DISCUSSION AND CONCLUSIONS
Chapter IV

Discussion and Conclusion

Studies on some parasitic aspects of Fusarium species causing rhizome rot and wilting of Ginger (zingiber officinale rosc) first reported from India (Haware and Joshi 1973a) has recently become a major disease of Ginger in Bundelkhand region. A survey was carried out from 1997 to 1999 during the present studies revealed 36.50% disease incidence in Lalitpur and adjoining areas of Jhansi division. The susceptibility of ginger infection increased after 35 days of incubation period in the ginger fields. The reason for this finding seems to be interaction of climatic conditions including effect of temperature ranging from (23 to 27°C) followed by heavy rains. The interaction of the pathogen Fusarium oxysporum f sp zingiberi with the host of Ginger (zingiber officinale rosc) seem to be most favourable for disease development in the above conditions. The high disease incidence may also be attributed to the physio- chemical changes occuring on the
surface of the host namely ginger rhizomes.

The wide host range of the pathogen may be the reason for the outbreak of *Fusarium* rot of ginger in new areas of cultivation including the present areas of investigation namely Lalitpur and adjoining areas, Baruasagar, Tikamgarh, Prithivipur and adjoining areas, Datia, Panna, Chattarpur, Pichore, Newari, Jatara and Tunka area of Babina block of Bundelkhand region. The outbreak of rot may also be partly attributed to reluctance of cultivators for not using biological and chemical agents of disease control.

The highest disease incidence in the form of rhizome rot is also likely the effect of environmental factors mainly in the form of optimum soil temperature effect of mean soil temperatures of 25°C and favourable soil moisture. However no significant disease incidence was observed at temperature lower than 20°C. This may be attributed inhibition in mycelial growth and
sporulation of the pathogen at the temperature lower than 20°C.

During the present investigation regarding the optimum period required for infection of ginger rhizomes in laboratory/field conditions the highest level of infection was observed after 35 to 40 days of incubation may have been necessary for obtaining the pathogenesis attributed to dissolution of middle lamella, the cell wall of the pathogen resulting in the softening of the host tissue, which may also be partly due to some cellulosic enzymes, which are yet to be worked out and work is in progress.

The highest disease incidence, causing rhizome rot may also be related to the amount of inoculum and germination of chlamydospores in the field condition during the favourable growth period of the pathogen.

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The difference in degree of virulence may be attributed to a Correlation between a amount of pH as well as the surface antigens present on different fruits and vegetables the affinity of some Glycolipids and pathogen on different fruits and vegetable may also be resulted degree of virulence. The findings are in confirmatory with Sharma and Upadhyaya (1977), Baqr et al (68)

During the studies on growth and sporulation of the pathogen on semi solid cultural media Potato Dextrose Agar medium and Czapek’s (Dox) medium found to be significantly effective. Similar types of findings were reported by Dohroo (1982), Sharma (1989) whereas the growth and sporulation in liquid (broth) medium Richard’s liquid medium and Corn meal modified liquid medium Czapek’s (Dox) liquid meidium were also found to be significantly effective. Whereas Coon’s medium was fond to be least significant.

During the present investigation to find out the effective control measures no. of fungicides namely Mancozeb M45.75 WP, Dhanucop 50 (Copper oxychloride 85WP), Carbendazim 51 WP, Sulpher 80 WP, Carbendazim 51 WP + Mancozeb
75 WP in the ratio of 1:1, Thiram 50 WP, Bavistin 50 WP, Achook Azadirachtin 1300 ppm, were used. Phenolic compounds as Amino acids, water soluble extracts oil-cakes & certain weeds were tested to find out their effectiveness in inhibition of the pathogen. The work on eight fungicides carried out against the test pathogen in invitro Mancozeb 75WP + Carbandezim 51 WP in the ratio of 1:1 proved to be highly effective against Fusarium rot of ginger caused by *Fusarium oxysporum f sp. zingiberi*.

Amendment of soil with oil-cakes is an effective measure to control the disease. All the oil-cakes are not effective for all the pathogens. Though Castor (*Ricinicus communis*) is effective oil cake for the control *Fusarium oxysporum f sp. zingiberi* whereas groundnut (*Arachis hypogea* L.), Mahua (*Madhuca indica* J.F. Gmel) were comparatively less effective, Castor (*Riccinus communis*) showed maximum growth inhibition amounting to 78.66%. The results shows that oil-
cakes extracts are to be used immediately sakia et al (2001).

It has now been fully realised that the increase in Agricultural production through use of chemicals, fungicides are polluting the air water and plant itself. Moreover fungi is resistance to fungicides and bacteria to antibiotics, under these circumstances, a search for alternative method of disease control has become more imperative. For avoiding the pollution under such circumstances the incorporation of weeds extracts and grasses extracts have become more imperative for the control or **Fusarium oxysporum f sp zingiberi**. The water soluble extract of **Datura alba** Nees, **Launaea asplinifolia** H.kf and **Calotropis procera** Br. proved to be growth controller and controlled 70.75% , 64.63% and 60.55% of growth inhibition of **Fusarium oxysporum f sp zingiberi**, The wilt and rot Causing pathogen of ginger (**Zingiber officinale Rosc**). Though water soluble extract of **Dicanthium annulatum** stapf., **Ocimum santum** L, **Tridax procumbens** L., **Euphorbia hirta** L., and **Vinca**
**rosea** L., have already tested against growth and sporulation of *Fusarium oxysporum f sp zingiberi* and proved to be ineffective against the test pathogen.

The growth inhibition of the above weeds are due the antifungal compound, are to be further analysed.

The conclusion pertaining to the studies on different water soluble extracts of soil amended with two different concentrations (table 11 conc. A and B) of amino acids. The maximum growth inhibition amounting to 58.82% was seen with Glycine whereas the minimum growth inhibition amounting to 19.22% was seen with Phenyl Alanine. The stimulation of the growth caused by the addition of Phenyl Alanine amino acids with the medium may be attributed to the Phenyl Alanine amino acids as the growth promoting amino acids while Glycine amino acids does not favour the growth of the pathogen *Fusarium oxysporum f sp zingiberi*. 

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The enhancement of disease percentage in ginger rhizomes treated with various cultural filtrates of the soil may well be the commulative effects of fungal metabolites isolated from the soil. The commulative effect of *Penicillium, Nectria* were significant. The isolation of fungal metabolites of soil isolates is being actively carried out and the work in progress to find out the enhancement effect of these fungi on rhizome rot of ginger caused by *Fusarium oxysporum f sp zingiberi*.

Anatomical studies of inoculated and incubated ginger rhizomes have revealed that the mycelium of *Fusarium oxysporum f sp zingiberi* spread to the host tissues peripheral as well as central part of host tissues, the rotting may be attributed to the mycelium invading the cell walls including the middle lamella, which may well be the result of Pectinase and cellulase enzymes dissolving the middle lamella. The subsquent wilting way may be the result of the mycelium infiltrating and rupturing the xylem vessels of the host tissue.