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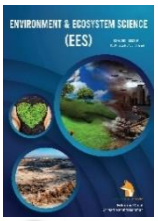

REVIEW ARTICLE

A MORNING ENCOUNTER WITH WEAVER ANTS (*OECOPHYLLA SMARAGDINA*): ECOLOGICAL INSIGHTS FROM THE DEPARTMENT OF BIOLOGY, UNIVERSITI PUTRA MALAYSIA

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ABSTRACT

Weaver ants (*Oecophylla smaragdina*) are a prominent species in tropical ecosystems, known for their unique leaf-folding nest-building behaviour and their mutualistic relationship with host plants. This article explores the ecological significance of weaver ants, their nest-building strategies, their impact on host plant health, and their role in biological pest control. The study is based on observations made in the Department of Biology, Universiti Putra Malaysia (UPM), where a large population of weaver ants was found building nests by folding leaves, with host plants showing no signs of pest damage. This phenomenon highlights the beneficial relationship between weaver ants and plants, where the ants provide protection from herbivores, ensuring plant health. The article also discusses the implications of this mutualism for ecological management and sustainable agricultural practices. This in-person observation should be part of understanding the Principles of Ecology.

KEYWORDS

Weaver ants, mutualism, biological control, sustainable agriculture, ecological interactions.

1. INTRODUCTION

In the morning at 7:50 a.m. on 7 May 2025, as I arrived at the Department of Biology (DOB), Universiti Putra Malaysia (UPM), I witnessed one of the remarkable wonders of nature. While Mr. Moin, our departmental assistant, was clearing the bushes for aesthetic purposes, I observed a large number of weaver ants actively weaving the leaves together (Figure 1), an impressive display of natural behaviour. Mr. Moin mentioned that all the plants were in excellent condition, their leaves intact and healthy. I remarked that if these ants were to attack and bite in large numbers, medical doctors would undoubtedly become busy dealing with the painful reactions caused by their stings.

Figure 1: Weaver ants (*Oecophylla smaragdina*) actively weaving the leaves together, observed at the Department of Biology, Universiti Putra Malaysia on the 7 May 2025.

This straightforward but insightful comment highlighted the close connection between ecological processes and human experiences, and it immediately related with the ideas I teach in the Principles of Ecology course. Human experiences are deeply intertwined with the natural world,

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as our well-being often depends on the health of ecosystems. By understanding these relationships, we can foster a greater appreciation for conservation efforts and the importance of biodiversity in maintaining balance in our lives. The sight of these ants engaging in cooperative leaf-weaving behaviour served as a vivid, real-life example of ecological principles in action, including mutualism, territoriality, and biological defence mechanisms. Such everyday observations are highly valuable as student assignments, encouraging them to apply theoretical ecological concepts to real-world situations. Observations like these not only enhance students' understanding of ecological interactions but also foster their ability to interpret and apply knowledge gained in the classroom.

Weaver ants (*Oecophylla smaragdina*) (Figure 2), locally known as "kerengga" in Malay, are a highly visible and ecologically significant species in tropical and subtropical regions, particularly in Southeast Asia, including Malaysia, and West Africa Countries Particularly South West, Nigeria. These ants are best known for their distinctive nest-building behaviour, where they construct nests by folding leaves together and securing them with silk produced by their larvae (Ogawa et al., 2023). This sophisticated nest-building strategy is not merely a display of their complex social structure but also a critical aspect of their ecological role. Weaver ant colonies are typically established on trees or shrubs, where they engage in a mutualistic relationship with their host plants, providing protection against herbivorous insects in exchange for nesting sites and food resources, such as nectar and honeydew (Babu and Patil, 2021). This mutualism is a classic example of a natural biological control system, where the presence of weaver ants significantly reduces pest damage to the host plants.

Figure 2: Weaver ants (*Oecophylla smaragdina*) (see arrow) observed at the Department of Biology, Universiti Putra Malaysia on the 7 May 2025.

Observations in the DOB, have further reinforced the ecological importance of weaver ants. A large population of weaver ants was observed constructing leaf nests on host plants, which remained healthy and free from insect damage, in contrast to nearby plants without ant colonies. This local observation aligns with findings from other regions, where the presence of weaver ants has consistently been associated with improved plant health and reduced insect damage (Raza et al., 2022; Kamaruddin et al., 2022). These findings highlight the critical role of weaver ants as natural defenders of plant health, making them an integral component of tropical ecosystems.

Beyond their ecological interactions, weaver ants also exhibit remarkable physiological adaptations. Their visual systems are highly specialized, supporting their efficient foraging and nest-building activities, even in complex environments (Ogawa et al., 2023). Additionally, their caste-based phenotypic plasticity, which involves significant differences in morphology between worker ants and reproductive queens, further enhances their ecological success (Mahima et al., 2021). Such adaptations not only support their survival in diverse habitats but also enhance their effectiveness as biological control agents.

This article explores the ecological role of weaver ants, their behaviour, their impact on plant health, and their potential applications in sustainable pest management. By examining their biology, behaviour, and ecological interactions, this study contributes to a broader understanding of the significance of weaver ants in tropical ecosystems and their potential role in sustainable agriculture.

