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Soil as a part of terrestrial ecosystem, as a natural habitat is known to support wide varieties of living components in the form of flora and fauna. These living entities are believed to exert profound influence on the fertility and productivity of soil. Among the faunal components, the arthropods undoubtedly occupy a significant position with regard to their numerical abundance, activity and distribution. They have been reported to occur in varied soil conditions in different ecosystems. Due to their wide distribution and numerical abundance the arthropods have attracted the attention of soil zoologists from time to time and series of observations have been made in different corners of the globe.

The arthropod fauna in soil is represented by insects and non-insects forms. The insects include the members of different orders namely collembola, protura, diplura, thysanura, orthoptera, hymenoptera, coleoptera, psocoptera, diptera and larval forms of many other orders. These individuals often exhibit the differences with regard to their distribution and abundance and are known to exert both beneficial and harmful roles. The non-insect group is represented mainly by acarines and to a less extent by pseudoscorpions, centipedes, millipedes, isopods etc. It has often been reported by soil biologists that acarines undoubtedly occupy the topmost position in numerical abundance and are represented by four different groups viz., cryptostigmatids, mesostigmatids, prostigmatids and astigmatids. In the degree of dominance next come the collembolans — an apterygotan order of insects. Both these groups are more or less cosmopolitan in their distribution and have been reported to occur in varied environmental conditions which indicate their wide tolerance range. These characteristic features have initiated most of the workers on soil arthropods to concentrate their effort in investigating different aspects of these groups leading to the availability of huge amount of literature contributed by them.

Great deal of works have been done on the distribution, density and seasonal abundance of different groups of arthropods in relation to different soil factors in diverse ecosystems. Since the early part of the 20th century workers in India and abroad have made substantial contribution on arthropod fauna of soil as a whole or on acarines and collembolans as two important components. It is rather impossible for any worker to present a comprehensive review of literature on arthropods for the last hundred years. For this reason contributions made in India as well as abroad in last thirty years have been included in the present review of literature on soil dwelling arthropods in the arena of Soil Zoology in chronological sequence.
REVIEW OF THE EXISTING LITERATURE

Works done Outside India

Workers outside India in last three decades have made notable contributions on the ecology and distribution of acarines, collembolans and total soil arthropods, either in plain or in hilly areas. But the works relevant to the present investigation have been cited in the review.

Wallwork (1970) in his interesting observation reported that human interference at any place may produce drastic and unrecoverable changes in the floral and faunal characters of any soil. The most harmful effect is the application of different chemical toxicants in the form of fertilizers or pesticides leading thereby a substantial decline in population.

Belfield (1971) while comparing the arthropod population of the shaded and unshaded plots of West Africa did not find any significant difference in the population density with regard to both vertical and horizontal distributions. However, he observed a significant correlation between the content of nitrate and the size of arthropod population.

Curry (1971) studied the seasonal and vertical distribution of the main arthropodan groups in a grassland site in Dublin and observed that individual species and genera varied considerably in their vertical distributions. He assumed that these variations were not dependent upon seasonal rhythm and in most cases were probably due to differential reproduction and mortality in the different soil stratum. He also found that the cryptostigmatid mites were most abundant in the top 3-8 cm of soil.

Alicata et al. (1972) while working on the distribution of the soil arthropods in the Ilex forest of Italy observed the phenomenon of aggregation in respect of almost all the species and the highest density of population in the upper 0-3 cm layer.

Price (1973, '75) studied the abundance and vertical distribution of microarthropods in the pine forest of California (USA) and found that a significant portion of population occurred below the humus layer. He assumed that this type of distribution might be related to the soil moisture.

Athias (1974, '75) made a comparative study on the abundance and vertical distribution of the microarthropods in the burnt and unburnt Savanna soils of Ivory Coast, West Africa. The biomass in the unburnt plot was three times higher than in the burnt plot. The predaceous and the saprophagous microarthropods were predominant
in the unburnt Savanna whereas the relatively more phytophagous microarthropods were observed in the burnt plot. The density of population in both the cases was found to be the highest in the first 20 cm of the soil profile.

Edwards and Lofty (1974) while ascertaining the effects of organic manure and other factors on the soil invertebrate fauna observed that the total collembolan population was little affected by the level of nitrogen. A slight increase in response to a single dose of nitrogen was noticed but the number of soil dwelling collembola decreased much more than those lived near the surface of the soil. In their opinion collembola as a whole, was influenced by soil pH more than mites.

