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Diversity of Soil Microarthropods in Different Agricultural Settlements with their Ecological Perspectives

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Abstract
Soil biological communities are influenced by multiple factors like edaphic factors, environmental variables, soil nutrient availability and anthropogenic changes, including urban development and agricultural practices. Therefore, we clarify how factors regulate the ecosystem functions in a contemporary combined fashion. The population of microarthropods is highly variable in terms of plant diversity. Generally single peak population is found in both highly managed agricultural sites, whereas bimodal peaks are confirmed in the remaining two sites. Seasonal rhythms were found to be more effective in microarthropod population buildup than compared to temporal (monthly) variation in all the sites. The higher deviation of populations was shown in both agricultural sites. Vegetation and habitat conditions both have a close relationship, profoundly affecting microarthropod populations, particularly on a local scale, resulting in microclimatic influence of the edaphic matrix, which might be soil system-oriented. It is observed that soil temperature is a critical factor in the diversity influence of microarthropods in soil ecosystems. We conclude that diverse species found in structurally diverse habitats, where they often appear to be specialized, conditions and edaphic factors exert a direct influence on microarthropod populations.

Keywords: Microarthropods; Diversity; Vegetation; Edaphic factors; Soil; Agriculture

Introduction

Soil provides a great variety of microhabitats for its inhabitants from which soil microarthropods makeup significant proportion. Soil microarthropods are different in size, generally 0.1-2 mm body width, (so called mesofauna, Swift et al., 1979), physiologically active and ecologically important indicators of soil conditions. Besides participating in various soil ecological activities (decomposition of residues, mineralization of nutrients, improving the soil microstructure by their fecal pellets, reducing the bacterial and pathogenic attack by consuming these organisms, and critically improving the porosity of soil by their vertical as well as horizontal movements), their species diversity facilitates maximum exploitation on the resource available in different soil habitats. Apart from soil microarthropods, Collembolans and Acarina (mites) might infer the degree of exploitation of available resources and complementarily affect ecosystem services. In most of Indian soil ecosystems, these two groups diversified up to 72-97 % among microarthropods (Singh and Mukharji 1971; Singh and Pillai 1975; Prabhoo, 1976), thus dominating in most kinds of soils (Brahmam et al., 2010; Parwez and Abbas, 2012). Therefore, there is ample scope for use of these key biological components, mostly in tropical and subtropical agricultural ecosystems.

Tropical and subtropical ecosystems exhibit specific ecological characteristics that make them difficult situations for their sustainable management. Most preferentially in agricultural ecosystems, soil matrix and textural conditions, and food resources, all shaped by vegetation type; whereas the vegetation itself is affected by all these factors including ecological factors. Therefore, rotation of vegetation is a general process of agriculture under crop cultivation. However, harsh climatic conditions such as drought, flooding and dry cold or warm conditions, dramatically affect the establishment of crop cultivation. In these conditions, soil-inhabiting biological communities, preferentially soil microarthropods, faced survival problems in a continuously changing edaphic environment. Thus, there is a need to study, how an ecologically changing environment affects microarthropods populations in an agricultural soil system. This can be evaluated by the study of ecological and edaphic factors in concerned study sites.

Previously several researchers have noted the effect of various ecological factors on distribution and abundance of microarthropods in different soil habitats. Most of these studies are on edaphic factors including, soil temperature (Usher, 1976; Whitford, 1989; Cancela Da Fonseca, 1995; Sulkava and Huhta, 2003; Cakir and Makineci, 2013), soil moisture (Wallwork, 1970; Usher, 1976; Badejo, 1982; Steinberger et al., 1984; Kamill et al., 1985; Ali-Shtayeh and Salahat, 2010), soil pH (Hagvar and Abrahamsen, 1980; Klausman, 2006; Rentao et al., 2013), soil organic matter (Fujikawa, 1970; Santos et al., 1978; Anderson, 1988; Scheu and Schulz, 1996; Ponce et al., 2011), and vegetation (Speight and Lawton, 1976). These studies suggest that there is ample scope for investigation on edaphic factors in context of soil microarthropods to envisage the challenges of ecological manipulations due to which microarthropod abundance fluctuates in a highly varied manner.

There is currently an interest in understanding the factors which regulate the structure of soil faunal communities with consequences of ecosystem function (Cole et al., 2008). However, an interesting fact, how factors regulate the ecosystem functions in contemporary a combined fashion. When considered the ecosystem function, it is likely depended on, how many species or communities are necessary in such ecosystem for proper functioning of an ecosystem concerned. As we know that biological species live with competitive exclusion, without which they can't survive in a more fascinate life. However, competitive exclusion may decline some species properly; because of the extent of varied situations and unavailability of suitable resources for survival critically effect on the diversity of communities. Therefore, existence of competition within soil microarthropods communities might be a contentious issue. The fact is that, each and every community has to be use maximum resources to survive and shape much diverse itself. However, soil biological communities are shaped by combined effect of several factors, like edaphic factors, environmental parameters, resource availability and anthropogenic influences, including urban development and agricultural practices. Edaphic factors exert the conditions to influence microarthropods populations. To test this hypothesis, we studied soil microarthropod populations in different soil ecosystems.

