Introduction to the special section on Biology of Termites

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INTRODUCTION

Special Section: Biology of Termites

Introduction to the special section on Biology of Termites

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Abstract

As descendants of social cockroaches, termites have an intriguing biology that makes them highly suitable study subjects in a wide variety of fields, such as eusocial evolution, ageing mechanisms, wood decomposition, ecosystem engineering, and pest management. This special section presents four studies ranging from the role of chemical compounds in foraging behaviour and food digestion to genetics and physiology of reproduction. Taken together, these studies offer new insights and ample suggestions for future work on these fascinating insects.

KEYWORDS

ageing, Blattodea, caste differentiation, ecosystem engineers, eusocial insect, exocrine gland, foraging behaviour, invasive species, lignocellulose degradation, mating behaviour, pest, reproductive system

Termites are descendants of social cockroaches and they have an intriguing biology that makes them highly suitable subjects for study in a wide variety of fields. They evolved into eusocial insects 150 million years ago and may therefore be used to investigate eusocial evolution of insects, a phenomenon that is still insufficiently understood. Termite castes vary greatly in life span, which provides a new model system for investigating ageing mechanisms. In addition, termites are ecosystem engineers. They play important roles in the earth's biogeochemical cycle, changing the structure and function of the natural environment. In tropical rainforests, for example, termites can decompose more than half of the dead wood. Their symbiotic microbial resources are essential for such lignocellulose degradation. Despite these beneficial roles, termites can form a major nuisance for humans. They can cause significant damage to houses and wooden furnishings, and to dams of rivers and reservoirs. Moreover, some termites feed on living plant material and may become serious crop pests.

This special section of *Entomologia Experimentalis et Applicata* on termite biology reflects the latest achievements in the fields of termite research. Costa-Leonardo et al. (2023) provide an extensive review of the exocrine systems of termites. Termites possess a wide range of exocrine glands that not only allow them to digest tough substances, such as lignocellulose, but also serve crucial functions in communication, immunity and nest building. There is still a large untapped reservoir of chemical compounds produced by termites, that may not only yield knowledge of the functioning of termites in nature, but that can also be exploited for human wellbeing. Gazal et al. (2023) experimentally investigate the role of salivary glands in foraging behaviour of the arboreal termite *Nasutitermes corniger* (Motschulsky) (Termitidae). They elegantly show that chemical compounds are used by last-instar workers to either increase or decrease recruitment of gnawing workers as part of the communication between nestmates.

Silva & Costa-Leonardo (2023) investigate the reproduction of the invasive termite *Coptotermes gestroi* (Wasmann) (Rhinotermitidae). They describe the morphological and physiological changes of the queen's spermatheca following mating. This study provides important insight into how queens store sperm and control fertilization of their eggs. Araujo et al. (2023) take a modern genomics approach to gain insight into caste differentiation of the termite *Cavitermes tuberosus* Emerson (Termitidae: Termitinae). This species has a peculiar reproductive system with both sexually and parthenogenetically reproducing queens. The authors find that many of the same genes are upregulated or downregulated during reproductive maturation of both queen types, but they also identify genes that are differentially regulated between these two caste types. Their results provide further evidence for the model of epigenetic regulation of genes in caste differentiation.

Taken together, these four studies offer interesting new insights into the intriguing biology of the insect order of termites, and they provide ample suggestions for future work.

AUTHOR CONTRIBUTIONS

Leo W Beukeboom: Conceptualization (lead); writing – original draft (lead); writing – review and editing (lead). **Lian-Xi Xing:** Conceptualization (supporting); visualization (lead); writing – original draft (supporting); writing – review and editing (supporting).

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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