



CHECKLIST AND PEST STATUS OF TERMITES (ORDER ISOPTERA): KERALA

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ABSTRACT: Termite fauna of Kerala has never been studied in its entirety despite of contributions by many scientists since Wasmann in 1896. The present paper provides a preliminary checklist and pest status of the termites of Kerala based on published records. 58 species of termites are now recorded in Kerala. They belong to three family (Kalotermitidae, Rhinotermitidae Termitidae), six subfamily (Coptotermitinae, Heterotermitinae, Apicotermitinae, Macrotermitinae, Nasutitermitinae, Termitinae) and 28 genera. Of the 58 termites identified from the state 11 (18.9%) including two genus are endemic. 27 are minor pest and 10 are major pests. *Cryptotermes domesticus*, *Macrotermes convulsionarius* and *Coptotermes heimi* are causing severe damage to the wood works in buildings. *Cryptotermes roonwali*, *Coptotermes ceylonicus*, *Coptotermes kishori*, *Heterotermes malabaricus*, *Odontotermes feae*, *Odontotermes obesus*, *Odontotermes redemanni* are causing severe damage to the forest and the cultivated crops. The number of termites identified from Kerala is less compared to the diversity of other insects due to the lack of serious study in this field. Serious efforts may lead to the identification of many new termites from this region.

Key Words: Termite, Kerala, Pest, endemism

INTRODUCTION

Kerala situated in the southern part of the Western Ghats in India. Western Ghats is a major centre of endemism and hotspot. The varied ecosystem of this region serves as natural habitats for innumerable number of species. The indigenous flora of the state is represented by 14435 plant species including 4575 species of angiosperm [1]. The indigenous fauna is represented by 8452 animal species which includes 6000 insect species. Kerala also records high endemism. The highest endemics is found among the amphibians (78%) followed by reptiles (62%), fish (53%), mammals (12%) and birds (4%) [2]. Insects are the most diverse organism in this region and most of them are not studied properly. Order Isoptera is one such group. The aim of this paper is to present a preliminary check list and pest status of the Kerala based on review of literature.

The early studies of termites from Kerala are those of Thakur Sen Sarma, 1981[3] Wasmann, 1896, 1902 [4, 5] Snyder, 1934 [6] Holmgren, 1912c, 1917 [7,8] Mathur and Sen-Sarma, 1959, 1960 [9,10] Mathur and Thapa, 1961, 1962 [11,12] Roonwal and Chhotani,1959[13] Prashad and Sen-Sarma, 1959[14] Bose, 1975, 1984[15, 16] Chhotani,1997[17] Thakur 1976, 1976, 1978 [18,19,20] Verma, 1983, 1984, 1985[21,22,23] Chhotani and Ferry, 1995[24] wang et al., 1998[25] Roonwal and Rathore, 2009 [26] Rashmi et al 2013[27]. Indian sub-region comprising India, Pakistan, Nepal, Bhutan, Bangladesh, Burma and Sri Lanka, 337 species of termites in 59 genera have been listed and comprehensively described by Roonwal and Chhotani, 1989 [28] and Chhotani,1997[17], Bose 1984[16] and reported 95 species of termites in five families and their distribution in Southern India. In India about 92 species have been reported to damage agricultural crops and timber in buildings. Most are soil inhabiting, either as mound builders or as sub-terranean nest builders.

Economically, termites are well known to cause enormous damage to woodworks in building, agricultural and forest crops, timber in storage and in use, books, records and other stored products of cellulosic origin [27]. The total loss thus caused in India alone runs into several millions of rupees per year, and the world loss must be something colossal. Roonwal and Chhotani, 1967 [29] reported 58 species of termites as major wood destroyers. Sen-Sarma *et al.*, 1975[30] in surveying all of India collected 64 species of wood destroying termites, 11 of those being major wood destroying termites. Roonwal, 1979 [31] listed 72 species of wood destroying termites from South East Asia. An overall perusal review revealed that until today, 92 species of wood destroying termites were reported from India.

