CHAPTER V

SUMMARY & CONCLUSION

The focus of the present work was to know the microbial diversity, physico-chemical characteristics of agricultural and industrial areas around Mysore district and to screen the potential isolates of bacteria and fungi which can degrade pesticides and tolerate heavy metals.

During the investigation an extensive field survey has been carried out in seven different taluks of Mysore district to collect soil samples from agricultural fields and industrial sites. Soil samples were analyzed for the microbial diversity.

The most common species found in agricultural fields are *Aspergillus flavus*, *Aspergillus terreus*, *Aspergillus niger*, *Aspergillus fumigatus*, *Trichoderma harzianum*, *Cladosporium spp.*, *Curvularia lunata*, and the most prevalent species found in industrially polluted soil are *Alternaria alternata*, *Penicillium fumiculosum*, *Penicillium chrysogenum*, *Fusarium solani*, *Fusarium oxysporum*, *Rhizopus stolonifer*, *Mucor spp.*, *Trichoderma viridae*, etc.

The physico-chemical characteristics such as pH, temperature, electrical conductivity, moisture content, water holding capacity, organic carbon, organic nitrogen, and phosphorus in agricultural fields varied. The pH was in the range of 6.85 to 7.63 and electrical conductivity not much varied except in the sampling sites (AS-1) and (AS-6). There was no much variation in moisture content and water holding capacity, where as in the organic carbon content is very less in (AS-12) and higher in the site (AS-9) and other characteristics such as organic nitrogen and phosphorus remains more or less same in all the sampling sites.
In the industrial sampling sites pH varies from 5.82 to 6.90 and electrical conductivity showed higher values in the site (IS-4) and less in (IS-7) compare to other sites. Water holding capacity and moisture content not much varied in all the sampling sites. The heavy metal concentrations in Iron, copper and zinc were not too much varied, where as nickel and chromium concentrations was almost similar. The lead and cadmium levels were below detectable limits in the sampling sites where as in the sites of (IS-3), (IS-5), (IS-7) and (IS-8) was detected in less concentration, cadmium was detected in (IS-4) and (IS-8) only.

Correlation coefficient revealed that \textit{Aspergillus flavus} showed positive correlation with \textit{Penicillium sp} and significant at 0.01 level. Principal component analysis for agricultural sampling sites reveald that, the sampling sites of AS-9, AS-10, AS-12, AS-13 and AS-14 are positively correlated with the controlled sampling sites. The other sampling sites AS-1, AS-2, AS-6 and AS-11 were negatively correlated. Fungal populations were low due to varied environmental factors. Bray Curtis similarity index for the agricultural soil samples showed that, the values above 80% are only taken with account for the occurrence and distribution. The cluster interlinking between all the groups were forms of four clusters each cluster of less than 60% were also recorded but were very low in number.

In industrial sampling sites the correlation co-efficient of fungal species was not well marked. Principal component analysis showed that the organisms in the sampling sites were similar in their distribution and occurrence. Totally three groups were interlinking between each other in bray Curtis similarity index.

Soil samples collected from fourteen sampling sites were screened for degradation of pesticide chlorpyrifos which is used extensively in all the sampling sites. Eight isolates
of bacteria and four fungal species were found to be degrading of pesticides at different concentrations such as 0.2%, 0.3% and 0.4%.

Among eight isolates HC-5 was the potential isolate which could tolerate highest concentration of pesticide chlorpyrifos. Fungal isolates such as Aspergillus niger, Penicillium sp, Trichoderma harzianum, Fusarium oxysporum were tolerant only at lower concentration of chlorpyrifos.

Biodegradation studies revealed that, the isolate Enterobacter cloacae (HC-5) could mineralize chlorpyrifos into some unknown polar metabolites after 14 days of incubation analysed through TLC and LC-MS.

Screening of heavy metal tolerance microorganisms from the soils of industrial polluted sites revealed that, six fungal isolates such as Aspergillus niger, Curvularia sp, Cladosporium cladosporoidis, Fusarium oxysporum, Trichoderma harzianum, Penicillium sp, showed the tolerance to the heavy metals such as Chromium, Nickel, Zinc, and Lead. Out of eight isolates Aspergillus niger was the most tolerating organism.

Bacterial strain HC-5 was characterized by morphological and biochemical tests and identified as Enterobacter cloacae by fatty acid methyl ester analysis (FAME).

The assessment of microbial diversity of industrial and agricultural polluted soil is very much essential to isolate the potential isolates of bacteria and fungi which can be used to cleanup the contaminated soil. The isolate Enterobacter cloacae (HC-5) which degrades the pesticide chlorpyrifos and can be used in large scale as a bioaugmenting agent. Further there is lot of scope to isolate many fungal and bacterial species which are present in the soil and improvement of the strains by biotechnological methods for the enhancement of ability of the strains to degrade the pollutants in the environment.