Advanced Studies in Biology, Vol. 15, 2023, no. 1, 205 - 213
HIKARI Ltd, www.m-hikari.com
https://doi.org/10.12988/asb.2023.91781

Spatial Distribution of Philippine Long-horned Beetle (*Lagriadoliops anichtchenkoi* sp. nov, Coleoptera: Cerambycidae) Pest of Breadfruit Tress (*Artocarpus altilis*, Parkinson Fosberg) in Ayoke Island, North Eastern Mindanao, Philippines

Ana Marie T. Acevedo

North Eastern Mindanao State University
Cantilan, Surigao del Sur, North Eastern Mindanao Philippines

Virginia B. Gruyal

North Eastern Mindanao State University
Cantilan, Surigao del Sur, North Eastern Mindanao Philippines

Reinar A. Acevedo

North Eastern Mindanao State University
Cantilan, Surigao del Sur, North Eastern Mindanao Philippines

Jaypee B. Julve

North Eastern Mindanao State University
Cantilan, Surigao del Sur, North Eastern Mindanao Philippines

Abstract

The Philippine Long-horned Beetle, identified as *Lagriadoliops anichtchenk*oi sp. nov, poses a significant threat to Breadfruit Trees (*Artocarpus altilis*, Parkinson Fosberg) in Ayoke Island, located in North Eastern Mindanao, Philippines. This study investigates the spatial distribution patterns of this newly discovered pest, aiming to enhance our understanding of its ecological preferences and potential impacts on the local ecosystem. Field surveys were conducted across Ayoke Island to assess the prevalence and distribution of the Philippine Long-horned Beetle within Breadfruit Tree populations. Utilizing geographic information system (GIS) technology, we mapped the spatial distribution of infestations and identified key environmental factors influencing the beetle's prevalence. Data analysis incorporated ecological parameters, including climate, soil composition, and vegetation density. Preliminary findings reveal a non-uniform distribution of the Philippine Long-horned Beetle across Ayoke Island, with certain areas experiencing higher infestation rates than others. Our study suggests a correlation between specific environmental conditions and the beetle's presence, providing insights into potential mitigation strategies. Understanding the spatial dynamics of this pest is crucial for developing targeted management plans to protect Breadfruit Trees, an essential component of the local agricultural landscape. This research contributes valuable information to the scientific community, local authorities, and farmers, offering a foundation for the development of effective pest control measures and conservation strategies tailored to Ayoke Island's unique ecological context. As the Philippine Long-horned Beetle continues to pose a threat to Breadfruit Trees, proactive and science-based interventions are essential to safeguard the agricultural and ecological balance of this island.

Keywords: Philippine Long-horned Beetle, Ecological Dynamics, Prevalence Mapping, Ecosystem Impact, Ayoke Island Ecology

Introduction

In the context of global biodiversity loss and the escalating challenges posed by invasive species, understanding the spatial distribution of this newly discovered pest is paramount for implementing effective management strategies [9, 10]. The Philippine Long-horned Beetle (*Lagriadoliops anichtchenkoi* sp. nov), a member of the Coleoptera family Cerambycidae, [2, 11, 12] has recently emerged as a significant pest affecting Breadfruit Trees (*Artocarpus altilis*, Parkinson Fosberg) in Ayoke Island, situated in North Eastern Mindanao, Philippines.

Previous studies on the spatial distribution of invasive species have provided valuable insights into their ecological behaviors and the factors influencing their prevalence [1]. Research on the dynamics of similar pests has demonstrated the importance of environmental variables, such as climate, soil composition, and vegetation density, in shaping their distribution patterns [6].

The identification of this new beetle species underscores the need for a comprehensive assessment of its spatial distribution patterns and ecological preferences. As an invasive pest targeting the economically and culturally significant Breadfruit Trees, urgent attention is required to mitigate potential agricultural losses and preserve the biodiversity of Ayoke Island.

This novel beetle species poses a potential threat to the ecological integrity of Ayoke Island's Breadfruit Tree populations, which play a crucial role in the local agricultural and environmental landscape. This study builds upon the growing body of research on the ecological dynamics of invasive species, combining entomological and ecological approaches to unravel the mysteries surrounding *Lagriadoliops anichtchenkoi* sp. nov. Drawing upon this knowledge, our study aims to contribute a localized perspective to the broader understanding of invasive species ecology.

