



## A review on diversity, distribution and mound patterns of termites (*Odontotermes*) in India

Chiranjeev Pandey\*, Majid Ali, Karuna Rawate, Sanjay Thiske, Gagan Singh Guru

Department of Zoology, Government Digvijay Autonomous Postgraduate College, Rajnandgaon, Chhattisgarh, India

Corresponding Author: Chiranjeev Pandey

DOI: <https://doi.org/10.66856/ijzs.2026.11.2.11055>

### Abstract

Termites are important ecosystem engineers that play a crucial role in soil formation, nutrient cycling and decomposition processes in tropical ecosystems. Among them, the genus *Odontotermes* (Family: Termitidae) is one of the most widely distributed and ecologically significant groups of fungus-growing termites in India. These termites construct conspicuous earthen mounds and maintain symbiotic relationships with fungi of the genus *Termitomyces*. The present review summarizes the diversity, geographical distribution and mound-building patterns of *Odontotermes* species in India. Approximately 18 species of *Odontotermes* have been reported from the Indian region, occurring in forests, grasslands and agricultural ecosystems. Their mound architecture varies depending on environmental conditions such as rainfall, soil type and vegetation. Mounds influence soil physicochemical properties and act as “islands of fertility” due to the accumulation of organic matter and nutrients. Understanding the diversity and mound patterns of *Odontotermes* is important for ecological research, soil management and biodiversity conservation. This review compiles available literature on *Odontotermes* termites in India and highlights future research priorities.

**Keywords:** *Odontotermes*, termite diversity, termite mound, India, soil ecology, fungus-growing termites

### Introduction

Termites are small to medium-sized eusocial insects that have attracted considerable attention due to their ecological, biological and economic importance. Many termite species live in subterranean habitats and construct epigeal nests or mounds above the soil surface that contain complex internal chambers. These mounds are composed of soil particles and organic material and often contain fungal gardens used by termites for digestion of plant-based food. Among the various termite genera, *Odontotermes* is widely distributed in tropical and subtropical regions, and *Odontotermes obesus* is one of the most common species found in South Asian countries including India, Bangladesh and Pakistan. Because of its feeding habits on plant materials and crops, this species is considered an important agricultural pest in several regions. [1] Termites are recognized as ecosystem engineers because of their strong influence on soil processes and ecosystem functioning. These insects contribute significantly to the total biomass of soil insects in tropical ecosystems and play a key role in decomposition and nutrient cycling. Globally, termites include more than 3000 species distributed across numerous families and genera, indicating their remarkable diversity. In India, termite diversity is dominated by the family Termitidae, which comprises a large proportion of the termite fauna and includes many species of ecological and economic significance. Despite this diversity, termite fauna in several regions of India remains insufficiently explored, highlighting the need for further studies on their taxonomy and distribution. [2] Termites are widely distributed in tropical and subtropical ecosystems and play an essential role as decomposers and soil engineers. They feed on a wide variety of organic materials including wood, leaf litter and other cellulose-rich substrates, thereby contributing

significantly to nutrient cycling and ecosystem functioning. Through their activities, termites modify soil structure and create tunnels and mounds that enhance soil aeration and porosity. Termite mounds are solid yet porous structures formed from soil particles and termite faeces, which help maintain a stable internal microclimate and provide habitats for microorganisms and other organisms associated with soil ecosystems. [3] Termites constitute an important component of soil macrofauna and are widely distributed across tropical and subtropical regions of the world. They represent one of the most successful groups of social insects due to their ecological adaptability and complex social organization. Globally, thousands of termite species have been described, many of which play significant ecological roles as decomposers, while others act as serious pests of agricultural crops, forestry plantations and wooden structures. In the Indian subcontinent, several species of the genus *Odontotermes*, including *O. obesus*, *O. brunneus* and *O. redemani*, are known as major pests affecting crops and forest resources. [4] They are widely distributed in tropical and subtropical regions where they act as important decomposers of organic matter and play a crucial role in nutrient cycling and soil formation (Sunitha & Miranda, 2011) [5]. Termites are among the most abundant soil-dwelling insects and are recognized as important ecosystem engineers due to their ability to modify soil structure and influence ecological processes. They contribute significantly to nutrient recycling by decomposing plant materials such as lignocellulose and other organic residues through the action of symbiotic microorganisms present in their digestive system. Their activities improve soil aeration, porosity, water infiltration and overall soil fertility, thereby playing a crucial role in maintaining ecosystem functioning. Despite their ecological importance, termites are also considered

serious agricultural pests in many regions where they damage crops, wooden structures and forest resources. [6] India possesses a rich diversity of termite fauna distributed across different ecological regions ranging from tropical forests to semi-arid landscapes. Studies indicate that more than 295 termite species have been recorded from India, representing several genera and families. Among these, the family Termitidae is the most dominant and species-rich group, contributing a major proportion of termite diversity in the country. In southern India alone, about 132 termite species belonging to five families have been documented, demonstrating the high diversity of termite fauna in this region. [7] Within the termite fauna, the genus *Odontotermes* Holmgren is one of the most widespread and ecologically significant groups. This genus occurs widely in the Ethiopian and Oriental regions and includes nearly 200 species worldwide, with a substantial number reported from the Indian subcontinent. In India, several species of *Odontotermes* are known to inhabit diverse habitats and play a significant role in decomposition processes and soil modification. However, many species of this genus are also known to cause considerable economic damage to crops, timber and wooden structures. [8] The diversity and distribution of termites vary significantly among different ecological regions depending on environmental factors such as vegetation, soil type, temperature and rainfall. For instance, biodiversity-rich areas such as the Western Ghats support a large number of termite species. Surveys conducted in this region have reported more than forty termite species belonging to several genera and subfamilies, indicating the ecological importance of this hotspot for termite diversity. Among these groups, the subfamily Macrotermitinae, which includes the genus *Odontotermes*, represents one of the most dominant termite groups in tropical ecosystems. [9] Regional studies have also revealed that the diversity and distribution of termites vary across different landscapes within India. For example, investigations conducted in northern India have documented multiple termite species belonging to different genera and families, highlighting the importance of ecological niches in shaping termite communities. Such studies emphasize the need for systematic documentation of termite fauna to better understand their ecological roles, distribution patterns and potential impact on agriculture and ecosystem functioning. [10]

#### **Diversity Distribution of *Odontotermes* in India**

The genus *Odontotermes* Holmgren is one of the most diverse and ecologically significant groups of termites in India. It belongs to the family Termitidae under the subfamily Macrotermitinae, which is known for fungus-growing termites that play an important role in decomposition processes and nutrient cycling in terrestrial ecosystems. Species of this genus are widely distributed across tropical and subtropical regions of India and are commonly associated with mound-building behavior and complex colony organization. [11]