Ghilarov (1975) in his study on arthropods of agricultural soils concluded that the agricultural practices influenced the soil fauna resulting in the change of distribution of the predominant forms. He considered tillage to be responsible for the elimination of some ecological groups. The influence of cultivation on arthropod fauna was also observed by Edwards and Lofty (1975) who believed the ploughing to be responsible for bringing any change to the population structure.

Mccoll (1975) observed the effects of some microclimates (temperature, relative humidity and rainfall) on the activity of the invertebrate fauna of the litter surface of a New Zealand forest floor and found that the hot, dry conditions depressed the activity of collembola and spiders but had no effect on the populations of beetles, sciarid flies and ants. In case of collembola climate was the most important factor regulating the population size, while in case of coleoptera the internal reproductive rhythms were reportedly more important than the climate.

Goffinet (1976) studied the phenology and seasonal demographic fluctuation of the animal communities in four natural ecosystems of Zaire and found that the decrease in moisture content generally led to a numerical fall in the population. In his opinion the quantitative spectrum of the vertical distribution of the soil fauna fluctuated during the seasonal transition, fluctuations varying according to the taxonomic groups and to the habits concerned.

Janetschek et al. (1976) made an attempt to correlate the altitude with time-related changes in the arthropod fauna involving the oribatid mites and the coleopteran insects only. According to them the abundance of oribatei could not be correlated with the altitude, but there was noticed a correlation between the population with the local conditions of soil and vegetation.
According to Nijima (1976) bare ground and waste soil were unsuitable for the soil dwelling animals. The ground covered with grass was more suitable as a habitat for them.

Sendstad (1976) in an attempt to establish a relationship between the soil mesofauna and its abiotic environment noticed a higher density of the soil mesofauna concentrated mainly on the upper 3 cm of the soil profile. According to him the mesofauna preferred a warm, humid habitat with a good soil texture.

Shiba (1976) while comparing the structure of soil biotic community between rocky and sandy littoral zone found maximum and minimum population in spring and summer respectively.

Aritajat et al. (1977) studied the effect of compaction on arthropods of agricultural soils in Thailand. They found that decrease in the density of population was related to the degree and time of compaction. The time of recovery of the population after compaction varied from soil to soil and also on the time the plots were compacted.

Shaddy and Butcher (1977) investigated the arthropod fauna of cultivated soils of USA and observed very few individuals in the upper 5 cm soil after cultivation and most forms were concentrated at the lower level. They observed no influence of irrigation on the seasonal abundance and aggregation of the fauna but tillage led to decrease in the aggregation size.

Hermosilla et al. (1977) studied the effects of compaction on soil microfauna in grazed field of Argentina. In this study the acarines were found to be predominant. The relation between its natural groups and the relation of groups with soil compaction were examined. Tarsonenimi, Acaridiae, and Oribatei were found from high soil compaction to low compaction respectively, while Uropodina were found in the places with the lowest compaction.

Price and Benham (Jr.) (1977) in a similar study in an agricultural field in California however noted greater number of individuals of arthropods in the upper sub-samples of agricultural soils. Price et al. (1977) described the vertical distribution of arthropods in agricultural region of San Joaquin Valley at California, USA. They analysed the population in different depth ranges and found that upper subsamples yielded maximum number of individuals which gradually decreased with depth.
Thiede (1977) in his studies on the population, ecology and energy turnover of arthropod fauna in Spruce forests of West Germany applied automatic catching device for the capture of fauna. The population in his case contained 69% pterygotes, 29% apterygotes and 2% arachnids and chilopods. The difference in the qualitative and quantitative composition of fauna were more prominent between different years than between the different Spruce stands.

Wong et al. (1977) analysed the population of soil arthropods in three different sites of Hongkong in relation to edaphic factors. Predaceous coleoptera and hymenoptera were common in all these sites while acarina and collembola were common in all these sites while acarina and collembola were more abundant in sites having high organic matter content. Lack of nutrients due to decomposition and rapid leaching in one site led to a decline in population.

Kaczmarek (1978) made a comparison between activity density, population density and individual mobility for various groups of soil macrofauna at different trophic levels in some forest sites. The study sites belong to a trophic gradient from a pine forest on a Podzilic soil to a wet older wood on an organic low mor soil. The average individual mobility of the total soil macrofauna showed a strong negative correlation with the total population density. In this study the activity density of particular trophic group of soil invertebrate was better reflected than their population density and biological production in the ecosystem studied.

