CHAPTER 2

REVIEW OF LITERATURE

The studies of microarthropods were initiated since the early 19th century. Glasgow (1939) studied the population of soil collembola in subterranean soil and found that microarthopods trend to be aggregated in the soil. Dowdy (1944) worked on the influence of temperature on vertical migration of invertebrates inhabiting different soil types and revealed that changes come due to increase of air temperature the soil dwelling animals migrate to the deeper layer.

In India, ecological aspect of soil microarthropods was first commenced in 1945 by Trehan. Salt et al., (1948) gave an account on the population of arthropods in pasture soil. Weis-Fogh (1948) studied on the population of mites and collembola in different soils and recorded highest population in the period between late autumns and early spring and lowest population during summer months. Drift (1951) studied the animal community in a Beech forest of Netherlands and found the astigmata to be a very small figure. Haarlov (1955) studying on the vertical distribution of protura in grassland and revealed that microarthropods trend to be aggregated in the soil. Sheals (1957) studied the vertical, horizontal and seasonal distribution of acari and collembola on some uncultivated soils of Glasgow and found higher population of collembola in autumn and winter season.

Wallwork (1959) studied on the population density of microarthropods and recorded a population of 7250 acarina per sq. metre, 6250 oribatids per sq. metre and 1350 collembola per sq.metre. Crossley and Bohnsak (1960) reported 59 oribated species from a mixed pine stand in East Tennessec. Hartenstein (1961) studied on classification of soil oribatid mites. Choudhuri (1961) noted that collembolans can withstand a wide range of moisture content. No association of moisture with population of soil fauna was observed by
Marcuzzi (1962) a study undertaken in South Eastern Alps. Davis (1963) studied on the community of microarthropods in mineral soil near Corby Northants found maximum population of microarthropods in monsoon months when moisture level reached its peak and minimum in summer when moisture content is low. Edwards and Heath (1963) investigated on soil samples and breakdown of leaf tissue and found various levels of population groups per sq. meter. Kevan (1963) stated that the air temperature is less important to soil animals. Berthet and Gerard (1965) studied on micro distribution of oribatid and noticed the influence of microclimate to seasonal fluctuation of oribatid mites in different soil layers. Loots and Ryke (1966) studied on quantitative microarthropods in different types of pasture soil and found maximum population during late summer and minimum during winter. Choudhuri and Roy (1967) studied on the soil microarthropods and their fluctuation pattern and effect of various factors on them in uncultivated soil in India.

Wood (1967) while investigating on acari and collembola in Moorland soils in Yorkshire England found maximum densities of both acari and collembola in upper surface layer of soil. Greenslade and Greenslade (1968) studied on the population density of soil and litter fauna in the Solomon Islands and reported that higher population density of collembolas occurred in upper layer of soil.

Aoki (1969) studied the taxonomy of free living mites in the sub tropical forest. Seasonal variation of soil arthropod population and its correlation with different edaphic factors at Banaras Hindu University, U.P, India was studied by Mukharji and Singh (1970).

Bodvarsson (1970) made an elementary study on common seven inhabiting collembola of Southern Sweden and noticed that collembola classification is often based on their gut content. Block (1970) investigated the abundance of microarthropod population in temperate zones and stated that it was due to changes in soil organic matter, mineral, moisture and temperature.
Distribution of oribatid in Northern Hokkaido forest of Japan was reported by Fujikawa (1970) and found that 70% oribatid from the top layer of soil in most complicated mixed natural forest. Singh and Mukharji (1971) analysed the quantitative composition of soil arthropods in some field of Varanasi and collected nine species of collembola from uncultivated fields. Curry (1971) worked on seasonal and vertical distribution of the arthropod fauna of an old grassland soil in Dublin and reported that each individual species and genera are varied in their vertical distributions. Niijama (1971) studied on the seasonal change in collembolan population in a warm temperate forest of Japan and found that low soil temperature result in the reduction of activity of soil microarthropods but rise in temperature and rainy season favour in increasing the collembola population. Choudhuri and Roy (1972) worked on collembola in West Bengal (India) who found significant positive correlation between collembola population and moisture content in some district. Price (1973) while studied the abundance and vertical distribution of microarthropods in surface layers of California pine forest soil and noted that acarina to be dominated followed by collembola. Singh and Mukharji (1973) made a comparative study of arthropod population in four cultivated and one uncultivated plot and found maximum population occur in uncultivated virgin plot.

