5.1 Summary

Though tomato is seriously affected by many diseases, early blight is an important destructive disease of tomato in Saurashtra region of Gujarat. Considering this fact, the present studies were carried out on various aspects to generate scientific information on this important pathological problem, which includes establishing the cause of disease, identification of causal organism, symptomatology, physiological studies, biological and chemical control and varietal screening.

The disease symptoms were oval or angular leaf spots one to four mm diameter and usually surrounded by discolored tissue with yellow halo. The spots enlarged with characteristic concentric rings in the center to produce a target board effect and the colour of the spots changed from brown to dark brown.

Older leaves got infection first and later it progressed upward. When plants were 60-90 days old symptoms also appeared on stem and petioles as brown to dark brown elongated cankerous target board type spots. The spots enlarged and covered the entire stem and petioles leading to withering of the plants and spread to sepals and fruits. The symptoms on fruits appeared first at stem end as black or brown sunken spots both on green and ripe fruits which enlarged within eight days involving most of the fruits, finally fruits were rotted.

The pathogen was isolated from tomato infected leaves and the pure culture of the fungus was obtained by following single spore isolation technique. The fungus produced dark brown colony on PDA, septate mycelium, brown conidiophores arising singly or in small groups, solitary straight or muriform conidia. The conidia had typical transverse (4-9) and longitudinal septa (0-4) with muriform with length 150-300 µm, 15-20 µm thick and long beak. The description of the fungus agreed with the description given by Common Wealth Mycological Institute, Kew, Surrey and England. Hence, the causal agent was identified as *Alternaria solani*. 
Successful pathogenicity of the fungus on tomato plant was established following Koch’s postulates by inoculating the spore suspension.

Morphological variability in colour of colony, substrate colour, margin of colony, topography of colony, colony growth, good sporulation of *A. solani* was observed in culture media.

The optimum temperature range for this fungus was 25 to 30 °C. however, maximum mean colony diameter of test fungus was recorded at temperature of 25 °C (77.70 mm) which was significantly superior over all other temperature and next better mean colony diameter growth of test fungus was recorded at temperature of 30 °C (75.56 mm) which was significantly superior then remain other temperature.

Out of eight solid media tested, maximum mycelial growth was obtained in potato dextrose agar medium (88.78 mm), which was significantly superior over all other media and next better media is Richard’s agar medium (77.12 mm).

Among the six antagonists tested *Trichoderma harzianum* were effective in checking the growth of the pathogen. Significantly maximum inhibition was recorded in *Trichoderma harzianum* (88.00 %) which was significantly superior over all other bio agent. While *Bacillus subtilis* (80.60 %) was next better. The result of study suggested that some bio agent control could be used as alternative of fungicides to control early blight of tomato. Furthermore, the load of fungicide can be minimize and reduce environmental pollution.

Among the seven non systemic fungicides tested for growth inhibition of *A. solani* and all were capable of inhibiting the growth of test fungus at various concentrations (500, 1000, 1500 ppm) as compared to the control. Significantly maximum growth inhibition was noted in mancozeb at 500, 1000, 1500 ppm which remain superior over all other fungicides.

Among the eight systemic fungicides tested *in vitro*, which were capable of inhibiting the growth of *A. solani* at various concentrations (100, 250, 500 ppm) as compared to the control. Hexaconazole proved to be the most effective for per cent growth inhibition of *A. solani* at all concentrations.
Among the eight insecticides tested were capable of inhibiting the growth of *A. solani* at various concentrations (250, 500, 750 ppm) as compared to the control. triazophos proved to be most effective and inhibited 94.67% mean mycelial growth of the test fungus. It was found statistically superior over all other insecticides.

Out of nine fungicides tested in field condition, all treatment were significantly reduced early blight as compared to the control. Minimum disease intensity (5.20 %) was recorded in mancozeb and it was significantly superior over all treatments. Hexaconazole (10.44 %) was remain next better in reducing alternaria blight disease followed by copper oxychloride (12.88 %) and carbendazim (11.62 %) they were at par. The yield was also significantly higher in all treatments as compared to control. The highest yield 35150 kg ha\(^{-1}\) was obtained in mancozeb followed by hexaconazole (34138 kg ha\(^{-1}\)), carbendazim (33605 kg ha\(^{-1}\)), copper oxychloride (32465 kg ha\(^{-1}\)) and chlorothalonil (31255 kg ha\(^{-1}\)).

Highest ICBR was recorded in fungicides mancozeb @ 0.20 % (1: 39.61) with Rs. 103090 net return. In yield loss assessment minimum per cent disease intensity was recorded in mancozeb (24.65 %) as compared to control (45.89 %) and 84.11 per cent disease control in mancozeb. The yield loss of 28.52 per cent and 39.91 per cent yield increase over control was recorded in control treatment.

Epidemiology study revealed that the progress of early blight disease was affected by various weather parameters as well as their interaction. The development of early blight in relation to weather parameters indicated that the maximum temperature and wind speed were found positive effect and minimum temperature found negative effective for the disease development.

Out of ten genotypes screened, entries *viz.*, NTL-12-07, GT-2 (13.52%), GT-1 (16.52%), JTL-08-14 (20.54%) and JTL-12-10 (24.52%) were found to be resistant. Four genotypes *viz.*, JTL-08-16 (26.22%), ATL-11-10 (26.54%), GTL-12-07 (27.24%) and JTL-12-02 (27.52%) were found moderately resistance. One genotype namely NTL-12-02 (11.20%) was found highly resistance.
Conclusion

Based on present studies, it can be concluded that tomato (*Lycopersicon esculentum* Mill) is susceptible to *Alternaria solani* (Ellis and Martin). The disease symptoms were oval or angular leaf spot with yellow holo, concentric rings and dark brown in colour.

The optimum temperature for this fungus is 25 to 30 °C. Among eight solid media tested PDA was best media for growth of *A. solani* *in vitro*. Among the six antagonist tested, *Trichoderma harzianum* have been identified as potent antagonistic to *A. solani*. While in fungicides mancozeb 75 %, hexaconazole 5 % and insecticides triazphos 40 % proved effective under *in vitro* condition.

Under field condition, mancozeb @ 0.20 % was effectively reduced early blight as well as too obtained higher tomato fruit yield. The loss of tomato yield 28.52 per cent was recorded in tomato crop during season. Epidemiology study indicated that the maximum, minimum temperature and wind speed affect the development of early blight. Out of ten genotype/varieties NTL-12-02 was found highly resistance.