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# Insect Fauna of Bhimbandh Wildlife Sanctuary, Bihar, India: A Baseline Assessment

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Authors SY and Abhishek conceptualized and supervised the study. Authors Mayank Singh, RR, Abhishek and AKM collected the data. Authors Mayank Singh, RR, Md Shahbaz and MMZ collated the data. Author MMZ prepared the map. Authors Abhishek and AKM responsible for Project administration and management of Resources. Authors Mayank Singh, RR, Md Shahbaz prepared the initial draft of the manuscript. Author SY edited the manuscript. All authors read and approved the final manuscript.*

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## ABSTRACT

This paper presents the list of insects found during the 15-day faunal assessment survey of the Bhimbandh Wildlife Sanctuary (BWS), Bihar. In total, 112 species of insects were documented. A preliminary checklist has been prepared that provides baseline information for biodiversity studies in the region. These species are distributed across 11 orders and 56 families. Of these, 41 species

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belonged to order Lepidoptera, 18 to order Coleoptera, 12 to order Hymenoptera, 11 to order Orthoptera, nine to order Hemiptera, eight to order Odonata, six to order Diptera, three to order Blattodea, two to order Mantodea, and one each to order Plecoptera and Dermaptera. This checklist is crucial for understanding the health of the ecosystem of Bhimbandh Wildlife Sanctuary.

*Keywords: Biodiversity; insects; pollinators; predators; decomposers; Solenopsis Invicta; plutella xylostella; Hyposidra talaca; Leucoma salicis; Neocurtilla hexadactyla; Leptocorisa oratoria; Tetranychus urticae.*

## 1. INTRODUCTION

Insects form the essential pillar of ecosystem services (Sanmartín-Villar & Cordero-Rivera, 2024) and serve as bioindicators of environmental health (Chowdhury et al., 2023). They play a fundamental role in maintaining a healthy ecosystem, yet their diversity remains under-documented. Moreover, the insect biodiversity is threatened globally. The primary drivers of insect species decline include: i) habitat loss due to agricultural expansion and urbanisation; ii) pollution, mainly due to the use of synthetic pesticides and fertilisers; iii) biological factors, including pathogens and invasive species; and iv) climate change (Sánchez-Bayo & Wyckhuys, 2019). Given the vital role of insects in ecosystems, documenting their presence across various environments is essential. Such efforts support species conservation and enhance biodiversity in environmental management programs (Verma et al., 2023).

Bhimbandh Wildlife Sanctuary (BWS) hosts a diverse array of wildlife and is particularly renowned for its rich birdlife, with 147 bird species documented. (Khan & Pant, 2017). However, no comprehensive checklist of insects specific to the sanctuary is currently available. This checklist aims to document the diverse insect groups present in BWS, providing a foundation for further exploration and study of its entomological diversity.

## 2. MATERIALS AND METHODS

BWS is located in the southwest of Munger district (25.23°N, 86.28°E) in Bihar, India, near the town of Haveli Kharagpur (Fig. 1). It spans an area of approximately 681.99 km² and is characterized by diverse terrain, including the undulating Kharagpur Hills, part of the Chota Nagpur Plateau in southeastern Bihar. The sanctuary lies south of the Ganges River, west of Santhal Pargana, and is surrounded by densely populated non-forestry areas. The sanctuary has a mix of hills, plains, and plateaus, with the Kharagpur Hills forming its core.

The area is covered by tropical dry deciduous forests, with dominant species like *Shorea robusta* (sal), *Diospyros melanoxylon* (kendu), *Boswellia serrata* (salai), *Terminalia tomentosa* (Asan), *Terminalia bellirica* (Bahera), *Terminalia arjuna* (Arjun), and *Pterocarpus marsupium* (Paisar). The terrain is undulating, with valleys and foothills. Grasslands, wetlands, and geothermal springs are also present. (Sinha & Santra, 2019).