India supports a rich diversity of termite fauna with approximately 300 species recorded across different ecological regions, including forests, agricultural lands, and urban ecosystems. Among these, several species belong to

the genus *Odontotermes*, which is particularly dominant in tropical environments due to their adaptability and ecological roles as decomposers of cellulose-rich organic matter. [12]

Regional surveys conducted in different parts of India have documented the occurrence of multiple *Odontotermes* species. For instance, studies carried out in Assam reported several species including *Odontotermes globicola*, *O. horni*, *O. obesus*, and *O. redemanni*. These species inhabit diverse habitats such as decaying wood, soil, and earthen mounds, indicating their ecological flexibility and adaptability to varied environmental conditions. Among them, *O. obesus* is often reported as the most abundant species and is commonly associated with mound construction in many ecosystems. [13]

Species of *Odontotermes* are also widely distributed in forest ecosystems across India where they influence soil properties and vegetation dynamics through their mound-building activities. For example, termite mounds constructed by *Odontotermes obesus* are common in moist deciduous forests of the Doon Valley in northern India. These mounds can significantly alter soil structure, nutrient availability, and micro-environmental conditions, thereby affecting plant growth and forest regeneration patterns. [14]

Apart from their ecological importance, several *Odontotermes* species exhibit complex nesting behavior and mound architecture. Studies on mound-building termites such as *O. obesus* and *O. wallonensis* have revealed variations in mound size, shape, and internal structure depending on environmental factors such as altitude, habitat type, and colony age. These mound structures often contain fungus gardens and specialized royal chambers that support colony development and survival. [15]

The genus *Odontotermes* is widely distributed across different ecological regions of India, including tropical forests, agricultural lands, grasslands, and urban ecosystems. India harbors a rich termite fauna with more than 300 species reported from the country, belonging to several genera and families. Among these, *Odontotermes* is one of the most dominant mound-building termite genera occurring throughout the Indian subcontinent. [16]

Species of *Odontotermes* have been reported from many states of India such as Karnataka, Assam, West Bengal, Haryana, and other regions where suitable climatic and ecological conditions support their colonies. Surveys conducted in the Kuvempu University campus and the adjacent Bhadra reservoir area in Karnataka recorded three mound-building species—*Odontotermes obesus*, *O. wallonensis*, and *O. redemanni*. Among these species, *O. obesus* was found to be the most abundant in the study area. [17]

Similarly, regional biodiversity surveys conducted in Durgapur Government College campus, West Bengal documented several species including *Odontotermes feae*, *O. horni*, *O. gurdaspurensis*, and *O. redemanni*. In that study, *O. redemanni* was recorded as the most abundant species and was observed in termite mounds, tree bark, and other habitats within the campus. [18]

Studies in northeastern India have also reported multiple species of *Odontotermes*, demonstrating the wide ecological distribution of this genus. For example, surveys conducted

in Assam identified species such as *O. globicola*, *O. horni*, *O. obesus*, and *O. redemanni* from different microhabitats including soil, decaying wood, termite mounds, and fallen logs. These findings indicate that species of *Odontotermes* can occupy a wide range of ecological niches.<sup>[19]</sup>

In northern India, molecular and morphological studies of termite fauna in southern Haryana identified several termite species belonging to different genera, including multiple species of *Odontotermes*. These studies highlighted the importance of combining morphological characters such as soldier mandible structure with molecular techniques like 16S rRNA gene sequencing to accurately identify termite species and understand their evolutionary relationships.<sup>[20]</sup>

The genus *Odontotermes* is one of the most widely distributed mound-building termite groups in India and plays an important ecological role in soil ecosystems. Species such as *Odontotermes obesus* have been reported from various regions of the country where they construct large earthen mounds and maintain fungus gardens inside their nests. These termites occur in different habitats including forest areas, agricultural fields, and plantation ecosystems, indicating their wide ecological adaptability in the Indian subcontinent (Rao *et al.*, 2013)<sup>[42]</sup>.

In tropical and subtropical ecosystems of India, species of the genus *Odontotermes* are commonly found in forest habitats where they function as important decomposers of organic matter. Studies conducted in southern Indian deciduous forests reported that *Odontotermes obesus*, *O. feae*, and *O. feoides* are dominant litter-feeding termites that contribute significantly to the decomposition of plant residues and nutrient cycling in soil. Their distribution is closely related to vegetation type, soil characteristics, and the availability of organic substrates such as leaves, wood, and animal dung (Cheik *et al.*, 2019)<sup>[41]</sup>.

The distribution of *Odontotermes* species across India is strongly influenced by climatic conditions, soil properties, and land-use patterns. These mound-building termites are commonly recorded from agricultural landscapes, grasslands, and forest ecosystems where environmental conditions support fungal cultivation and colony development. Their wide occurrence across tropical agro-ecosystems indicates their ecological significance as both decomposers and potential agricultural pests in the Indian subcontinent (Peshin *et al.*, 2022)<sup>[43]</sup>.

Early ecological and taxonomic studies on Indian termites indicate that *Odontotermes obesus* is one of the principal mound-building termite species widely distributed across the country. Roonwal reported that several mound-building species of *Odontotermes*, including *O. obesus*, *O. redemanni*, and *O. wallonensis*, occur throughout India except in extremely cold regions. This widespread occurrence demonstrates the ecological adaptability of the genus to different climatic and environmental conditions across the Indian subcontinent (Roonwal, 1960)<sup>[44]</sup>.

Research on termite ecology in Indian ecosystems has shown that *Odontotermes* species are widely distributed in tropical landscapes where environmental conditions favor fungal symbiosis and mound construction. Their colonies are typically associated with soils rich in organic matter and moderate moisture levels, which support fungal growth within termite nests. Because of these ecological

requirements, *Odontotermes* species are frequently recorded from forest ecosystems, agricultural lands, and grasslands across India (Cheik *et al.*, 2019)<sup>[41]</sup>.

The genus *Odontotermes* is widely distributed in different ecological habitats of India, particularly in tropical forest ecosystems. A study conducted in the Western Ghats of Karnataka reported several species of *Odontotermes*, including *O. obesus*, *O. feae*, *O. anamallensis*, *O. bellahunisensis*, and *O. assmuthi*, occurring across forest, pasture, and plantation ecosystems. Among these, *O. obesus* and *O. feae* were recorded as the most widely distributed species due to their ability to adapt to diverse ecological conditions and utilize various food resources such as wood, plant debris, and crop residues. This broad ecological adaptability allows *Odontotermes* species to occupy a wide range of habitats throughout India (Vidyashree *et al.*, 2018)<sup>[10]</sup>.