Banerjee (1974) in his study on qualitative composition and seasonal fluctuation of oribatid mite (acarina) in Burdwan soil, West Bengal (India) and found that growth of vegetation exerted impacts on population makeup of soil mites. Willard (1974) analysed population and biomass of soil arthropods and found that no. of collembola in litter layer was generally small in comparison to those 0-10 cm soil upper layer. Singh and Singh (1975) studied population density of different group of microarthropods during rainy season in tropical deciduous forest floor of Varanasi (India) and reported that cryptostigmata constitute higher percentage of population density in both soil and litter.
Choudhuri and Banerjee (1975) studying the soil meso and micro fauna of uncultivated plots in West Bengal and found that cryptostigmatid mites were predominant during monsoon season. Arthropods of agricultural soils where agricultural practices influence soil fauna resulting change of distribution of predominant forms reported by Ghilarov (1975). Usher (1975) worked on some properties of aggregation of soil arthropod mainly cryptostigmata and found that abundance of microarthropods depend on the factors such as temperature, precipitation and litter fall. Prabhoo (1976) studied on soil microarthropods of cultivated and uncultivated soil, their fluctuation and effects on various factors. Sendstad (1976) made a study on a relationship between soil mesofauna and its abiotic environment and latter found that higher density of soil mesofauna were concentrated mainly on upper 3 cm of the soil profile. Persson and Lohm (1977) while studying the soil microarthropods in Swedish grassland observed dominance of collemboala (44%) and acari (42%) from rest of the population. Qualitative and quantitative study of soil cryptostigmatid mites in four different sites of Shantiniketan, West Bengal was studied by Joy and Bhattacharya (1977).

Choudhuri and Banerjee (1977) observed that soil oribatid mites found most abundant during July-August and minimum in April-May in alluvial and sandy loam soil. Reddy and Alfred (1978) studied on the seasonal fluctuation of soil arthropods in a pine forest. Bhattacharya and Joy (1978) studied on the population of microarthropods in laterite paddy field, fodder field and fallow grassland in Shantiniketan and found maximum population in fallow grassland. Hazra (1978) worked on soil moisture and collembolan population and pointed out strong positive correlation between them. A significant positive correlation with abiotic factor and total microarthropod population was reported by Bhattacharya (1979) while working on density of soil microarthropods. Raina et al., (1979) worked on soil and litter meso fauna in Kashmir and found acari were maximum followed by Springtails. Usher et al., (1979) also noted that both soil and litter communities usually contain less than 150 microarthropods species and most abundant among them is collemboala. Choudhuri and Pande
(1979) worked on high altitude soil animals and their relationship with soil micro climatic factors and found increasing in mite population with the increase in moisture and organic carbon. Mitchell (1979) worked on insect population in forest soil and found Acarina alone contributed more than 50% of total population. Christensen (1980) studied on some abiotic parameters which may be significant for the distribution pattern of *Liebstdia humerera* (Acari, Cryptostigmata) in Danish Oak forests. Bhattacharya and Joy (1981) worked on the structure of cryptostigmata under different vegetation in Shantiniketan and observed 6236 no/m$^2$ population in 38 species of cryptostigmata, out of all, *Scheloribates sp.* being common to all sites. Takeda (1981) observed population density of collembola was significantly high in forest area than in the shifting cultivation area. Ghatak and Roy (1981) made a comparative study of acarina between cultivated and forest lands in Hooghly district of West Bengal. Hagvar (1982) worked on collembola in Norwegian Coniferous forest soils and observed abundance of collembola tend to increase soil fertility. Peterson and Luxton (1982) made a comparative analysis of soil fauna population and their role in decomposition processes. Kevan (1982) while studying on soil fauna observed that moisture content of the soil is the vital to soil fauna. Douce and Crossley (1982) studied the effect of soil fauna on litter mass loss and nutrient loss dynamics in arctic tundra at Barrow, Alaska. Singh and Mahajan (1982) worked on community structure and bioecology of soil microarthropods in deciduous forest in Varanasi and found highest percent composition of acari in forest soil while collembola was dominant in the litter. Hazra and Choudhuri (1983) worked on the collembola communities in cultivated and uncultivated sites of West Bengal and found 14 genera out of which 5 genera were common to both the fields. Schenker (1984) recorded 65 orbited species from a forest soil in Switzerland and distribution pattern showed clearly in relation to the habitat structure. Holt (1985) while studying on acari and collembola in the litter and soil in North Queensland rain forest observed higher percentage of collembolan population was found in upper soil layer at each site. Leetham and Milchunus (1985) worked on the composition
and distribution of soil microarthropods in North America shortgrass prairie sites.

