6.
PRESENT STATUS OF THE TERMITE FAUNA OF SRI LANKA

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ABSTRACT

Termites have been recognized as an important group of soil inhabiting insects due to their role as soil engineers in improving soil structure and decomposing plant matter and thereby enriching the soil. The past studies have mainly concentrated on termite control due to their role as pests of timber. The important role that termites play in forest ecosystems has not been addressed largely due to the difficulty in identification of termites on account of being a primitive group of insects. Recent studies have addressed the termites of the plantations and natural forests. However, information on their biology and ecology are lacking. According to current records 64 species of termites in 27 genera and four families; Hodotermitidae, Kalotermitidae, Rhinotermitidae and Termitidae have been documented from Sri Lanka. The objective of this investigation is to review the present status of termite research in Sri Lanka and to identify gaps in research and make recommendations for future research.

INTRODUCTION

Termites are considered as an important group of soil inhabiting insects that have adapted to the soil environment through specific nesting and feeding habits. They are important in creation of habitats, enrichment of soil and as a source of food for number of predators. Their role as decomposers of plant matter and timber maintain and support the carbon and nitrogen balance in ecosystems. The biomass of this breakdown process is recycled and added to the soil as humus. The termites that are wood-cellulose feeders are classified as dry-wood, damp-wood, live-wood or subterranean termites. The latter three groups live or maintain some connection with the soils at least through tunnels in wood or through shelter tubes they construct. A typical termite colony consists of nymphs (semi-mature young), workers, soldiers, and reproductive individuals of both genders and an egg-laying queen (Pearce, 1997).

Termites have been in existence since Cretaceous period and were classified under the order Isoptera. However, recent DNA evidence has confirmed that termites are most closely related to cockroaches. Establishment of the above finding was supported through the discovery of the transitional species; the termite like cockroaches (of the genus Cryptocerus) and cockroach like termites of the genus Mastotermes. Accordingly, taxonomic position of termites has been reviewed and proposed to classify them under the order Blattodea and suborder Termitoidae (Inward *et.al.* 2007), *http://en.wikipedia.org/wiki/Termite#Taxonomy* (accessed 4 March 2013). Termite fauna of the world is estimated to be around 2,864 species in 195 genera (including 60 fossil species) and 7 families. All the known families had been in existence since the late Mesozoic.

The seven Families and 14 sub families of termites recorded from Sri Lanka are: Mastotermitidae, Kalotermitidae, Termopsidae (Sub families: Termopsinae, Porotermitinae, Stolotermitinae), Hodotermitidae, Rhinotermitidae (Sub families: Coptotermitinae, Heterotermitinae, Psammotermitinae, Termitogetoninae, Stylotermitinae, Rhinotermitinae, Prorhinotermitinae), Serritermitidae, Termitidae (Sub families: Macrotermitinae, Apicotermitinae, Termitinae, Naustitermitinae). The termites of the first six families are considered as lower termites due to their cellulose digesting mechanism involving symbiotic gut protozoan flagellates. Termites of the Family Termitidae use bacteria present in their gut for digesting cellulose. Therefore, they are considered as higher termites (Pierce, 1997).

PRESENT STATUS OF TERMITES ASSOCIATED WITH SOILS IN SRI LANKA

According to the annotated checklist of termites, a total of 64 species of termites in 27 genera and four families; Hodotermitidae, Kalotermitidae, Rhinotermitidae and Termitidae have been recorded from Sri Lanka dating back to 1893 (Hemachandra *et. al.*, 2012). Termite research has not received much attention in the past except for the few studies conducted by the plantation industry research institutions and universities on termites of plantations and the forestry sector respectively. Furthermore, there is no published information on termite species associated with buildings and structural timber, even though it is considered as one of the significant area to be investigated. The present paper reviews and updates the information on the present status of termites in Sri Lanka.

TERMITES RECORDED FROM FORESTS AND GRASSLANDS

There are records on the distribution of termites in natural and secondary forests in the central hills of Sri Lanka (Hemachandra *et.al.*, 2010). Their study conducted in natural and a secondary forest located at two different elevations in the Hantane hills, has revealed the presence of six species of temites; *Ceylonitermellus hantanae* (Holmgren), *Dicuspiditermes incola* (Wasmann), *Odontotermes horni* (Wasmann), *Odontotermes globicola*, (Wasmann), *Odontotermes ceylonicus* (Wasmann) *and Nasutitermes fletcheri* (Holmgren & Holmgren). Of them, only *C. hantanae* (Holmgren) and D. *incola* (Wasmann) had been recorded from natural forests (Hemachandra *et.al.* 2010).

