperature, increased incidence of insect pests and diseases in turn reduces the seed yield and quality drastically in summer crop and also relatively early onset of high temperature hamper the production of female flowers, fruit setting and fruit development in summer season. Growing seed crop under protected structures, viz, naturally-ventilated poly house and insect proof net house can overcome these problems by protecting the crop from various insect vectors and unfavorable climatic conditions. It also provides an option for off-season seed production too. However, very few references are available on production of hybrid seeds of cucumber crop under naturally ventilated poly house and insect-proof net house. Seed extraction from fleshy vegetables is cumbersome process. There are two methods, of seed extraction employed in cucurbits. In dry method the fruits are cut from one side and the seeds come out from the fruits e.g. sponge gourd, ridge gourd and snake gourd while wet method is employed for seed extraction of cucumber, muskmelon, watermelon, ash gourd, bitter gourd, round melon and long melon. The fruits of cucumber, bitter gourd, summer squash and long melon are cut longitudinally and seed is scooped out along with placenta then the seed is extracted from
scooped material through machine extraction or natural fermentation or chemical extraction. However, information regarding comparative efficiency of these methods on seed quality is lacking.

Keeping in view of the importance of cucumber hybrid seed production and challenges faced by seed growers in open field and limited knowledge on seed production under protected structures and experiment was planned to produce hybrid seed of cucumber cv. Pant Shankar Khira-1 under insect proof net house and open field conditions, influence of insect proof net house on seed yield and quality of cucumber. It is necessitated to develop suitable seed production technology under Delhi condition with the following objectives:

Objectives:

- To study the growth and reproductive behavior of parental lines of cucumber cv. Pant Shankar Khira -1 under insect-proof net house and open-field conditions.
- To study the effect of growing conditions (insect-proof net house and open-field conditions) on hybrid seed yield and seed quality.