Research conducted in Shivamogga district of Karnataka revealed that several species of the genus *Odontotermes* are distributed across different ecological zones such as rainforest, semimalnad, and maidan habitats. Species such as *Odontotermes obesus*, *O. feae*, *O. anamallensis*, *O. bellahunisensis*, *O. adampurensis*, *O. boveni*, *O. horni*, and *O. yadevi* were recorded from these habitats, demonstrating the wide distribution of the genus across varying environmental conditions. The highest species diversity was observed in rainforest ecosystems, indicating that forest habitats provide favorable conditions for the survival and proliferation of *Odontotermes* species (Kalleshwaraswamy *et al.*, 2018)<sup>[10]</sup>.

In southern India, mound-building termites belonging to the genus *Odontotermes*, particularly *Odontotermes obesus*, are commonly found in forest landscapes where they construct prominent above-ground mounds. These termite mounds are typically cathedral-shaped structures that may reach heights of up to two meters. The species is widely distributed in dry deciduous forests such as those found in the Bandipur Tiger Reserve, where the colonies utilize soil from deeper layers (50–100 cm depth) for mound construction. The presence of these large mounds indicates the widespread occurrence and ecological dominance of *Odontotermes* species in southern Indian ecosystems (Harit & Jouquet, 2021)<sup>[47]</sup>.

Termite fauna of India includes several genera and species distributed across different ecological regions, particularly within tropical forest ecosystems. Taxonomic investigations conducted in the Western Ghats have revealed the occurrence of multiple termite species in the region, highlighting the high diversity of termite fauna in India. Field surveys in Kerala reported several soil-dwelling termite species inhabiting soil, logs, tree bark, and termite mounds. These habitats provide suitable nesting conditions and resources that support the distribution of fungus-growing termites, including members of the Macrotermitinae subfamily such as *Odontotermes* (Amina *et al.*, 2020)<sup>[48]</sup>.

In India, insect diversity studies conducted in central Indian landscapes such as Chhattisgarh indicate that forest ecosystems support a wide range of insect fauna due to favorable climatic conditions and vegetation diversity. These environments provide suitable habitats for soil-dwelling insects including termites that inhabit

decomposing wood, soil, and plant debris. Such forest ecosystems create ecological niches that support the distribution of termite genera including *Odontotermes*, which commonly occur in tropical forest regions where organic matter is abundant (Majumder *et al.*, 2014)<sup>[31]</sup>.

India possesses a rich diversity of termite fauna distributed across a wide range of ecological zones including forests, grasslands, agricultural fields and urban habitats. Approximately 337 species and subspecies of termites belonging to 59 genera and seven families have been reported from India. Among these, the genus *Odontotermes* represents one of the most dominant and widely distributed groups, comprising around 18 species. Members of this genus are commonly found in tropical and subtropical regions where they construct large soil mounds and play significant roles in decomposition and nutrient cycling. Their wide distribution is influenced by environmental factors such as climate, soil type, vegetation and seasonal variation (Premalatha *et al.*, 2025)<sup>[50]</sup>.

Termites belonging to the genus *Odontotermes* are important components of tropical ecosystems and are widely distributed in grassland and forest habitats of India. These termites contribute significantly to the decomposition of plant litter and organic matter in soil ecosystems. A study on *Odontotermes gurdaspurensis* demonstrated that their feeding activity plays an important role in the breakdown of plant debris and nutrient recycling in tropical grassland environments. Their ecological activities influence soil properties and contribute to the maintenance of ecosystem productivity, highlighting the ecological significance and widespread occurrence of *Odontotermes* species in Indian landscapes (Gupta *et al.*, 1981)<sup>[51]</sup>.

Taxonomic studies on termites in India have significantly contributed to the understanding of their diversity and distribution patterns. The identification and description of new termite species from different regions of the country highlight the complexity of termite biodiversity in the Indian subcontinent. For instance, faunistic surveys conducted in northeastern India have documented new termite species from tropical rainforest ecosystems, demonstrating the rich diversity of termite fauna in the region. Such studies emphasize that India's diverse climatic and ecological conditions support a wide distribution of termite genera, including fungus-growing termites related to *Odontotermes* (Basak *et al.*, 2020)<sup>[52]</sup>.

Termite infestations are common in Indian agroforestry systems where mound-building termites such as *Odontotermes* and *Microtermes* occur frequently. These termites play dual roles in agricultural ecosystems by acting both as pests and as beneficial organisms involved in organic matter decomposition and soil improvement. Their distribution is strongly associated with soil moisture, temperature, vegetation cover and agricultural practices. Because of their widespread occurrence in crop fields and plantations, *Odontotermes* species have been extensively studied for their ecological and economic importance in Indian agroecosystems (Ghode, 2025)<sup>[53]</sup>.

Central Indian landscapes such as the Deccan Plateau and forested regions of Chhattisgarh provide suitable ecological conditions for diverse insect fauna due to high forest cover and varied biogeographic zones. These environments

support numerous soil-dwelling insects, including termites that inhabit forest soils, decaying wood and underground nests. The extensive forest ecosystems and climatic conditions of central India create favourable habitats for mound-building termites such as *Odontotermes*, which are commonly associated with tropical forest and plateau ecosystems (Majumder *et al.*, 2014)<sup>[31]</sup>.

India possesses a rich diversity of termite fauna, particularly within the genus *Odontotermes*, which is widely distributed across tropical and subtropical regions of the country. Taxonomic studies have reported a large number of species belonging to this genus, reflecting its ecological adaptability and wide geographical distribution. According to surveys conducted in central India, particularly in the state of Chhattisgarh, several species of *Odontotermes* occur in forest ecosystems, grasslands and agricultural habitats. A detailed checklist indicates that more than forty species of *Odontotermes* have been recorded from India, including *O. obesus*, *O. gurdaspurensis*, *O. assmuthi*, *O. latigula*, and *O. wallonensis*, demonstrating the extensive distribution of this genus across different ecological zones of the country.

India harbors a rich diversity of termites, particularly within the genus *Odontotermes*, which is widely distributed in tropical and subtropical regions of the country. Taxonomic studies have reported numerous species of *Odontotermes* occurring in forests, grasslands, agricultural lands and urban habitats. In central India, particularly in Chhattisgarh, several species such as *Odontotermes obesus*, *O. gurdaspurensis*, *O. assmuthi*, *O. latigula*, and *O. wallonensis* have been recorded from different habitats including mounds, fallen logs and leaf litter. These findings indicate that the genus *Odontotermes* has a wide geographical distribution across various ecological zones of India (Saha *et al.*, 2016)<sup>[55]</sup>.

