RESEARCH ARTICLE

Role of ants genera on induced modification and fertility of soil

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ABSTRACT

Different ant species navigate across all the trophic levels in search of architecture of vegetation, dead twigs on soil for nesting. An ant represents a unique focal group having the potential to be used as biological indicators. The maximum population of ants species effects on the physical and biological properties of soil greatly. Also, the movement of particles from lower horizons to the surface area by ants aids affects the mixing of organic and mineral fractions of the soil to increase the fertility. The faeces of ants are the basis for the formation of soil aggregates and humus, which physically stabilize the soil and increase its porosity to store nutrients. Present study examined the effects of invasive species of ants on soil properties and plant growth simultaneously decrease in soil pH and increase in Phosphorous (P*) and Potassium (K*) in soil.

Keywords: Ant, porosity, nutrients, fertility.

INTRODUCTION

As plants grow, they consume nutrients in the soil. As the mineral content depletes in the soil, they need to be replenished. This is where the organisms living in the soil play their part by helping in the decomposition and transportation of nutrients to be used by plants. Some ants like weaver ants, pharaoh ants, wood cutter ant and carpenter ant species construct their nest in the soil to deposit their food and egg laying playing an important role in the basic nutrient cycle of the soil. As some wood ants are keystone species in wood-land ecosystems, with effects on the community structure of local invertebra-tes as well as providing a food source for predators (Hughes and Broome, 2007). Nest construction results in modification of soil structure, increasing porosity (Frouz and Jilková, 2008) and accumulation of food and detritus makes nests hotspots of nutrient exchange (Domisch *et al*., 2009). The nests constructed by these ants support high levels of biodiversity, including many species that are dependent on the nests as habitat (Wagner and Jones 2005). There are different ant species shows burrowing activity among these ants species under subfamilies Dolichoderinae, Myrmicinae, Pseudomyrmicinae, Ponerinae, Formicinae, are important in soil tilting during nest building (Chavhan and Pawar, 2011). These ants genera plays important role to create porous soil, provide better aeration, improves the moisture content and helps in the transfer of organic materials into the soil.

Among these species some genera, *Iridomyrmex, Tapinoma, Camponotus, Oecophylla, Paratrechina, Aphaenogaster, Crematogaster Solenopsis, Pachycondyla,* are the polymorphic hymenopterans utilizes the plant residues, animal manure or other organic materials to build up their nest colony (Frouz *et al*., 2003). These organic materials decomposed by bacteria, fungi and converts the complex organic matter into simple components (Eldridge and Pickard, 1994). The reduced simple organic components are again carried by the ants in to excavated nest underground the soil where they are further being absorbed by the plants roots as growth nutrients (Cammeraat *et al*, 2002). The population of these ants genera are directly effects on the physical, chemical and biological properties of soil through the modification of soil profile, aeration, drainage and density and are therefore able to influence the energy and nutrient cycles and to act as ecological engineers (Folgarait, 1998; Frouz and Jilkova, 2008; Chavhan and Pawar, 2011).

MATERIAL AND METHODS

This experiment was conducted to find out whether the fauna inhabiting the soil will help with soil fertility and plant growth. The experiment was carried out in different region of rural areas near Kalmeshwar (MS). The five different experimental areas were studied where maximum population of different ant genera under subfamilies Dolichoderinae, Myrmicinae, Pseudomyrmicinae, Ponerinae, Formicinae, are observed. The soil sample collected from roof of the plant and tested in the laboratory in college using Soil Testing Kit. The phosphorus concentration in soil tests measure ortho-phosphate (PO4-P) and ammonium acetate extraction method is the most common method to analyse potassium concentration in ppm. The area without carpenter ants population were also studied as check or control.

RESULTS AND DISCUSSION

The ant genera in the given experimental plots shows burrowing activity among the ants genera under subfamilies Dolichoderinae, Myrmicinae, Pseudomyrmicinae, Ponerinae, Formicinae, are very importantin soil tilting during nest building. These ants genera plays important role to create porous soil, provide better aeration, improves the moisture content and helps in the transfer of organic materials into the soil. It is observed that the soil collected from different areas denoted as A-1, A-2, A-3, A-4 and A-5 had grown taller than the control area denoted as A-c. The presence of these ants genera in areas A-1 to A-5 show increasing height and growth of plant population. The hypothesis that the presence of these ants in the soil help to provide a better environment for the plant growth. The concentration of Potassium (K), Phosphorous(P) and pH in the respective soil sample from A-1 to A-5 areas show variable values as compared to control area (Table-1).

CONCLUSION

The present study shows burrowing habitat and mining activity among some ant genera under subfamilies Dolichoderinae, Myrmicinae, Pseudomyrmicinae, Ponerinae, Formicinae, are very importantto play important role to create porous soil, provide better aeration, improves the moisture content and helps in the transfer of organic materials into the soil to fertilize the soil in many ways (Frouz *et al*., 2003). They help in the recycling of decomposed materials which increase soil porosity and may cause separation of soil particles according to their size. Some of the ants eat other insects and caterpillars that are harmful to the plants and will help nourish the soil with their processed food (Barsagade *et al*., 2013). The burrowing activity of the ant genera helps to penetrates water upto the plants roots (Domisch, 2006). The ants also help in spreading the plants seeds during these soil mining. Ant-mediated chemical changes of soil are represented mainly by a shift of pH towards neutral and an increase in nutrient content (mostly Potassium and phosphorus) in ant nest-affected soil (Frouz and Jilkova, 2008). These effects correspond with accumulation of food in the nests and the effect on biological processes, such as hastening of

S. No.	Conc in Soil (ppm)	A-1	A-2	A-3	A-4	A-5	Control A-C
1.	Potassium(K)	125>	130>	145>	155>	160>	110<
2.	Phosphorous(PO4-P)	80 >	95>	115>	125>	130>	72<
3.	pH	7.0	6.8	6.7	6.9	7.1	5.6<

decomposition rate (Kadu, 2010, 2014). Effects on biological soil properties may be connected with increased or decreased microbial activity, which is affected by accumulation of organic matter and internal nest temperature and especially moisture (Eldridge and Myers1998).Effects on the soil vary between ant species; substantial variation can be found in the same species living in different conditions. The increase in concentration of Potassium and phosphorus and neutral pH represent an ideal indicator for experiments targeting soil ecosystems (Lafleur, 2005). In this study, we compared nutrient exploitation by spruce seedlings growing in substrates from abandoned ant nests (i.e., local nutrient-rich hots-pots) vs. from the control soil floor area (Ohashi *et al*., 2007). At field moisture, microbial biomass Carbon and Nitrogen were significantly more concentrated in ant nests at all experimental study sites (A-1 to A-5) as compared to control sites (Frouz *et al*., 2008). The soil becomes naturally moistenedin the form of nest soils and had higher capacity for microbial growth than soils from other microhabitats(Wagner and Jones, 2005). From the above study it is concluded that different ant genera involved in nest building nests impact on the ecosystems by creating highly concentrated patches of soil nutrients could affect biogeochemical cycling rates and plant community dynamics..

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