Methods

(a) *Area and sites of study*

The area selected for study is situated at Aligarh. It is a flat topographical area, located in western part of UP, India at latitude 27-54'N, longitude 78-05E' and altitude 187.45 meter above sea level. It is a subtropical zone with fluctuating climatic conditions consisting of four different seasons characterized by extreme winter and summer followed by medium to heavy rainfall during monsoon months and a post winter sweet spring. In hot dry summer, the temperature goes up to 50 ºC, while in winter cold, the temperature down below 2 ºC. Such widely varying climatic conditions provide a variety of ecological niche to soil dwelling animals and interesting for ecological studies on microarthropods in this region (Abbas and Parwez, 2025).

Four different study sites have been selected to collect the soil samples for the population study of soil microarthropods, namely Agriculture Quarsi Site, Agriculture Panjipur Site, Mango Orchard Site and Un Arable Site, (Abbas and Parwez, 2025). AQS and APS were agriculturally well managed sites with the difference that AQS was totally organic managed site whereas APS was conventionally managed site. MOS was a orchard site which generally less managed and UAS, a natural site without any human interference found in field site.

(b) *Sampling, Extraction, Preservation and Identification of microarthropods*

Samples have been taken from all study sites at regular weekly intervals in every month for two consecutive years (Total 384 samples). A modified Tullgren funnel apparatus (Abbas and Parwez, 2020) has been used for extraction of soil microarthropods. All microarthropods have collected, preserved, separated and identified as described, Abbas and Parwez (2025).

(c) *Measurement of Edaphic factors*

The edaphic factors include soil temperature, relative humidity, and moisture content of the soil estimated according to Abbas and Parwez (2025). The absolute content of water, which has an impact on the activities and distribution of soil microarthropods, exists in variable quantities in soil. Therefore, soil moisture has been measured by directly inserting the digital moisture instrument in the soil. The soil depth generally used 10 cm to collect soil temperature directly. Soil pH was estimated by using digital soil pH meter. Organic carbon of soil was estimated according to Walkley and Black (1934) back titration method.

(d) ***Statistical Analysis***

We analyzed the correlation among the population of soil microarthropods and edaphic factors. SPSS version 21.0 has been used to carry out the statistical analysis Lognormal @ log10 basically used for cyclic differentiation of microarthropods populations. Box and Whisker plot for microarthropods made by using Graf pad Prism version 7.0 to represent the significant response of population dynamics.

We also estimated population density of soil microarthropods as described previously in our study, (Abbas and Parwez, 2009).

The indexes such as, Simpson Index, Shannon Index are evaluated as under-

Shannon Index
$$\sum\left(\frac{n_i}{N}\log_{10}\left(\frac{n_i}{N}\right)\right) \quad (1)$$

Simpson Index
$$\frac{\sum_i n_i(n_i-1)}{N(N-1)} \quad (2)$$

Ultimately, we examine the corresponding values of both indexes to check whether there is any relation between these two indexes or not if correlated.

Results

Total 15,286 specimens of soil microarthropods have been collected from all four selected sites during investigation time. The population of microarthropods exhibits decreasing trend from first year (8,047 specimens) to second year (7,239 specimens). Seasonal variations of soil microarthropods exhibit different trends for different sites. It is observed that the density of soil microarthropods found higher in winter and spring in both agricultural sites (AQS & APS) whereas in monsoon in Un-arable Site found relatively larger. Also, for Mongo Orchard Site, the density of soil microarthropods is observed to be relatively larger in summer and monsoon seasons (Fig. 1) as compared to rest of time.

The lognormal values of cyclic patterns of microarthropods populations have been the subject of remark for two consecutive years (Figure 2a). This confirms the population of microarthropods highly variable in order of AQS>APS>MOS>UAS. Generally single peak population found in both highly managed agricultural sites (AQS & APS) whereas bimodal peaks (Figure 1) are confirmed in rest two sites (MOS & UAS). On the other hand, both AQS and APS were highly abundant than compare to MOS & UAS (Figure 2b). However, seasonal rhythms are more effective in microarthropods population buildup than compare to temporal (monthly) variation in all the sites. The higher deviation of populations showed in both agricultural sites (Figure 2a) whereas lower populations but stability observed in Un Arable Site (Figure 2b).