Serafino and Julio (1978) studied the density, vertical distribution and degree of aggregation of soil microarthropods in forest, pasture and agricultural soils of Costa Rica. The population in this case was predominantly represented by Isotomid collembolans, cryptostigmatid mites and symphylans, which showed aggregated distribution and gradual decline with depth. In another investigation Julio and Serafino (1978) studied the seasonal diversity and vertical distribution of microarthropods in a coffee plantation of Costa Rica. Different groups of soil arthropod exhibited a variable response to climatic condition, collembola, protura, symphyla and acarina being susceptible to rainfall while no clear relation of moisture was found with coccoidea and other groups. According to them the density of coffee plant was important in determining the distribution of coccoidea.

Weil and Kroontje (1979) studied the effects of manuring (with poultry manure) on the arthropod community in an agricultural soil in USA. They noticed that manuring greatly increased the population of arthropods but brought about little changes in their pattern of seasonal fluctuation.
Sulaman et al. (1979) made a preliminary survey of soil fauna with special reference to arthropods in the Peshawar University Campus, Pakistan. They recorded different groups of arthropods viz., arachnids, crustaceans, different types of insects, pauropods, symphylans and chilopods.

Andrén and Lagerlöf (1980) showed the abundance of microarthropod fauna in fields of Sweedish Agricultural cropping system, where crop rotation practice was found. They observed a decreasing abundance of fauna in the sites having varied rotation of crops. A slower recolonisation of cryptostigmatids was also mentioned by them.

Baath et al. (1980) studied the effects of experimental acidification and liming on the soil organisms and decomposition in a Scotch Pine forest. Acidification lowered the decomposition rate of both needle and root litter liming and less effect. The acidification caused an increase in number of collembolans while the number of mites was unchanged. Liming had no marked effect on fauna or flora.

Faizy et al. (1980) stated that the yield of rice grain increased hyperbolically with increasing density of soil microarthropods like collembola and density of acarina increased hyperbolically with increasing dry weight of roots.

Schenker and Sreit (1980) found the collembolan and acarines to be the superior groups of microarthropods on both the forest and meadow soils.

Tadros and Saad (1980) studied the soil fauna in a horticultural farm in Egypt and found that the closer the plants (Tomato and cucumber) were planted, the more the fauna flourished. This was presumably due to the environments offered by root systems as food, shelter and suitable aeration. They reported a decrease in faunal percentage with higher rate of NPK fertilizers and observed that the oribatid population flourished in aggregated plants (20 cm apart). The mean density of the extracted fauna in their study was higher under cucumber than under tomato bed.

Tadros (1980) on further investigation on beach soil microfauna in Lower Egypt found that alfalfa and beans were the croplands most preferred by soil fauna while tomato was the least preferred. Population peaks were observed in plots which were about 420 meters away from the sea i.e., soil with lower salt concentration. He further found a higher percentage of acarina (82.35%) in fallow fields where the population flourished in the upper soil layer.

Vannier (1980) in his experimental study desiccated and sterilised by heat two forest soil types (a calcareous soil, pH 8.5 and a loamy sand soil, pH 3.7) and then
replaced in the field to allow invasion by microarthropods and micro organism from the surrounding soil. The colonization by collembola was significantly more intense than by the oribatid mites in alkaline soil cores, but in acid soil an opposite pattern was observed. Through this experiment the author tried to characterise the biological activity of soil by microarthropod invasion.

Andrén and Lagerlöf (1983) in another study, showed that season, soil type, plant cover and intensity of soil cultivation may have greater influence on soil faunal diversity and abundance than the studied experimental factors.

Steinberger and Whitford (1984) found that the arthropod population would exhibit greater increase in population densities and activities at the base of the desert watershed where water and organic matter accumulated than they would be in the upper shed locations. Only collembolans exhibited numerical responses as a function of moisture.

Investigation of Robert et al. (1985) revealed that soil fauna was distributed over the whole depth of the sample i.e., 20 cm arthropods were only slightly more numerous in the upper 10 cm. This observation further revealed that mites and collembolans were the most predominant groups.

Holt and Spain (1986) observed that the large litter arthropods were more abundant in rain forest soils with Aurocaria sp. in northern Queensland soil having high organic carbon content and supported a larger population than the coniferous forest soils.

