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DIVERSITY AND IMPORTANCE OF SOIL-DWELLING ANTS

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ABSTRACT

Soil-dwelling ants play important roles in improving physical, chemical and biological properties of the soil but very little is known about the diversity as well the role of diversity of such ants in Sri Lanka. Ground-dwelling ant species that were recorded by sifting soil and observing nests within quadrats laid on the ground in selected lands in Sri Lanka are listed here. Ecosystem services such as contribution to nutrient recycling, decomposition of organic matter, bioturbation, suppression of soil-borne diseases and pests, provided by the soil ant species in Sri Lanka should be studied in detail. Studies on the effects of pesticides and fertilizers on the colonization, survival and colony demography of soil-dwelling ant species that are found in the cultivated lands should be encouraged.

INTRODUCTION

Soil-dwelling ants (Family: Formicidae) constitute a greater part of animal biomass in soil and are important soil engineers that have a large impact on the soil ecosystem (Cammeraat and Risch, 2008). Among the twelve subfamilies of Formicidae recorded from Sri Lanka (Dias *et al.*, 2013) Aenictinae, Amblyoponinae, Cerapachyinae, Dolichoderinae, Dorylinae, Formicinae, Myrmicinae and Ponerinae include common, soil-dwelling members. Several formicines (*e.g. Camponotus* spp.) many myrmicines (*e.g. Solenopsis geminata*, *Pheidole* spp., *Myrmicaria brunnea etc.*) and almost all ponerine species (Dias *et al.* 2013) are common soil-nesting ants in Sri Lanka.

Impact of soil-dwelling ants on the properties of soil as well as on ecosystem functioning have been discussed elsewhere (Folgarait 1998, Cammeraat and Risch 2008) but relevant research outputs or discussions related to soil-dwelling ant species in Sri Lanka are currently scarce and initiation of such research is essentially required.

IMPORTANCE OF SOIL-NESTING ANTS

The construction of ant nests changes the physical, chemical and biological properties of the soil. These ants pick up soil grains, bite off fragments of soil aggregates and relocate soil particles. They also excrete chemical substances, which alter the soil structure and soil aggregate stability. Ants may bring soil materials from deeper soil horizons to the top surface and the soil organic matter is buried deeper increasing the water-holding capacity of deep soil. As there are many workers in a colony this leads to intensive mixing of soil from different soil depths and changes soil textural properties (Cammeraat and Risch, 2008). The network of galleries and chambers in the nests increases the porosity of the soil, increasing drainage and soil aeration. Studies in agricultural fields have shown that the effectiveness of water infiltration depends on the spatial and temporal pattern of ant burrows and whether the biopores remain open under conditions of heavy irrigation or rainfall.

Among the chemical properties an increase in soil organic matter (organic carbon), P, N, K, Na, Ca and Mg in ant mounds in comparison to adjacent soil has been reported. These changes vary with the species involved, ant colony size and the biomass. Generally, the observed differences in organic matter and nutrient levels are attributed to the accumulation of food, or excrements in nest areas or separation and translocation of food and soil material during nest construction. The most constant finding (Cammeraat and Risch, 2008) is that K is generally higher in ant nests or mineral mounds compared to the surrounding soil. Few studies have found that ant activity influenced soil pH (Folgarait, 1998). Generally, the changes depend on the ecosystem type and its ant species.

Biological properties of ecosystems such as plant species composition and relative abundance differ on the ant mounds and close to them, in comparison to adjacent areas. In infertile sites, the enrichment of the soil through the actions of ants is a key element for the development of vegetation and this highlights the importance of ant activity in agricultural production. Ants affect the decomposition and microbial activity in below-ground nests and mineral mounds. Generally, higher levels of microfauna and microflora have been detected in ant nests because ants facilitate their development (Cammeraat and Risch, 2008). Many arthropods (myrmecophiles) live in ant mounds as specialized inhabitants of refuse piles, brood or queen chambers and storage areas or on the body of the ants. Soil ants may belong to different trophic levels and have an important effect due to their voracity. Omnivore ant species living in meadows can consume up to 3% of the primary production and 40% of the prey biomass available per season (Petal, 1980).