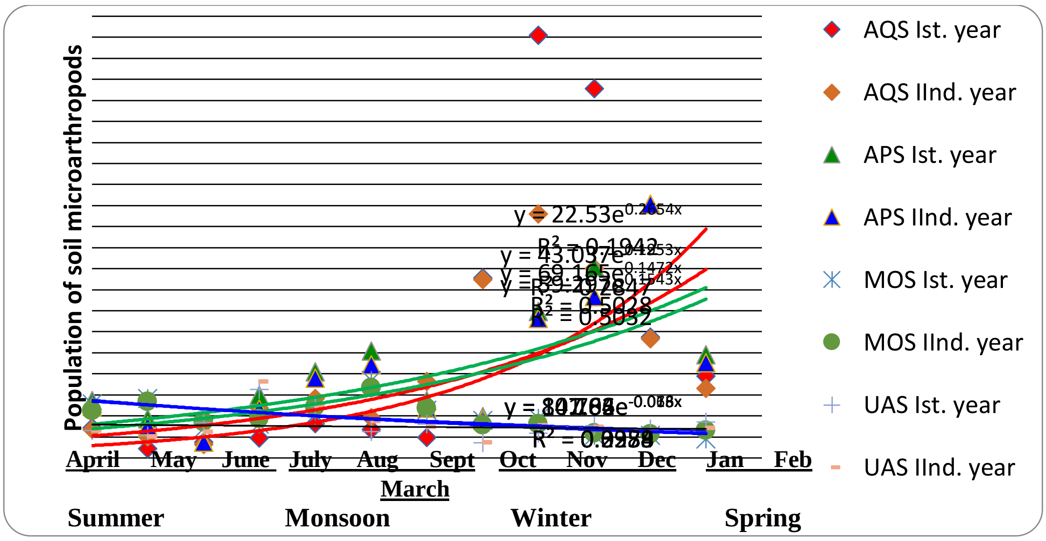

Fig. 1. Variation of microarthropods in different study sites within two consecutive years

Relationships between soil microarthropods and soil matrix

In AQS, soil temperature was always observed statistically negative (first year, $p<0.05$, –0.768 and second year, $p<0.05$, –0.573) whereas soil moisture always found statistically positive significant (first year, $p>0.05$, 0.736 and second year, $p>0.05$, 0.780) with reference to microarthropods population (Table 1). Soil organic carbon was always found positively significant in all the sites except Mango Orchard site (Table 1).