Adis et al. (1987a, b) made a comparative study on the abundance and vertical distribution of arthropods from yellow latosol (0-14 cm depth) of a secondary dryland forest in Brazil during the dry and rainy seasons. They observed that arthropod population was greater in the upper layer of the soil and decreasing abundance was significantly correlated with lower soil humidity at greater soil depths. Their observation however gave no indication that arthropods show vertical migration into the soil in response to changing litter and soil moisture level.

Hijii (1987) made a study on the soil arthropods in a Japanese Cedar plantation and observed that the oribatid mites and collembolans maintained a stable population level.

In 1988, Jagers Op Akkerhuis et al., in their study on soil microarthropods in two crop rotations on a heavy marine clay soil of an experimental farm at Netherlands observed that the mesofauna was much more abundant in cereals than in root and
tuber crops. Most of the mites and springtails were found near the surface of the soil except in potato when it was preceded by a cereal crop that was ploughed down.

Adis et al. (1989a, b) in their subsequent study in white sand soil of dryland forest in Brazil during the dry and rainy seasons observed maximum population in the upper 3-5 cm soil which gradually decreased with depth. Acari and collembola constituted 75-80% of the total catch. In this case also they did not observe any vertical migration of soil arthropods in response to changing abiotic factors as observed in tropical forest.

Seastedt et al. (1989) investigated the microarthropods in decaying wood from temperate coniferous and deciduous forests. They observed that the microarthropod population densities in large woody debris increased during the decay process but population appeared to be numerically low in comparison to that obtained from an equivalent amount of litter and soil from either coniferous or deciduous forests. Oribatid mites were most abundant microarthropods in the woods.

Werner and Dindal (1990) studied the soil biological community under three treatment regimes planted with corn: organic manure, organic legume and a conventional system in an agricultural conversion experiment in Pennsylvania. Microarthropods were dominated by fungivorous prostigmatid mites, which reached their peak abundance two to five months after organic matter incorporation. Oribatid mites followed the same pattern and were probably most influenced by tillage disturbances. Surface dwelling collemobola was abundant briefly in the spring, but soil dwelling species dominated numerically throughout the cropping season. Their study further suggests that organic amendments tend to enhance soil biological activity, while tillage disturbance tends to disrupt the biotic community.

Winter et al. (1990) made an interesting observation on soil microarthropods in long term no tillage (NT) and conventional tillage (CT) corn production in Canada. They observed that the microarthropods and soil organic carbon were more concentrated in the surface 5 cm of soil in NT than in CT fields. They further observed that soil under brume grass contained 1-3 times more microarthropods (99% acarina) than under continuous no tillage and conventional tillage corn.

Convey et al. (1995), in their study on terrestrial arthropod fauna of the Byers Peninsula, Lewington Island and South Shettard Island found that species abundance differed between samples collected from poorly vegetated stony ground and vegetated cores. Folsomia gresia was both the commonest (55%) and most widely distributed springtail in the former habitat.
Krogh and Pederson (1997) investigated the effect of dried sludge from a pesticide producing chemical plant deposited in a Danish Spruce forest soil. They observed a sharp reduction (upto 80%) of microarthropods on the application of inorganic fertilizers with an exception of a few species, which have been stimulated. The effect of the inorganic fertilizers had an impact shortly after application only.

The influence of climate, substrate quality and microarthropods on decomposition was studied by Heneghan et al. (1998) by comparing the mass loss of litter at three forested sites: two tropical and one temperate. The litter bag technique followed by them revealed that the faunated litter bags lost more mass at all sites for all litters studied than the litter bags with reduced microarthropod population (by naphthalene treatment). The effect of fauna was more marked at the tropical sites at the initial period of experiment while in temperate site the effect was low with slight increase towards the end of experiments.

Kandeler et al. (1999) investigated the influence of microarthropods on biomass, structure and function of the soil microbial community in an acid spruce forest by using field mesocosms. They observed that in the litter layer the re-immigration of mesofauna did not significantly affect substrate induced respiration biomass C, biomass N and biomass P. Mesofaunal activities increased microbial biomass in the humus layer and significantly increased soil protease activity and phosphate content in the said layer.

Convey et al. (2000) in their observations reported the terrestrial microarthropod community of South Sandwich Islands, 550-600 km South-east of South Georgia. The terrestrial fauna included 29-freeliving microarthropod species (9 Collembola and 20 Acari) and two enchytraeid worms.

