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Termite Diversity and its Extent of Crop Damage in Vayalogam Soil Series of Tamil Nadu, India

S. Suganya Kanna [a++*], K. Premalatha [b++], T. Senguttuvan [c#] and S.Suganya [d†]

[a] Department of Fruit Science, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam, India.
[b] Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore, India.
[c] ARS, Tamil Nadu Agricultural University, Kattuthottam, India.
[d] Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A survey was conducted to study the distribution of termites in Vayalogam soil series, red sandy loam soil in Tamil Nadu, India. Among the termites collected from eleven places in Pudukottai district, Tamil Nadu all under one genera and three species, the predominant species was *Odontotermus wallonensis* (Wasmann) which was noticed in seven locations followed by *O. assmuthi* in three locations and *O.obesus* in one location. Further, an abundance of *O. wallonensis* was high (64.64%) followed by *O. assmuthi* (27.27%.) and *O. obesus* (9.90%.). The termite, *O.*

[++]Associate Professor (Agrl. Entomology);
[#]Professor and Head;
[†]Associate Professor (SS&AC);
**Corresponding author: E-mail: suganyakannas@tnau.ac.in;*

wallonensis was recorded more in moundscompared to *O. assmuthi* and *O. obesus*, whereas in tree wood logs, three termite species were found. Among the avenue trees, pungam recorded less damage (7.25%) followed by jack trees (10.25%), Polyalthia (15.50%), tamarind (23.50%) and neem and eucalyptus (32.55 and 37.50%). In field crops termite damage was less in maize (5.75%), groundnut (10.25 %), and sugarcane (10.25%). The highest damage was recorded in jack fruit at seedling stage (46.50%) cultivated in Vayalogam soil series. The termite attack was not observed in field crops *viz*., pulses, castor, brinjal and chilli.
termite species

Keywords: Termites; diversity; red sandy loam soil; damage; termite species; Vayalogam soil; soil nitrogen.

1. INTRODUCTION

Termites are one of the most problematic pests and there are over 2800 described species of termites with approximately 185 considered pests [1]. They are abundant in tropical and subtropical environments. Termites economically important pests when they started to destroy the wood and wooden products of human homes, building materials, forests, agricultural crops and other commercial products [2]. The red loamy soil influences construction of termatorium and fungal comb construction by termites [3]. The Vayalogam soil series of Pudukottai district is a red sandy loam soil covering 1.69 lakh hectares. Sharma et al*.,* [4] reported that termite damage was minimum in clay and black soils, high in sandy loam soils and severe in red soils. The preliminary observations conducted at Agricultural College and Research Institute, Kudumiyanmalai showed that field and horticultural crops, tree crops v*iz.,* teak, neem, eucalyptus, mango, sapota etc. grown in red sandy loam soil were prone to termite attack. Soil pests have been reported as a major cause of yield losses in field crops [5]. The termite fauna of fifteen species belonging to two families and seven genera were found to attack wheat, cotton, castor, sugarcane and tree crops in and around the crop fields during seedling and maturing stages [6]. The termites by their foraging behavior enhance soil nitrogen content [7]. But, termites large colony size, nesting behavior, and feeding preferences, termites can cause considerable damage to artificial structures and commodities. Although termites are excellent decomposers of dead wood and other sources of cellulose, they become a serious problem when they attack standing trees, logs and crops. The termite damage may lead to 100 per cent damage [8] and estimated cost to control termites exceeds $20 billion annually worldwide [9]. Therefore the present study was to investigate various species of termites in Vayalogam soil series in Pudukottai district, Tamil Nadu and their infestation on different trees and annual crops.

2. MATERIALS AND METHODS

2.1 Collection and Identification of Termite Species

Survey was undertaken during June 2016 – December 2019 in Vayalogam soil series of Pudukottai district, Tamil Nadu (Red sandy loam soil) at Agricultural College and Research Institute Campus, Farm and villages of Pattipunjai, Usilankollai- Mangadu, Sathankudi-Alangudi, P. Paramannagar, Paramannagar, Mellapullanveeduthi, Kothamangalam, Anna Pannai, Kudumiyanmalai, Vyalogam, Visalur, Seranur and Agarapatti in Pudukottai district, Tamil Nadu. Termites were collected from diverse sources such as agricultural lands, litters, fallow lands and roadsides. Earthern mounds, roots and bark of trees cut branches and dead logs of 10 numbers were randomly examined for the presence of termites and if present, five replicated samples were collected. Aspirators, plastic containers (50 ml), and forceps were used for collection. Specimens thus collected were transferred to a plastic lid, which had a smooth surface to arrest the fast movement of termites. They were also again collected with fine forceps into glass vials of 3x1 cm containing 4 per cent formalin. Each vial was marked with details of the location, habitat and date of collection. Identification of the species was done by studying mandibular characters of soldier castes characters using keys/descriptions of Chhotani [10].