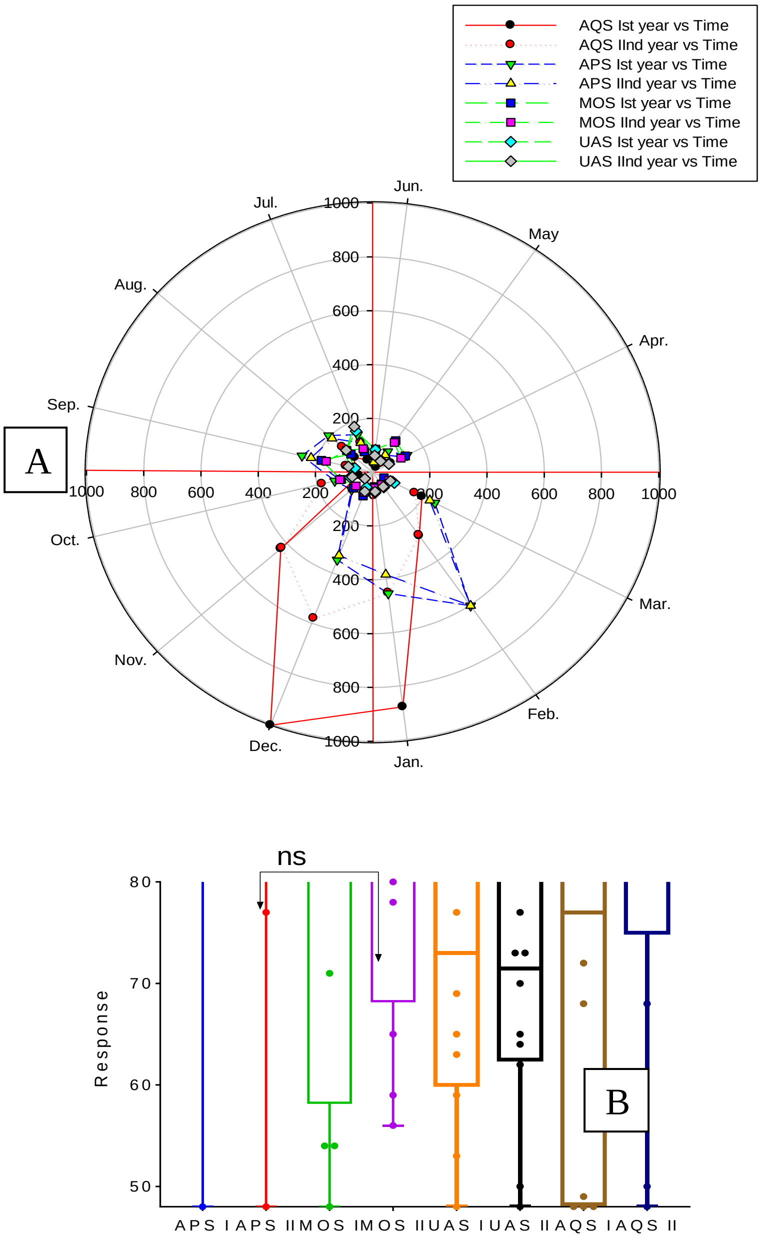

Fig. 2. (A) Real deviation limits of populations showed by polar plot (B) Box and Whisker plot for microarthropods population's response significantly using one way ANOVA.

Relationships between Shannon and Simpson's diversity indices

We analyze two main diversity indices, Shannon and Simpson diversity index. Simpson's diversity index found temper of Shannon's diversity. Both are corresponding interdependent on each other as observed (Figure 3) in this experiment. This observation also introduces the differential between sites studied. The fact is that the higher populations always found in highly diverse habitat with diversity influence (Figure 3).

Discussion

The close relationship of climatic variations, its effect on the species concern and resistibility of species affected are inseparable (Parwez et al., 2011) in field conditions. Therefore, the alteration of soil faunal species depends on functional relationships of inter and intra climatic interferences. A large number of studies have documented that present global climatic change has significant consequences on flora, fauna and ecosystem processes worldwide (Graham and Grimm, 1990; Walther et al., 2002; Parmesan and Yohe, 2003; Weltzin et al., 2003), which may be temporal or seasonal. As observed in this study, soil temperature is a critical factor in shaping the diversity of microarthropods in soil ecosystems. Temperature is an important factor, regulates many aspects of their life (Christiansen, 1964; Butcher et al., 1971; Hopkins, 1997).

Table 1. Correlation between edaphic factors and microarthropods populations.

Parameters → / ***Sites*** ↓	Density	Soil temperature (°C)	Soil moisture (%)	RH (%)	Soil pH	SOC (%)
AQS Ist year	66.08	-0.768**	0.736**	0.282	-0.640*	0.786**
AQS IInd year	54.02	-0.573*	0.780**	0.425	-0.470	0.491
APS Ist year	57.50	-0.759**	0.344	0.723**	-0.420	0.513*
APS IInd year	52.42	-0.705*	0.302	0.718**	-0.422	0.605*
MOS Ist year	19.96	0.439	0.261	-0.075	-0.394	-0.168
MOS IInd year	20.02	0.578*	0.221	0.052	-0.837**	-0.245
UAS Ist year	24.10	0.391	0.246	0.344	-0.300	0.697*
UAS IInd year	24.35	0.183	-0.054	0.394	0.094	0.359

Significant effects are given in red coloured values having ** Correlation is significant at P < 0.01 level and * Correlation is significant at P < 0.05 level.

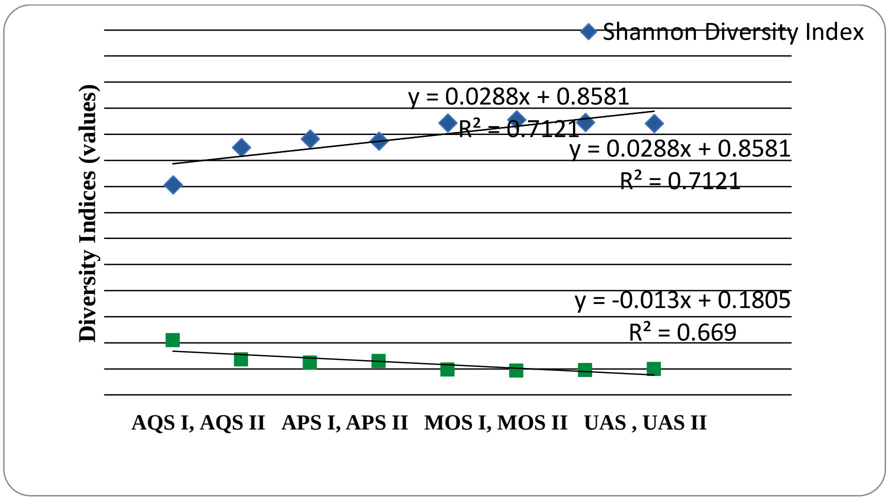

Fig. 3. Regression between Shannon and Simpson's diversity with reference to site differentiation

