SUMMARY

1. This thesis incorporates the results of an ecological study involving the impacts of different edaphic factors on the spatio-temporal distribution of the soil arthropod fauna in three different sampling sites located within the township of Darjeeling in the Himalayan West Bengal, India. The sites selected for this study were Padmaja Naidu Himalayan Zoological Park (PNHZP), Happy Valley Tea Estate (HVTE) and Lloyd Botanic Garden (LBG) situated at relatively different altitudes. Each site had two plots for collecting the soil samples.

2. Sampling was always done from two plots of each site at a monthly interval and each time three cores were drawn randomly from each plot and those were homogeneously mixed and treated as a “sample of soil” i.e., in a month 6 samples were collected and altogether 216 soil samples collected over a period of three consecutive years i.e., Jan., 1999 to Dec., 2001, made materialistic basis for faunistic survey and other analysis of this study. Of the six plots studied, three (two at PNHZP and one at LBG) as already stated were uncultivated, undisturbed and free from human interference while the remaining three (two at HVTE and one at LBG) experienced occasional agricultural-horticultural practices. Since all the sites were located in the same geographic zone they did not exhibit marked variation in climate but the soil conditions and vegetational cover showed some differences from site to site and also from plot to plot.

3. The arthropod fauna extracted from the sampling sites included members of the groups like acarina (RA 63.1%), collembola (RA 16.8%), hymenoptera (RA 4.9%), coleoptera (RA 4.4%), orthoptera (RA 1.7%), diplura (RA 0.9%), dermaptera (RA 0.9%), protura (RA 0.4%), pscooptera (RA 0.2%), centipedes (RA 1.5%), isopods (RA 1.1%), pseudoscorpions (RA 0.7%) and millipedes (RA 0.7%). The juveniles of both the arthropods and insects together constituted 5.6% relative abundance of them acarina, collembola, hymenoptera, coleoptera, centipedes and isopods were universally present though their density and mode of population fluctuation varied in different sites as well as in different plots.

4. The population of total arthropods was found to be maximum in plot-A of PNHZP (2078) and minimum in plot-B of LBG (1354). The plot-B of PNHZP, B at HVTE, A at LBG and A at HVTE occupied the second, third, fourth and fifth position respectively with regard to the total number of arthropods. The highest number in plot-A of Zoological Park was owing to the rich litter layer available there and characterized by moderate soil moisture and temperature thus offering a more suitable microenvironment for them. The partially disturbed plots were
relatively poor in litter content and to some extent exposed to sunlight leading to the reduced faunal abundance. This decline in certain species, clearly indicates their susceptibility to agricultural-horticultural stress.

5. In all three sampling sites acarines occupied the topmost position in numerical abundance among all arthropods studied and were represented by 13 cryptostigmatid and 7 mesostigmatid species. The cryptostigmatids in all the sites superseded the latter in number and were extracted from all the samples. The collembolans reached the second position and included 10 species. The other insects and non-insect arthropods altogether consisted of 11 genera and their distribution in many instances were irregular, some of them were altogether absent in many samples. Numerically, the genus Scheloribates (Acari) and the genus Lepidocyrtus (Collembola) occupied the topmost position. But with respect to other arthropods (excluding acarines and collembolans) it was interesting to note that each of the groups in most cases was represented by a single genus that too is insignificant number. Species composition of six plots when considered was found to exhibit differences, some species being widely distributed while others were restricted to only one plot.

6. Faunal population density varied considerably from month to month and season to season, usually showing winter / post-winter (Spring) maxima and monsoon minima. A partial increase was sometimes observed in post-monsoon or pre-winter period.

7. Edaphic factors analysed in this study were temperature, moisture, pH and organic matter, all of which were found to vary in different sites and in different seasons whose impact on the spatio-temporal distribution of soil arthropods were also studied. The values of pH in all the sampling sites were found to be acidic and ranged between 4.41-5.45. Soil temperature changed with change in atmospheric temperature and as expected it reached the minimum level in January and rose to the maximum in July-August and it varied between 8.13°C-21.50°C. Soil moisture exhibited appreciable variation with change of seasons and ranged between 7.1%-40.26%. Organic matter content too exhibited variation in different seasons and ranged within 3.26%-11.23%. All these factors exhibited more or less similar trend with respect to their variation of concentration in different seasons but their degree or extent of variation was not strictly identical. Attempts have also been made to find out the impact of mechanical composition of soil.
8. To establish the relationship between the aforesaid faunal components with the physico-chemical parameters both bivariate and multivariate correlation-regression analysis were performed. When the soil factors were studied singly, organic matter always exhibited a significant positive correlation with the population of total arthropod fauna in all the sampling sites. In respect of soil temperature and moisture, the nature of correlation was found to be negative in all three sampling sites which appeared to be significant in many instances. The value of pH in most cases revealed a negative correlation with arthropod population excepting in three occasions where it was found to be weakly positive and significant.

9. Multiple correlation-regression analysis study revealed that the joint impact of edaphic factors had a strong significant positive effect upon the population in all cases during the period of investigation (P<0.006). Results of ANOVA revealed that there was a significant variation of population in plots and sites.

10. The statistical analysis revealed that differences existed between sampling sites regarding faunal makeup and seasonal variation. It also revealed that seasonal pattern (difference between months of a year) was more or less constant in all the years and in all sites but the pattern of year to the year or month to month variation were not strictly identical in all sites.

11. The diversity values of all the sampling plots having been analysed separately, they revealed that the plots at PNHZP had relatively higher values than most of the sampling plots and the values of all the plots ranged between 2.65–2.90. The close similarities between the values indicate the presence of more or less identical situation in microclimate of the plots, as a result the species present in the plots were not so widely diverse. The quotient of similarity between the two plots of HVTE was 0.77. The PNHZP and LBG plots exhibited a relatively lower index of similarity compared to the last set of plots i.e., PNHZP and LBG plot-B.

12. The joint influence of different edaphological factors on faunal population were more pronounced than influence of a particular single factor. In addition to these, local microclimatic conditions had influenced to cause difference in faunal composition both quantitatively and qualitatively. Moreover, high altitude environment itself is a very complex factor; so the results obtained here exhibit close similarities as well as striking differences from those already reported by earlier workers with respect to plots in plains.