International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 23-10-2024, Accepted: 22-11-2024, Published: 07-12-2024
Volume 9, Issue 12, 2024, Page No. 40-43

The role of insect pests in affecting the Poba Reserve Forest, Dhemaji district, Assam in India

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Abstract
The present study examines the insect diversity in the Poba Reserve Forest, identifying 8 families, 2 orders, and 17 insect species. The two insect orders observed were Coleoptera and Hemiptera, with Coleoptera being the most abundant, constituting 75% of the total insect population, while Hemiptera accounted for 25%. Among the 9 insect families recorded, Cerambycidae was the most dominant, representing 40% of the total insect diversity, followed by Chrysomelidae at 32%. Other families observed in smaller proportions include Scarabaeidae, Bastrichidae, Curculionidae, Rhopalidae, Cicadidae, Flatidae, and Pyrrhocoridae, each making up 5% of the total. The study highlights the significant dominance of beetles (Coleoptera) within the forest ecosystem and underscores the need for further investigation into the ecological roles these insects play in forest health and biodiversity. The findings provide valuable baseline data for future conservation efforts and pest management strategies in the Poba Reserve Forest, emphasizing the importance of understanding insect dynamics in maintaining ecological balance.

Keywords: Insect diversity, Poba Reserve Forest, Coleoptera, Hemiptera, Cerambycidae, biodiversity, pest management

Introduction

Human-wildlife conflict is a global challenge with significant social, culture, economic, and conservation-related consequences. This conflict has existed for as long as human and wild animals have shared habitats and resources (Lamarque *et al.,* 2008) [1]. While direct interactions between human and wildlife can occur in both urban and rural environments, these conflicts are more frequently observed is habitat encroachment, which leads to the overlap of human and animal territories, resulting in negative outcomes for both parties (WPC, 2003) [2]. As human activities continue to degrade habitats both qualitatively and quantitatively, wild animals are forced to expand their ranges and raid human crops in search of food (Borah *et al.*, 2005) [3]. One prominent example of human-wilflife conflict is the interaction between human and elephants, where elephants often raid crops, cause infrastructural damage, and disrupt daily activities, leading to injuries or deaths of both humans and elephants (Hoare, 2000) [4]. Elephant incursions into human settlements are not a recent phenomenon; they have been occurring ever since humans began farming within elephant habitats. Similarly, the wild boar (Sus scrofa), one of the most widely distributed large mammals, is also known to be a major agricultural pest (Wilson-Holt and Steele, 2019) [5]. Other animals, such as monkeys, often enter homes and farms consuming or damaging food, leading to crop loss. In addition to larger mammals, small vertebrates like rodents also pose a significant threat to agriculture, causing substantial financial losses for farmers.

As human activities continue to expant into areas traditionally inhabited by wildlife, the competition for space and resources intensifies, often resulting in violent confrontations. As animals like elephants, wild boars, and monkeys move into agricultural areas or human settlements, they can cause extensive damage to crops, infrastructure, and even human lives. The consequences of these interactions can be devastating for local communities, who rely on agriculture and livestock for their livelihoods. In some cases, these negative interactions lead to retaliatory killings, which further harm animal population and exacerbate the conflict. To reduce the impact of human-wildlife conflict, it is essential to adopt a combination of approaches that address both the root causes and the immediate consequences of these interactions. Strategies could include improving land-use planning, enhancing wildlife management practices, creating wildlife corridors to reduce habitat fragmentation, and increasing public awareness and education about the importance of conserving wildlife (König *et al.*, 2020; Erlinda *et al.*, 2021) [6, 7]. Additionally, compensating farmers for their losses, using non-lethal deterrents, and implementing proactive measures such as early-warning systems can help reduce the likelihood of conflict. Human-wildlife conflict is a significant and growing issue that affects both human communties and wildlife populations worldwide. With effective strategies focused on habitat conservation, community engagement, and mitigating the negative impacts of these conflicts, it is possible to find solutions that benefit both people and wildlife.