Interactions between crops and soil micro-and mesofauna within the root zone were investigated by Becker et al. (2001) under field and laboratory conditions on sandy-loam soils with wheat crops. The field results revealed considerable interactions between plant roots affecting the population of soil fauna. In the laboratory close relationships between soil fauna as well as enzyme activities and nutrient contents were also found with the root zone.

Liiri et al. (2002) conducted a laboratory microcosm experiment with coniferous forest soil and seedling of silver birch (Betula pendula). A gradient of microarthropod diversity of soil mites and collembola was created to the systems and subsequently the microcosm disturbed with drought to test whether systems with altering microarthropod species richness respond differently to disturbances. The effect of drought on the birch biomass production was found to be independent on the
species richness of microarthropods. During the disturbance the biomass of microarthropods declined in diverse systems but not in simple ones.

**Works done in India**

In Indian sub-continent many researchers have made substantial contribution on different aspects of Arthropod community found in soil. But contributions so far made in hilly terrains appear to be rather not so significant and restricted to acarines and collembolans.

Mukherjee and Singh (1970) studied the seasonal variation in the densities of the soil arthropod population in a rose garden at Varanasi. They found a peak period in August and the population decreased in May-July. The increase in population was believed to be associated with increase in moisture and vice versa. Rise in temperature resulted in a decrease of population. The value of pH and concentration of organic matter varied between a very narrow range, making it difficult to correlate the population fluctuation with them.

In the following year Singh and Mukherjee (1971) studied the qualitative composition of the soil arthropods in some fields at Varanasi, UP and identified 33 acarine and 19 collembolan genera predominating over the other group viz., diplura, pauropoda, symphyla, palpigradi, uropygi, schizomida and pseudoscorpionida.

Singh and Mukherjee (1973) made a comparative analysis of the arthropod population inhabiting 5 different plots (four cultivated and one uncultivated plot). According to them the populations of acarina, collembola, pauropoda and other soil arthropods varied in their numerical strength from plot to plot, depending on the nature of vegetation and the maximum numbers being found in the uncultivated virgin plot.

A series of investigations were made in 1975 by Singh and Pillai, Singh and Singh, who studied the soil microarthropods in some uncultivated fields, deciduous forest floor at Varanasi and in the Himalayan grassland biome. They observed maximum population in forest litter.

Prabhoo (1976) analysed the microarthropods of the different plots (a forest plot, a two year old tea field called the new clearing, and a 50 year old tea field). According to him there occurred a drastic change in the microarthropod fauna in the course of deforestation. He also observed that the ratio of collembola/acari in the forest, new clearing tea field, and in the old tea field was $\frac{3}{2}$, $\frac{1}{0.9}$ and $\frac{1}{1.5}$
respectively during the peak period, indicating thereby the predominance of the collembolans over the acarines in the cultivated fields.

In 1976, Singh tried to find the effects of human activities on the population density of soil mesofauna in tropical ecosystems around Varanasi. He found the maximum population in forest soil followed by grassland and cropland site respectively. Human impact appeared to be threatening, so far as the population size was concerned.

The study of the soil mesofauna in a grassland ecosystem by Pillai and Singh (1977) revealed the occurrence of two peak periods of mesofauna, one in the rainy season and the other in the winter season. According to them the contents of moisture and organic matter in the soil played significant role on the population fluctuation.

Reddy and Alfred (1977) studied the seasonal fluctuation of the soil arthropods in a pine forest and reported that the population was maximum in July (wet season) and minimum in January (dry season). In case of collembola and acari they noticed two peaks, one in July and the other in November. According to them moisture and temperature had profound effects on the population fluctuation.

According to Roy and Ghatak (1977) the microarthropods showed an irregular trend of population fluctuation being maximum in July-August and minimum in April-May.

Singh and Shukla (1977) measured CO₂ evolution on the floor of a tropical dry deciduous sal (Shorea robusta) forest and found its correlation with the population of both mesofauna and mycoflora.

Bhattacharya and Joy (1978) made an investigation on the microarthropod population in the fields like laterite paddy field, fodder field, and fallow grassland in Shantiniketan and found the maximum population in the grassland. Bhattacharya and Roy Choudhuri (1979) made a study on the population of soil microarthropods in the wasteland of Shantiniketan in relation to some climatic and edaphic factors and observed a population peak in post monsoon period.