Changes in soil microarthropod populations associated with patterns of spatial and temporal variation might be substantially due to changes in vegetation in an agricultural ecosystem because heterogeneity of soil microarthropods in an agricultural land is strongly correlated with the number of floral species or their density. It is confirmed from the situations under ecosystems dominated with plant species adapted for fertile conditions can support high faunal densities. Fertile conditions are therefore likely to support rapid, leaky nutrient cycles and low net accumulation of soil carbon, whereas infertile conditions support slow nutrient cycles and soil carbon sequestration is promoted (Wardle, 2002; Coleman et al., 1983) which is less imparting in growth and support of microarthropods; ultimately meager population of soil microarthropods are observed (both in UAS & MOS). This is much clear from the observations of this study, because most of the populations of soil microarthropods were highly abundant during dense floral vegetation or crop (wheat crop in both agricultural sites during mid-October to last March, Figure 1) in both agriculturally managed sites compared to less managed mango and un-arable site.

Agro-ecosystems differ from natural (un-arable) ecosystems in terms of management, soil biodiversity and nutrients output via crop harvest for exceeding nutrient loss pathways in combined sequences because, agriculture replaces the nutrients lost via crop harvests and many amendments are also added either inorganic or organic fertilizers. Aside from amendments added, organic amendments improve soil physical properties and help maintain soil organic matter contents. However, the effect of organic inputs on physical properties of soil depends on the time residence, quality and placement of the material concerned, which means that, the longer the residence, the more durable the effect, might intern the higher quality of organic carbon in soil. Thus, population of soil microarthropods was found higher in managed sites than compared to un-arable (non-managed) and less managed sites as observed in this study (Figure 1).

It is clear from the growing number of ecological network studies that, biotic interactions often take place in multispecies frameworks, rather than few species-specific pair wise interactions (Stanton 2003). Thus, it has been widely recognized that the interactions between species, such as predator–prey relationships or competition within a guild, are crucial for shaping community dynamics (May 1974). Rapid increase of a community might be a surprise to those who expect that organisms form permanent mutualistic associations more likely to be highly specific, ensure a result of competitive exclusion.

Gause (1934) stated in competitive exclusion theory that differences in competitive abilities can cause non-random patterns of species occurrences among sites and generate inequalities in species abundances within sites. As per another study cleared that, competitively inferior species are predicted to occur less frequently and at lower abundance which has an important and largely unresolved question; how such species can persist in a community over long time periods (Fox, 2013). Actually, this depends upon less frequent environmental conditions favorable for particular species. The reason is that, competition can moderate the species concerned, which may be depend on environmental heterogeneity (Allesina and Levine, 2011). Thus, environmental heterogeneity increases the competition between species and within the communities. In case of soil microarthropods, it is clear that they are much more sensitive to the environmental variations. Shakir and Ahmad (2014) recently stated that, soil arthropods respond very quickly to the changes in the environment. Recently, Tsiafouli et al. (2015) stated that, not only diversity of many taxonomic groups decreased and communities were composed of more closely related species, but also some functional groups may be completely lost under intensive agriculture with potential implications for ecosystem functioning.

The aggregations of individual organisms is actually depend upon the favorability of environment either climatic or field conditions rather than being made up of organisms whose characteristics are complement to each other and whose functions are highly integrated. However, presence or absence of other organisms affects a species' ability to exploit or tolerate conditions, not only through competition or mutualism, but also through their impact on the habitat itself, either opening up new niches or shrinking niche dimensions for other species. The cumulative effect of the biotic components of an ecosystem affects the local environment in a nonlinear fashion. However, a saturated community represents a state of equilibrium, governed largely by competitive interactions between species (Giller, 1996) and within species. Therefore, stability tends to greater (UAS) in soil ecosystems where a larger number of functionally diverse species are present (Figure 2a & 2b).

The interaction between drought and soil carbon enrichment may also be the consequent measure that directly affects the performance of the concerned soil ecosystem. This is due to that soil moisture content strongly controls carbon availability in soils. The pressure of influential temperature also reduces when the soil has suitable and stable moisture conditions. In this investigation, more stable soil moisture conditions were found in AQS and APS sites, favouring the higher concentrations of available carbon contents in soils of both study sites, which ultimately influenced the populations of soil microarthropods.