Material and mathods

Study area

The Poba Reserved Forest (located at 27◦50'11" N and 95◦17'45" E) is found in the Jonai Subdivision of Dhemaji District in Assam. Established in 1924, the reserved Forest spans an area of 10,221 hectares. Poba is renowned as one of the most biologically diverse rainforests in Northeast

India, making it a significant biodiversity hotspot. The highest experiences an annual rainfall between 3,600mm and 4000mm. The highest recorded temperature during the summer is 35°C, while winter temperature can drop as low as 7°C. In terms of boundaries, to the north, it is bordered by the foothills of the Himalayan range in Arunachal Pradesh; and Lohit rivers into the mighty Brahmaputra, as well as the Dibru-Saikhowa National Park; and to the west, it is adjacent to the revenue villages of Jonai Subdivision, Dhemaji district, Assam. Poba Reserve Forest is an essential elephant corridor, linking the foothills of Arunachal Pradesh with Dibru-Saikhowa National Park through the proposed Kobu Chapari Reserve Forest. The surrounding areas of the forest are home to various ethnic groups, including the Mising, Bodo, Sonowal, Kachari, and Hajong (Rabha) communities, who rely heavily on the forest for their livelihoods. Ongoing scientific research continues to explore the diverse flora and fauna of the region. However, the forest faces significant threats from both human activities and natural evants, particularly erosion caused by the Siang River. If deforestation and erosion persist, immediate and effective conservation efforts will be necessary to protect this vital rainforest.

Materials

Following material were used during field work: -

a. Sweeping net.
b. Collecting vials.
c. Transparent envelop.
d. Field guide book
e. Camera/Mobile phone.
f. GPS
g. 70% alcohol.

Sampling method

The Siang river basin, encompassing the villages of Melnhug and Bahir Sille, was thoroughly studied during the summer months (April to July). Accessible walking trails in the forest from various directions (connecting the village areas) were used to collect insect pests.

Insect collection

A thorough survey was conducted along accessible walking trail to gather insect pests. Pests were collected using netting and hand-picking techniques, and photographs were taken to document the pests affecting specific parts of the plants. The twings, leaves, branches, and timber of the plants were examined for pests, while the frequency of the insect pests was also recorded.

Data analysis

The raw data were organized using Excel software and analyzed using the relative abundance formula. Relative abundance (%) refers to the percentage representation of a specific organism in relation to the total number of organisms present in the area. This method was employed to display the composition of identified insect pests by family and order.

Relative abundance $(\%) = (n/N) * 100$

n= Number of each individual
N= Total number of individual

Results

The present study found 8 families, 2 orders, and 17 insect species (Table 1).

Two insect orders, Coleoptera and Hemiptera, were observed in the study area. Of these, the Coleoptera order was the most prevalent, accounting for 75%, while the Hemiptera order was the least abundant at 25% (Fig. 2). Nine insect families were identified in the study area. Among them, the Cerambycidae family was the most abundant, comprising 40%, followed by the Chrysomelidae family at 32%. The remaining families, including Scarabaeidae, Batrichidae, Curculionidae, Rhopalidae, Cicadidae, Flatidae, and Pyrrhocoridae, each represented 5% of the total (Fig. 3).

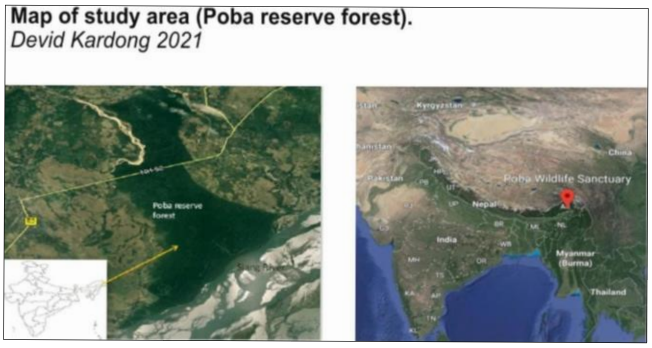

Fig 1: Map of Study Area (Poba Reserve Forest)

