

## TERMITES OF THE GENUS ANACANTHOTERMES

**M.Sh.Zafar**

Ph.D., Head of Department  
Khorezm Mamun  
Academy;

**I.I. Abdullaev**

Dr. of Biological Sciences, Professor, Chairman of Academy  
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### Introduction

Termites are eusocial insects with a wide Old World distribution, notable for their dual role as ecosystem engineers and structural pests[1][2]. In arid and semi-arid ecosystems, termites accelerate decomposition and nutrient cycling, yet can also damage wooden structures and crops. The genus *Anacanthotermes* (Family Hodotermitidae) comprises so-called “harvester termites” found in the deserts and semi-deserts of North Africa, the Middle East, and Southwest Asia[2]. These termites forage on dry grasses and plant debris, storing material in extensive underground nests[3]. In Central Asia (e.g. Uzbekistan’s Khorezm region), *Anacanthotermes* species infest dry landscapes as well as irrigated oases and even urban settlements[4][5]. This thesis reviews up-to-date knowledge of *Anacanthotermes* biology (morphology and life cycle), distribution and habitat preferences, ecological significance (feeding behavior and effects on soil fertility), and economic importance (both beneficial effects and damage caused). The objective is to synthesize recent scientific findings on this genus, highlighting its roles in ecosystems and impacts on human environments.

### Biological Description of *Anacanthotermes*

*Anacanthotermes* are typical caste-organized termites. The alates (winged reproductives) have smooth, glabrous wings lacking the microsculpturing found in many higher termites[2], reflecting their basal (primitive) status among Isoptera. Colonies are founded by a monogamous pair of primary reproductives (king and queen) after a nuptial flight. Termite development is hemimetabolous: eggs hatch into nymphs (larval instars) that later differentiate into adults[6]. Each immature larva (pseudergate) has the potential to develop into one of several castes (workers, soldiers, or secondary reproductives) depending on colony needs[6]. Sterile workers forage for food, feed other castes, and maintain nest structure, while soldiers are morphologically specialized defenders with enlarged heads and mandibles (a typical trait in Hodotermitidae). New reproductives are produced as winged alates in specific seasons (often spring) and disperse to start new colonies. In *Anacanthotermes* (as in other termites), castes and

reproductives arise through molting of nymphs rather than pupation[6]. Detailed morphometrics vary by species, but in general *Anacanthotermes* soldiers have robust heads and strong jaws for defense, and the workers are blind, soft-bodied, and specialized for foraging and tunneling.

The life cycle of a colony can extend over many years. During colony growth, the queen lays eggs that develop into workers and soldiers; periodically the colony produces alates (winged queens and kings) that engage in mating swarms. After dispersal, alates shed their wings and pair up to found a new nest. The social system is similar to other higher termites: workers and soldiers remain permanently sterile, while secondary (supplementary) reproductives may emerge if the primary king or queen dies[6]. Physiologically, *Anacanthotermes* termites, like other Isoptera, harbor gut symbionts (protozoa and bacteria) that enable cellulose digestion, allowing them to subsist on dead plant material.

### **Distribution and Habitat**

The genus *Anacanthotermes* is strictly Old World and is confined to arid and semi-arid regions. Globally, species occur across Saharan and North African deserts, through the Middle East, into Southwest and South Asia including Baluchistan and southern India[2]. All known *Anacanthotermes* species are absent from tropical rainforests and temperate zones, reflecting their specialization for hot, dry climates. In the Arabian Peninsula (e.g. Saudi Arabia) several *Anacanthotermes* species have been recorded throughout the country except the moister southern regions[7]. In Central Asia (Uzbekistan, Turkmenistan, etc.), at least two species – *A. turkestanicus* (Turkestan termite) and *A. ahngerianus* – are known. Surveys in Uzbekistan's Khorezm region found that *A. turkestanicus* is widespread across desert, irrigated agricultural, and even urban areas, whereas *A. ahngerianus* is restricted to riparian (floodplain) forest remnants and adjacent towns[4]. Thus, some *Anacanthotermes* species can inhabit cultivated and settled landscapes as well as wild deserts.