2.2 Study on Termite Infestation in Trees and Annual Crops

During the survey, termite damage on trees (Neem, jack, pungam, polyalthia, *Acacia* sp.teak)

and major crops (sugarcane, maize, pulses, brinjal, chilli, ground nut and paddy) was also assessed. The trees of 10 numbers, 2 m above ground level and crops by quadrat method (2 m X 2 m) were closely and carefully inspected for signs of termite activity, damages such as earthen sheet, runways and galleries on tree trunks, and damage to seedlings, stems, roots and pods of various crops were recorded and per cent presence was calculated using the formula [11], di = (ni X 100) lN, where, di = Percent presence, ni = No. of individuals of taxa, and, N = Total individuals**.** The data obtained from experiments were subjected to ANOVA (Analysis of variance). The data on percentage and population in numbers were transformed into arcsine and square root values, respectively before statistical analysis.

3. RESULTS AND DISCUSSION

3.1 Survey on Termite Species in Vayalogam Soil Series

The termites were collected from eleven different locations with Vayalogam soil series. The results revealed that, all of the termites were from the same genera and three species. The most common species found was *Odontotermus wallonensis* (Wasmann), which was found in seven locations. The second most common species was *O. assmuthi*, found in three locations, and the least common was *O. obesus*, found in only one location (Table 1 and Fig. 1). Murthy et al*.,* [12] reported that among 300 species of termites in India about 12 per cent of species (35 species) were known to damage agricultural crops. Two species, *O. obesus* and *M. obesi* account for almost 80% of total losses in South Asia. The incidence of termites was higher in red sandy loam soil compared to the other soils in Pudukottai district. The result was in accordance with the findings of Varshney [13], who found that termites are widely distributed in red, sandy loam, lateritic and red loam soils. Further, abundance of *O. wallonensis* was high (64.64%) followed by *O. assmuthi* (27.27%.) and *O. obesus* (9.90%.) (Fig. 2). Also, *O. wallonensis* was found to be more in mounds compared to *O. assmuthi* and *O. obesus*, whereas in the wood log all three termite species were found (Table 2 and Fig. 3). *O. wallonensis* was found economically important termite that constructs earthen mounds above the ground and forms subterranean galleries to feed on roots, logs and barks of the trees and grasses [14]. *O. obesus* were found to be the most damagingin thedeveloping and maturing stages of almost all crops [6,15,16].

3.2 Assessment of Termite Damage in Avenue Trees and Major Crops

Termite damage was not observed in pulses, brinjal, chilli, and castor from termites. Whereas, minimum damage was recorded in maize (5.75%) followed by pungam (7.25%), groundnut and jack trees (10.25%), sugarcane and polyalthia (15.50%) and tamarind (23.50%). Neem and eucalyptus had the highest termite damage, with 32.55 and 37.50 per cent, respectively (Table 3). But, Paul et al*.,* [17] observed that losses due to termite attack up to 25-30 per cent, 10-15 per cent and 5-17 per cent in cowpea, moth bean and moong, respectively. Similarly, the severe damage of termites in vegetables like brinjal, chillies, cabbage, capsicum was observed from seedling to harvest stage [18,19,17]. In groundnut and sugarcane, the regions with moderate rainfall and red sandy

Table 1. Diversity of termite species in Vyalogam soil series

S. No.	Place of Collection	Source of collection	Termite identified
1.	Agricultural College and Research Institute, Kudumiyanmalai	Mound	*Odontotermus wallonensis* (Wasmann)
2.	Pattipunjai	Wood log	*O. wallonenesis*
3.	Usilankollai, Mangadu	Mound	*O. wallonenesis*
4.	Pattipunjai	Mound	*O. wallonenesis*
5.	Sathankudi, Alangudi	Mound	*O. wallonenesis*
6.	P. Paramannagar	Woodlog	*O. obesus*
7.	Paramannagar	Woodlog	*O. assmuthi*
8.	Agricultural College and Research Institute, Kudumiyanmalai-Farm	Mound	*O. wallonenesis*
9.	Paramannagar	Mound	*O. assmuthi*
10.	Mellapullanveeduthi	Mound	*O. wallonenesis*
11.	Kothamangalam	Mound	*O. assmuthi*