The sanctuary's diverse microhabitats support rich biodiversity, warranting further study. A comprehensive biodiversity survey focusing on smaller organisms, such as amphibians, insects, and plants, could reveal endemic subspecies or unique genetic adaptations. The present study is the first attempt to document the insect fauna of BWS. This paper presents a list of insects seen in the sanctuary during a short faunal survey of a duration of 15 days spanning the last week of March to the first week of April 2025. The insects were photographed and documented during a faunal survey by line transect in the Kharagpur and Mallepur areas of BWS. Digital cameras and smartphone cameras with macro capabilities were used to photograph the insects in their natural habitat. Identification was done with the help of experts in the field and standard entomological field guides. No specimens were collected, adhering to non-invasive survey protocols.

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## 3. RESULTS AND DISCUSSION

A total of 112 species of insects belonging to 11 orders and 56 families were documented during the survey (Table 1). Although the area is highly disturbed due to anthropogenic activities such as

mining, deforestation, and extremism, including poaching, a rich assemblage of insects was found in the area. Lepidopterans were the most dominant group, followed by Coleoptera (Fig. 2). This dominance pattern is ecologically significant as both orders represent key functional groups essential for ecosystem stability. Lepidoptera serve as primary pollinators, herbivores, and prey species in food webs, while Coleoptera function as decomposers, predators, and soil engineers (Fig. 2). The prominence of these groups indicates the presence of intact ecological processes, including pollination networks, decomposition pathways, and predator-prey dynamics that are fundamental to ecosystem functioning. Similar findings were reported by (Arya et al., 2021; Balakrishnan et al., 2014; Mathew et al., 2004; Rasheed & Buhroo, 2020). The presence of pollinators, predators, and decomposers highlights the functional diversity of the insect community in the area. The observation of invasive species like *Solenopsis invicta* and *Plutella xylostella* indicates potential ecological challenges that warrant further investigation.

**Table 1. Checklist of insects in Bhimbandh wildlife sanctuary**

| S. No. | Family name | Common name | Zoological name |
|---|---|---|---|
| Order Lepidoptera | | | |
| 1 | Nymphalidae | Blue pansy | *Junonia orithya* |
| 2 | | Baronet butterfly | *Euthalia nais* |
| 3 | | Chocolate pansy | *Junonia iphita* |
| 4 | | Common crow | *Euploea core* |
| 5 | | Common glider | *Neptis sappho* |
| 6 | | Tawny coster | *Acraea terpiscore* |
| 7 | | Danaid eggfly | *Hypolimnas misippus* |
| 8 | | Common castor | *Ariadne merione* |
| 9 | | Red-eye bush brown butterfly | *Heteropsis adolphei* |
| 10 | | Gulf fritillary | *Dione vanillae* |
| 11 | | Dark brand bushbrown | *Mycalesis mineus* |
| 12 | Pieridae | Common emigrant | *Catopsilia pomona* |
| 13 | | Common grass yellow | *Eurema hecabe* |
| 14 | | Common albatross | *AppiasAppias albina* |
| 15 | | Psyche butterfly | *Leptosia nina* |
| 16 | | Lesser gull | *Cepora nadina* |
| 17 | | Common wanderer | *Pareronia valeria* |
| 18 | Lycaenidae | Lesser grass blue | *Ziznia otis* |
| 19 | | Common pierrot | *Castalius rosimon* |
| 20 | Erebidae | Oak moth | *Phoberia atomaris* |
| 21 | | Shaded fan-foot | *Herminia tarsicrinalis* |
| 22 | | Simplicia | *Simplicia bimarginata* |
| 23 | | Tiger moth | *Asota ficus* |
| 24 | | Underwing moth | *Catocala nupta* |
| 25 | | White satin moth (pest) | *Leucoma salicis* |
| 26 | | Yellow-belted burnet | *Amata phegea* |
| 27 | Crambidae | Autocharis | *Autocharis fessalis* |
| 28 | | Parotis | *Parotis marginata* |
| 29 | | Spotted beet webworm moth | *Hymenia perspectalis* |
| 30 | Geometridae | Black looper (pest) | *Hyposidra talaca* |
| 31 | | Comibaena | *Comibaena striataria* |
| 32 | | Lesser cream wave | *Scopula prosoeca* |
| 33 | | Maple spanworm moth | *Ennomos magnaria* |
| 34 | Noctuidae | Oriental armyworm moth | *Mythimna separata* |
| 35 | | Semi-looper | *Trigonodes hyppasia* |
| 36 | Nolidae | Nola | *Nola lucidalis* |
| 37 | Papilionidae | Common rose | *Pachliopta aristolochiae* |
| 38 | Plutellidae | Diamondback moth (invasive species) | *Plutella xylostella* |
| 39 | Pterophoridae | Twin-spot plume moth | *Stenoptilia bipunctidactyla* |
| 40 | Pyralidae | Indian meal moth | *Ploida interpunctella* |
| 41 | Tortricidae | Oak leaftier | *Acleris semipurpurana* |
| Order Coleoptera | | | |
| 42 | Cleridae | Checkered beetle | *Trichodes apiarius* |