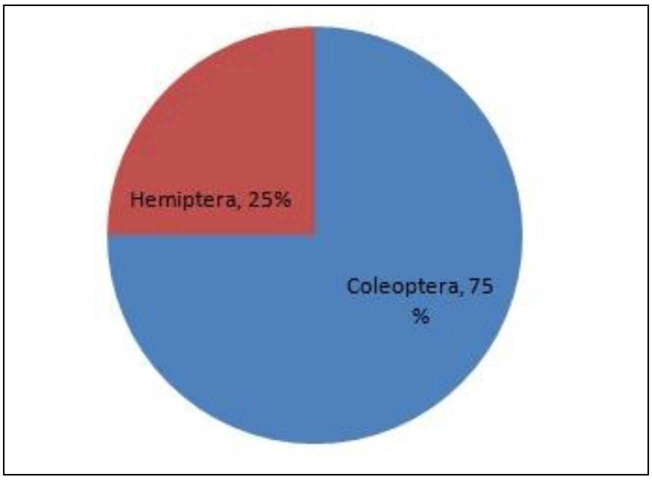

Fig 2: Order wise composition of insect pest in study area

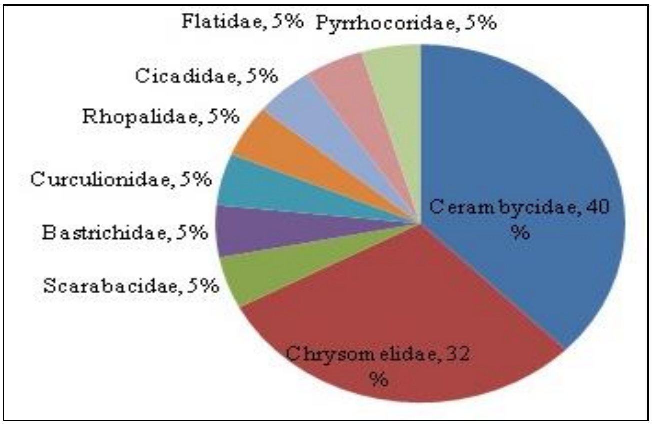

Fig 3: Family wise composition of insect pest in study area

Table 1: The description of identified insect pests and which plant part damage

Order	Family	Species name	Common name	Host plant	Damage part
Coleopteran	Chrysomelidae	*Aspidimopha sanctaecrucis*	Golden tortoise beetle	*Ipomoea spp., bind weed*	Both larvae and adults feed on foliage. The typical form of injury is the creation of numerous small to medium-sized irregular holes. Both stages usually inhabit the lower surface, but eat entirely through the foliage.
	Cerambycidae	*Acanthophorus serraticornis*	Longicorn beetle	*Acacia arabica, Dalbergia paniculata*	Roots, stem
		Analeptes trifasciata	Flat-faced longhorn beetle	Cashew	Stem
		Batocera rufomaculata	Fig borer, mango stem borer	*Mangifera indica*	Grubs, feeding below the bark, making tunnels, boring into the main stem.
		Chlorophorus anmuleris	Bamboo longhorn beetle	*Bambusa vulgaris*	Infests dry bamboo and feeds internally with in stems.
		Pseudonemphas versteegi	Citrus trunk borer	*Citrus aurantium*	Branches to feed on foliage.
		Pyrrhidium sanguineum	Oak longhorn beetle	*Quercus velutina*	Larvae attack dry or rotten wood.
	Scarabaeidae	*Anomala cuprea*	Oriental beetle	*Tectona grandis*	Root feeder, feed on flowers and leaves.
	Chrysomelidae	*Calopepda leayana*	Gamar defoliator	*Gmelina arborea*	Defoliation. The larvae and adults start feeding voraciously, skeletonising the leaf completely leaving midrib.
		Chrysolina coerulan	Blue mint beetle	*Wild mint plants*	Feed on mint leaves.
		Chrysochus cobaltinus	Blue milkweed beetle	*Apocynum cannabium*	Feed on the foliage
	Bostrichidae	*Dinoderus minutes*	Bamboo borer or wood-boring beetle	*Bambusa tulda*	Stems (above ground) Shoots / Trunks / Branches.
	Curculionidae	*Alcidodes crassus*	Weevil	Hollong tree	Root, stem
Hemiptera	Cicadidae	*Gaeana maculata*	Speekled black cicada	*Michelia champaca*	Feed on plants
	Flatidae	*Metcalfa pruinosa*	Flatid plant hopper	Citrus tree, Orchard, numerous shrub etc	Damage buds of freeze damaged citrus, and may cause sooty mold deposits on leaves, in heavy infestations.
	Pyrrhocoridae	*Dysdercus cingulatus*	Red cotton stainer	Red seed cotton tree	Seed, leaves
	Rhopalidae	*Boisea trivittata*	Boxelder bug	*Acer negundo*	Feed on sap from seeds, flowers and leaves.