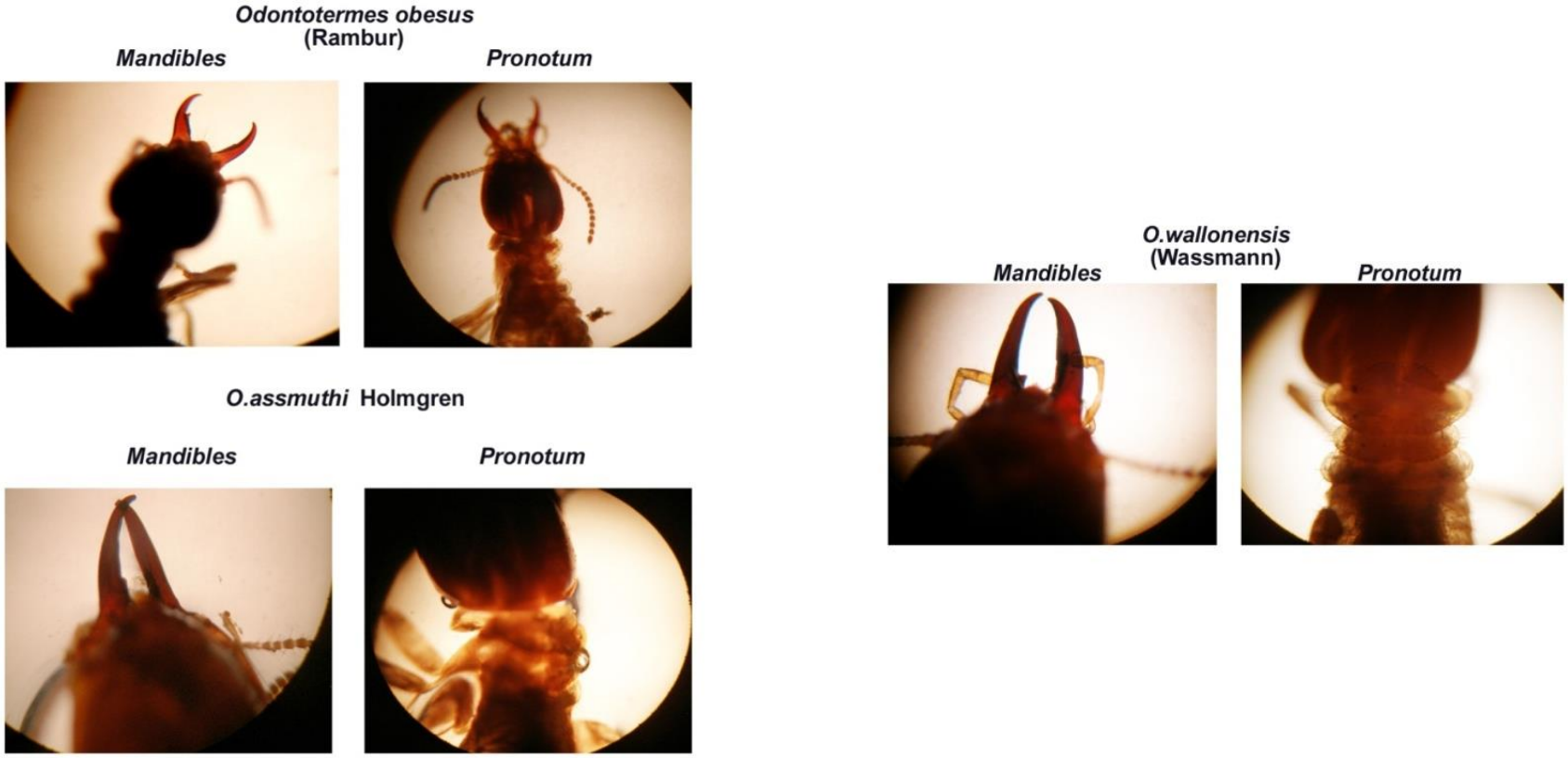

Fig. 1. Distribution of different species of termite in Vyalogam soil series

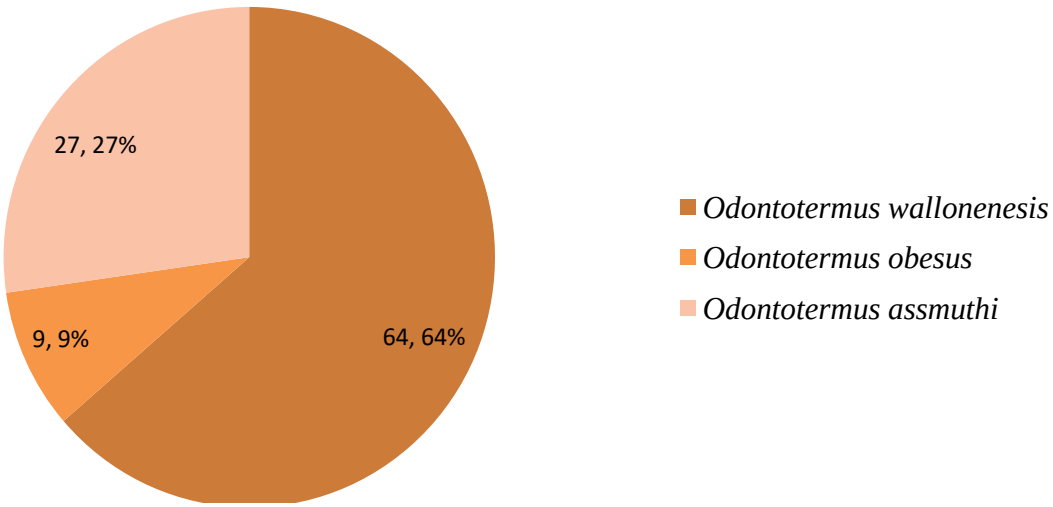

Fig. 2. Frequency distribution of three species recorded in Vyalogam soil series

Table 2. Occurrence of termite species in different microhabitats in Vyalogam soil series

Termite species	Microhabitats
Odontotermus obesus(Ramb.)	Leaf litters, tree bark, tree logs, fallen tree twigs and woods used for construction.
O. wallonensis	Mounds, crops and crop residues, tree barks and dry twigs
O. assmuthi	Mounds, crops and crop residues, dry cowdungs, tree barks and dry twigs

loam soil had higher termite attacks [17,20]. In tree species, termite attack was maximum due to poor maintenance and water stress. Mandal et al., [21] studied the damage potential of termites in different tree crops and reported 100% infestation. The highest damage was recorded in jack at seedling stage (46.50%) cultivated in Vayalogam soil series (red loamy soil) (Table 3). The water stress during the seedling stage leads to more termite damage in young seedlings [22].

Fig. 3. Occurrence of termite species in different microhabitats

Table 3. Assessment of termite damage on various stages in avenue trees and major crops in Vayalogam soil series

Crops	Stage	Damage (%)
Jack	Seedling	46.50 (42.99)h
	Tree	10.25 (18.67)c
Neem	Tree	32.55 (34.79)f
Eucalyptus	Tree	37.50 (37.76)f
Teak	Tree	15.75 (23.38)d
Pungam	Tree	7.25 (15.62)b
Tamarind	Tree	23.50 (23.18)e
Polyalthia	Tree	15.50 (28.99)d
Sugarcane	Seedling	15.50 (23.19)d
	Maturity	15.25 (22.98)d
Groundnut	Maturity	10.25 (18.67)c
Maize	Maturity	5.75 (13.87)a
Pulses	All	-
Castor	All	-
Brinjal	All	-
Chilli	All	-
SEd		0.243
CD (P=0.05)		0.503

Mean of ten replications
Figures in parentheses are arcsinetransformed values by DMRT (P=0.05)