| S. No. | Family name | Common name | Zoological name |
|---|---|---|---|
| 43 | Coccinellidae | Common Australian ladybug | *Coelophora inaequalis* |
| 44 | | Lady beetle | *Rodatus boucardi* |
| 45 | | Seven-spot ladybird | *Coccinella septempunctata* |
| 46 | | Spotless ladybug | *Cycloneda sanguinea* |
| 47 | | Transverse lady beetle | *Coccinella transversalis* |
| 48 | Chrysomelidae | Blue flea beetle | *Altica corrusca* |
| 49 | | Blue milkweed beetle | *Chrysochus cobaltinus* |
| 50 | Dystiscidae | Great diving beetle | *Dytiscus marginalis* |
| 51 | Lampyridae | Firefly | *Photinus pyralis* |
| 52 | Scarabaeidae | May beetle | *Phyllophaga longitarsa* |
| 53 | Staphylinidae | Rove beetle | *Paederus littoralis* |
| 54 | Tenebrionidae | Darkling beetle | *Cossyphus limbatus* |
| 55 | | Destructive flour beetle | *Tribolium destructor* |
| 56 | | Flour beetle | *Tribolium castaneum* |
| 57 | Carabidae | Ground beetle | *Ophionea indica* |
| 58 | Cerambycidae | Burnt pine longhorn beetle | *Arhopalus ferus* |
| 59 | | Old house borer | *Hylotrupes bajulus* |
| Order Hymenoptera | | | |
| 60 | Apidae | Dwarf honey bee | *Apis florea* |
| 61 | | Indian honey bee | *Apis cerana indica* |
| 62 | | Rock bee | *Apis dorsata* |
| 63 | Chrysididae | Cuckoo wasp | *Chrysura refulgens* |
| 64 | Evaniidae | Blue-eyed ensign wasp | *Evania appendigaster* |
| 65 | Formicidae | Asian weaver ant | *Oecophylla smaragdina* |
| 66 | | Black carpenter ant | *Camponotus pennsylvanicus* |
| 67 | | Fire ant (invasive alien species) | *Solenopsis invicta* |
| 68 | Ichneumonidae | Dusona | *Dusona leptogaster* |
| 69 | Vespidae | Indian potter wasp | *Delta pyriforme* |
| 70 | | Oriental hornet | *Vespa orientalis* |
| 71 | | Yellow paper wasp | *Polistes carnifex* |
| Order Odonata | | | |
| 72 | Coenagrionidae | Saffron-faced blue dart | *Pseudagrion rubriceps* |
| 73 | | Yellow wax tail | *Ceriagrion coromandelianum* |
| 74 | Gomphidae | Pincertails | *Onychogomphus forcipatus* |
| 75 | Libellulidae | Brown dusk hawk | *Zyxomma petiolatum* |
| 76 | | Crimson marsh skimmer | *Trithemis aurora* |
| 77 | | Ditch jewel | *Brachythemis contaminata* |
| 78 | | Common picture wing | *Rhyothemis variegata* |
| 79 | | Violet dropwing | *Trithemis annulata* |
| Order Orthoptera | | | |
| 80 | Acrididae | Chinese grasshopper | *Acrida cinerea* |
| 81 | | Pallid-winged grasshopper | *Trimerotropis pallidipennis* |
| 82 | | Short-winged grasshopper | *Dichromorpha viridis* |
| 83 | | Tree locust | *Anacridium flaviscence* |
| 84 | Gryllidae | Black field cricket | *Teleogryllus commodus* |
| 85 | Gryllidae | Two-spotted cricket | *Gryllus bimaculatus* |
| 86 | Gryllotalpidae | Northern mole cricket (pest) | *Neocurtilla hexadactyla* |
| 87 | Pyrgomorphidae | Big green locust | *Phymateus viridipes* |
| 88 | Tettigonidae | Black-kneed meadow katydid | *Conocephalus melaenus* |
| 89 | | Common true katydid | *Pterophylla camellifolia* |
| 90 | | Long legged katydid | *Mecopoda niponensis* |
| Order Diptera | | | |
| 91 | Asilidae | Robber fly | *Promachus vertebratus* |
| 92 | Chironomidae | Black&white midge | *Coelotanypus scapularis* |
| 93 | | Poster buzzer midge | *Chironomus plumosus* |
| 94 | Culicidae | Common house mosquito | *Culex pipiens* |
| 95 | Muscidae | Housefly | *Musca domestica* |
| 96 | Tephritidae | Melon fly | *Bactrocera cucurbitae* |
| Order Blattodea | | | |
| 97 | Blaberidae | Madagascar hissing cockroach | *Gromphadorhina portentosa* |
| 98 | | German cockroach | *Blatella germanica* |
| 99 | Ectobiidae | Amber wood cockroach | *Ectobius vittiventris* |