Habitat preferences are linked to soil and moisture conditions. *Anacanthotermes* termites favor dry habitats that still allow nesting underground. In Karakalpakstan (Uzbekistan), they occur in groves, steppes, semi-arid plains, and desert foothills[5]. These insects excavate extensive gallery systems and chambers in earth, often constructing shallow mounds or "cities" of packed soil[5]. Their nests typically require a minimum clay content or damp patches to maintain structure; in regions without sufficient groundwater they remain in well-drained sands and silts. In all cases *Anacanthotermes* prefer open, sparsely vegetated terrain where grass and low shrubs provide forage. They are

not found in humid forests or waterlogged soils. The wide distribution of *A. turkestanicus* even into irrigated oases shows the genus's ecological flexibility: although a desert specialist, this species can thrive in anthropogenic habitats as long as its food (dry plant material) is available and nesting conditions are met[4].

### **Ecological Significance**

*Anacanthotermes* species are detritivorous “harvester termites.” They forage above ground for dry plant debris – chiefly dead grasses, seeds and stems – and carry this material back to underground storage chambers. In field and laboratory experiments, workers of *A. turkestanicus* showed strong preference for grass stems: stems of sunflower (*Helianthus* spp.) and sorghum were among the most consumed substrates[3]. In general, grasses and annual herbaceous plants were preferred over woody stems or reeds. This confirms their role as grassland detritivores. Foraging activity of *Anacanthotermes* recycles otherwise unused plant biomass into the soil ecosystem. The decomposition behavior of these termites has important consequences for arid land ecology. By consuming cellulose-rich litter and wood, *Anacanthotermes* accelerate nutrient cycling. Termite digestion (aided by gut symbionts) mineralizes carbon, nitrogen and other elements locked in plant debris. Termites are widely recognized as “ecosystem engineers” that enhance soil fertility[8][9]. Specifically, their activity returns nitrogen, phosphorus and other nutrients to the soil, making them available for plants (for example, termite frass and decayed wood enrich the soil). Research has shown that termite activity can significantly improve soil conditions: for instance, by breaking down organic matter termites increase soil nutrient content and support plant diversity[8][9]. A survey of termite ecosystem services notes that “by breaking down organic matter, such as dead plant material and woody debris, [termite] contribute to nutrient cycling, returning essential elements like nitrogen and phosphorus to the soil”[9]. Termite tunneling and nest-building also improve soil physical structure. As *Anacanthotermes* workers dig galleries, they create macropores in the soil, enhancing aeration and water infiltration. In arid regions, this has a pronounced effect: improved infiltration reduces runoff and erosion, and helps retain scarce water near plant roots. It has been estimated that termite tunnels can greatly increase soil porosity and water penetration compared to undisturbed desert soil[9]. In turn, better water availability supports vegetation and crop growth. Collectively, these processes support diverse plant communities; by modulating moisture and nutrients, termites can even influence plant succession. In fact, studies note that termites can “increase the diversity of vegetation, animals, and microbial communities” in

their habitats[1]. *Anacanthotermes*, by creating local soil hotspots (often at nest sites) and redistributing litter, likely contribute similarly to microhabitat diversity in desert landscapes. Termites also affect ecosystem carbon dynamics. By decomposing lignocellulosic material, they release carbon dioxide and methane (via gut fermentation), but the carbon incorporated into soil organic matter through their feces and nest structures helps sequester some carbon locally. In this sense, they play a complex role in carbon cycling. Overall, the ecological significance of *Anacanthotermes* mirrors that of other termites: they consume and mineralize dead plant materials, engineer the soil environment, and thus influence vegetation and microbial diversity[1]. In arid systems where decay by other organisms is slow, termites may be among the most important decomposers. In summary, *Anacanthotermes* termites have a profound impact on desert ecosystem function. Their feeding on grass detritus turns debris into nutrient-rich soil, and their nesting activity aerates the earth. These actions underpin soil fertility and plant growth in semi-deserts[8][9]. However, the same foraging behavior can also bring them into contact with human crops and structures, as discussed next.