David (1978) worked on the soil arthropod pest of sugarcane of Tamilnadu and recorded a number of soil insects, such as termites, white grubs, aphids, ants, mealybugs, weevils etc. and non-insect arthropods like isopods and symphylids as minor pests of sugarcane. This subterranean pests were reported to damage the sugarcane crops at different stages, beginning with germination and continuing till the
time of harvest. It was also observed in this study that organic matter and in many cases soil moisture initiated the increase in density of some of the pest.

Ghatak (1978) made a comprehensive study of soil arthropods in the cultivated and uncultivated fields of Hooghly district, West Bengal. The population in this study exhibited marked fluctuation reaching its peak in monsoon months (Jul, Aug) followed by gradual decline. Plots supported minimum population in summer months (April, May). Soil factors like moisture, organic carbon and nitrate in most cases exhibited positive correlation with population.

Mahajan and Singh (1978) made a critical evaluation of the microarthropods in tropical dry deciduous forests near Varanasi.

Reddy and Alfred (1978) studied the seasonal variation of soil arthropod in a coniferous pine forest of Meghalaya and reported the population maxima in the month of July and minima in January. They considered moisture and temperature to be important parameters influencing the population fluctuation.

Anantakrishnan (1979) in his study entitled “Microarthropods and Soil Ecosystem” considered some groups to be important components of soil fauna being substantially represented by collembolans, diplurans, proturans and thysanopterans in the soils of the different ecosystems of the Indian subcontinent.

Anantha Pai and Prabhoo (1979) made an observation on the microarthropod fauna of paddy fields and adjoining uncultivated soils in south Kerala. It was noted that the uncultivated soil was richer qualitatively and quantitatively in soil microarthropods compared to the paddy field. It also appeared from present study that prolonged inundation was the most prominent factor adversely affecting the soil microarthropods in the paddy field.

Choudhuri and Pande (1979) investigated the soils of Himalayan West Bengal and recorded the relation between high altitude soil animals and different soil factors. Their records reveal a monsoon maxima of mites with increase in moisture and organic carbon. They, however, observed no correlation of pH values with the said fauna.

Singh and Mahajan (1979) analysed the quantitative composition of soil mesofauna in tropical arable and deciduous forest soil. Acari were dominant in arable and forest soil while in forest litter collembola dominated. Acarines were predominantly represented by cryptostigmatids followed by prostigmata and mesostigmata.
Veeresh et al. (1979) studied the soil fauna of grassland and cultivated soil of Hebbal, Bangalore. Here collembola and acari constituted major fauna in both types of soil followed by other insects and symphylids. The collembolan population increased with higher precipitation in grassland compared to cultivated field and showed negative correlation with temperature. The acari, other insects and symphylids did not vary in their number between cultivated and uncultivated soils and neither moisture nor temperature had any significance with them.

Roy and Ghatak (1980) studied the arthropod community of a forest ecosystem of West Bengal. Their investigation depicts that the arthropodan fauna were represented mainly by acarines and collembolans and to a less extent by other insects, centipedes, millipedes and pseudoscorpions. The fauna in most cases was concentrated in the litter layers and exhibited an irregular trend of fluctuation being maximum in July–August and minimum in April–May.

Pai and Prabhoo (1981) while working on the paddy fields in the soils of south Kerala and its nearby located uncultivated soil reported higher population of microarthropods in uncultivated soils than in the corresponding cultivated ones. The acarines were the dominant form in both the sampling sites.

Bhattacharya and Roy (1984) studied the microarthropod fauna in a ‘Jhum’ field and found that shifting cultivation had a relatively less catastrophic effect on the density and diversity of soil microarthropods compared to the modern agricultural practices.

Hazra (1984) in his work on the above ground and underground insect fauna in relation to the respective floral changes in a grassland ecosystem observed that both the flora and fauna were minimum on the above ground part and maximum in the underground part, of which microarthropod population was maximum (59.04%); he further observed the activities of collembola and fungi in humification and mineralization in grassland ecosystem.

Vats and Handa (1988) while working on soil litter arthropods in a deciduous forest stand at Kurukshetra observed that the population was represented significantly by collembolans (71%) followed by acarines. The temperature and soil moisture influenced the density of population whereas the quantity of litter had no effect in this case.

Hazra and Choudhuri (1990) in an extensive investigation studied the composition and distribution pattern of soil arthropods found in general and acarina and collembola in particular of 14 different kinds of degraded, disturbed, polluted,
uncultivated and cultivated ecosystems in relation to some major soil factors, heavy metals and soil microflora (Fungi) in some areas of West Bengal.