STUDY AREA

Kerala is situated between 8°18' and 12°48' N latitude and 74°52' and 77°22' E. longitude. The area is characterized by humid tropical climate with a mean annual rainfall 2800 mm, temperature ranging from 19.8 °C to 36.7 °C. The State has a total area of 38,864 km². Out of the 1600 km of the Western Ghats, over 500 km falls in Kerala and this region constitutes over 42 percent of the entire Ghat region, covering nearly 56 percent of the geographic area of the state. Physiographically, Kerala is divisible into three distinct regions called highlands occupying altitudes greater

than 75 meter above Mean Sea Level (MSL) and reaching a peak height of 2694metres, the midlands with foothills and plains within an altitudinal range of 7.5-75 m above MSL and a narrow stretch of lowlands covering the coastal belt and falling within the altitudinal range of 0-7.5 m above MSL. Kerala has a vast network of 44 rivers, two distinct rainfall seasons (south west and north east monsoons) and 32 soil sub-types creating diverse ecosystems. The major habitats of Kerala include tropical rainforests, shola rolling grasslands, scrub jungles, grass lands, wetlands, estuaries, mangroves, coral reefs, marine and agro ecosystems.

METHODOLOGY

The check list is based on the reviews of the published literature including several recent world catalogues of termites and recent books. The check list is presented in a taxonomic order, Family, Sub-family, Genus and species. The classification of Isoptera follows, Krishna et al 2013 [32]. For each species presented in the list, information is presented in the following sequence: name of the family, Name of the genus, name of the species and Pest Status.

Table-1: Termite pest reported from the study area

Si No.	Genus	Number of Miner pest	Number of Major pest	Pest status not reported
1	<i>Cryptotermes</i>		2	
2	<i>Glyptotermes</i>	1		
3	<i>Neotermes</i>	3		
4	<i>Postelectroterme</i>			2
5	<i>Coptotermes</i>		3	
6	<i>Heterotermes</i>		1	
7	<i>Eurytermes</i>	1		
8	<i>Speculitermes</i>			2
9	<i>Macrotermes</i>		1	
10	<i>Odontotermes</i>	10	3	3
11	<i>Microtermes</i>	1		
12	<i>Ampoulitermes</i>			1
13	<i>Ceylonitermes</i>	1		
14	<i>Emersonitermes</i>			1
15	<i>Hospitalitermes</i>			1
16	<i>Nasutitermes</i>	3		
17	<i>Trinervitermes</i>	1		
18	<i>Angulitermes</i>			1
19	<i>Dicuspiditermes</i>			3
20	<i>Homallotermes</i>			1
22	<i>Indocapritermes</i>			1
23	<i>Krishnacapriterm</i>			1
24	<i>Labiocapritermes</i>			1
25	<i>Microcerotermes</i>	5		
26	<i>Procapritermes</i>			2
27	<i>Pseudocapriter</i>			1
28	<i>Synhamitermes</i>	1		
Total		27	10	21

Table 2: Number of termite genus and species reported from Kerala

Family	Number of Subfamily	Number of genus	Number of Species
Kalotermitidae	---	4	8
Rhinotermitidae	2	2	4
Termitidae	4	22	46
Total	6	28	58

Checklist of termites: Kerala

Si. No.	Species	Pest Status
	Family: Kalotermitidae Froggatt	
	Genus: <i>Cryptotermes</i> Banks	
1	<i>C. domesticus</i> (Haviland)	Major: Wood works in buildings
2	<i>C. roonwali</i> Chhotani	Major: Many Trees
	Genus: <i>Glyptotermes</i> Froggatt	
3	<i>G. coorgensis</i> (Holmgren & Holmgren)	Minor: Many Trees
	Genus: <i>Neotermes</i> Holmgren	
4	<i>N. fletcheri</i> (Holmgren & Holmgren)	Minor: Many Trees
5	<i>N. keralai</i> Roonwal and Verma	Minor: Many Trees
6	<i>N. nilamburensis</i> Thakur	Minor: Many Trees
	Genus: <i>Postelectrotermes</i> Krishna	
7	<i>P. bhimi</i> Roonwal & Maiti	Not reported
8	<i>P. nayari</i> Roonwal & Verma	Not reported
	Family: Rhinotermitidae Froggatt	
	Subfamily: Coptotermitinae Holmgren	
	Genus: <i>Coptotermes</i> Wasmann	
9	<i>C. ceylonicus</i> Holmgren	Major: Many Trees
10	<i>C. heimi</i> (Wasmann)	Major: Many Trees, Wood works
11	<i>C. kishori</i> Roonwal and Chhotani	Major: Many Trees
	Subfamily: Heterotermitinae Froggatt	
	Genus: <i>Heterotermes</i> Froggatt	
12	<i>H. malabaricus</i> Snyder	Major: Many Trees
	Family: Termitidae Latreille	
	Subfamily: Apicotermatinae Grassé & Noirot	
	Genus: <i>Eurytermes</i> Wasmann	
13	<i>E. topslipensis</i> (Chatterjee & Thapa)	Miner: Eucalyptus