Termites play a crucial role in tropical ecosystems and are widely distributed across different habitats including forests, grasslands and coastal regions. Surveys conducted in northeastern Puducherry recorded several termite species belonging to different genera, including *Odontotermes*. These termites occupy diverse ecological niches such as soil layers, decaying wood, leaf litter and underground galleries. Their presence in coastal ecosystems highlights their adaptability to different environmental conditions and confirms the widespread occurrence of *Odontotermes* species in tropical regions of India (Anantharaju *et al.*, 2014)<sup>[56]</sup>.

Among the mound-building termites in India, *Odontotermes wallonensis* is considered one of the most common and widely distributed species, especially in southern parts of the country. This species constructs large dome-shaped earthen mounds and forages through subterranean galleries for food resources such as grasses, roots, bark and leaf litter. Its ability to exploit a variety of food sources and habitats contributes to the widespread distribution of the genus *Odontotermes* across different ecological regions of India (Sushilkumar, 1994)<sup>[57]</sup>.

The fungus-growing termite *Odontotermes distans* is widely distributed across South Asia, including India, Pakistan, Bangladesh and Myanmar. Studies on the species have revealed that it constructs complex subterranean nests consisting of fungus chambers and interconnected galleries.

Although its biology has been less extensively studied compared with other species of the genus, its occurrence in multiple countries indicates a broad geographical distribution and ecological adaptability of *Odontotermes* species within tropical environments (McMahan *et al.*, 1984).

India's termite fauna is highly diverse due to its varied climatic conditions and ecological habitats ranging from tropical forests to coastal ecosystems and island environments. Taxonomic investigations have reported numerous termite species belonging to several families and genera across the country. These studies emphasize the richness of termite biodiversity in India and provide important insights into the distribution patterns of different genera, including *Odontotermes*, which forms a significant component of tropical termite communities (Sengupta *et al.*, 2019)<sup>[58]</sup>.

Termites are among the most important soil-dwelling insects in tropical ecosystems and are widely distributed across the tropical and subtropical regions of the world. Their ecological success is largely attributed to their eusocial organization, chemical communication systems and specialized caste differentiation, which allow them to efficiently exploit cellulose-rich food resources. India supports a rich diversity of termite fauna due to its varied climatic conditions and habitats ranging from forests and grasslands to agricultural landscapes. Recent studies indicate that the country harbors more than 320 termite species belonging to over 50 genera and multiple families, with the family Termitidae being the most diverse group. These termites significantly influence soil formation and ecosystem processes through their nesting structures, galleries and mound-building activities that modify soil aeration, porosity and nutrient dynamics (Aiswarya *et al.*, 2025)<sup>[59]</sup>.

Termites are considered ecosystem engineers because of their ability to modify both the physical and chemical properties of soils. They play a significant role in nutrient cycling by decomposing cellulose-rich organic matter such as dead wood, plant litter and crop residues. Through their feeding and mound-building activities, termites enhance soil aeration, infiltration and mixing of organic matter with mineral soil layers. These processes improve soil fertility and influence the productivity of terrestrial ecosystems. In tropical landscapes, termites are among the most abundant soil invertebrates and contribute substantially to below-ground biodiversity and ecosystem functioning (Chandel *et al.*, 2019)<sup>[60]</sup>.

Within the family Termitidae, the genus *Odontotermes* represents one of the most dominant groups of mound-building termites in tropical regions. These termites are widely distributed in humid plains and forest ecosystems of India where they construct large earthen mounds and subterranean galleries. Their distribution is influenced by environmental factors such as soil moisture, vegetation type and availability of organic matter. Several species of *Odontotermes* are known to occur across different parts of the country, indicating their ecological adaptability to diverse environmental conditions (Chandel *et al.*, 2019)<sup>[60]</sup>. The internal organization of termite colonies is characterized by the distribution of different castes such as

workers, soldiers and nymphs within specific regions of the mound. Studies on *Odontotermes wallonensis* have shown that workers are predominantly found in the peripheral fungus garden and foraging runways, where they are involved in mound construction, food collection and maintenance of the nest. Minor workers and soldiers are more concentrated near the royal chamber where they perform tasks related to feeding the royal pair and protecting the colony. Such spatial distribution of castes within the mound reflects the complex social organization and functional specialization within termite colonies (Vasantkumar & Vijaykumar, 2010)<sup>[61]</sup>.

Recent taxonomic studies have expanded the knowledge of termite diversity in India with the discovery of new species records. For instance, faunistic surveys conducted by the Zoological Survey of India reported two species of the genus *Odontotermes* (*Odontotermes annulicornis* and *Odontotermes foveafrons*) from different parts of the country for the first time. These discoveries highlight the rich but still incompletely explored diversity of termites in India and suggest that further systematic surveys may reveal additional species and expand the known distribution ranges of several taxa (Roy *et al.*, 2025)<sup>[2]</sup>.

#### **Mound Patterns and Nest Architecture of *Odontotermes***

Termites are highly diverse eusocial insects that play a crucial role in ecosystem functioning, particularly in decomposition and nutrient cycling. Globally, more than 2,900 termite species belonging to several genera and families have been described. In India alone, approximately 300–314 species of termites have been reported, representing more than 10% of the world's termite fauna. Among these, the family Termitidae is the most dominant, and the genus *Odontotermes* is one of the most species-rich genera occurring widely across tropical regions of the country (Abhirami & Prasad, 2024)<sup>[20]</sup>.

Regional surveys conducted in different ecological regions of India have documented the presence of several *Odontotermes* species in natural and agricultural ecosystems. For example, studies carried out in different farming areas of Karnataka revealed that species belonging to the genus *Odontotermes*, including *O. holmgren* and *O. obesus*, were widely distributed across the Malanad and coastal regions. The abundance and distribution of these termites were influenced by cropping patterns, soil type, and climatic conditions, highlighting the ecological adaptability of the genus (Murthy, 2020)<sup>[24]</sup>.

Local biodiversity studies have also demonstrated the occurrence of multiple *Odontotermes* species in northeastern India. A survey conducted in the Dakshin Kamrup College campus in Assam reported the presence of *Odontotermes obesus* and *Odontotermes parvidens* from different microhabitats such as termite mounds, soil tubes, tree bark, and decaying wood logs. Morphometric analysis of soldier caste characteristics such as body length, head width, and antennal segments has been widely used for the taxonomic identification of these species (Saikia *et al.*, 2024)<sup>[23]</sup>.