| S. No. | Family name | Common name | Zoological name |
|---|---|---|---|
| Order Hemiptera | | | |
| 100 | Alylidae | Rice ear bug (a pest) | *Leptocorisa oratoria* |
| 101 | Cicadellidae | Leafhopper | *Idiocerus stigmaticalis* |
| 102 | Flatidae | Citrus flatid planthopper | *Metcalfa pruinosa* |
| 103 | Pentatomidae | Brown marmorated stink bug | *Halyomorpha halys* |
| 104 | | Green vegetable bug (a pest) | *Nazara viridula* |
| 105 | | White spotted stink bug. | *Eysarcoris ventralis* |
| 106 | Pyrrhocoridae | Red cotton stainer | *Dysdercus cingulatus* |
| 107 | Rhyparochromidae | One-spotted seed bug | *Metochus uniguttatus* |
| Order Mantodea | | | |
| 108 | Amelidae | Grey mantis | *Ameles decolor* |
| 109 | Mantidae | Mexican unicorn mantis | *Phyllovates chlorophaea* |
| Order Plecoptera | | | |
| 110 | Perlidae | Stonefly | *Acroneuria perplexa* |
| Order Trombidiformes | | | |
| 111 | Tetranychidae | Red spider mite (Pest) | *Tetranychus urticae* |
| Order Dermaptera | | | |
| 112 | Labiduridae | Black field earwig | *Nala lividipes* |

