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Caste-Specific Expression of Na^+/K^+-ATPase in the Asian Weaver Ant, *Oecophylla smaragdina* (Fabricius, 1775)

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Abstract

Social insect colonies adopt different levels of survival strategies and exhibit well-defined reproductive division of labour. *Oecophylla smaragdina* (Fabricius, 1775) has physiological and behavioral adaptations that enable them to forage at extreme environmental conditions and are lethal to most other insects. Ion homeostasis is the key process in an organism's survival mechanism. Among ion pumps, the ATP-dependent sodium–potassium ion pump is essential for maintaining the Na^+ and K^+ ionic balance and is well known as the primary consumer of energy. *Oecophylla smaragdina* plays pivotal role as a model among social insects for understanding ion homeostasis at the organization level of the castes. We have evaluated the expression and activity of Na^+/K^+-ATPase among various castes of *O. smaragdina* (worker subcastes, queen and male). Real-time PCR and immunoblotting analyses revealed the differential expression of Na^+/K^+-ATPase in the castes. Significantly higher expression of Na^+/K^+-ATPase mRNA and protein were observed in the minor workers, queen, major workers and males respectively. These results suggest that in the weaver ant colony, the castes might have variously adapted and evolved with a well-developed ion transport mechanism which allows them to perform allocated tasks within the nest and could be a key to their adaptive benefits towards division of labour.

Introduction

Among social insects, the ant colonies are considered as one of the greatest achievements of organic evolution (Wilson 1971). The Asian weaver ants, *Oecophylla smaragdina* (Fabricius, 1775), are one among the most successful and most refined eusocial hymenoptera. They are widely distributed across the Indian subcontinent and South East Asia extending up to Australia. Very few studies have been reported on this species (Devarajan 2016). Considering the wide distribution and the remarkable adaptation to different environmental conditions, *O. smaragdina* has become a suitable model to study the physiological adaptations in social insects. There is a highly structured division of labour between the members of the colony. Queens are green in color, winged, larger and heavier than all the other castes and reproductive in function. Males are winged and black in color. They mate with the queen and shed their wings and die (Lokkers 1990). The worker caste is highly polymorphic (Wilson 1953, Kamhi *et al* 2015). Alternative phenotypes among the worker castes produce the major and the minor subcastes (Cole & Jones 1948). They look alike but differ in size and body proportion. The major workers are larger in size (almost double) and more in number than the minor workers (Crozier *et al* 2010, Kamhi *et al* 2015). The two subcastes show clear division of labour. Majors are mainly foragers while the minors are caretakers of the nest. Minors live for a long time than the majors (Chapuisat & Keller 2002). The weaver ant colony is an ideal example of energy conservation as the colony is immobile at a given time. The nest construction and maintenance is a huge investment of time and energy by the members of the colony (Devarajan 2016).

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