Reddy and Venkataiah (1990a, b) made an exhaustive study to reveal the effects of tree plantation on qualitative and quantitative composition and seasonal fluctuation of soil arthropods in a grassland (G.L) and tree planted (T.P) areas of a semiarid tropical savannah of Andhra Pradesh. They observed that tree plantation increased the qualitative as well as quantitative composition of both the soil surface and soil dwelling macro-and micro-arthropods significantly. The arthropods were dominated by collembola followed by acarine. These arthropods were minimum in abundance in Summer (i.e. April to mid-June) and maximum during the rainy season (mid-June to September). The micro-arthropods were more common in surface layers compared to the sublayer of grassland while the acarina were present in both the layers particularly during the rainy season. In tree planted areas all three groups were recorded in both the layers.

Alfred et al. (1991) carried an investigation on the population dynamics, vertical migration and community analysis of collembola and acari from natural and plantation forests, cultivated lands, orchards and Jhum fallows of the northeastern Indian soils. Original forest stands in their study were taken as control. They observed that in all cases there was a drastic reduction in soil microarthropods as compared to the forest stand. Variations were also seen among themselves between orchard and cultivated lands.

Haq and Ramani (1991) in their study on population ecology of microarthropods in shaded grass (S.G) and Bamboo grove (BG) of Kerala observed that the species composition of two sites showed a more or less similar pattern, but hemiptera and thysanoptera were not recorded in S.G. However, the population density of B.G. was comparatively higher than that of S.G because of higher litter accumulation resulting from dense vegetation of the sites.

While Hazra (1991) analysed the arthropod community encountered in a reserve forest floor of a deforested site at Nadia district, West Bengal. The deforested site in his study showed marked variation in total arthropod fauna and species diversity of Collembola in comparison to the reserve forest floor. The number of genera of Collembola were 12 in deforested site and 21 in reserve forest floor. Prostigmatid mites occupied the topmost position in both the cases in numerical abundance followed by mesostigmatid and cryptostigmatid forms. The population of other arthropod groups in both the sites were numerically low and irregular in distribution pattern.
Majumdar and Deb (1991a) investigated the composition and relative abundance of soil microarthropods in uncultivated grassland and a cultivated paddy field of West Dinajpur in West Bengal. The cultivated fields supported a poorer fauna. The relative abundance of dominant groups appeared to be different in the two biotopes. Ants occurred in large number in uncultivated fields. Excluding the ants acari predominate other arthropods in both the plots. In a subsequent study Majumdar and Deb (1991b) analysed the quantitative distribution of edaphic mesostigmata, cryptostigmata and collembola in relation to two distantly related crop plants and two closely related crop plants. They observed that the population differs between the distantly related species and resembles between the closely related ones.

Sarkar (1991) made an investigation on the community structure of soil microarthropods in an undisturbed habitat in Tripura. Acari with a percentage of 62.83 dominated the site. This was followed by collembola 22.83% and other microarthropods 14.34%. Acarines were dominated by the oribatids. The total arthropod population exhibited an irregular trend of fluctuation being maximum in November and minimum in June.

Sengupta and Sanyal (1991) studied the soil micro-arthropod population of a paddy field of West Bengal and showed that population suffers from a reduction in both number and species under the stress of agricultural practices. However, application of fertilizer, handweeding, ploughing seemed to favour their populations. They observed that inundation of paddy fields had the most adverse effect during cultivation. collembolans in their case had greater ability to overcome the stress of inundation than cryptostigmatids.

Sinha et al. (1991) made a comparative study of soil microarthropod of vegetable garden and deciduous forest at Ranchi and observed that in the degree of frequency and dominance, the acari outnumbered the collembolans. The seasonal periodicity of micro-arthropod population was of bimodal type showing post monsoon maxima followed by a winter-hike. The population cycle in their study was significantly affected by moisture, organic carbon and CaCO\textsubscript{3} content of the soil.

Chattopadhyay (1993) studied the composition, abundance and seasonal fluctuation of insect and acarine community of uncultivated soils, agricultural lands and woodland soils of Midnapore District, West Bengal in relation to different edaphic factors and reported that cumulative influence of different soil factors on faunal population was more pronounced than individual influence of a particular factor. In another part of the same investigation he also studied the impact of two insecticides on the distribution of insect and acarine community.
Chakrabarti (1994) in an exhaustive ecological study evaluated the impact of different edaphic factors on the spatio-temporal distribution of cryptostigmatid mites in undisturbed, cultivated and forest soils of Sunderban region of West Bengal. He reported low species diversity in the forest sites indicating thereby the presence of environmental stresses. In his study, sampling sites having closer proximity exhibited higher similarity with regard to their species composition.