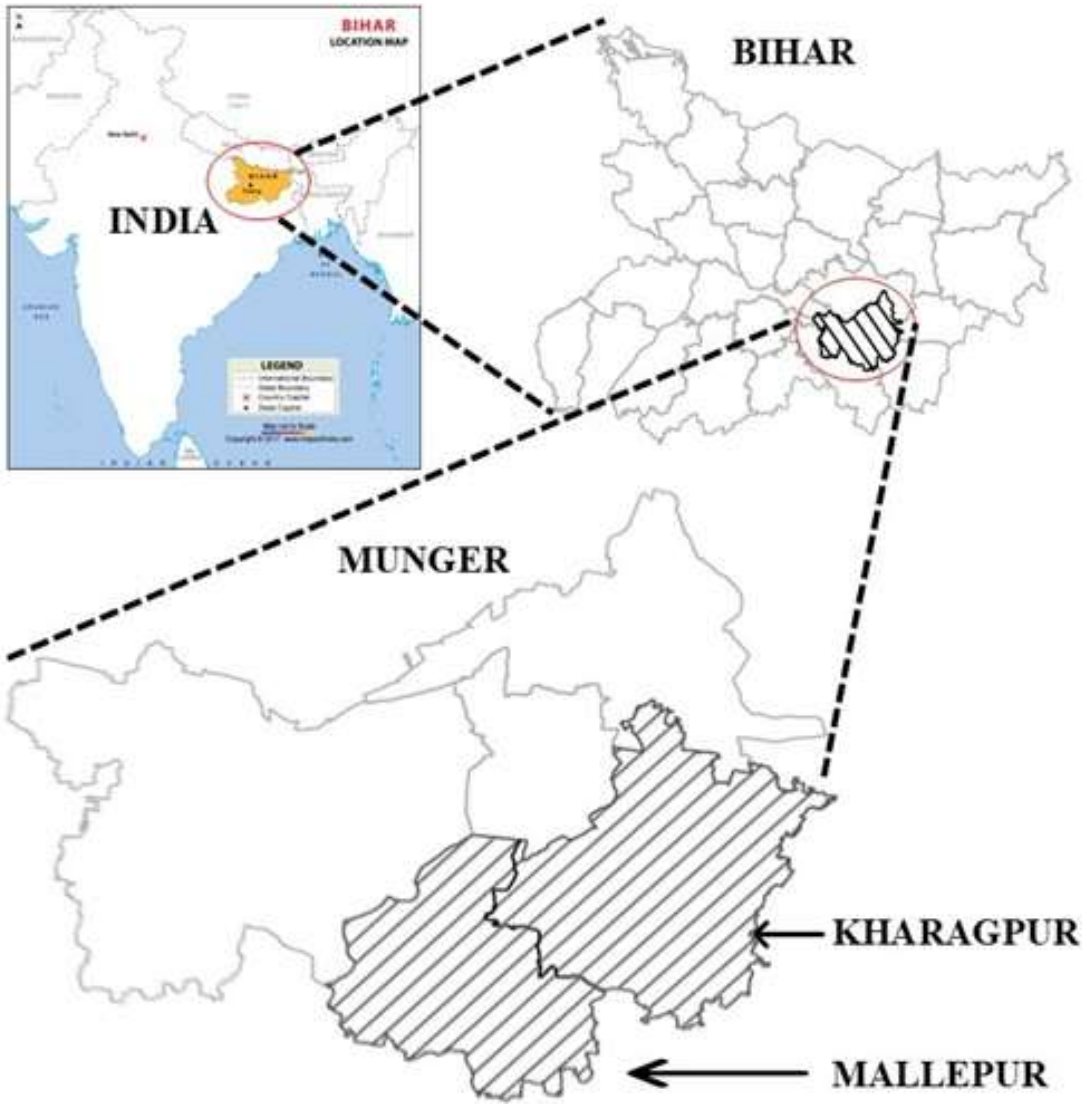



**Fig. 1. Map of study area**

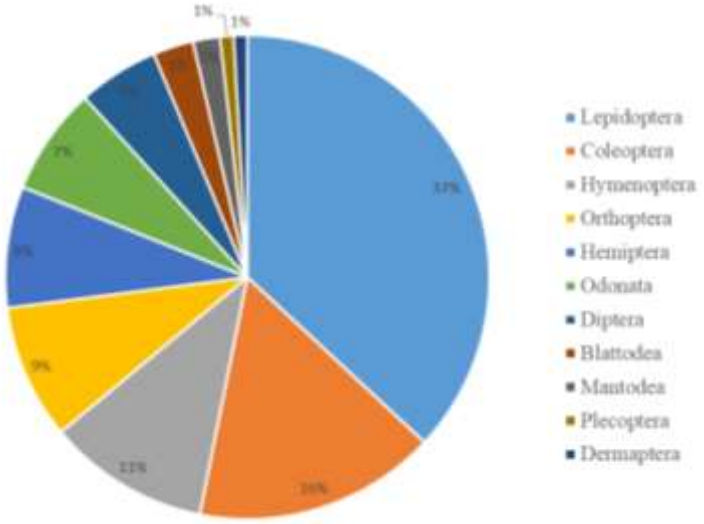



**Fig. 2. Percent occurrence of different insect orders in BWS**

The study's finding of a rich assemblage of 112 insect species (Fig. 3), across 11 orders and 56 families, appears paradoxical given the acknowledged "highly disturbed" nature of the area due to human activities. This is not a contradiction but rather a key element of the ecological narrative. The presence of a vibrant insect community, despite pressures from mining, deforestation, and poaching, may indicate a degree of ecological resilience. This species richness may be sustained by the proliferation of generalist species that are more tolerant of habitat fragmentation and edge effects. The comprehensive inventory of BWS entomofauna offers a vital snapshot of a dynamic ecosystem, serving as a baseline to monitor changes in species composition in response to future disturbances. Furthermore, this study addresses a significant gap in both local and global entomological research.