Holt and Spain (1986) while studying in Northern Queensland soil having high organic carbon content that supported large population of arthropods. Pande (1987) worked on vertical distribution of different species of collembola in cropfield of Eastern Orissa found higher population species of collembola in upper layer and decreased towards the bottom layers. Adis et al., (1987) made a comparative study on abundance and vertical distribution of arthropods from yellow latosol (0-14 cm depth) of secondary dryland forest in Brazil during dry and rainy seasons also observed more arthropod population in upper layer. Sarkar (1990) while studying in undisturbed habitat of Tripura found minimum oribatid mites population during monsoon. Norton (1990) noticed oribatid mite with high diversity and dominance in population among other microarthropods. Sanyal (1991) reported that soil oribatid fauna in two contrasting environment in Calcutta showed number of mites always predominated over other microarthropods. Hazra (1991) also observed decreased in population percentage of mites occurred in deforested site as compared to Reserve forest. Alfred et al., (1991) worked on microarthropods and their conservation measure in North- Eastern Indian soil who found that population was lower in plantation forests, cultivation lands orchards and jhum as compared to natural forest. Sarkar (1991) studied on community structure of soil microarthropods in undisturbed habitat in Tripua, NE India and found acari was most dominant group followed by Collembola and other microarthropods. Reddy (1992) worked on effect of microarthropods abundance and abiotic variables on mass loss and concentration of nutrients during decomposition of Azadirachta indica leaf and found in leaf litter rapidly loss of mass occurred during initial monsoon month followed by slower rate of decomposition in dry period. Hattar et al., (1992) worked on soil acarina and collembola in pine forests and cultivated land in Khasi Hill, Meghalaya who found higher number of species in pine forests as compared to cultivated land.
Ananthakrishnan *et al.*, (1993) studied on dynamics of microarthropods communities in relation to chemical environment of decomposing *Eucalyptus globulus* litter. Sanyal and Sarkar (1993) while studying on ecology of soil oribatid mites in three contrasting sites at Botanical garden, West Bengal noted that banana plantation harboured maximum population of oribatid mites followed by Jamum and Bamboo sites. Takeda (1995) worked on collembolan community during decomposition of needle litter in a coniferous forests and found species with different life forms reached their maximum abundance level in the same depth. Badejo *et al.*, (1995) while studying on collembolan abundance, Species richness, diversity and evenness found that effect on them tends to be greater with mulch versus no mulch application. Thomas *et al.*, (1995) worked on dynamics of insect communities at vary altitudes in Shola forests of Kodaikand hills and noted that mites, collembola and coleopterans were dominant faunal elements at all the elevations.

The structure of microarthropod communities associated with four types of leaf litters and found acarina and collembola comparised more than 65% of total arthropods reported by Reddy and Reddy (1996). Siepel (1996) studied on the importance of unpredictable and short term extremes environment for oribatid mite and reported that its population declined with disturbance. Badejo *et al.*, (1997) studied on the distribution and abundance of mite and springtails under different temperature and moisture regimes in tropical rain forest floor and found that mites and springtails are generally aggregated under low temperature and high moisture which exists only in wet season under tropical conditions.

Singh and Yadava (1998) studied on seasonal fluctuation of oribatid mites in sub-tropical forest ecosystem of Manipur, NE India and found that soil temperature and humidity exhibited a positive significant relationship with the changes in the population density of mites. Narula *et al.*, (1998) observed on collembolan and mites of deciduous forest in Kurukshetra and noticed both collembolan and mites together constituted major part of soil arthropods in
which soil moisture and temperature collectively regulated the population. Sanyal et al., (1999) worked on soil oribatid population in two undisturbed, uncultivated as well as vegetated sites in Dakshineswar in West Bengal and observed that oribatid mites exhibited maximum population sometimes in January and February and minimum in summer or monsoon months.

Sharon et al., (2001) while investigating soil macro fauna in two Oak-wood forests found that in both the forests species richness and diversity were low during dry season and high during wet season. Chitrapati et al., (2002) while worked on population density of litter microarthropods in forest ecosystem of Manipur showed positive significant relationship with temperature and moisture content of the litter. Maruan et al., (2003) worked on oribatid mites and collembolan diversity, density and community structure in beech forest and found density of most groups of oribatids mites and collembolans declined due to disturbance treatments.

Ducarme et al., (2004) studied on mites of the forest and found meso and microporosity were strongly correlated with species distribution while macroporosity and pH correlated with density and richness. Several studies in forest and secondary succession have shown a positive correlation between soil moisture and the abundance of arthropods in soils (Ray and Gope 2006). Palacious-Vargas et al., (2007) worked on the litter and soil arthropods and density in a tropical dry forest ecosystem in western Mexico and observed that precipitation and temperature were significantly correlated with collembola and mesostigmata densities and also with total arthropods. Barbercheck, et al., (2009) investigated soil microarthropods as a useful bioindicators of soil condition in forest, wetland, and agricultural ecosystems over a range of ecoregions. Kardol et al., 2011 studied on the moisture-induced shifts in soil microarthropod abundance and community composition may have important impacts on ecosystem functions, such as decomposition, under future climatic change.
Ray and Gope (2011) observe litter quality, decomposition dynamics and nutrient release pattern in *Tectona grandis* (Linn.f.) in Cachar District of Assam and reported that maximum decomposition is characterized by heavy rainfall, high relative humidity and temperature by the microarthropods. Singh *et al.*, (2012) worked on the seasonal ecology and diversity of soil microarthropod with special reference to acari and collembolan in forest and imperata grassland of Cachar district of Assam and it showed that maximum microarthropod population is found in forest as compared to imperata grassland. Gope and Ray (2012) explored the diversity of soil oribatid in four different ecosystems in Cachar district of Assam and observed that the member of oribatulidae family is most resistant survivor under different landuse practices. Density of total cryptostigmatid mites showed decreased order in the undisturbed site to disturbed sites (forest>secondary succession>homegarden>teak plantation).Ray *et al* (2013) worked on the faunal composition of soil cryostigmata in different ecosystems of Cachar District, Assam and observed that forest recorded maximum density cryptostigmata followed by secondary succession>homegarden>teak plantation.