Mangroves constitute one of the most productive ecosystems in tropical and sub-tropical countries in the world. The term “mangrove” refers to an assemblage of tropical trees and shrubs that grows in the intertidal zone. These are the most productive, valuable salt tolerant coastal wetland ecosystems, distributed over the seaward fringes of many countries. As per the latest census of 2011, the mangrove vegetation in Indian coastline covers an area of 4,662 sq km. Over all 59% of the mangrove area lies along the East coast, 28% on the West coast and the remaining 13% in the Andaman Nicobar Islands (FSI, 2009, 2011). The Sunderban deltaic complex covers the largest single contiguous mangroves spread between India and Bangladesh. Among the South Indian states, Kerala had been blessed with good stretches of mangrove vegetation covering an area of about 700 sq kms in the past (Ramachandran and Mohanan, 1987). However, various natural cum anthropogenic activities resulted in a drastic decline in the mangrove ecosystem of Kerala and currently only mangrove vegetation is restricted to an area of 17 sq kms alone. The records of Kerala Forest Department in 2006 listed that about 88% of the mangroves in Kerala is under private property and rest is under the Kerala Forest Department. Majority of the mangrove
area of Kerala is found distributed in the Northern districts. The mangrove vegetations in North Kerala, especially in the districts of Malappuram, Kozhikode, Kannur and Kasaragod extend to areas of 12, 293, 755 and 79 hectares respectively.

The mangrove ecosystem is dominated by mangrove plants which contribute primarily as producers and interact with the neighbouring aquatic fauna, flora, physical and socio-economic factors of the coastal environment. The mangrove flora consists of both ‘true’ and ‘associated’ species, which are seen in restricted intertidal zones and in the vicinity of mangroves. The occurrence and distribution of different mangrove plants are not randomly scattered, but often occur in discrete and more or less monospecific zones. The intricate root system (pneumatophores, prop roots, and stilt roots) support numerous marine as well as freshwater benthic fauna in relation to the changing environment and also provide protection and shelter for coastal settlements against extreme weather conditions, such as storm winds and floods, as well as Tsunamis.

These diverse intertidal regions provide good shelter as well as breeding and feeding habitats/sites for both terrestrial and aquatic vertebrates and invertebrates. Mangrove plants produce large amount of litter, which would serve as sheltering accumulations of organic matter along with soil interstices. Especially the burrowing forms of intertidal invertebrates aerate
the soil and hence are considered as the integral parts for the structure, health and functioning of intertidal habitats. Being the active members of detritus food chains, some of these faunal elements play vital roles in triggering biodegradation and humification process, nutrient cycling and transfer of energy from lower to higher trophic levels.

Mites represent an abundant and highly diverse group among the soil invertebrates, the soil acari, especially the oribatid mites exhibit multiple roles, majority of which have been recognized under the beneficial category. They are ubiquitous in habit, enjoying diverse patterns of distribution in every nook and corner of the terrestrial, aquatic and aerial habitats available on earth. As of 2013, there are over 50,000 species of mites have been described to date and many taxonomists predict that the species richness of mites would be greater than that of insects. Thanks to the remarkable evolutionary plasticity and relatively small size of mites, which would have helped in their bewildering diversity in habits and habitats.

Among mites, the soil mites, particularly the oribatid mites or the cryptostigmatid mites represent the most numerically dominant, species rich group in almost all types of soils. As per the latest World Oribatid mite Catalogue compiled by Subias, 2004, updated (2015), the suborder oribatida comprises 10,695 species and subspecies (1,461 synonyms) recognized under 1,262 genera and subgenera (424 synonyms) and 164 families. Of these,
3,791 spp. are Palearctic; 1,114 spp. are Nearctic; 1,803 spp. are Ethiopian; 2,268 spp. are Oriental; 1,425 spp. are Australian; 97 spp. are Antarctic and 2,216 spp. are Neotropic in distribution (Plate-1, Fig.1). Around 11,000 species have been described so far and in temperate forest soils, a small area often harbours up to 150 species (Norton and Behan–Pelletier, 2009). These mites are characterized by incredible morphological and habitat diversity coupled with highly conserved biological features.