Genus: *Speculitermes* Wasmann

- 14 *S. emersoni* Bose Not reported
 15 *S. sinhalensis* Roonwal & Sen-Sarma Not reported

Subfamily: Macrotermitinae Kemner

Genus: *Macrotermes* Holmgren

- 16 *M. convulsionarius* (Konig) Major: Wood works in buildings

Genus: *Odontotermes* Holmgren

- 17 *O. anamallensis* Holmgren & Holmgren, Miner: Wood works in buildings
 18 *O. assmuthi* Holmgren Minor: Many Trees
 19 *O. bellahunisensis* Holmgren and Holmgren Minor: Many Trees
 20 *O. brunneus* (Hagen) Minor: Many Trees
 21 *O. ceylonicus* (Wasmann) Miner: Ficus
 22 *O. escherichi* (Holmgren) Miner: Millet
 23 *O. feae* (Wasmann) Major: Many Trees
 24 *O. globicola* (Wasmann) Not reported
 25 *O. guptai* Roonwal & Bose Minor: Many Trees
 26 *O. horni* (Wasmann) Minor: Many Trees
 27 *O. malabaricus* Holmgren & Holmgren Not reported
 28 *O. microdentatus* Roonwal & Sen-Sarma Minor: Many Trees
 29 *O. obesus* (Rambur) Major: Many Trees
 30 *O. redemanni* (Wasmann) Major: Many Trees
 31 *O. vaishno* Bose Not reported
 32 *O. wallonensis* (Wasmann) Minor: Many Trees

Genus: *Microtermes* Wasmann

- 33 *M. obesi* Holmgren Minor: Many Trees

Subfamily: Nasutitermitinae Hare

- Genus: *Ampoulitermes* Mathur & Thapa
- 34 *A. wynaadensis* Mathur & Thapa Not reported
- Genus: *Ceylonitermes* Holmgren
- 35 *C. indicola* Thakur Miner: Bamboo
- Genus: *Emersonitermes* Mathur and Sen-Sarma
- 36 *E. thekadensis* Mathur & Sen-Sarma Not reported
- Genus: *Hospitalitermes* Holmgren
- 37 *H. monoceros* (Konig) Not reported
- Genus: *Nasutitermes* Dudley
- 38 *N. anamalaiensis* Snyder Miner: Albizia
- 39 *N. brunneus* Snyder Minor: Many Trees
- 40 *N. indicola* (Holmgren & Holmgren) Miner: Stump of *Vateria indica*
- Genus: *Trinervitermes* Holmgren
- 41 *T. biformis* (Wasmann) Minor: Many Trees
- Subfamily: Termitinae Latreille
- Genus: *Angulitermes* Sjostedt
- 42 *A. keralai* Verma Not reported
- Genus: *Dicuspiditermes* Krishna
- 43 *D. achankovili* Verma Not reported
- 44 *D. incola* (Wasmann) Not reported
- 45 *D. sisiri* Chhotani Not reported
- Genus: *Homalotermes* John
- 46 *H. pilosus* (Mathur & Thapa) Not reported
- Genus: *Indocapritermes* Chhotani
- 47 *I. aruni* Chhotani Not reported
- Genus: *Krishnacapritermes* Chhotani