By integrating field surveys with advanced geographic information system (GIS) technology, we seek to map the spatial distribution of the Philippine Long-horned Beetle across Ayoke Island. This multidisciplinary approach will enable us to identify key environmental determinants influencing the beetle's prevalence, providing a foundation for the development of targeted pest management strategies. Hence, we delve into the spatial dynamics of *Lagriadoliops anichtchenkoi* sp. nov, this research not only addresses the immediate threat to Breadfruit Trees in Ayoke Island but also contributes to the broader scientific discourse on invasive species management and ecological conservation.

Materials and Methods

The conducted research exclusively focused on examining the spatial distribution of infestations by *Lagriadoliops anichtchenkoi* sp. nov within Breadfruit Trees on Ayoke Island. To achieve this objective, we utilized Geographical Information Systems (GIS) to generate maps illustrating the prevalence and distribution of the beetle within the Breadfruit Tree populations. Notably, the study did not encompass an analysis of additional factors, such as the physical characteristics of the study sites.

Study Area

The investigation took place on Ayoke Island in Cantilan, located in Surigao del Sur, within Northeastern Mindanao, Philippines. (see Figure 1).

Sampling Design

A thorough survey was undertaken to evaluate the degree of infestation by *Lagriadoliops anichtchenkoi* sp. nov among the total of 495 Breadfruit Trees on the island. Each individual tree underwent a meticulous examination and was assessed for the presence of the pest.

Source: Google Map

Figure 1. Location of the study site.

Instruments and Data Gathering Procedure

The research utilized the Global Positioning System (GPS) to precisely determine the coordinates of each Breadfruit Tree within the study sites, irrespective of their infestation status by pests and diseases. Simultaneously, the collection of data and identification of these pests and diseases were conducted. Initially, on-site identification was facilitated with the guidance of local experts, who provided local names for the organism under investigation. Detailed photographs of the pests and diseases were captured on-site using a DSLR Nikon 3200 camera.

Subsequently, the gathered samples were transported to the Bio Lab of NEMSU for thorough verification and identification. This process involved consulting monographs, reference books, online resources, and engaging in direct communication with experts in the field. The GPS data collected were then utilized to generate an infestation map through the use of the QGIS software.

Data Analysis

The analysis of data was performed using QGIS 3.18 Zurich Version, chosen for its effectiveness in processing the collected data. The GPS coordinates acquired played a pivotal role in generating a distribution map, visually depicting the prevalence of *Lagriadoliops anichtchenkoi* sp. nov infestation among the Breadfruit Trees on Ayoke Island.

This spatial representation of *Lagriadoliops anichtchenkoi* sp. nov infestation serves as an illustration of the geographic relationship between the pest and the Breadfruit Trees. These geographical patterns offer valuable insights for further exploration into environmental factors, encompassing temperature, climate, light conditions, atmospheric pressure, and landforms. By establishing correlations between these factors and the distribution of the pest on Breadfruit Trees, we can

glean a deeper understanding of the ecological dynamics associated with this infestation.

Results and Discussion

A total of 495 Breadfruit Trees were meticulously examined for *Lagriadoliops anichtchenkoi* sp. nov (Figure 2, 3) pest infestations on Ayoke Island, with a significant number of these trees situated in close proximity to residential areas. The comprehensive survey revealed varying degrees of infestation by *Lagriadoliops anichtchenkoi* sp. nov among the Breadfruit Trees. The collected data was instrumental in creating a detailed distribution map using QGIS 3.18 Zurich Version.

Figure 2. The Philippine Long-horned Beetle (*Lagriadoliops anichtchenkoi sp. nov*)

Figure 3. Damage caused by Philippine Long-horned Beetle (*Lagriadoliops anichtchenkoi sp. nov*) in one of the Breadfruit Tress in Ayoke Island.

Spatial analysis unveiled non-uniform distribution patterns of the Philippine Long-horned Beetle across Ayoke Island, highlighting localized clusters of preval-

ence in certain areas with higher infestation rates (Figure 4). The spatial distribution map indicated potential correlations between the prevalence of *Lagriadoliops anichtchenkoi* sp. nov and specific geographic features. Further exploration of these correlations is essential for gaining insights into the ecological preferences of the beetle.