By virtue of their very vital role in litter fragmentation and associated soil humification process, these mites hasten the nutrient cycling and subsequent enhancement of soil fertility and productivity. In addition, oribatid mites play leading roles in bioindication of soil conditions including radioactive pollution, bioremediation, and biological control of pests, parasites and pathogens, detection of post mortem intervals and thereby catalyzing the advancement of forensic science and so on. The study of existing oribatid communities, greatly improves our knowledge on the ecology and biology of oribatid mites, which is of utmost importance in order to infer habitat changes. In soil ecosystems, especially in forest soils and litter accumulated areas, oribatid mites regulate decomposition and nutrient turn over by actively feeding on the litter substrates/microbial colonies, comminuting organic matter, feeding on microbes etc. which in turn would help in the mixing up of the microbial propagules with fresh resources in the fecal pellet, and often their transportation to new sites. The detritus like the
fallen leaves, decaying twigs, dead pneumatophores and prop roots function as the major feeding substrates for littoral invertebrates and microbes.

Oribatid mites inhabiting forest ecosystems are considered to have the origin of two types i.e., littoral and arboreal. The littoral mangrove fauna always tend to submerge under daily, periodic inundation by the saline and sometimes fresh water. Therefore, they possess certain specialized characters specialized for the arboreal and littoral mode of life and develop some morphological modifications like tridactylous and monodactylous legs with toothed claw, reduced sensillus etc.

Relatively very few studies have been carried out presently, on the species diversity and functional status of oribatid mites harbouring the marine/coastline, riverine and mangrove habitats, on a global level. Only limited number of the oribatid mites are known to exhibit a close association with the marine littoral habitats and to cite some examples are the members of the families viz. Ameronothridae, Selenoribatidae and Fortuyniidae of the superfamily Ameronothroidea. The mites restricted to this particular challenging environment by getting adapted themselves morphologically, physiologically and behaviorally are collectively termed as the “Intertidal oribatids”. Most of the intertidal oribatid mites are subjected to tidal currents, they become submerged partially or completely, and in such conditions, they possess certain morphological adaptations like the respiration accomplished

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through more or less developed plastron mechanisms and the ability to withstand effects of seawater for prolonged periods. Among the truly intertidal oribatids, species like *Alismobates inexpectatus*, *Fortuynia atlantica* and *Carinozetes bermudensis* inhabit in the intertidal zones of tropical and subtropical coastal habitats and are known to possess well-developed plastron respiration mechanisms.

Various microhabitats are found exploited by the intertidal mites which include the rock crevices, barnacle shells, sand, intertidal debris, salt-marshes, supralittoral lichens, moss and some algal filaments and mangrove pneumatophores. Many of the marine associated mites are detritus feeders while some of them consume algae and fungi, and some others are carnivorous. Supralittoral species of mites have been classified (Pugh and King, 1988) into 3 categories viz. (a) maritime species, which include mites are limited to the seashore, especially supralittoral sometimes they guessing into the upper littoral zone (b) Non-maritime species which include mites which are habitually at the seashore and (c) Nomadic species which include mites which migrate freely from the littoral to the supralittoral zones.

The intertidal mites show their own particular modes of distribution in accordance with the various climatic conditions. Biological processes in soil ecosystems including the mangrove soils are more complex and soil-inhabiting mites take part in all vital processes by inoculating microbes.
through grazing on microbial encrustations and introducing spores into fresh residues so that they can accelerate the decomposition process. As mangroves soils are detritus- based, they form ‘hotspots’ of microbial diversity. These microbes mediate decomposition and complex interactions between them and the detritus feeders like the mites culminate in the transformation of fresh and dead organic residues into either mineral nutrients or recalcitrant humic acids. Soil inhabiting animals perform both direct and indirect roles in this context by transporting the organic and inorganic materials within and between soil systems. The extend of oribatid feeding activity culminating in the release of nutrients which are locked in organic debris is very less explored and in mangrove ecosystems it still remains as an unexplored entity. Kerala being a land blessed with vast stretches of coastal areas and varied types of water bodies in the form of ponds, lakes, rivers, backwaters and swamps supplement diverse natural habitats for marine as well as terrestrial fauna. The soils of the intertidal (mangrove) areas of Kerala have not been explored so far for the elucidation of the faunal diversity of mites. Considering this lacuna, the present study was undertaken to explore the diversity of intertidal species of oribatid mites harbouring the mangrove ecosystems of North Kerala and also to trace the feeding and breeding habits of selected species. The study was also extended to gather information on the impact of oribatid mites in the release of nutrients in mangrove soils.

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