SUMMARY

Pathogenic microorganisms cause several diseases to both plants and animals including human beings. They are responsible for the post harvest diseases of fruits and vegetables. They also deteriorate grains and other food commodities during storage and transportation thus rendering them unfit for human consumption. It is an established fact that the synthetic chemicals which are used for control of plant diseases not only pollute the environment but also pose a serious threat to human beings as some of the compounds are non-biodegradable, bio-accumulating and also increase the chance of developing resistance among the pathogen populations. Plant metabolites and plant based pesticides have become one of the better alternatives as they are known to have minimal environmental impact and minimal toxic effects to human and other organisms in contrast to the synthetic pesticides. These botanicals have been proved to be an effective and environmental friendly component of integrated pest management systems. The medicinal plants are rich sources of active antimicrobial metabolites. They are now widely used for treatment of a number of human diseases.

The present investigation was taken up to evaluate the antimicrobial activities of ten locally available medicinal plants against nine pathogenic fungal strains, one antagonist fungus and four bacterial species and also to assess the efficacy of selected plant extracts against *Penicillium* rot of apple and seed mycoflora of rice during storage.

The ten fungal species used in the study were *Alternaria alternata, Alternaria solani, Aspergillus flavus, Aspergillus niger, Curvularia lunata, Drechslera oryzae,*
*Fusarium oxysporum, Penicillium expansum, Penicillium italicum* and *Trichoderma viride*. They were isolated from the respective diseased plant parts and soil. The identity of some of the fungal strains were confirmed at ITCC, IARI, New Delhi and NFCCI, Pune. The cultures of four bacterial species namely *Escherichia coli* ATCC 25922, *Enterococcus faecalis* ATCC 29212, *Pseudomonas aeruginosa* ATCC 27853 and *Staphylococcus aureus* ATCC 25923 were obtained from the Department of Microbiology, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India.

Ten medicinal plants were selected on the basis of their ethnobotanical importance. They were *Acorus calamus* (rhizome), *Curcuma leucorrhiza* (rhizome), *Cynarospermum asperrimum* (aerial shoot), *Equisetum hyemale* (aerial shoot), *Euphobia hirta* (aerial shoot), *Hyptis suaveolens* (leaf), *Melastoma malabathricum* (leaf), *Mellilotus indicus* (aerial shoot), *Rotheca serrata* (leaf) and *Tithonia diversifolia* (leaf). The selected plant parts were collected, washed, dried in shade, powdered and then successively extracted using petroleum ether (PE), chloroform (CH) and methanol (ME). The extracts thus obtained were used for assaying *in-vitro* antimicrobial activities against the test microorganisms.

The *in-vitro* antifungal activity was done by following the poisoned food technique and the radial growth of the test fungi were measured and the percent growth inhibition was calculated. The extracts having significant antifungal activity were further subjected to the minimum inhibitory concentration (MIC) assay. The present study revealed that different plants extracts exhibited differential effects on different organisms. Among the plant extracts the PE extract of rhizome of *A. calamus* showed the most potent antifungal activity followed by the CH extract of *A. calamus*, PE extracts of *C. leucorrhiza, T. diversifolia* and *H. suaveolens*. The MIC of the PE
extract of *A. calamus* ranged from 0.5mg/ml to 1mg/ml while the MIC of the CH extract of *A. calamus* ranged from 0.5mg/ml to 2mg/ml. The MIC values of PE extracts of *C. leucorrhiza*, and *H. suaveolens* were in the range of 1mg/ml to 8mg/ml and 8mg/ml to 16mg/ml, respectively. The MIC value of PE extract of *T. diversifolia* against the susceptible fungi was 8mg/ml. The extracts of *C. asperrimum, E. hyemale* and *M. malabathricum* were found to have less antifungal activities. The CH and ME extract of *C. asperrimum*, CH extracts of *E. hyemale* and *M. malabathricum* and ME extract of *M. indicus* could not inhibit any of the test fungal species.

The *in-vitro* antibacterial activity of the plant extracts were assessed using disc diffusion method and by measuring the diameter of zone of inhibition. The effect of different plant extracts were also different against different bacterial species. All the three extracts of *E. hyemale*, *R. serrata* and *T. diversifolia* showed significant antibacterial activity against all the four bacterial species. The PE and CH extracts of *E. hirta*, the PE extracts of *C. asperrimum, H. suaveolens, M. malabathricum* and *M. indicus* were effective against all the bacterial strains. The PE extracts of *A. calamus*, CH extracts of *C. asperrimum* and *M. indicus* and ME extracts of *M. malabathricum* and *M. indicus* were effective against three bacterial strains. The CH extract of *A. calamus* and ME extracts of *C. asperrimum* and *E. hirta* were effective against two bacterial species. All the extracts of *C. leucorrhiza*, CH extract of *H. suaveolens, M. malabathricum* and ME extract of *A. calamus* were effective against only one bacterial species. *S. aureus* was found to be the most susceptible to the plant extracts as it was susceptible to all the extracts except the ME extract of *A. calamus*. While *E. faecalis* was found to be the most resistant against the plant extracts. The MIC and MBC (minimum bactericidal concentration) were also determined for the effective extracts against the susceptible bacterial species. The MIC values of the plant
extracts ranged from 0.39mg/ml to 6.25mg/ml and the MBC ranged from 0.78mg/ml to 6.25mg/ml.

To assess the efficacy of plant extracts against post harvest diseases of fruits, the aqueous extracts of *A. calamus* and *C. leucorrhiza* were tested against *P. expansum* rot of apples. In the study it was observed that the pre-inoculation dip treatment of *A. calamus* and post-inoculation dip treatment of *C. leucorrhiza* significantly reduced the disease severity. Though both the plant extracts showed significant inhibitory effects against *P. expansum* rot of apples it could not completely protect the fruit against the disease.

The plant extracts which were effective against the storage mycoflora of rice seeds in the earlier experiment viz., PE extract of *C. leucorrhiza*, ME extract of *C. leucorrhiza*, PE extract of *A. calamus*, CH extract of *A. calamus*, PE extract of *H. suaveolens*, PE extract of *T. diversifolia*, CH extract of *T. diversifolia*, ME extract of *T. diversifolia*, ME extract of *E. hirta*, CH extract of *R. serrata* and ME extract of *R. serrata* were tested for their effect on storage mycoflora in rice seeds. The result showed general reduction of fungal infestation on the seeds treated with plant extracts in comparison to the untreated seeds. Rice seeds treated with PE and CH extract of *A. calamus* and PE extract of *C. leucorrhiza* showed no fungal growth even after 3 months of storage period.