PRESENT STATUS

Very little is known about diversity of soil ant fauna in different types of lands in Sri Lanka. Many species were common to forests, cultivated lands and uncultivated lands (opportunists) whereas very few species (specialists) were restricted to each type of land showing that each land had its own ant community (Kosgamage, 2011; Peiris, 2012). Table 1 shows a list of ant species recorded by sifting soil and observing nests within quadrats laid on the ground in selected lands in Sri Lanka but details on the roles of soil ant species in forests as well as in cultivated lands are not much known.

CONCLUSIONS AND RECOMMENDATIONS

Soil-dwelling ants play important roles to improve physical, chemical and biological properties of the soil elsewhere but very little is known about the diversity as well as the role of diversity of such ants in Sri Lanka. Surveys on soil-dwelling ants in different types of lands (*e.g.* forests and cultivated lands) should be initiated. Ecosystem services such as contribution to nutrient recycling, decomposition of organic matter, bioturbation, suppression of soil-borne diseases and pests, provided by the soil ant species in Sri Lanka should be studied in detail. Studies on the effects of pesticides and fertilizers on the colonization, survival and colony demography of soil-dwelling ant species that are found in the cultivated lands should be encouraged.

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Table 1: Soil-dwelling ant species recorded from soil sifting method and the quadrat method for counting ground nests of ants

Aenictinae

Aenictus fergusoni elongates (subsp.) Karavaive, 1901
Aenictus porizonoides Walker, 1860
Aenictus biroi Forel, 1907
Aenictus pachycerus (Dalla Torre)
Aenictus ceylonicus (Mayr, 1866)

Amblyoponiinae

Amblyopone spp.

Aneuretinae

Aneuretus simoni Emery

Cerapachyinae

Cerapachys aitkenii Forel, 1900
Cerapachys fossulatus Forel, 1895
Cerapachys fragosus (Roger, 1862)
Cerapachys typhlus (Roger, 1861)

Dolichoderinae

Bothriomyrmex wroughtonii Forel, 1895
Dolichoderus taprobanae taprobanae (Smith F., 1858)
Technomyrmex albipes albipes (Smith F., 1861)
Technomyrmex bicolor Forel, 1909

Dorylinae

Dorylus (Alaopone) orientalis orientalis Westwood, 1835

Formicinae

Acropyga acutiventris Roger, 1862
Anoplolepis gracilipes (Smith F., 1857)
Camponotus (Tanaemyrmex) compressus compressus Fabricius, 1787
Camponotus (Tanaemyrmex) irritans irritans (Smith F., 1857)
Camponotus (Myrmosericus) rufoglaucus rufoglaucus (Jerdon, 1851)
Camponotus (Orthonotomyrmex) sericeus sericeus (Fabricius, 1798)
Camponotus (Tanaemyrmex) oblongus Forel, 1916
Lepisiota frauenfeldi frauenfeldi (Mayr, 1855)
Paratrechina longicornis longicornis (Latrielle, 1802)
Plagiolepis exigua exigua Forel, 1894
Plagiolepis jerdonii Forel, 1894
Polyrhachis (Myrma) punctillata punctillata Roger, 1863

Myrmicinae

Crematogaster (Crematogaster) dohrni dohrni Mayr, 1879
Lophomyrmex quadrispinosus (Jerdon, 1851)
Meranoplus bicolor (Guerin-Meneville, 1844)
Monomorium criniceps (Mayr, 1879)
Monomorium destructor (Jerdon, 1851)
Myrmicaria brunnea Saunders, 1915
Pheidole spp.
Solenopsis geminata (Fabricius, 1804)
Tetramorium bicarinatum (Nylander, 1846)
Tetramorium tortuosum Roger, 1863
Tetramorium smithi Mayr, 1879
Tetramorium tortuosum Roger, 1863
Tetramorium walshi (Forel, 1890)

Ponerinae

Anochetus graeffei Mayr, 1870
Anochetus longifossatus Mayr, 1897
Diacamma ceylonense ceylonense Emery, 1897
Diacamma rugosum Forel, 1911
Leptogenys peuqueti (Andre, 1887)
Leptogenys processionalis processionalis (Jerdon, 1851)
Leptogenys pruinosa Forel, 1900
Odontomachus simillimus Smith F., 1858
Pachycondyla luteipes (Mayr, 1862)
Pachycondyla tesseronoda (Emery, 1877)