**Order: Lepidoptera**


Euthalia nais


Junonia iphita


Euploea core


Neptis sappho


Appias albina


Acraea terpsicore


Leptosia nina


Hypolimnas misippus


Cepora nadina


Ariadne merione


Heteropsis adolphei


Pareronia valeria


Dione vanillae


Mycalesis mineus


Parotis cf marginata


Phoberia atomaris


Stenoptilia bipunctidactyla


Plutella xylostella


Scopula prosoeca


Ennomos magnaria


Simplicia bimarginata


Hyposidra talaca


Herminia tarsicrinalis


Comibaena striataria


Autocharis fessalis


Plodia interpunctella


Catocala nupta


Amata phegea


Trigonodes hyppasia


Nola luculalis


Leucoma salicis


Acleris semipurpurana


Hymenia perspectalis


Asota ficus


Mythimna separata

**Order: Coleoptera**

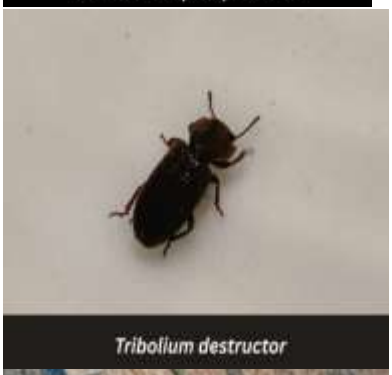

Ophionea indica


Cycloneda sanguinea


Coccinella septempunctata


Coccinella transversalis


Tribolium castaneum


Tribolium destructor


Paederus littoralis


Photinis pyralis


Dytiscus marginalis










**Order: Hymenoptera**












**Order: Orthoptera**










Gryllus bimaculatus


Anacridium flaviscence

**Order: Hemiptera**


Metochus uniguttatus


Dysdercus cingulatus


Reduvius personatus


Eysarcoris ventralis


Idiocerus stigmaticalis


Halyomorpha halys


Leptocorisa oratoria


Nazara viridula


Metcalfa pruinosa

**Order: Odonata**


Rhyothemiss variegata


Ceriagrion coromandelianum


Zyxomma petiolatum






**Order: Diptera**







**Order: Blattodea**




**Order: Mantodea**



**Order: Plecoptera**


**Order: Dermaptera**


**Fig. 3. Insects found in the Bhimbandh Wildlife Sanctuary**

A global analysis of insect diversity revealed that many of the world's most dominant and abundant insect families are "dark taxa"—taxonomically neglected and poorly studied (Srivathsan et al., 2023). As the first comprehensive inventory of insects in BWS, this research provides crucial baseline data that contributes to a broader, global effort to fill this information void. This elevates the study's contribution from a localized assessment to a document of international scientific relevance, providing a foundation for future conservation and taxonomic efforts (Srivathsan et al., 2023). The ecological health of any ecosystem is directly tied to the functional diversity of its constituent species. The insect community of BWS is not merely rich in numbers but also performs a variety of critical ecosystem services. The report's mention of pollinators, decomposers, and predators highlights a functionally robust community that is integral to the sanctuary's overall integrity. The insect inventory of BWS serves as a foundational step in applying the principles of bioindication. The presence of specific species or groups can now be used to track changes in the ecosystem's health over time. A decline in certain sensitive Lepidoptera or Coleoptera species could be an early indicator of increasing deforestation or climate stress.

## 4. CONSERVATION IMPERATIVES AND RECOMMENDATIONS

- **Policy and Management Context for BWS:** Effective conservation of BWS requires a multifaceted approach that integrates existing policy frameworks with on-the-ground action. The Ministry of Environment, Forests, and Climate Change has officially notified an Eco-sensitive Zone (ESZ) extending up to two kilometers around the sanctuary's