Ghosh (1995) in a preliminary study of soil acarine community in three Tea garden soils located at different altitudes of Darjeeling Himalayas-SubHimalayas and reported a higher population in post winter (spring) or post-monsoon / pre-monsoon period. Of the four edaphic factors studied only organic carbon exhibited positive correlation with the population while it was found to be negative in relation to other factors.

Hazra and Sanyal (1996) made an ecological observation of collembolan fauna in a periodically inundated newly emerged alluvial Island in the river Hooghly, West Bengal. The peak population was obtained in the month of December (winter) when low soil temperature and relatively less soil moisture prevailed in the periodically inundated soil.

Bhattacharya and Hazra (1997) in an attempt to make a preliminary study on the activities of collembola and microbial community and their probable role in sustainable agroecosystem analyzed the floral and faunal component in two agricultural fields undergoing different agronomic practices. The site with a single type of crop supported a poor number of collembola, bacteria, actinomycetes and fungi but the site with different types of vegetable crops was abundant in both microfauna and flora.

Hazra et al. (1999) in an interesting study analyzed the interaction between collmebola and fungal population in municipal garbage dumping area at Dhapa in Kolkata. They also studied the correlation of population with major soil factors like temperature, moisture, pH organic carbon and nitrate.

Sanyal et al. (1999) made an exhaustive ecological study of soil oribatid population in two undisturbed, uncultivated and well vegetated sampling sites at Dakshineswar in West Bengal. Soil Oribatid mites encountered from both the sites were represented by 14 genera which exhibited maximum population sometimes in January and February and the population was at the minimum level in summer or monsoon months.
Bhattacharya (2000) made an extensive study on collembolan fauna of some agricultural soils and waste disposal sites of West Bengal with special reference to their microbial association. From this study it was observed that agricultural practices and dumping of municipal wastes might have led to a disturbed and polluted soil environment which ultimately resulted in a qualitative and quantitative decline of both microflora and fauna.

Hazra et al. (2001a, b) made two observations on the diversity and distribution of collembola, one from Sikkim Himalayas and the other from Manipur State. In the first case they reported 39 species of collembola under 26 genera and 8 families. The maximum diversity of collembolan species was recorded from North district of Sikkim while maximum abundance of individuals was observed in the South district. In the second study from the State of Manipur altogether 27 species under 14 genera of 3 families were reported.

From the foregoing review it is evident that a series of investigations have been made in India as well as abroad on the distribution, density, and seasonal abundance of arthropod community in different ecosystems in relation to climatic and edaphic factors. But the ecological studies of soil microarthropods so far attempted in Himalayan and SubHimalayan West Bengal are not so exhaustive to arrive at a definite conclusion with regard to their seasonality and distribution. Moreover, investigators in many instances concentrated and restricted their study to a particular ecosystem and also to specific group of arthropods and often failed to single out a factor(s) responsible for bringing out the changes in density, distribution and population structure of soil microarthropods. They sometimes failed to analyse the interrelation between several biotic and abiotic factors operating in soil and their probable impact on arthropod community. The state of West Bengal with 19 districts in its fold represents a very complex ecological set up in different geographical zones. It is rather impossible for any worker to make a comprehensive study of all the groups of soil arthropods available in different ecosystems in such a vast area. Keeping in view of such difficulty, the present author has undertaken an investigation in relatively small area i.e., Darjeeling town in Darjeeling district situated in Himalayan West Bengal to fulfil the following objectives:

1. To ascertain the qualitative and quantitative composition of different components of soil microarthropod community in three different sites Padmaja Naidu Himalayan Zoological Park (PNHZP), Happy Valley Tea Estate (HVTE) and Lloyd Botanical Garden (LBG) located in Darjeeling town.
2. To account for the seasonal fluctuation of arthropodan fauna inhabiting those sites.

3. To establish the relation that possibly exists between different soil factors like temperature, moisture, pH and organic matter with arthropod population.

4. To make a comprehensive study on the faunal biodiversity which includes the Shannon-Weinner Diversity Index, Simpson’s Dominance Index, Sorenson’s Quotient of similarity, species abundance and species richness.

Before presenting the observation in detail it should be logical to mention that the duration of the work was three years i.e., Jan. 1999 to Dec. 2001.