Soil microarthropods are positively recorded with soil moisture although these correlations largely depend upon season and site sampled (Kamill et al., 1985; Ali-Shtayeh and Salahat, 2010). These results coincide with that of Wallwork (1970); Usher (1976); Vannier (1987); Whitford (1989); Asikidis and Stamou (1991). Soil pH was negatively correlated with soil microarthropods abundance although the correlation was sometimes weak (Table 1). A similar observation was reported by Klausman (2006), who found negative correlations between soil pH and microarthropods. Overall, changes in the edaphic matrix affect the soil characteristics which in turn influence the soil microarthropods. Thus, it is confirmed that, edaphic factors exert conditions to influence the population of soil microarthropods.

Vegetation types tend to occur along with the gradient of available moisture in soil. Available moisture was used here as the amount of moisture available to the plants (agricultural sites) that is necessary for their establishment and maintenance. This may be the reason by which higher population found in agricultural sites compared to Un-arable site. Moisture gradient can be steep or gradual. Consequently, an interesting feature of the gradual increase of moisture contents in soil directly increase influence the density of soil microarthropods. Soil moisture levels declined rapidly when temperature of soil increases. Moisture contents of soil underneath the irregularly varied between seasons with least in summer and highest in Rainfall. Therefore, the population of soil microarthropods was susceptible recorded in these periods (Figure 1). Hence, it may suggest that stability of edaphic environment specifically soil moisture with less fluctuation of soil temperature can lead the survival of soil microarthropods.

Vegetation also protects soil surface to warm from direct solar radiation/sun light rays therefore soil temperature found lower in agriculturally managed sites (AQS & APS) mostly in dry period (summer). Oppose to this indication, vegetation keep warm the soil surface in winter by avoiding the cool air due to abundant crop plants. The cold interference of climate induced variations due to which better survival conditions adopted by microarthropods in winter which cleared and observed in both agricultural management sites (AQS & APS). In agricultural lands (AQS & APS), perennial vegetation has been setup for the purpose of farming. It has been reported that these sites were highly diversified than compare to other two less managed (MOS) and unmanaged UAS. The reason may be that, increase root microbial diversity and their activities enhance nutrient cycling and possible allocation of more carbon into deeper horizons of soils (Millard and Singh 2009). Furthermore, perennial vegetation strips within agricultural fields may accumulate soil organic carbon relatively quickly because of runoff retardation, improved hydraulic properties, and nutrient deposition in the vegetative buffer strips (Udawatta et al., 2002, 2008; Udawatta and Jose 2011) compare to plantations in orchards or in un-arable fields. This may be the strong reason for higher population buildup of soil microarthropods as well as higher soil carbon contents observed (Table 1) in both agricultural sites (AQS & APS) compare to other two sites (MOS & UAS). Thus, this is reasonably cleared the fact that factors regulate the ecosystem functions in contemporary a combined fashion because, effect of several factors, like edaphic factors, environmental parameters, resource availability and anthropogenic influences, including urban development and agricultural practices critically play the role in shaping biodiversity of soil microarthropods in different soil environments.

Conclusions

The sustainability of agricultural ecosystems and their responses depend on the continuation of essential ecological processes. Ecological processes are dependent on the type and intensity of management within particular landsite for what purpose to be achieved in one hand and seasonal manipulations in other hand, in tropical and sub-tropical countries. Extreme events of seasonal patterns might disrupt the biological populations. However, the management can serve the ecological communities by enhancing the active ecological processes. Ecological processes depend on what functional contribution of habitat specific for its inhabitants. Therefore, continuous and reliable delivery of ecosystem functions depends on maintenance of functionally diverse ecological assemblages. Climate change in past few years has caused a seasonal shift of monsoon in Indian continent, mostly in the North Central part of India, resulting in less frequent but more extreme events during summer. This may prognosticate many more changes in annual rainfall in future. The direction, magnitude and variability of such changes in precipitation events and their effect on soil systems functioning will depend on how much the change deviates from the existing variability and the ability of soil ecosystems and their inhabiting soil organisms to adapt to new conditions as – (1) Adaptability or response of soil biological constraints might shape the functional potential of an ecosystem (2) Increasing uncertainty of environmental changes profoundly affect soil biological constraints (3) Environmentally site-specific effect may intern the survival of microarthropods resulting decline of some species up to extinct situations in an ecosystem.

References

Abbas MJ and Parwez H (2009) Temporal variation in population dynamics of soil microarthropods: Acarina and Collembolans. Research Journal of Biological Sciences 4(9):1016-1021. ISSN: 1815-8846 (Print), 1993-6087 (Online).

Abbas MJ and Parwez H (2025) Effect of temperature on the population of soil microarthropods in different land use systems. International Journal for Multidisciplinary Research (IJFMR) 7(5):1-8. E-ISSN: 2582-2160.

Ali-Shtayeh MS and Salahat AGM (2010) The impact of grazing on natural plant biodiversity in Al-Fara'a area. Biodivers Environ Sci Stud Ser 5:1–17.