Studies on mound-building termites have shown that species of *Odontotermes* exhibit considerable variation in mound architecture depending on environmental conditions and

colony development. Research conducted in crop fields of Udaipur, Rajasthan recorded several structural types of termite mounds built by *Odontotermes obesus*. These mounds ranged from dome-shaped and buttressed structures to irregular broad-based forms with heights ranging between 21–110 cm and basal diameters up to 560 cm, demonstrating substantial variability in mound patterns within the species (Intodia, 2019) [21].

The nesting behavior and colony development of *Odontotermes* species have also been investigated in detail. In the case of *Odontotermes wallonensis*, mound formation begins after the establishment of a royal chamber by a newly formed reproductive pair following nuptial flight. As the colony grows, workers gradually construct the mound structure above the ground, forming internal chambers such as fungus gardens, galleries, and tunnels that support colony expansion and maintain favorable environmental conditions for fungal cultivation (Prakash & Reddy, 2012) [22].

### Types of Termite Mounds

Termite mounds exhibit considerable variation in structure, size, and complexity depending on species characteristics, environmental conditions, and colony development. Studies

on *Odontotermes obesus* conducted in Udaipur, Rajasthan documented five distinct types of mound structures based on morphology and internal organization. Type I mounds are tall, buttressed, and unilocular structures containing a single underground burial chamber with fungus combs, while Type II mounds are multilocular buttressed structures with multiple burial chambers containing well-developed fungus gardens. Type III mounds, which are commonly found in agricultural fields, have broad bases and irregular dome-shaped or subconical forms with numerous chambers scattered throughout the mound. Type IV mounds are comparatively smaller, dome-shaped or irregular structures that contain a large burial chamber with a fungus comb at ground level and a few smaller chambers underground. Type V mounds are typically associated with trees or vegetation where termites construct earthen galleries on tree trunks or plant stems, sometimes extending several meters above the ground. These variations in mound architecture reflect adaptations to environmental conditions, colony size, and functional requirements such as ventilation, protection, and maintenance of a stable internal microclimate for colony survival. (Prakash & Reddy, 2012) [22].

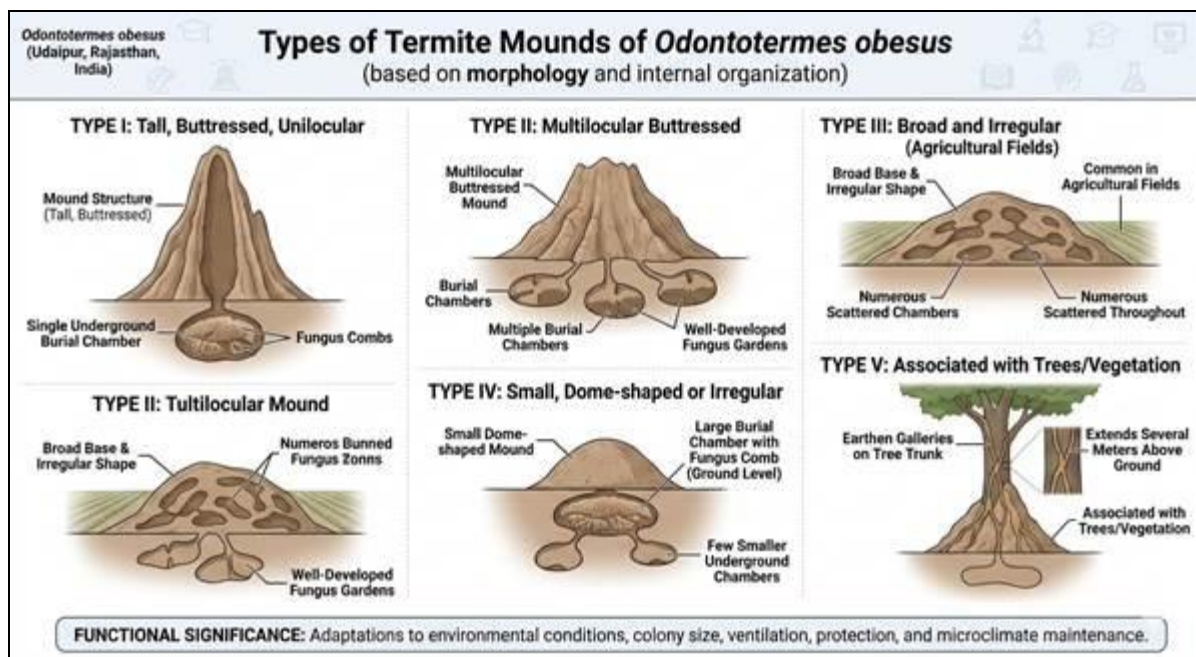


Fig 1: Types of Termite Mounds

Two major types of termite mounds are commonly observed in India:

1. **Cathedral Mounds:** Tall, tower-like structures, Built above ground and Often several meters high.
2. **Lenticular Mounds:** Dome-shaped, Mostly underground and Less visible compared to cathedral mounds.

Both types occur in forest ecosystems and agricultural areas.

**Structure of Termite Mounds:** Termite mounds are highly organized structures constructed by worker termites using soil particles, saliva and fecal matter. These structures function as protective shelters that provide favorable environmental conditions for the survival and development

of the termite colony. The internal architecture of termite mounds generally consists of chambers and interconnected galleries that facilitate movement of workers, soldiers and reproductive individuals within the colony. Such structural organization helps in maintaining suitable temperature and humidity inside the mound, which is essential for colony growth and stability (Velayuthan *et al.*, 2022) [29].

The structural complexity of termite nests is closely related to the ecological roles performed by termites in soil ecosystems. Termites modify soil structure through their mound-building activities and create intricate networks of tunnels and chambers that enhance aeration and water infiltration in soils. These structures often extend both above and below the ground surface and provide microhabitats for many microorganisms and other soil fauna. As ecosystem

engineers, termites significantly influence soil properties and contribute to nutrient cycling through the decomposition of organic materials (Ningthoujam *et al.*, 2024)<sup>[27]</sup>.

In many termite species, particularly those belonging to the family Termitidae, mound structures contain specialized chambers such as brood chambers, food storage chambers and fungus gardens where symbiotic fungi are cultivated. These fungus combs play an important role in the digestion of cellulose-rich plant materials collected by worker termites. The internal organization of these chambers ensures efficient colony functioning and allows termites to maintain stable microclimatic conditions necessary for fungal growth and colony survival (Bhanupriya *et al.*, 2022)<sup>[26]</sup>.