Discussion

Insect pests have considerable and widespread effects on the economic and ecological functions provided by India's forests. In particular, invasive insect cause significant harm to the biodiversity, economy, and ecology of the affected regions. To better understand the impacts of pests on India's forests, we identified the key insect pests harming major tropical tree species and assessed their potential effects on forest ecosystems. Gathering information on the severity of pest damage to native host tree species is crucial for making informed conservation decisions for these species. Specifically, this data is essential for analyses that aim to evaluate and prioritize the vulnerability of native tree species to one of the main threats to their long-term survival in the landscape. Such assessments consider not only the sensitivity and adaptive capacity of the host species but also their exposure to the threat.

The current study identified 17 insect pest species from two orders (Coleoptera and Hemiptera) and 9 families (Chrysomelidae, Scarabaeidae, Cerambycidae, Bostrichidae, Curculionidae, Rhopalidae, Flatidae, Cicadidae and Pyrrhocoridae). The Cerambycidae family within the order Coleoptera was found to be the most abundant. Among the pests recorded in the study, some have been previously reported as major pests due to the damage they cause to host trees. Notably, *Diastocera trifasciata* has been identifies, while *Anomala cuprea* has been reported as a major pest of *Tectona grandis* (Sagun) trees in India and abroad (Rahman *et al.*, 2017) [8]. The abundance of insect pests varied significantly across different host plants. The presence of pests is influenced by factors such as the suitability of the host, climate conditions, and other disturbances, which results in differences in pest occurrence and infestation across various host plants. Additionally, pest distribution is affected by variations in management practices within the study area (Talukder *et al.*, 2018) [9].

Insect populations are influenced by both biotic and abiotic factors. Among the abiotic factors, temperature, relative humidity, and rainfall play crucial roles (Soultani *et al.*, 2012) [10]. The present sutdy found a positive correlation between the frequency of insect pest species and temperature, with pest abundance increasing as temperature rose. This observation aligns with the findings of Vidya *et al.*, (2011) [11], where the abundance of insect pests on cruciferous vegerables increased with higher temperatures in the Nilgiri district of India. Relative humity also has a significant impact on insect life, influencing their development and reproductive activities either directly or indirectly (Chang *et al.*, 2008) [12]. In this study, insect pest frequency showed a negative correlation with relative humidity, indicating that as humidity increased, pest frequency decreased. Higher humidity levels negatively affect arthropod populations, as they promote fungal pathogens that harm the insects, leading to a decline in their numbers (Sharma, 2014) [13]. This could explain why the insect pest population decreased as relative humidity increased.

Conclusion

Forests are essential for life on Earth. They have been of immense value to humans and other organisms since ancient times. Once, about 60% of the Earth's surface was covered by forests. However, with societal development, vast areas have been cleared for agriculture, mining, urbanization, and infrastructure. Currently, approximately 30% of the Earth remains forested. Forests provide a wide range of resources, including timber, plywood, and fuelwood. Timber is commonly used in furniture production, construction, and other industries. Additionally, forests offer fruits, nuts, and spices. However, global changes and growing human activities have altered the habitats of many species, including plants and animals, leading to reduced ecosystem stability and more frequent insect pest outbreaks. In many countries, invasive forest pests are now a major concern, causing significant negative impacts on both ecological systems and the economy.

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