The experiment entitled on “Hybrid seed production of cucumber (Cucumis sativus L.) under insect proof net house and open field conditions” was conducted to study the growth and reproductive behaviour of parental lines of cucumber cv. Pant Shankar Khira -1 under insect-proof net house and open field conditions and to study the effect of growing conditions (insect proof net house and open field conditions) on the hybrid seed yield and seed quality at Centre for Protected Cultivation Technology (CPCT), IARI New Delhi, and Department of Horticulture, CCR(PG) College, Muzaffarnagar (U.P), during kharif seasons of 2013-14 and 2014-15. The results of the experiments are discussed here under.

5.1 Growth and Reproductive Behaviour of parental lines

Growth and development were affected influenced by the environmental factors (temperature, relative humidity and light intensity) and growing conditions (insect-proof net house and open field conditions) which ultimately affected seed yield and quality. There were significant differences on vine length and number of leaf nodes at 30 days, 45 days after sowing and internal node length was also affected under both insect-proof net house and open field conditions (Tables 4.1, 4.2, 4.3, 4.4 and 4.5). The effects were observed due to stimulation of cellular expansion and cell division under diffused light
conditions in protected structures (Schoch, 1972). The similar results were reported by El- Aidy et al., (1987) in sweet pepper.

The Cucurbit family having a morphological character to days taken for induction of first lateral, days to opening of first male flower in pollen parent and days to opening of first female flower in seed parent were longer under open field condition as compared to net house conditions due to effect of different environmental factors. The morphological characters were reduced days under net house conditions in comparison of open field condition (Table 4.6). Basu and Singh (2009) reported effect of cooler temperature, under net house condition provided lesser days to opening male and female flowers in hybrid brinjal. Similar report was submitted to Nerson (2009) also reported similar finding in sweet peppers.

The data shows that cucurbits have a tendency to produce significantly more number of male and female flowers, and number of pollinated flowers under insect-proof net house condition as compared to open field condition (Table 4.7). The proportion of male: female flower varied from 10:1 to 25-30:1 among cucurbits. Total numbers of flowers produced were more under insect-proof net house compared to open field condition. The higher number of female and male flowers, and number of pollinated flowers under protected structures might be due to optimum temperature, light intensity, relative humidity and very low incidence of insects and diseases inside, that might resulted in better growth and flowering. The number of male and female flower was low in open condition because of high incidence of cucumber mosaic virus
and red pumpkin beetle. The results are in conformity with those of Wang et al., (2007), Singh and Sirohi (2006). Similar results are also reported that Hossain et al., (1990) also reported similar results in pumpkin.

The number of fruits set and number of fruits developed to maturity (5.71 and 2.52, respectively) were significantly higher under net house condition as compared to open condition (2.84 and 1.65, respectively) (table 4.8). The number of fruits set per/plant and number of fruits developed to maturity significantly higher under insect-proof net house compared to open field condition. High light intensity can lead to several disorders in development and appearance of fruits that affected the quality (Dorais et al. 2001). Sun scald injury and uneven ripening are two disorders brought on by direct effects of light on fruits. The number of fruits sets and fruit developed to maturity were significantly higher in *kharif* season of 2014 season compared to *kharif* season of 2013 season under protected structures. The insect proof net houses can be used for virus-free cultivation of tomato, chilli, sweet pepper and other vegetables mainly during the rainy season (Singh and Sirohi, 2006). Vishwanath *et al.* (2007) also reported that pollination by insects resulted in higher fruit setting, seed yield and seed quality during hybrid seed production.

The data revealed that percentage of incidences of viruses, white fly and leaf minor significantly responded under net house condition as compared to open field condition (Table4.9). The environmental condition during *kharif season of 2013 and 2014 were also significantly superior over under net house condition as compared to open field condition. There was no incidence of
viruses, white fly or leaf minor on cucumber under insect-proof net house while many viruses, white fly and leaf minor diseases affected in open field condition. Due to that cucumber variety did not survive under open field condition as compared to net house condition during both the years. Singh et al., (2005) and Cheema et al., (2004) also similar results in sweet pepper. Kaur et al. (2010) also reported similarly in cucumber under net house condition.

Number of seeds/fruit significantly responded under different growing conditions (Table 4.10). Due to genetically difference the number of seeds was maximum under net house condition as compared to open field condition. The data showed that the cucumber variety was better responded in insect-proof net house condition than open field condition. Such results are also reported by Kushwaha and Pandey (1998) and Singh et al. (2010) in pumpkin. Devadas et al., (1999) also reported the finding in pumpkin variety.

