

A Review of Insect Pests of Cocoa (*Theobroma cacao* L.) in Nigeria

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Abstract

Cocoa production in Nigeria has experienced a significant decline in recent decades, primarily due to a combination of biotic and abiotic stresses. Among these, insect pests stand out as a major contributing factor to substantial yield and quality losses. This comprehensive review synthesizes current knowledge regarding the diversity, biology, economic impact, and effective control strategies for key insect pests affecting cocoa in Nigeria. The primary pests identified include cocoa mirids (*Sahlbergella singularis* and *Distantiella theobroma*), cocoa pod borer (*Characoma stictigrapta*), termites, mealy bugs, stem borers, and various secondary pests. The review strongly advocates for the implementation of integrated pest management (IPM) strategies that judiciously combine cultural, biological, and chemical control methods. Furthermore, it highlights critical research gaps and proposes future directions for sustainable pest management, ultimately aiming to bolster cocoa productivity and enhance farmer livelihoods in Nigeria.

Keywords: Cocoa production, insect pest, integrated pest management, cultural, biological and chemical control methods

1. Introduction

Cocoa (*Theobroma cacao* L.) is a vital tropical cash crop that forms the backbone of the global chocolate industry, generating over USD 100 billion annually (ICCO, 2022). Globally, more than 40 million people rely on cocoa for their livelihoods, with West Africa alone accounting for over 70% of the world's production. While Côte d'Ivoire and Ghana are leading producers, Nigeria has historically been a significant contributor, ranking second in 1965 and consistently maintaining a top-five position (Oluyole and Lawal, 2008). Cocoa plays a crucial role in Nigeria's economy, particularly in the southwestern states, by supporting rural incomes, fostering agro-industrial development, and generating export earnings (Adeogun *et al.*, 2010). Despite its economic importance, cocoa production in Nigeria faces increasing threats from various biotic challenges, particularly insect pests. Key pests such as mirids (*Sahlbergella singularis*, *Distantiella theobroma*), pod borers (*Characoma stictigrapta*), stem borers (*Eulophonotus myrmeleon*), and sap-sucking insects like mealybugs and psyllids (*Tyora tessmanni*) inflict considerable damage at different growth stages, negatively impacting cocoa yield, quality, and plant health (Egwuatu and Ajayi, 2013; Oyediran *et al.*, 2016). The economic repercussions are severe; mirids alone can cause up to 30% yield loss, while cocoa pod borers contribute to a 17% loss in marketable pods (Aigbedion-Atalor and Aigbedion, 2020). Insect damage also exacerbates disease infections, notably black pod disease, leading to compounded economic losses and discouraging investment in cocoa farming (Daramola and Adewale, 2015). The effective management of these pests is further complicated by evolving pest dynamics, the development of pesticide resistance, and the unpredictable effects of climate variability. This review aims to synthesize current research on the identification, biology, economic impact, and management of insect pests prevalent in Nigerian cocoa farms. It also seeks to pinpoint existing knowledge gaps and propose actionable recommendations for the development and implementation of effective and sustainable pest control strategies, thereby contributing to the long-term viability of cocoa production in Nigeria.

2. Diversity of Cocoa Insect Pests in Nigeria

Cocoa cultivation in southwestern Nigeria, encompassing Ondo, Osun, Oyo, and Ogun States, is significantly impacted by a diverse array of insect pests (Folayan *et al.*, 2017; Oyedokun *et al.*, 2011). These pests can be broadly categorized based on their feeding habits and the type of

damage they inflict. A detailed understanding of these pests is crucial for developing targeted and effective management strategies.

2.1 Mirid Bugs (*Sahlbergella singularis*, *Distantiella theobroma*)

Mirid bugs are considered the most destructive pests of cocoa in Nigeria. These insects feed by piercing and sucking sap from young pods and tender stems, leading to characteristic necrotic lesions, wilting, and ultimately dieback of affected plant parts (Agunbiade *et al.*, 2012; Babatunde *et al.*, 2019). The damage caused by mirids can be extensive, resulting in significant yield losses.

2.2 Mealybugs (*Planococcus citri*, others)

Mealybugs are sap-sucking insects that excrete a sugary substance known as honeydew. This honeydew promotes the growth of sooty mold, a black fungal growth that covers the leaves and interferes with photosynthesis, thereby impairing plant health and productivity. Furthermore, certain species of mealybugs are known vectors of *Phytophthora* spores, which cause the devastating black pod disease in cocoa (Adeogun *et al.*, 2020).

2.3 Cocoa Pod Borer (*Characoma stictigrapta*)

The cocoa pod borer is an internal feeder that tunnels into developing cocoa pods. This internal damage directly reduces bean quality and can lead to significant crop losses. The incidence of this pest has been observed to be on the rise in southwestern Nigeria (Ojo *et al.*, 2015).

2.4 Termites (*Macrotermes spp.*, *Odontotermes spp.*)

Termites pose a threat to both young seedlings and mature cocoa trees, particularly during the dry season. Their feeding activity weakens the plant structure, making the trees more susceptible to secondary pests and diseases (Akinlosotu *et al.*, 2012).