Termite mound architecture also varies according to environmental conditions such as climate, soil texture, vegetation cover and altitude. In mountainous and forest ecosystems, termite nests may consist of complex subterranean galleries connected with surface openings that facilitate ventilation and movement of colony members. These structural adaptations allow termite colonies to survive in diverse ecological conditions and contribute to the distribution and abundance of termite species across different geographical regions (Thakur & Kumar, 2012)<sup>[28]</sup>. Field observations have shown that termite colonies frequently build mounds in habitats rich in organic matter such as forest soils, decaying wood and agricultural fields. These mound structures act as important ecological microhabitats that influence vegetation growth and soil fertility. The mound-building behavior of termites also contributes to the redistribution of soil particles and organic materials, thereby improving soil structure and promoting ecological processes within terrestrial ecosystems (Velayuthan *et al.*, 2022)<sup>[29]</sup>.

### **Ecological Role of Termite Mounds**

Termite mounds play an important ecological role in terrestrial ecosystems by improving soil structure and supporting biological productivity. The mound-building activity of termites involves the transport and mixing of soil particles with organic materials such as saliva and fecal matter, which results in the formation of stable soil aggregates. These activities enhance soil aeration, nutrient availability and microbial activity within the mound environment. As a result, termite mounds often become nutrient-rich microhabitats that support plant growth and various soil organisms in surrounding ecosystems (Kumar, Naveed, & Hosseti, 2006)<sup>[17]</sup>.

Termites play a significant ecological role in forest and agricultural ecosystems by contributing to the decomposition of organic matter and nutrient cycling. Many termite species are soil-inhabiting and construct mounds or subterranean nests that influence soil fertility and vegetation patterns. In regions such as Kerala, where diverse ecosystems exist, termite activity helps in the breakdown of plant materials and recycling of nutrients back into the soil. This ecological function makes termites important contributors to ecosystem productivity despite their reputation as pests in agricultural systems (Mathew, 2015)<sup>[36]</sup>.

Forest ecosystems provide a wide range of habitats for insects that interact with wood and plant materials during

decomposition processes. Wood-boring insects and other invertebrates contribute to the breakdown of woody debris and organic materials within forest environments. Such ecological interactions are essential for maintaining nutrient cycling and forest health, as decomposing organisms facilitate the transformation of dead plant material into organic nutrients available for soil organisms and vegetation (Majumder *et al.*, 2014)<sup>[31]</sup>.

In forest ecosystems, insects associated with wood and plant material contribute significantly to the decomposition of organic matter and the recycling of nutrients. Wood-boring insects play a key role in breaking down dead or decaying timber, thereby facilitating ecological succession and nutrient flow within forest habitats. Such processes indirectly influence soil fertility and biodiversity by creating habitats for microorganisms and other organisms that depend on decomposing wood resources (Majumder, Raha, Mitra, & Chandra, 2015)<sup>[35]</sup>.

Insects also contribute to ecological balance by acting as predators, decomposers, or biological control agents in different ecosystems. Groups such as antlions and other predatory insects regulate populations of smaller insects and pests in natural habitats. These ecological interactions help maintain biodiversity and stability in terrestrial ecosystems where insects play interconnected roles within food webs and environmental processes (Chandra *et al.*, 2014)<sup>[31]</sup>.

### **Environmental Factors Affecting Mound Distribution**

The distribution of termite mounds is strongly influenced by habitat characteristics and environmental conditions such as soil properties, vegetation cover, and moisture availability. Studies conducted in different habitats including forest, agricultural, rural, and urban ecosystems revealed that termite mound density is generally higher in forest habitats compared to other land-use systems. Favorable soil moisture, organic matter content, and suitable nesting conditions in forest ecosystems promote greater termite activity and mound formation. In contrast, disturbed habitats such as agricultural and urban areas often show relatively lower mound density due to human activities and changes in soil conditions (Mishra, 2017)<sup>[39]</sup>.

Environmental variables such as soil type, cropping pattern, and topographical conditions significantly influence termite distribution and abundance. Termite populations vary across different regions depending on the nature of the habitat and the availability of food resources. In South India, differences in soil characteristics including red loamy soil, sandy loam, laterite soil, and alluvial soil were found to affect termite occurrence and mound formation. Agricultural landscapes with suitable vegetation and organic residues often support higher termite abundance compared to areas with limited food resources (Murthy, 2020)<sup>[24]</sup>.

Termite mound distribution is also affected by habitat type and ecological disturbance. Comparative studies conducted in rainforest, semimalnad, and maidan habitats showed that termite species richness and abundance are highest in rainforest ecosystems due to stable environmental conditions and abundant organic resources. In contrast, degraded habitats and open agricultural landscapes tend to support fewer termite species. Factors such as rainfall, vegetation structure, anthropogenic disturbances, and

bioclimatic conditions play a significant role in shaping termite diversity and mound distribution across different habitats (Kalleshwaraswamy *et al.*, 2018)<sup>[10]</sup>.

Climatic factors such as rainfall, temperature, soil moisture, and seasonal variations strongly influence termite activity and mound distribution. Termites generally thrive in tropical and subtropical regions where environmental conditions support their foraging and nesting activities. Seasonal changes also affect termite populations, with higher activity levels observed during warmer and more humid months. Environmental disturbances, soil moisture levels, and landscape variations further influence the spatial distribution of termite colonies and their mound-building behavior (Bhanupriya, Kakkar, & Gupta, 2022)<sup>[26]</sup>.

Environmental conditions such as habitat availability, ecological stability, and microclimatic factors play a crucial role in determining the occurrence and distribution of termite species. Termites are more abundant in regions with favorable climatic conditions and suitable ecological niches that provide adequate food resources and shelter. Variations in environmental parameters such as humidity, temperature, and vegetation cover can influence the formation, size, and distribution pattern of termite mounds across different landscapes (Journal of Threatened Taxa, 2022).

### Conclusion

The genus *Odontotermes* represents one of the most important termite groups in India due to its ecological and economic significance. Approximately 18 species are reported from the Indian region, occupying diverse habitats ranging from forests to agricultural landscapes. Their mound-building behavior influences soil structure, nutrient cycling and ecosystem productivity. Environmental factors such as rainfall, soil type and vegetation strongly affect mound distribution and density. Further research on termite diversity, mound architecture and ecological interactions is essential for improving our understanding of soil ecosystems and biodiversity conservation in India.