48	<i>K. thakuri</i> Chhotani	Not reported
	Genus: <i>Labiocapritermes</i> Krishna	
49	<i>L. distortus</i> (Silvestri)	Not reported
	Genus: <i>Microcerotermes</i> Silvestri	
50	<i>M. beelsoni</i> Snyder Miner:	Root of many trees
51	<i>M. cameroni</i> Snyder	Minor: Many Trees
52	<i>M. fletcheri</i> Holmgren & Holmgren	Minor: Many Trees
53	<i>M. heimi</i> Wasmann	Miner: Dried roots of bamboo
54	<i>M. pakistanicus</i> Akhtar	Miner: Cashew, Tea
	Genus: <i>Procapritermes</i> Holmgren	
55	<i>P. dakshinae</i> (Chhotani & Ferry)	Not reported
56	<i>P. keralai</i> (Chhotani & Ferry)	Not reported
	Genus: <i>Pseudocapritermes</i> Kemner	
57	<i>P. fletcheri</i> (Holmgren & Holmgren)	Not reported
	Genus: <i>Synhamitermes</i> Holmgren	
58	<i>S. quadriceps</i> (Wasmann)	Minor: Many Trees

DISCUSSION

Total of 58 species of termites belongs to 28 genera, are now recorded from Kerala. They belong to three families: Kalotermitidae Froggatt, Rhinotermitidae Froggatt and Termitidae Latreille and 6 subfamilies such as Coptotermitinae Holmgren, Heterotermitinae Froggatt, Apicotermitinae Grassé and Noirot, Macrotermitinae Kemner, Nasutitermitinae Hare, Termitinae Latreille (Table-2). Termitidae is the most diverse family with 22 genera and 46 species. Four genera with 8 species are reported from the family Kalotermitidae. Two genera with four species are reported from the family Rhinotermitidae.

Ampoulitermes Mathur & Thapa, and *Indocapritermes* Chhotani are the two endemic genera reported from this region. 11 endemic species are also reported from this region such as *Neotermes keralai* Roonwal & Verma, *Neotermes nilamburensis* Thakur, *Postelectrotermes bhimi* Roonwal and Maiti, *Postelectrotermes nayari* Roonwal & Verma, *Ampoulitermes wynaadensis* Mathur & Thapa, *Angulitermes keralai* Verma, *Dicuspitermes sisiri* Chhotani, *Indocapritermes aruni* Chhotani, *Krishnacapritermes thakuri* Chhotani, *Procapritermes dakshinae* Chhotani & Ferry, *Procapritermes keralai* Chhotani & Ferry. This high endemism may be resulting from the presence of the Western Ghats, which shows a high degree of endemism [33]. Of the 58 termites identified from the state 27 are minor pests and 10 are major pests (Table-1). In the family Kalotermitidae 75% of the members are pests of which *Cryptotermes domesticus* and *Cryptotermes roonwali* (25%) are major pests [28, 29, 34, 35]. All the members of the family Rhinotermitidae, *Coptotermes ceylonicus*, *Coptotermes heimi*, *Coptotermes kishori* and *Heterotermes malabaricus* are major pests to many trees and wooden structures [26, 27, 36, 37]. In the family Termitidae 59% of

the members are pest, of which *Macrotermes convulsionarius*, *Odontotermes feae*, *Odontotermes obesus* and *Odontotermes redemanni* (8%) are major pest [26, 27, 28, 29]. *Cryptotermes domesticus*, *Macrotermes convulsionarius* and *Coptotermes heimi* cause severe damage to the wood works in the buildings. *Cryptotermes roonwali*, *Coptotermes ceylonicus*, *Coptotermes kishori*, *Heterotermes malabaricus*, *Odontotermes feae*, *Odontotermes obesus*, *Odontotermes redemanni* are the most important pest of many trees and agriculture [34, 35]. These termites cause enormous loss to agricultural production and forest in Kerala, are found all over the state, and attack a large variety of crops which include sugarcane, paddy, rubber, coconut, tea, coffee, cashew nut and several vegetables and fruit crops. This study showed that Kerala is a region of rich termite diversity and endemism. Species richness and endemism is contributed by the Western Ghats, which cover about half of this state. We can expect many more endemic genes and species from this region because of the peculiar environment and geographical position of this region. This review may be helpful for the further research in this area.

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