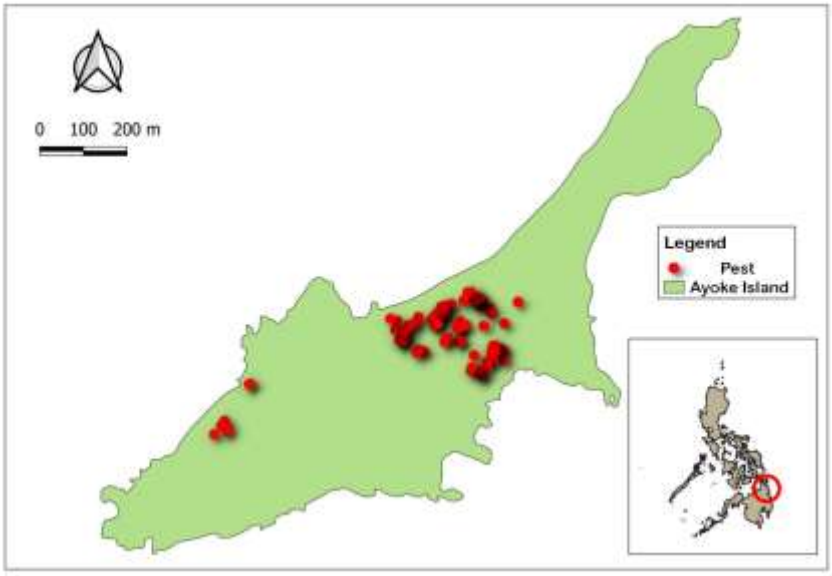

Figure 4. Pest distribution map

Preliminary observations suggest that environmental factors, including temperature, climate, and vegetation density, may significantly influence the spatial distribution of the beetle [8]. This information is crucial for comprehending the broader ecological dynamics of the infestation.

In terms of ecological implications, the non-uniform spatial distribution of *Lagriadoliops anichtchenkoi* sp. nov raises questions about its interactions within the Ayoke Island ecosystem. Understanding how the beetle selects habitats and spreads can contribute to formulating targeted conservation strategies.

The spatial information gathered serves as a foundation for developing effective management strategies. Localized interventions can be designed based on identified clusters of infestation, optimizing resource allocation and increasing the likelihood of successful pest control.

Correlating the distribution of the Philippine Long-horned Beetle with environmental factors allows for the exploration of the impact of climate and other geographic features on infestation patterns. This insight is crucial for predicting potential future spread and designing proactive measures.

Given the potential economic and ecological consequences of *Lagriadoliops anichtchenkoi* sp. nov infestation, collaborative efforts between local authorities, farmers, and researchers are deemed essential. The spatial data can serve as a basis for collaborative initiatives aimed at mitigating the impact of the beetle on Breadfruit Trees.

Conclusion

The spatial distribution study of the Philippine Long-horned Beetle *(Lagriadoliops anichtchenkoi* sp. nov) in Ayoke Island, North Eastern Mindanao, Philippines, reveals important insights into its prevalence as a pest of Breadfruit Trees (*Artocarpus altilis*, Parkinson Fosberg). The findings underscore the significance of understanding the ecological patterns and geographical spread of this beetle, which poses a threat to the cultivation of breadfruit in the region.

The research provides valuable information about the specific areas on Ayoke Island that are more susceptible to infestations, shedding light on the localized impact of the beetle on breadfruit trees. This knowledge is crucial for the development and implementation of targeted pest management strategies to mitigate the potential damage to breadfruit crops.

Additionally, the study enhances our understanding of the interaction between the Philippine Long-horned Beetle and breadfruit trees, contributing to the broader field of agricultural entomology. The identification of the beetle as a pest of breadfruit emphasizes the importance of monitoring and controlling its population to safeguard the agricultural and economic interests of the local community.

Acknowledgements. The authors express their sincere gratitude to the NEMSU Cantilan Administration led by Campus Director Dr. Juancho A. Intano, as well as the Research and Development Office under the guidance of Dr. Odinah C. Enteria and her dedicated staff, particularly Ms. Mary Ann G. Lafuente, for the financial support. Special appreciation is extended to the late Research Assistant, Anrdelou Bucalon, for his invaluable contribution, especially in data collection.
The authors also acknowledge the unwavering support of the LGU of Cantilan and BGU of Ayoke Island, which significantly contributed to the successful execution of the study. A special mention goes to Miss Sheila Kylene A. Tawas for generously sharing her expertise in the application of GIS.