### References

1. Mishra H, Bhattacharyya B, Gogoi D, Bhagawati S, Bhattacharjee S. Management of *Odontotermes obesus* (Ramb.) through bio-control agents in preserved setts of sugarcane. *Journal of Entomology and Zoology Studies*,2018;6(5):662-664.
2. Roy M, Basak J, Konar B, Rajmohana K. New distributional record of termites (Blattodea: Isoptera) from Gujarat and Maharashtra, India. *Hexapoda, Insecta Indica*,2025;32(2):194-202.
3. Kavyashree RK, Murugan S, Namratha A. Termite mounds' diversity and distribution: A study at Jnanabharathi, Bangalore University. *International Journal of Forest, Animal and Fisheries Research*,2022;6(4):9-13.
4. Goyal N, Sharma VL, Singla M, Kaur R, Sharma R. State of Isopteran biodiversity in the Indian subcontinent. *The Research Journal*,2016;2(2):80-82.
5. Sunitha S, Miranda MTP. Population dynamics of termites with special reference to *Odontotermes obesus*. *Asian Journal of Animal Science*,2011;6(1):43-45.
6. Buragohain A, Kalleshwaraswamy CM, Saikia S, Naorem AS. First report of *Odontotermes profeae* Akhtar from Assam, India. *Hexapoda, Insecta Indica*,2025;32(1):71-75.

7. Kumar A, Kalleshwaraswamy CM, Sharma R, Poonia A. Diversity and distribution of termites (Blattodea: Isoptera) in Bhiwani, Haryana, India. *Annals of Entomology*,2023;41(2):97-110.
8. Ranjith M, Kalleshwaraswamy CM. Termites (Blattodea: Isoptera) of southern India: Current knowledge on distribution and systematic checklist. *Journal of Threatened Taxa*,2021;13(6):18598-18613.
9. Ranjith M, Kalleshwaraswamy CM, Meghana KJ, Sandeep A. New records of *Odontotermes Holmgren* from Andhra Pradesh, India with an updated list of termites from the state. *International Journal of Tropical Insect Science*, 2025.
10. Vidyashree AS, Kalleshwaraswamy CM, Shanarabasappa. Termites (Isoptera) fauna in Western Ghats, India. *AgricINTERNATIONAL*,2018;5(1):20-23.
11. Agarwal VB. Temperature and relative humidity inside the mound of *Odontotermes obesus* (Rambur) (Isoptera: Termitidae). *Proceedings of the Indian Academy of Sciences (Animal Sciences)*,1980;89(2):91-99.
12. Biswas S, Deka K. A study on the diversity of termites with reference to their morphometrics and mound construction in Tezpur of Sonitpur district, Assam, India. *International Journal of Basic and Applied Biology*,2019;6(3):198-203.
13. Brahma N, Haloi AK. Altitudinal variations in the mound nests of termites *Odontotermes wallonensis* and *Odontotermes obesus*. *Indian Journal of Entomology*,2024;86(4):1193-1198.
14. Chakraborty JS, Ram N, Jeeva V, Singh S. Status of tree species regeneration with special reference to the role of termite mounds in a moist deciduous sal forest of Doon Valley. *Indian Forester*,2017;143(2):128-134.
15. Kaur G, Anantharaju T, Gajalakshmi S, Abbasi SA. Inventory of termite species in thickly vegetated region of northeastern Puducherry, India. *International Journal of Biodiversity and Conservation*,2017;9(8):265-272.
16. Bhanupriya, Mukherjee S, Kakkar N, Gupta SK. Identification and phylogenetic analysis of various termite species distributed across southern Haryana, India. *Journal of Threatened Taxa*,2023;15(6):23382-23396.
17. Kumar PMP, Naveed A, Hosseti BB. Occurrence and distribution of mound building termites in and around Kuvempu University campus, Shimoga, Karnataka State, India. *Environment Conservation Journal*,2006;7(1-2):11-16.
18. Roy US. Diversity of termites from Durgapur Government College campus, Paschim Bardhaman, West Bengal, India. *International Journal of Ecology and Environmental Sciences*,2023;49(6):651-653.
19. Biswas S, Deka K. A study on the diversity of termites with reference to their morphometrics and mound construction in Tezpur of Sonitpur district, Assam, India. *International Journal of Basic and Applied Biology*,2019;6(3):198-203.
20. Abhirami AS, Prasad G. Termites (Isoptera) of Kerala: An updated checklist and comprehensive review of species diversity. *Entomon*,2024;49(4):527-538.
21. Intodia A. Variation in mound structure built by the termite *Odontotermes obesus* (Rambur) (Isoptera: Termitidae) in Udaipur, Rajasthan. *International*