2.5 Ants (*Crematogaster spp.*)

The role of ants in cocoa pest management is complex. While some ant species, such as *Crematogaster spp* can act as beneficial predators of mirids, others are known to protect mealybugs, thereby interfering with biological control efforts (Ekpa *et al.*, 2018).

2.6 Leaf Defoliators (*Lascoria omeodalis*, *Anomis* spp.)

Leaf defoliators, primarily the larvae of species like *Lascoria omeodalis* and *Anomis* spp., feed on young cocoa leaves. This defoliation reduces the plant's photosynthetic capacity and can delay growth, impacting overall tree vigor and productivity (Omoloye *et al.*, 2002). Other pests, including scale insects, capsids, and fruit flies, also contribute to sporadic damage depending on local conditions and environmental factors (Asogwa *et al.*, 2009).

3. Economic Impact

Uncontrolled insect pest infestations in cocoa farms can lead to severe economic losses, with yield reductions ranging from 40% to 50%. Mirid and pod borer infestations alone are responsible for over 45% of these yield losses. Beyond direct yield reduction, pests indirectly contribute to the deterioration of cocoa quality and increase the susceptibility of plants to diseases, further exacerbating production losses and significantly diminishing farmer profits (Daramola and Adewale, 2015). The cumulative effect of these losses poses a substantial threat to the economic viability of cocoa farming in Nigeria.

4. Management Strategies

Effective management of cocoa insect pests in Nigeria necessitates a multi-faceted approach that integrates various control methods. The goal is to minimize pest damage while ensuring environmental sustainability and economic viability for farmers.

4.1 Cultural Control

Cultural control methods involve modifying farming practices to reduce pest populations and their impact. Key strategies include:

- **Pruning and Shade Regulation:** Proper pruning of cocoa trees and regulation of shade levels can significantly reduce habitats favorable for mirid breeding, thereby lowering their populations (Asogwa *et al.*, 2009).
- **Field Sanitation:** Regular removal of infested pods and plant debris from the field disrupts pest life cycles and reduces sources of infestation (Asogwa and Dongo, 2009).

4.2 Biological Control

Biological control utilizes natural enemies to suppress pest populations. Important biological control agents in cocoa include:

- **Predatory Ants:** Certain species of predatory ants, such as *Oecophylla* spp., and various parasitoids play a crucial role in suppressing mirid populations (Asogwa *et al.*, 2009).
- **Entomopathogenic Fungi:** Fungi like *Beauveria bassiana* have demonstrated effectiveness against mirids and other cocoa pests (Ekesi and Maniania, 2000).

4.3 Chemical Control

Chemical control involves the judicious use of insecticides. While effective, it must be implemented carefully to avoid resistance development and environmental harm:

- **Selective Insecticides:** The application of selective insecticides, such as cypermethrin, can effectively reduce pest populations. However, their use should be based on economic thresholds to prevent the development of resistance and minimize negative environmental impacts (Aigbedion-Atalor and Aigbedion, 2020).
- **Botanical Products:** Natural extracts, such as neem, have shown moderate efficacy against sap-sucking pests (Ofuya and Akinbohunbe, 1992), offering a more environmentally friendly alternative.

4.4 Integrated Pest Management (IPM)

Integrated Pest Management (IPM) is a holistic approach that combines cultural, biological, and chemical controls into a cohesive and sustainable solution. Essential components of a successful IPM program for cocoa include farmer training, systematic pest surveillance, and the establishment and use of economic thresholds to guide intervention decisions (Asogwa and Dongo, 2009; Okezie *et al.*, 2021). IPM aims to achieve long-term pest suppression with minimal environmental disruption.

5. Research Gaps and Future Directions

Despite significant research efforts, several critical knowledge gaps remain in the effective management of cocoa insect pests in Nigeria. Addressing these gaps is crucial for developing more sustainable and resilient cocoa production systems:

- **Economic Thresholds:** There is a pressing need to accurately determine economic thresholds for intervention across different agro-ecological zones. This will enable farmers to make informed decisions on when pest control measures are economically justified, preventing unnecessary pesticide application and reducing costs.
- **Pest-Resistant Varieties:** Continued research and development are essential for breeding and deploying cocoa varieties that exhibit enhanced resistance to key insect pests. This long-term strategy offers a sustainable solution to pest challenges.
- **Biocontrol Systems:** Further development of low-cost, field-applicable biocontrol production systems is vital. This includes research into mass-rearing techniques for beneficial insects and fungi, and effective methods for their deployment in cocoa farms.
- **Remote Sensing and GIS:** The application of advanced technologies such as remote sensing and Geographic Information Systems (GIS) for pest outbreak forecasting and monitoring holds immense potential. These tools can provide early warnings and enable targeted interventions, improving the efficiency of pest management efforts.

6. Conclusion

Insect pests continue to pose a significant and persistent threat to cocoa production in Nigeria. Effectively addressing this multifaceted challenge necessitates the implementation of a robust, ecosystem-based Integrated Pest Management (IPM) framework. This framework must be comprehensively supported by ongoing research, effective extension services to disseminate knowledge, and active participation from farmers. Enhanced pest surveillance, continued development and application of biological control methods, and supportive policy measures will be absolutely critical in boosting cocoa yields and ensuring the long-term livelihoods of cocoa farmers in Nigeria.

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