Allesina S and Levine JM (2011) A competitive network theory of species diversity. Proc Natl Acad Sci USA 108:5638–5642.

Anderson J (1988) Spatio-temporal effects of invertebrates on soil processes. Biol Fertil Soils 6(3):216–227.

Asikidis M and Stamou G (1991) Spatial and temporal patterns of an oribatid mite community in an evergreen-sclerophyllous formation (Hortiatis, Greece). Pedobiologia 35(1):53–63.

Badejo M (1982) The distribution and abundance of soil microarthropods in three habitats at the University of Ife. MSc thesis, Department of Zoology, University of Ife, Nigeria.

Brahmam P, Sravanthy C, Laxman P, Samantha C and Sammaiah C (2010) Biodiversity of soil arthropods in BT-cotton fields of Warangal, Andhra Pradesh, India. The Bioscan 5(1):159–160.

Butcher JW, Snider R and Snider RJ (1971) Bioecology of edaphic Collembola and Acarina. Annu Rev Entomol 16:249–288.

Cakir M and Makineci E (2013) Humus characteristics and seasonal changes of soil arthropod communities in a natural sessile oak (Quercus petraea L.) stand and adjacent Austrian pine (Pinus nigra Arnold) plantation. Environ Monit Assess 185(11):8943–8955.

Cancela Da Fonseca L (1995) Characterization of benthic communities of St. Andrew's pond. In: Proceedings of the 4th Congress of the Alentejo, pp. 36–51.

Christiansen K (1964) Bionomics of Collembola. Annu Rev Entomol 9:147–178.

Cole L, Buckland SM and Bardgett RD (2008) Influence of disturbance and nitrogen addition on plant and soil animal diversity in grassland. Soil Biol Biochem 40:505–514.

Coleman DC, Reid CPP and Cole CV (1983) Biological strategies of nutrient cycling in soil systems. Adv Ecol Res 13:1–55.

Fox JW (2013) The intermediate disturbance hypothesis should be abandoned. Trends Ecol Evol 28:86–92.

Fujikawa T (1970) Distribution of soil animals in three forests of northern Hokkaido: II. Horizontal and vertical distribution of oribatid mites (Acarina: Cryptostigmata). Appl Entomol Zool 5(4):208–212.

Gause GF (1934) The struggle for existence. Williams and Wilkins, Baltimore.

Giller PS (1996) The diversity of soil communities, the poor man's tropical rainforest. Biodivers Conserv 5:135–168.

Graham RW and Grimm EC (1990) Effects of global climate change on the patterns of terrestrial biological communities. Trends Ecol Evol 5:289–292.

Hagvar S and Abrahamsen G (1980) Colonisation by Enchytraeidae, Collembola and Acari in sterile soil samples with adjusted pH levels. Oikos 34:245–258.

Hale WG (1967) Collembola. In: Burges A and Raw F (eds) Soil biology. Academic Press, London, pp. 397–411.

Parwez H and Abbas MJ (2012) Seasonal diversity, habitat quality and species-specific differences of microarthropod abundance in two different managed agro-ecosystems at Aligarh. International Journal of Geology, Earth and Environmental Sciences 2(2):206–217.

Hopkin SA (1997) Biology of springtails (Insecta: Collembola). Oxford University Press, Cambridge, UK.

Kamill BW, Steinberger Y and Whitford W (1985) Soil microarthropods from the Chihuahuan Desert of New Mexico. J Zool 205(2):273–286.

Klausman L (2006) Decomposition and microarthropod abundance in litter and soil in a southern Appalachian wetlands complex. In: Proceedings of the National Conference on Undergraduate Research (NCUR), University of North Carolina at Asheville, 6–8 April, pp. 300–307.

May RM (1974) Stability and complexity in model ecosystems. Princeton University Press, Princeton, pp. 1–304. ISBN: 9780691088617.

Millard B and Singh BK (2009) Does grassland vegetation drive soil microbial diversity? Nutr Cycl Agroecosyst 88:147–158.

Abbas MJ and Parwez H (2020) Seasonal diversity of soil microarthropods in two different vegetable plots of Aligarh, India. Tropical Ecology.

Parmesan C and Yohe G (2003) A globally coherent fingerprint of climate change impacts across natural systems. Nature 421:37–42.

Parwez H, Abbas MJ and Ilyas M (2011) Effect of edaphic factors on diversity of soil microarthropods: A review. In: Animal diversity, natural history and conservation. Daya Publishing House, New Delhi, pp. 367–386.

Petersen H and Luxton M (1982) A comparative analysis of soil fauna populations and their role in decomposition processes. Oikos 39:287–388.