References

[1] K.M. Al-Kindi, P, Kwan, N.R. Amdrew, M. Welch, and N.R. Andrew, Remote sensing and spatial statistical techniques for modelling *Ommatissus lybicus* (Hemiptera: Tropiduchidae) habitat and population densities, *Peer J,* **5** (2017), (e3752). https://doi.org/10.7717/peerj.3752

[2] A. Barševskis, A new genus and species of long-horned beetles of the tribe Apomecyni Lacordaire, 1872 (Coleoptera: Cerambycidae: Lamiinae) from the Philippines, *Acta Biol. Univ. Daugavp.*, **14** (2014), no. 2, 109 – 114.

[3] F. Duarte., M. V. Calvo, A. Borges and I. Scatoni, Geostatistics and geographic information systems to study the spatial distribution of *Grapholita molesta* (Busck)

(Lepidoptera: Tortricidae) in peach fields. *Neotropical Entomology,* **44** (2015), 319-327. Ethnobotany Research & Applications. (2011). *9* 129-149. https://doi.org/10.1007/s13744-015-0288-3

[4] S.O. Ijarotimi, F. Aroge, Evaluation of the nutritional composition, sensory and physical properties of potential weaning food from locally available food materials – breadfruit (Artocarpus altilis) and soybean (Glycine max), *Polish J. Food Nutr. Sci.*, **14** (2005), 411-415. https://doi.org/10.1108/00346650610642142

[5] A.M.P. Jones, D. Ragone, N.G. Tavana, D.W. Bernotas, and S.J. Murch, Beyond the Bounty: Breadfruit (Artocarpus altilis) for food security and novel foods in the 21st Century, *Ethnobotany Research & Applications,* **9** (2011), 129-149. https://doi.org/10.17348/era.9.0.129-149
www.ethnobotanyjournal.org/vol9/i1547-3465-09-129.pdf

[6] S. Liu ,Y. Li, H. Zhao and Y. Jin, *Spatial Distribution Pattern of Longhorn Beetle Assemblages (Coleoptera: Cerambycidae) in Mongolian Oak (Quercus Mongolica) Forests in Changbai Mountain, Jilin Province, China*.
https://doi.org/10.21203/rs.3.rs-795304/v1

[7] Yotkham S., Suttiprapan P., Likhitrakarn N., Sulin G., Srisuka W., Biodiversity and Spatiotemporal Variation of Longhorn Beetles (Coleoptera: Cerambycidae) in Tropical Forest of Thailand, *Insects*, **12** (2021), no. 1, 45.
https://doi.org/10.3390/insects12010045

[8]. M.M. Musthafa, F. Abdullah, A.P. *et al.* Martínez-Falcón, How mountains and elevations shape the spatial distribution of beetles in Peninsular Malaysia, *Sci. Rep.,* **11** (2021), 5791. https://doi.org/10.1038/s41598-021-84965-5

[9] D. A. P. Acal, J. Wiesner, O. M. Nuñeza, R. Jaskuła, Tiger beetles (Coleoptera, Cicindelidae) of Northern Mindanao region (Philippines): checklist, distributional maps, and habitats, *ZooKeys*, **1017** (2021), 37-75.
https://doi.org/10.3897/zookeys.1017.34500

[10] M. A. Abayon, R B. Parilla, B. Lassalle and R. Schnell, Occurrence of Distinct Carabid Beetles (Coleoptera: Carabidae) in Eastern Visayas, Philippines, *Journal of Entomological Science*, **55** (2020), no. 4, 507–519.
https://doi.org/10.18474/0749-8004-55.4.507

[11] R.A.B. Leschen and R.G. Beutel, *Handbook of Zoology*. *Arthropoda: Insecta. Coleoptera*, Beetles. V. 3: Morphology and Systematics (Phytophaga). Walter de Gruyter GmbH, Berlin/Boston, 2014, 687p.
https://doi.org/10.1515/9783110274462

[12] M.L. Monné, M.A. Monné, and Q. Wang, *General Morphology, Classification and Biology of Cerambycidae*. In: Wang Q (Ed.) Cerambycidae of the World: Biology and Pest Management. CRC Press, Boca Raton, 2017, 1–76.

Received: December 2, 2023; Published: December 12, 2023