- Journal of Scientific Research in Science and Technology,2019:6(1):742-749.
22. Prakash PS, Reddy KR. Nesting pattern of the termite *Odontotermes wallonensis* (Wasmann) (Isoptera: Termitidae). *Journal of Experimental Zoology India*,2012:15(2):349-353.
  23. Saikia FR, Kalita P, Das D. Diversity of termites with reference to their morphometrics in Dakshin Kamrup College campus, Mirza, Kamrup, Assam. *International Journal of Entomology Research*,2024:9(4):98-100.
  24. Murthy KS. Diversity of termites in different farming areas of Karnataka. *International Journal of Current Research*,2020:12(6):12062-12065.
  25. Prakash PS, Reddy KR. Nesting pattern of the termite *Odontotermes wallonensis*. *Journal of Experimental Zoology India*,2012:15(2):349-353.
  26. Bhanupriya, Kakkar N, Gupta SK. Checklist of termites (Blattodea: Isoptera): Southern Haryana. *Asian Journal of Biological and Life Sciences*,2022:11(3):844-852.
  27. Ningthoujam K, Rethinam H, Ramappa K, Pathak M, Suting EG. Diversity and distribution of termite fauna in mid hill-range of Meghalaya (Eastern Himalayan region), India. *International Journal of Tropical Insect Science*, 2024.
  28. Thakur RK, Kumar S. Termite diversity in north western Himalayan region with new distributional records. *Journal of Experimental Zoology India*,2012:15(2):365-373.
  29. Velayuthan S, Kalleshwaraswamy CM, Thangavelu M, Kulandaivel S, Palanisamy K. Diversity of termite species and their distribution in various habitats in Palakkad district, Kerala. *Indian Journal of Ecology*,2022:49(3):780-784.
  30. Chandra K, Raha A, Majumder A, Parida A, Sarsavan A. First record of banded krait *Bungarus fasciatus* from Guru Ghasidas National Park, Chhattisgarh, India. *Records of the Zoological Survey of India*,2013:113(2):77-80.
  31. Chandra K, Majumder A, Raha A, Halder S. New records of antlions (Neuroptera: Myrmeleontidae) from Chhattisgarh, India. *Entomology and Applied Science Letters*,2014:1(4):70-74.
  32. Kumar PMP, Naveed A, Hosseti BB. Occurrence and distribution of mound building termites in and around Kuvempu University campus, Shimoga, Karnataka State, India. *Environment Conservation Journal*,2006:7(1-2):11-16.
  33. Majumder A, Raha A, Mitra B, Chandra K. Contributions to the studies on Prioninae (Coleoptera: Cerambycidae) of Central India with checklist of Indian species. *Munis Entomology & Zoology*,2014:9(2):848-857.
  34. Majumder A, Raha A, Mitra B, Chandra K. New records of Cerambycidae (Insecta: Coleoptera) from Madhya Pradesh, India. *Journal of Threatened Taxa*,2015:7(15):8242-8249.
  35. Mathew J. Checklist and pest status of termites (Order Isoptera): Kerala. *International Journal of Plant, Animal and Environmental Sciences*,2015:5(2):151-158.
  36. Bhanupriya, Kakkar N, Gupta SK. Species diversity and community composition of termites (Isoptera) in southern Haryana, India. *Ecology, Environment and Conservation*,2022:28(4):1882-1890.
  37. Kalleshwaraswamy CM, Pavithra HB, Vidyashree AS, Sathisha GS. Comparative termite (Isoptera) diversity in three different habitats of Shivamogga district, Karnataka, India. *Journal of Entomological Science*,2018:53(2):219-229.
  38. Mishra H. Ecology and management of mound building termites. Assam Agricultural University, Jorhat, India, 2017.
  39. Murthy KS. Diversity and abundance of subterranean termites in South India. *Indian Journal of Pure and Applied Biosciences*,2020:8(5):141-149.
  40. Cheik S, Shanbhag RR, Harit A, Bottinelli N, Sukumar R, Jouquet P. Linking termite feeding preferences and soil physical functioning in southern-Indian woodlands. *Insects*,2019:10(1):4. DOI: 10.3390/insects10010004.
  41. Nageswara Rao A, Narayana E, Sravanthy C, Sammaiah C. Distribution of various castes in different parts of the mound of the termite *Odontotermes obesus*. *International Journal of Pharmacy and Biological Sciences*,2013:3(1):416-422.
  42. Peshin R, Kaul V, Perkins JH, Sood KK, Dhawan AK, Sharma M, *et al.* Sustainable agricultural innovations for resilient agri-food systems. *Proceedings of the Indian Ecological Society International Conference 2022*, 2022.
  43. Roonwal ML. Biology and ecology of oriental termites: Mound structure, nest and moisture content of fungus combs in *Odontotermes obesus*. *Records of the Indian Museum*,1960:58:131-147.
  44. Vidyashree AS, Kalleshwaraswamy CM, Sharanabasappa. Termite (Isoptera) diversity in three distinct habitats of Western Ghats of Karnataka. *Journal of Entomology and Zoology Studies*,2018:6(3):1301-1303.
  45. Kalleshwaraswamy CM, Pavithra HB, Vidyashree AS, Sathisha GS. Comparative termite (Isoptera) diversity in three different habitats of Shivamogga district, Karnataka, India. *Journal of Entomological Science*,2018:53(2):219-229.
  46. Harit AK, Jouquet P. Origin and dynamics of termite mound soils in southern India. *Asian Soil Research Journal*,2021:5(4):19-23.
  47. Amina P, Rajmohana K, Aliyas SC. A new species and a new record of *Dicuspitermes Krishna* (Blattodea: Isoptera: Termitidae) from the Kerala part of Western Ghats, India. *Oriental Insects*, 2020.
  48. Majumder A, Raha A, Mitra B, Ghate HV, Chandra K. Longhorned beetles (Coleoptera: Cerambycidae) from Chhattisgarh, India. *Journal of Threatened Taxa*,2014:6(1):5393-5399.
  49. Premalatha K, Devindra G, Murugan M, Shanmugam PS, Harish S, Uma D. Review of subterranean termites in India: Understanding taxonomy, distribution patterns and ecological functions. *Plant Science Today*,2025:12(sp1):1-12.
  50. Gupta SR, Rajvanshi R, Singh JS. The role of the termite *Odontotermes gurdaspurensis* (Isoptera: Termitidae) in plant decomposition in a tropical grassland. *Pedobiologia*,1981:22:254-261.
  51. Basak J, Sengupta R, Rajmohana K, Baraik B. A new nasute termite *Ceylonitermes nivedita* sp. nov. (Isoptera: Termitidae) from India along with first record of worker dimorphism. *Journal of Insect Biodiversity*,2020:19(1):8-13.
  52. Ghode N. Management strategies for termite infestation in Indian agroforestry system: A review with a focus on *Microtermes* and *Odontotermes*. In: Al-Naggar AMM,

- editor. Research Perspective on Biological Science. Vol. 8. BP International, 2025, 142-163.
53. Majumder A, Raha A, Parida A, Mitra B, Chandra K. Record of *Pachyteria fasciata* (Fabricius) (Coleoptera: Cerambycidae) from Chhattisgarh, central India and Deccan Peninsular biogeographic zone. *Prommalia*,2014:2:109-113.
  54. Saha N, Mazumdar PC, Basak J, Raha A, Majumder A, Chandra K. Subterranean termite genus *Odontotermes* (Blattaria: Isoptera: Termitidae) from Chhattisgarh, India with its annotated checklist and revised key. *Journal of Threatened Taxa*,2016:8(3):8602-8610.
  55. Anantharaju T, Kaur G, Gajalakshmi S, Abbasi SA. Sampling and identification of termites in northeastern Puducherry. *Journal of Entomology and Zoology Studies*,2014:2(3):225-230.
  56. Sushilkumar. Polyethism (division of labour) in sterile castes of the termite *Odontotermes wallonensis* (Wasmann). *Journal of Entomological Research*,1994:18(2):127-133.
  57. Sengupta R, Rajmohana K, Poovoli A, Basak J, Baraik B. Revalidation of the presence of *Glyptotermes brevicaudatus* (Haviland) and *Glyptotermes caudomunitus* Kemner in India (Isoptera: Kalotermitidae). *Oriental Insects*, 2019.
  58. Aiswarya PM, Honey S, Sudhikumar AV. Termites (Blattodea: Isoptera) of India: An updated checklist. *Acta Zoológica Lilloana*,2025:69(1):77-158.
  59. Chandel RS, Verma KS, Baloda AS, Sanjta S, Rana A. The ecology and management of termites in India. CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, 2019.
  60. Vasantkumar B, Vijaykumar K. Population density of various castes in different parts of the mound of the termite *Odontotermes wallonensis* Wasmann (Isoptera: Termitidae). *Wetlands, Biodiversity and Climate Change Conference Proceedings*, 2010.
  61. Roy M, Basak J, Das S, Baraik B, Konar B, Rajmohana K. First report of four species of termites from India (Blattodea: Isoptera: Termitidae). *Spixiana*,2025:48(1):51-58.