4. CONCLUSION

The predominant termite species was *Odontotermus wallonensis* (Wasmann) red sandy loam soil The termite, damage was maximum in jack seedlings, pungam, Polyalthia, tamarind, neem and eucalyptus but in field crops it was less in maize, groundnut, and sugarcane.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Lewis VR. Alternative control strategies for termites. Journal of Agricultural Entomology. 1997;14:291-307.
2. Monica V, Satyawati S, Rajendra P. Biological alternatives for termite control: A review. International Biodeterioration and Biodegradation. 2009;63:959-972.
3. Tucker CL, Koehler PG, Oi FM. Influence of soil compaction on tunnel network construction by the eastern subterranean termite (Isoptera: Rhinotermitidae). Journal of Economic Entomology. 2004;97:89.
4. Sharma RK, Srinivasa Babu K, Chhokar RS, Sharma AK. Effect of tillage on termites, weed incidence and productivity of spring wheat in rice–wheat system of North Western Indian plains, Crop Protection. 2004;23(11):1049–1054.
5. Wightman JA, Dick K., Ranga-Ra, GV, Shanower TG, Gold CG. Pests of groundnut in the semi-arid tropics. In: Insect pests of tropical food legumes. John

Wiley and Sons, Chichester, England, UK. 1990;243–322.
6. Pardeshi MK, Kumar D, Bhattacharyya AK. Termite (Insecta: Isoptera) fauna of some agricultural crops of Vadodara, Gujarat. Zoological Survey of India. 2010;110:47-59.
7. Hemachandra J, Edirisinghe P, Karunaratne WAIP, Gunatilleke CVS. Distinctiveness of termite assemblages in two Fragmented Forest types in Hantane hills in the Kandy district of Sri Lanka. Ceylon. Journal of Science (Biological Sciences). 2010;39(1):11-19.
8. Rana Abhishek, Chandel RS, Verma KS, Joshi Manishkumar J. Termites in Important Crops and Their Management. Indian Journal Entomology. 2021;83(3): 486-504.
9. Su NY. Novel technologies for subterranean termite control. Sociobiology. 2002;40:95-101.
10. Chhotani OB. Fauna of India-Isoptera (Termites). Zoological Survey of India Publication, Calcutta. 1997;II:800.
11. Southwood TRE, Henderson PA. Ecological Methods. 3rd Rev. Ed., Blackwell Science Ltd., Oxford. 2000; 575.
12. Murthy S, Rajeshwari K, Ramya R, Jalali T, Verghese A. Genetic diversity among Indian termites based on mitochondrial12S rRNA gene. European Journal of Zoological Research. 2015;4:1-6.
13. Varshney AK. Household pests: Termites (The white ants)-Applied Entomology-Insecticidal methods of pest control, Zoology Department, Hindu College, Delhi. 2007;1-13.
14. Sushilkumar. Polyethism (division of labour) in sterile castes of the termite, *Odontotermeswallonensis* (Wasmann) (Isoptera: Macrotermitidae). Journal of Entomological Research. 1994;18(2):127-133
15. Mahapatro GK, Sreedevi K. Indigenous approaches for the management of termite and white grub in upland rice. Current Biotica. 2014;8(1):97-108.
16. Ranjith M, Nisha Pradeepa, Ramya R S. Inventorying Various Termite Species Attacking Agricultural Crops in Tamil Nadu, India. Madras Agric. J; 2023. Available:https://doi.org/10.29321/MAJ.10.200801.
17. Paul B, Khan A, Paul S, Shankarganesh K, Chakravorty S. Termites and Indian Agriculture. Termites and sustainable management, sustainability in plant and crop protection. Khan M, Ahmad W (eds). Springer International Publishing. 2018;51-96.
18. Yadav RS, Kumar D, Singh U, Singh DK. Insect-pests complex of cabbage in eastern Uttar Pradesh. - Vegetable Science. 2015;42(2):90-92.
19. Bugti GA, Ahmed M, Baber JK, Tareen JK, Rasool G, Tareen MH. Survey of insect pests and predators on chilli crop. International Journal of Life Sciences. 2014;8(1-4):3071-3074.
20. Umeh VC, Waliyar F, Traore S, Egwurube E. Soil pests of groundnut in West Africa Species diversity, damage and estimation of yield losses. Insect Science and its Application. 1999;19:131-140.
21. Mandal BK, Bashar K, Howlader AJ, Rahman KMZ. Incidence of termite infestation to tree species in Jahangirnagar University Campus, Bangladesh. Bangladesh Journal of Life Sciences. 2010;22(2):7-15.
22. Bong CFJ, King PJH, Ong KH, Mahadi NM. Termite assemblages in oil palm plantation in Sarawak, Malaysia. Journal of Entomology. 2012;9:68-78.

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