The effect of growing conditions on seed behaviour in cucumber was significantly affected under net house condition as compared to open field condition (Table 4.11). Due to climatic changes and varietals habitat the number of filled seeds produced maximum under net house condition. Under net house condition, no climatic condition and indices affected to the variety as compared to open field condition. The number of unfilled seed was also found minimum in insect-proof net house condition compared to open field condition. Cheema et al. (2004) and Singh et al. (2005) also reported such results in tomato.
The insect-proof net house exhibited significant effect on seed yield/fruit and seed yield/plant (Tables 4.20 and 4.21). There was significantly higher seed yield/fruit, seed yield/plant as compared to open field condition due to increased growth components of plants, such as increased more fruit setting, more fruits developed to maturity, increased fruit weight, length, width and number of filled seed/fruit. The seed yield per plant was significantly higher in kharif season of 2014 (17.95 g) compared to kharif season of 2013 (17.79 g) under insect-proof net house condition while, average it was significantly higher under insect-proof net house (17.47 g) compared to open field condition (4.18g). The similar results were obtained by Flemine Xavier (2010) in pumpkin, Gograj Singh Jat (2011) in bitter gourd and Kunj Bhihari (2012) in summer squash hybrid seed production under insect proof net house.

The seed quality is basically judged by germination %, electrical conductivity, seedling length, seedling dry weight and seed vigour index (I &II). The seed quality was significantly higher under insect proof net house compared to open field condition. The superiority of these attributes due to the higher photosynthetic efficiency and better assimilation of food reserve in seed compared to open field. The significantly lesser electrical conductivity of seeds under insect-proof net house was indicated the sound development of seeds (tables 4.30, 4.31 and 4.32).
5.2 Effect of Growing Conditions on seed yield and seed quality:

The quality of seed in terms of viability and vigour is attained when fruits are harvested at adequate physiological maturity stage. The stage of harvesting has marked effect on fruit development attributes, seed yield and quality. It is evident from the results that harvesting of fruits in *kharif* season resulted in higher fruit development attributes compared to other harvesting stages owing to accumulation of food reserves in fruits with increase in period of harvesting. The fruit weight, fruit length and fruit width were significantly higher under insect-proof net house as compared to open field condition. The fruit weight, fruit length and fruit width showed increasing trend from *kharif season of 2013* to *kharif season of 2014*. Similarly, decreased fruit weight in early harvested also reported by Vinod Kumar *et al.* (2002) in Paprika, Sureshbabu *et al.* (2003) in brinjal and Hamsaveni, (2002) in tomato and Singh *et. al.* (2010) in pumpkin.

The seed yield parameters viz. number of seeds/fruit, number of filled seeds, number of unfilled seeds, seed yield/fruit and 100 seed-weights were significantly higher under insect-proof net house compared to open condition. The number of seeds/fruit significantly decreases from *kharif season of 2013* (212.09) to *kharif season of 2014* (209.60). But during the same period number of filled seeds increased and unfilled seeds reduced, significantly. The 100-seed weight was recorded maximum under insect-proof net house condition (3.48g) as compared to open field condition (2.59g). The seed yield/fruit showed increasing trend under insect-proof net house condition compared to open field.

The data revealed that the seed length (mm) and seed width (mm) were significantly affected by different growing conditions during the study period. The seed length and seed weight were showed significantly higher under insect-proof net house condition due to meteorologically or different indices were not affected. Seed length was produced more in *kharif season of* 2014, while seed width was recorded higher in *kharif season of* 2013. Whereas, it was higher under insect-proof net house condition as compared to open field condition as shown in (Table 4.29). Similar results were reported by Suryavanshi *et al.* (1995) and Pervej *et al.* (2010).

The cotyledon weight and seed coat weight of cucumber revealed the physiological status of seeds at each maturation stage. The seed coat weight was responded statistically higher under net house condition except cotyledon weight. The cotyledon weight obtained was maximum in *kharif season of* 2013 as compared to *kharif season of* 2014 while similar values of seed coat weight were obtained in *kharif season of* 2013 and kharif season of 2014. Due to better germination and performance of seed quality, the seed coat weight and cotyledon weight was found higher under insect-proof net house condition (Table 4.15). The results corroborate with Marcos Filho (2005) in cucurbits and Pamela *et al.* (2011) in cucumber.
The germination percentage and seedling length exhibit significantly higher (87.21% and 31.43mm) under insect-proof net house condition as compared to open field condition (82.02% and 26.38mm). Similar results were reported by Flemine (2010), Singh et al. (2010), Saleh and Shaleel (2012) and Kaddi et al. (2014).

The data on seed quality as affected by growing methods during both the season are presented in (table 4.30 and 4.31). The seed vigour index I and II were significantly higher under insect-proof net house condition (2825.54 and 11.08, respectively) but significantly lesser under open field condition (2224.83 and 7.62, respectively). Due to growing environment the seed vigour index I was observed higher (2526.67) in kharif season of 2014 as compared to (2523.70) in kharif season of 2013 while, seed vigour index II was recorded higher in kharif season of 2013 compared to kharif season of 2014. Such results were also collaborated to Singh et al., (2010), Kaddi et al. (2014) and Lakshmi and Celine (2015).

Among growing environments insect-proof net house showed lowest electrical conductivity (11.22) as compared to open field conditions (12.03). The electrical conductivity was found lowest in Kharif season of 2014 as compared to kharif season of 2013 (Table 4.32). The less electrical conductivity under insect-proof net house condition was due to well developed seed coat which releases less seed lechate as compared to open field.