boundary. This notification mandates the preparation of a Zonal Master Plan (ZMP) within a two-year period, which will include a dedicated Tourism Master Plan. The ZMP is designed to regulate and promote activities to safeguard the sanctuary's ecosystem and will likely prohibit new polluting industries, stone quarrying, and brick kilns, mirroring the regulations of other ESZ notifications, such as the one for Kaimur Wildlife Sanctuary in Bihar (Civis.vote. 2025).

- **From Policy to Practice: The Need for Community Engagement:** Policy documents alone are insufficient for long-term conservation. Their success is predicated on the active participation and education of the local communities that live in and around the sanctuary. A model for such engagement already exists within the Munger district itself. The "Sustainable Agriscapes for Future" program, supported by the International Union for Conservation of Nature (IUCN), has successfully introduced the concepts of Biodiversity Management Committees (BMCs) and Biodiversity Registers to local farmers. This grassroots-level initiative aims to raise awareness about the benefits of a biodiverse landscape and empowers communities to systematically record and manage the species found in their surroundings. The report recommends that this proven model of community-based conservation be integrated into the Zonal Master Plan for BWS, ensuring that conservation efforts are collaborative and sustainable (International Union for Conservation of Nature 2018, October 4).

## 5. CONCLUSION

The comprehensive inventory of insect species in BWS provides a critical scientific baseline for future ecological studies and conservation planning. The findings, which document a rich and functionally diverse entomofauna despite significant human pressures, offer a valuable snapshot of an ecosystem’s capacity for resilience. However, the analysis also reveals a complex web of interconnected threats. Poaching disrupts the food source for decomposer beetles, which are vital for soil fertility, while invasive species present a complicated duality, serving as both potential biocontrol agents for agriculture and as threats to the native insect predator community. The presence of a notorious pest like the Diamondback Moth, which has developed universal insecticide resistance, underscores the need for integrated pest management strategies that extend beyond the sanctuary's boundaries. The study's data, interpreted through the lens of bioindication, provides an invaluable tool for continuous environmental monitoring. The presence and abundance of key insect orders can serve as a dynamic early warning system for habitat degradation and climate stress. As the BWS moves forward with the development of its Zonal Master Plan, this study's findings will be essential. The report concludes that the successful conservation of this natural treasure will depend on a multi-faceted approach that not only implements robust, science-backed policies but also fosters a deep-seated commitment to biodiversity stewardship within the local community.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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