A similar study on termite fauna in Mahogany plantations in the Gannoruwa hills of the Central Province of Sri Lanka (Hemachandra *et al.*, 2011) recorded a total of ten termite species in five genera of the family Termitidae namely, *Bulbitermes* sp.1, *Ceylonitermellus hantanae*, *Dicuspiditermes incola*, *Nasutitermes* sp.1, *Odontotermes bellahunisensis, O. globicola, O. guptai, O. hainanensis, Odontotermes* sp. 6 and *Odontotermes* sp. 5. The Genus *Odontotermes* has the largest representation. Mahogany plantation had yielded a lesser number of species (10), degraded forest the highest (13), and followed by the least disturbed forest (12) (Hemachandra *et al.*, 2011).

Surveys in three montane forest types in the Knuckles region; Upper montane (UMF), Dry lower montane (LMF) and wet lower montane (LMF) conducted by Edirisinghe *et. al.*, (2012) documented 26 species of termites in three Families and 10 Genera. Of them, 25 species had been documented from the wet and dry LMF and none from UMF transects. Wet LMF transects are reported to have a higher relative abundance (78%) but low species richness (40%) of soil and soil wood interface feeders. In dry LMF transects both species richness (82%) and abundance (88%) of fungus growing wood feeders were higher (Edirisinghe *et.al*, 2012).

Termites of the Lower Hantane Forest have been reported by Ekanayake and Karunaratne, (2011) comprising a total of 14 species (*Coptotermes gaurii, Nasutitermes ceylonicus, N. fletcheri, N. kali, Nasutitermes* sp. 1, *Hypotermes obscuriceps, H. xenotermitis, Odontotermes globicola, O. horni, O. obesus, Odontotermes* sp. 1, *Odontotermes* sp. 2, *Odontotermes* sp. 3 and *Dicuspiditermes incola*) belonging to five genera, four subfamilies and two families. Further, it has been reported that the termite diversity decreased with increasing altitude, temperature and humidity but the relationships were not found to be significant.

TERMITES RECORDED FROM PLANTATION CROPS

Termites have been recorded as major pests in certain plantation crops causing economic losses. Kumarasinghe (2008) provides research findings from this sector.

(a) Termites of Coconut plantations

Infestations to coconut cultivations by termites have been recorded from all coconut growing areas of the country. Termites are reported to live either within the root zone of the plant or nearby mud galleries. A high abundance of termites has been recorded from clay soils, where *Odontotermes obesus, Odontotermes redimani, Odontotermes horni* and *Naustitermes ceylonicus* of the family Termitidae has been identified as pests of Coconut. The two species *Odontotermes obesus* and *Odontotermes redimani* in particular are reported to infest young plants in nurseries and cultivations.

(b) Termites of Tea plantations

Much information is available on termites of tea plantations. Damage to tea plantations in Sri Lanka by termites was first reported in 1904 with the description of *Postelectrotermes militaris* found in plantations at higher elevations. Two other species namely *Neotermes greeni* (1908) and *Glyptotermes dilatatus* (1909) have been recorded from plantations in medium and low altitudes areas respectively. Their biology and control have been studied by Dantanarayana and Fernando (1970). A summary of the findings during the above period is included as a chapter in the book titled "Monograph of insect and mite pests of tea" by Cranham (1966). The first detailed report on 59 species of tea infesting termites was by W.A. Sands (1975) who visited Sri Lanka in 1973 on an invitation from the Tea Research Institute. These species belong to the four families; Kalotermitidae, Hodotermitidae, Rhinotermitidae and Termitidae and they are listed in Table 1. The termite distribution is reported to vary with topography. *Postelectrotermes militaris* has been recorded from elevations above 900 m, mostly from Maskeliya, Dimbula and Dickoya districts and have been termed up-country live-wood termites. Two other species, *Neotermes greeni* and *Glyptotermes dilatatus* are reported to be confined to lower elevations below 900m and have been termed low-country live-wood termites.

(c) Termites of Sugarcane plantations

Damage to sugarcane plantations by termites have been documented by several researchers. Damage due to termites has been recorded from rain fed sugarcane plantations in all the sugarcane growing areas of the country. Severe damage to seed sets of sugarcane preventing germination is reported as termites damage to seed sets after planting. Fernando (1977) reports six termite species attacking sugarcane in Sri Lanka. They belong to the family Termitidae; *Odontotermes redimanni, Odontotermes ceylonicus, Odontotermes horni, Coptotermes ceylonicus, Heterotermes ceylonicus* and *Naustitermes ceylonicus*. Kumarasinghe (2003) has confirmed the presence of the first three species in Pelwatte, Sevanagala and Uda Walawe rainfed plantations. A higher infestation of termites at higher elevations during prolong drought periods have been reported (Kumarasinghe, 1988; Kumarasinghe and Ranasinghe, 1986, 1988).