Ponce C, Bravo C, De León DG, Magaña M and Alonso JC (2011) Effects of organic farming on plant and arthropod communities: a case study in Mediterranean dryland cereal. Agric Ecosyst Environ 141(1–2):193–201.

Prabhoo NR (1976) Soil microarthropods of a virgin forest and adjoining tea fields in the Western Ghats in Kerala: A brief ecological study. Oriental Insects 10:435–442.

Rentao L, Yongqing C and Fan Z (2013) Effect of long-term cultivation on soil arthropod community in sandy farmland. Journal of Agricultural Science and Technology (Beijing) 15(1):144–151.

Santos P, Depree E and Whitford W (1978) Spatial distribution of litter and microarthropods in a Chihuahuan Desert ecosystem. J Arid Environ 1:41–48.

Scheu S and Schulz E (1996) Secondary succession, soil formation and development of a diverse community of oribatids and saprophagous soil macro-invertebrates. Biodivers Conserv 5(2):235–250.

Shakir MM and Ahmed S (2014) Seasonal abundance of soil arthropods in relation to meteorological and edaphic factors in the agroecosystems of Faisalabad, Punjab, Pakistan. Int J Biometeorol 59:605–616.

Singh J and Mukharji SP (1971) Qualitative composition of soil arthropods in some fields at Varanasi (India). Oriental Insects 5(4):487–494.

Singh J and Pillai KS (1975) A study of soil microarthropod community in some fields. Rev Ecol Biol Sol 12(3):579–590.

Speight MR and Lawton JH (1976) The influence of weed cover on the mortality imposed on artificial prey by predatory ground beetles in cereal fields. Oecologia 23:211–223.

Stanton ML (2003) Interacting guilds: moving beyond the pairwise perspective on mutualisms. Am Nat 162:S10–S23.

Steinberger Y, Freckman D, Parker L and Whitford W (1984) Effects of simulated rainfall and litter quantities on desert soil biota: nematodes and microarthropods. Pedobiologia 26(4):267–274.

Sulkava P and Huhta V (2003) Effects of hard frost and freeze–thaw cycles on decomposer communities and N mineralisation in boreal forest soil. Appl Soil Ecol 22(3):225–239.

Swift MJ, Heal OW and Anderson JM (1979) Decomposition in terrestrial ecosystems. University of California Press, Berkeley.

Tsiafouli MA, Thebault E, Sgardelis SP, de Ruiter PC and van der Putten WH, et al. (2015) Intensive agriculture reduces soil biodiversity across Europe. Glob Change Biol 21:973–985.

Udawatta RP and Jose S (2011) Carbon sequestration potential of North American agroforestry practices. In: Kumar BM and Nair PKR (eds) Carbon sequestration potential of agroforestry systems: opportunities and challenges. Springer, Dordrecht, pp. 17–42.

Udawatta RP, Kremer RJ, Adamson BW and Anderson SH (2008) Variations in soil aggregate stability and enzyme activities in a temperate agroforestry practice. Appl Soil Ecol 39:153–160.

Udawatta RP, Krstansky JJ, Henderson GS and Garrett HE (2002) Agroforestry practices, runoff, and nutrient loss: a paired watershed comparison. J Environ Qual 31:1214–1225.

Usher M (1976) Aggregation responses of soil arthropods in relation to the soil environment. In: Anderson JM and Macfadyen A (eds) The role of terrestrial and aquatic organisms in decomposition processes. Blackwell Scientific Publications, Oxford, pp. 61–94.

Vannier G (1987) The porosphere as an ecological medium emphasized in Professor Ghilarov's work on soil animal adaptations. Biol Fertil Soils 3(1):39–44.

Walkley A and Black IA (1934) An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Sci 37:29–38.

Wallwork JA (1970) Ecology of soil animals. McGraw-Hill, New York, pp. 283.

Walther G, Post E, Convey P, Menzel A, Parmesan C, Beebee TJC, Fromentin J, Hoegh-Guldberg O and Bairlein F (2002) Ecological responses to recent climate change. Nature 416:389–395.

Wardle DA (2002) Communities and ecosystems: linking the aboveground and belowground components. Princeton University Press, Princeton, NJ.

Weltzin JF, Muth NZ, Von Holle B and Cole PG (2003) Genetic diversity and invasibility: a test using a model system with a novel experimental design. Oikos 103:505–518.

Whitford WG (1989) Abiotic controls on the functional structure of soil food webs. Biol Fertil Soils 8(1):1–6.

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Author Contributions

MJA prepared this manuscript of original research work (from Doctoral Thesis) and analyzed data concerned with this manuscript whereas HP refined this manuscript.

Abbreviations

Agriculture Quarsi Site (AQS)
Agriculture Panjipur Site (APS)
Mango Orchard Site (MOS)
Un Arable Site (UAS)

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