### **Economic Importance**

The economic impact of *Anacanthotermes* is twofold, reflecting both beneficial and detrimental effects. On the beneficial side, the termite-mediated improvements in soil fertility and water retention can boost agricultural productivity. For example, enhanced infiltration from termite galleries can increase crop yields in dry climates (one field study estimated a ~36% yield increase from ant and termite soil engineering)[9][8]. Healthier, enriched soils following termite activity can support better plant growth, indirectly benefiting pasture and crop lands. Moreover, termite nests (mounds) sometimes act as nutrient reserves in fields; in some traditional practices the soil from old termite mounds is collected as fertilizer or used in building materials. These ecosystem services are advantageous, but they are diffuse and often underappreciated outside ecological circles[8][9]. The harmful (pest) aspects of *Anacanthotermes* have been well documented in Central Asia and other regions. These harvester termites are notorious for attacking wooden structures and cultural heritage sites in arid lands. In Uzbekistan, *A. turkestanicus* and related species are serious structural pests of buildings. One survey reported that these termites had “severely damaged” 3,019 houses and 14 historical monuments in Karakalpakstan[10]. The Khanaka (Khiva) fortress in Khorezm and other ancient adobe structures have shown telltale termite tunnels in the mudbrick walls. All

parts of woody and cellulosic material in such buildings – beams, posts, as well as decorative woodwork and even stored forage – are vulnerable. The termites may hollow out wooden elements or construct subterranean galleries that undermine foundations. Agricultural damage is also a concern. *Anacanthotermes* workers foraging in fallow fields or gardens can strip crops of leaves or stems. In dry years they may consume entire stands of grasses or young cereal plants. Field observations note that in drought-stressed areas, these termites “completely destroy living and dry plants” in the ecosystem[10]. This can lead to the loss of forage for livestock and even the death of orchard trees when moisture is scarce. In rare cases, they may enter dwellings in search of dry wood or thatch. Given their cryptic nesting (underground) and large colony sizes, infestations can go unnoticed until damage is extensive. The economic threshold for termite damage is therefore an important issue in arid agriculture and heritage conservation. For Khorezm Mamun Academy and regional authorities, understanding these termites is critical: control measures (e.g. targeted baits using preferred plant baits[3], soil treatments, building design) must balance efficacy with environmental safety. In sum, *Anacanthotermes* termites provide ecosystem benefits through soil engineering[8][9], but when they forage on human resources (wood, crops, fiber) they cause significant economic harm[10]. This dual role makes them both vital components of desert ecology and pests of concern to farmers and conservationists.

### **Conclusion**

Termites of the genus *Anacanthotermes* occupy a keystone position in Old World desert ecosystems. This review has shown that they exhibit the characteristic termite social biology – hemimetabolous development into worker, soldier and reproductive castes[6] – and are morphologically adapted for subterranean life (e.g. glabrous alate wings)[2]. They inhabit sandy and semi-arid soils across North Africa, the Middle East and Central/South Asia[2], where they build extensive underground nests. Ecologically, *Anacanthotermes* species are important detritivores: they harvest grass and dead plant material, decomposing it and enriching soils with nutrients. Their activities increase soil porosity and fertility, thereby promoting plant growth and ecosystem productivity[8][9]. These processes underpin the health of desert biomes by maintaining a cycle of organic matter. Conversely, the same behaviors that make them ecosystem engineers also bring them into conflict with human uses of the landscape. *Anacanthotermes* termites can inflict serious damage on wooden buildings and crops. In Central Asia thousands of structures have been compromised by their

feeding[10]. Effective management therefore requires careful study of their biology.

In conclusion, Anacanthotermes termites exemplify the balance of service and disservice that many soil insects provide. Up-to-date research highlights their role in sustaining soil fertility and biodiversity in arid regions[1][9], while also documenting their potential as pests of infrastructure. Continued investigation into their life history, distribution and control will be essential for leveraging their ecological benefits and mitigating their economic impacts. Acknowledgments: This thesis synthesizes research by many authors. We thank the Khorezm Mamun Academy for support and colleagues who have advanced the study of Central Asian termites.

Sources: Authoritative entomological and ecological literature on Anacanthotermes and termite biology[2][4][6][3][8][9][1][10] has been cited throughout. These include recent journal articles and surveys up to 2025.

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