GAPS IN KNOWLEDGE ON TERMITE FAUNA OF SRI LANKA

The lack of information on species composition and distribution of termites in the rest of the country especially in the forest coverage is a major setback. Therefore the identity, distribution and ecology of termite species in the island's forest coverage should be considered as an important step in this regard. The involvement of the National Museum, research organizations, University departments and environmental organizations with necessary direction and support by the Biodiversity Secretariat is vital to fill important gaps in knowledge of the termite fauna in Sri Lanka. Termites of buildings and structures are another neglected area. Steps should be taken to strengthen the identification of this taxonomically difficult group of primitive insects of much importance as beneficial organisms and pests. Molecular techniques would make identification more accurate and easier which should be then followed by studies on their biology, distribution and ecology. Such studies are essential for immediate protection measures to avoid destructions of timber used in the construction industry and the conservation of forest termites that enrich the forest soils and facilitate decomposition of dead plant matter. Necessary attention should be paid to prioritize these two important areas relating to termites.

RECOMMENDATIONS

Having identified the gaps in termite research, the following recommendations are made for the progress of termite studies in Sri Lanka.

1. Preparation of an action plan with necessary funding for identification and compilation of the termite fauna of Sri Lanka
2. Establishment of reference collections of termites at National level
3. Establishment of a working group on termites to promote national and international collaborative research
4. Providing necessary training for researchers in identification of termites

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Table 1. Termite of Sri Lanka

Family	Species
Kallotermitidae	*Postelectrotermes militaris* (Desneux) 1904 *Neotermes greeni* (Desneux) 1908 *Neotermes kemneri* Roonwal & Sen Sarma 1960 *Kalotermes jepsoni* Kemner 1932 *Glyptotermes ceylonicus* (Holmgren) 1911 *Glyptotermes dilatatus* (Bugnion & Popoff) 1910 *Glyptotermes minutus* (Kemner) 1932 *Bifiditermes pintoi* (Kemner) 1932 *Cryptotermes dudleyi* Banks 1918 *Cryptotermes havilandy* (Sjostedt) 1900 *Cryptotermes perforans* Kemner 1932 *Cryptotermes domesticus* (Haviland) 1898
Hodotermitidae	*Anacanthotermes rugifrons* Mathur & Sen Sarma 1958
Allotermitidae	Sub Family: Coptotermitinae *Coptotermes ceylonicus* Holmgren 1911 *Coptotermes emersoni* Ahmad 1953 *Coptotermes gauri* Roonwal & Krishna 1955 Sub Family: Heterotermitinae *Heterotermes ceylonicus* (Holmgren) 1911 Sub Family: Termitogetoninae *Termitogeton umbilicatus* (Hagen) 1858 Sub Family: Rhinotermitinae *Prorhinotermes flavus* (Bugnion & Popoff) 1910
Termitidae	Sub Family: Macrotermitinae *Macrotermes estheri* (Desneux) 1908 *Odontotermes ceylonicus* (Wasman) 1902 *Odontotermes brunneus* (Hagen) 1858 *Odontotermes escherichi* (Holmgren) 1911 *Odontotermes feae* (Wasmann) 1896 *Odontotermes horni* (Wasmann) 1902 *Odontotermes hutsoni* Kemner 1926 *Odontotermes minor* Kemner 1926 *Odontotermes koenigi* (Desneux) 1906 Odontotermes preliminaries (Holmgren) 1911

Family	Species
	Odontotermes redemanni (Wasmann) 1893 *Odontotermes taprobanes* (Walker) 1853 *Hypotermes obscuriceps* (Wasmann) 1902 *Microtermes obesi* Holmgren (1913) *Microtermes macronotus* Holmgren 1913 Sub Family: Apicotermitinae *Eurytrmes ceylonicus* Holmgren 1913 *Speculitermes cyclops* Wasmann 1902 *Speculitermes sinhalensis* Roonwal & Sen Sarma 1960 Sub Family: Termitinae *Synhamitermes ceylonicus* (Holmgren) 1911 *Synhamitermes colombensis* Roonwal & Sen Sarma *Microcerotermes bugnioni* Holmgren 1911 *Microcerotermes cylindriceps* Wasmann 1902 *Microcerotermes greeni* Holmgren 1902 *Microcerotermes heimi* Wasmann 1902 *Microcerotermes heimi minor* Holmgren 1913 *Termes lighti* Snyder & Emerson 1949 *Dicuspiditermes hutsoni* (Kemner) 1926 *Dicuspiditermes incola* (Wasmann) 1893 *Pericapritermes ceylonicus* (Holmgren) 1911 Sub Family: Nasutitermitinae *Ceylonitermes escherichii* (Holmgren) 1911 *Hospitalitermes monoceros* (Koenig) 1779 *Nasutitermes ceylonicus* (Holmgren) 1911 *Nasutitermes horni* (Wasmann) 1902 *Nasutitermes lacustris* (Bugnion) 1912 *Nasutitermes oculatus* (Holmgren) 1911 *Trinervitermes biformis* (Wasmann) 1902 *Trinervitermes rubidus* (Hagen) 1859 *Ceylonitermellus hantanae* (Holmgren) 1911 *Ceylonitermellus kotuae* (Bugnion) 1914 *Bulbitermes singaporiensis* (Haviland) 1898

(Source: Unpublished Country visit report by W.A. Sands, 1975)