SUMMARY
AND
CONCLUSION
Chilli (*Capsicum annuum* L.) is an important spice crop grown in many states of the country and commonly used in Indian diet. The crop is subjected to a number of fungal, bacterial and viral diseases. Among the fungal diseases die-back incited by *C. capsici* (Syd.) Butler and Bisby is the most serious one and inflicts considerable quantitative and qualitative losses. In view of the importance of the crop and seriousness of the disease, studies on different aspects of the disease were made in detail with the aim of minimizing losses caused by the disease and the results are summarized as under:

Die-back disease of chilli caused by *Colletotrichum capsici* (Syd.) Butler and Bisby has gained importance due to its severity during the recent years. Jaunpur and Varanasi districts were selected for the study and surveyed in 2005. The survey results revealed that the disease was of wide occurrence and most prevalent during rainy season. During rainy season maximum die-back intensity ranging from 6.4-18.4 per cent. Minimum die-back intensity was observed in March, 2005 and it ranged from 0.0-3.6 per cent, while in May, 1998 it was 0.0-4.2 per cent.

Symptoms on stem were characterized by necrosis of tender twigs, form the tip which gradually spread downwards affecting larger portion towards stem resulting in withering of entire plants or top branches of the plant. Large number of acervuli appeared like black dots all over necrotic surface of the affected twigs, which turned as water-soaked to brown becoming grayish white and finally white or straw coloured. Symptoms on leaves appeared as small, black, water soaked spot often surrounded by yellow to light brown halo. These spots coalesced to form large lesions. On red ripe fruits symptoms appeared as small, black, circular
lesions on the skin which extended towards the long axis giving ultimately elliptical shape. As the infection progressed, the spots either defused or turned black or greenish black in colour. On the infected portions numerous acervuli like black dots of the fungus were also formed.

Diseased specimens were collected from different locations and pathogen was isolated, purified and maintained on Potato dextrose agar medium for further studies.

Pathogenicity was tested by Koch's postulate which revealed that the pathogen responsible for die-back disease of chilli is Colletotrichum capsici (Syd.) Butler and Bisby.

Mycelium whitish in colour, septate, branched and measuring 2.2-5.2 μ in width with an average of 3.7 μ. Conidia borne singly at the tip of conidiophores, hyaline, aseptate, sickle shaped, oil globule in centre measuring 20.45-28-63 μ x 2.1-4.09 μ with an average of 24.13 x 3.76 μ. Conidiophores unbranched, erect, aseptate, hyaline arose from acervuli in masses and size varied from 29.45-60.28 μ x 2.93-3.96 μ with an average of 49.37 μ x 3.83 μ. Acervuli hemispherical, dark brown in colour with the diameter which varied from 56.0-116.0 μ (average 84.37 μ). The acervuli consisted of conidiophores, conidia, setae and mycelium. Setae dark brown, erect, stiff, scattered, tips light brown, generally 2-5 septa, needle shaped, size varied from 70.0-173.0 μ 1.4-2.8 with an average of 120.83 x 1.68 μ.

To find out the suitable growth medium for C. capsici and its biomass production, six solids as well as liquids media viz., Potato-dextrose, Host extract, oat meal, Corn meal, Czapek's Dox and Richard's medium were taken. Potato dextrose agar medium was found to be the best for radial growth of the fungus, which supported maximum growth (90 mm) after 8 days of incubation, least radial growth (86.2 mm) was observed in Czapek's Dox medium. Maximum bio-
mass was produced from Richard's liquid medium i.e. 423.0 mg while minimum (171.8 mg) was found from Host extract medium.

Nineteen available chilli germplasm/ cultivars/ varieties were screened under natural as well as under artificial epiphytotic conditions to find out the source of resistance against the disease. Under natural field conditions non entry was found susceptible. However, entries like Faizabadi long, Pant C-1, Chaman, Chanchal, Surajmukhi, Chilli Kali Agahania, Pusa Sadabahar and Agnideva were found resistant and eight entries such as X-335, G-4, Varanasi Local-1, Faizabad Local-1, Patna, Selection-1, JCA-283 and Faizabadi Mirch showed moderately resistant reaction. Rest three viz., Pusa Jwaja, Faizabad local-2 and Varanasi local-1 expressed moderately susceptible reaction while under artificial epiphytotic conditions none of the entries tested was found to be even more resistant out of nineteen entries. Only two entries viz., Pusa Jwala and Faizabad local-2 were rated as susceptible while rest seventeen entries showed moderately susceptible reaction to the disease.

Out of five fungicides and one biogenesis, Bavistin @ 1 per cent was found best which inhibited the fungal growth of the pathogen to the extent of 87.22 per cent over control followed by Subeej (0.25 %) 76.11 per cent and Thiram (0.25 %) 68.36 per cent. Blitox-50 @ 0.3 per cent performed poorest in inhibiting the growth of *C. capsici* (42.22 %).

Significant increase in seed germination was observed when seeds were treated with Subeej @ 2.5 g/ kg seed followed by Thiram @ 2.5 g/ kg seed. Minimum percentage of seed germination was obtained when seeds were treated with *Trichidrma viride* @ 4 g/ kg seeds as it increased only 16.13 per cent over control.

In the study of synergistic effect of seed treatment and foliar spray of fungicides, seed treatment by Subjeej and Thiram coupled with foliar spray of
Dithane Z-78 EC and seed treatment with Subeej and Thiram accompanied with foliar spray of Bavistin (Carbendazim) were quite effective in reducing die-back and fruit rot incidence which resulted in increase of yield.

To see the effect of fertilizers as disease management, all the combinations resulted positive effects in suppression of disease and resulted in increase in yield. Among nitrogen, phosphorus and potash, higher dose of nitrogen provides higher yield of chilli.

As regards studies on bio-chemical transformation in diseased as well as in healthy leaves, twigs and fruits, the level of Ascorbic acid, total phenol, reducing, non-reducing and total sugars were higher in healthy plant parts as compared to diseased ones. Ascorbic acid content was higher in healthy fruits such as 165.76 mg/100 g, while minimum content of Ascorbic acid was recorded in diseased twigs as it showed 8.68 mg contents. Higher level of total phenol was obtained from healthy leaves *i.e.* 218.57 mg, while diseased fruits contained least quantity of 51.42 mg. Healthy fruits consisted highest amount of total sugars as it was 286.66 mg, however diseased leaves contained minimum amount *i.e.* 190.83 mg of total sugars.
CONCLUSION

The findings of the present investigations are concluded as under:

1. Die-back and fruit rot disease of chilli (*Capsicum annul* L.) caused by *Colletotrichum capsici* (Syd.) Butler and Bisby is of wide prevalence and most damaging in all the areas surveyed during July, 2005. Its intensity varied from 6.4-18.4 per cent.

2. The fungus under study proved to be the virulent pathogen for causing the disease.

3. None variety was found resistant against disease under artificial epiphytotic conditions.

4. Combination of seed treatment with Subeej and foliar spray with Dithane Z-78 fund best in reducing disease intensity and increased yield.

5. Soil application of 120 kg Nitrogen + 0 kg Phosphorus + 0 kg Potash also reduces the intensity of disease and increased the yield.

6. Level of ascorbic aced, total phenol, reducing, non-reducing and total sugars were higher in healthy plant parts as compared to disease ones.