2. Ecological Significance of Weaver Ants

The *O. smaragdina* is known for its aggressive defence of their territories, a behaviour that significantly benefits their host plants by protecting them from herbivorous insects (Jayanthi et al., 2022). This mutualistic relationship is well-documented, where plants provide nesting sites and food resources, including nectar and honeydew, to the ants. In return, the ants protect the plants from various pests, acting as a natural form of biocontrol (Kamaruddin et al., 2022). For instance, weaver ants have been shown to effectively reduce pest populations in citrus plantations by preying on or deterring herbivorous insects (Ferdous and Jahan, 2021). Their role as biological control agents has been widely studied, making them valuable in sustainable pest management systems.

Observations in the DOB further support this mutualistic relationship. Plants associated with weaver ants consistently show no visible pest damage, a clear indication of the ants' protective effect (Advento et al., 2022). This ecological benefit is not limited to agricultural systems but also extends to natural ecosystems, where weaver ants maintain plant health by minimizing herbivore damage (Jayanthi et al., 2022).

3. Nest-Building Behaviour

Weaver ants are best known for their sophisticated nest-building strategies, which are a remarkable demonstration of collective intelligence and cooperation within the colony. These ants construct nests by folding leaves together and securing them using silk produced by their larvae, a behaviour that is both complex and highly organized (Advento et al., 2022). The nest-building process is a coordinated effort involving thousands of worker ants, each performing specific tasks, from pulling leaves together to securing them with silk (Karthick et al., 2024).

These leaf nests are not only a shelter for the colony but also serve as a defensive fortress. Weaver ants are highly territorial and will aggressively defend their nests against any intruders, including herbivorous insects and other predators (Karthick et al., 2024). This aggressive behaviour has been exploited in various agricultural systems, where weaver ants are introduced as natural pest controllers, providing an eco-friendly alternative to chemical pesticides (Jayanthi et al., 2022). Their nest-building activities and territorial behaviour highlight their role as keystone species in many tropical ecosystems, where they significantly influence the structure of insect communities.

4. Impact on Plant Health

The presence of *O. smaragdina* is often associated with improved plant health, primarily due to their aggressive territorial behaviour, which deters herbivorous pests (Jayanthi et al., 2022). These ants actively patrol their host plants, attacking any herbivorous insects that pose a threat.

Studies have shown that plants hosting weaver ant colonies are typically free from herbivorous pests, as the ants aggressively defend their territory. For instance, in citrus plantations, weaver ants have been demonstrated to significantly reduce pest populations, providing an effective form of natural pest control (Kamaruddin et al., 2022).

This mutualistic relationship is further supported by observations in the DOB, where plants hosting weaver ants showed no signs of insect damage, unlike nearby plants without ant colonies. This clear difference between the two plant groups highlights the protective benefits provided by weaver ants. Similar findings have been reported in other agricultural systems, where weaver ants not only reduce pest numbers but also enhance overall plant health and productivity (Ferdous and Jahan, 2021). These ecological interactions emphasize the role of weaver ants as natural biocontrol agents in maintaining plant health.

5. Applications in Sustainable Agriculture

Weaver ants have been widely used in various agricultural settings as a natural form of pest control, providing an eco-friendly alternative to chemical pesticides (Jayanthi et al., 2022). By maintaining healthy ant colonies on crop plants, farmers can reduce their reliance on synthetic chemicals, which helps prevent environmental contamination and promotes biodiversity. For instance, in mango plantations, weaver ants have been successfully used to control pests such as the mango hopper (*Idioscopus clypealis*), significantly reducing crop damage (Ferdous and Jahan, 2021).

The ecological benefits provided by weaver ants extend beyond mere pest control. They are known to emit chemical compounds such as 1-octanol, which has been shown to repel certain pests, including the Queensland fruit fly (*Bactrocera tryoni*), making them a valuable resource in sustainable pest management (Kempraj et al., 2022). This chemical defense mechanism is complemented by their highly adaptive foraging behaviour, which involves the use of both olfactory and visual cues, enabling them to efficiently locate and capture prey (Yan et al., 2024). Studies have demonstrated that weaver ants can maintain healthy plant populations by suppressing herbivore populations, a characteristic that has been effectively harnessed in various agricultural settings (Ferdous and Jahan, 2021).

Research has further demonstrated the effectiveness of weaver ants in reducing pest populations in citrus, cocoa, and cashew plantations, where their aggressive predatory behaviour minimizes the need for chemical inputs (Kamaruddin et al., 2022). In DOB, the use of weaver ants as a natural pest control method aligns with sustainable agricultural practices, offering an educational model for integrating biological control into farming systems. This approach not only supports sustainable crop management but also aligns with integrated pest management (IPM) principles, making it a viable strategy for smallholder farmers in tropical regions (Jayanthi et al., 2022).

6. Conclusion

The weaver ants (*O. smaragdina*) are a remarkable species demonstrating a mutually beneficial relationship with host plants. Their ability to protect plants from herbivores while using them as nesting sites highlights their ecological importance. The observations made in DOB provide clear evidence of this mutualism, and the broader implications for sustainable pest management are significant. Further research can explore the optimization of weaver ant colonies for natural pest control in various agricultural settings.

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