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Medicinal potential of insects: An ethnoentomological and field-based assessment in Chennai, India

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Abstract
Insects constitute the largest group in the animal kingdom and are distinguished by their immense diversity and unique characteristics. For centuries, insects have played a significant role in traditional medicinal systems across Asia, Africa, and other regions of the world. The present study documents non-*Hymenopteran* insect species with reported medicinal properties that were collected from different locations in Chennai through field surveys and validation using published scientific literature. It highlights their medicinal attributes and their distribution within the city.

Insects were collected from multiple green spaces in Chennai, including Government Museum (Egmore) complex, Semmozhi Poonga, Guindy Children's Park, Madhavaram Botanical Garden, Perambur Park, Tholkappiyar Poonga, and Government Art College campus. Subsequently, information on their medicinal properties was verified through published scientific literature and ethnomedical records.

A total of 40 non-*Hymenopteran* insect species were collected from different locations of Chennai. Among the collected species, 12 have documented medicinal applications according to published scientific literature and traditional ethnomedicinal records.This field study reveals the widespread presence of insects with medicinal significance across different locations in Chennai. Consequently, it suggests that insects can serve as a sustainable biological resource for future advancements in pharmacology and biomedicine.

Keywords: Medicinal insects, ethnoentomology, non-hymenopteran, insect biodiversity, bioactive compounds, urban biodiversity

Introduction

In a world rich in biodiversity, humans, plants, and animals coexist in an interconnected manner. Medicinal plants have played an immeasurable role in human history; similarly, the contribution of medicinal animals is significant. Among medicinal animals, insects have provided valuable nutritional, ecological, and therapeutic benefits for centuries. Globally, more than 2,100 insect species are consumed as food, while over 1,500 species have been reported to possess medicinal properties (Wahengbam *et al*., 2023). For generations, diverse ethnic groups across the world have utilized them as both food and medicine. In India, several indigenous communities including the Kalo, Nishi, Gond, Baiga, Bhil, Rathwa, Kurumba, and Irula, use insects as remedies for ailments such as fever, asthma, joint pain, digestive issues, and respiratory diseases, as well as for boosting immunity (Siddiqui *et al*., 2023) [24].

While Hymenopteran insects have been extensively studied for their medicinal potential, comparatively fewer studies have focused on non-Hymenopteran insects of medical importance, particularly within urban ecosystems. Therefore, the present study aimed to identify medicinally important non-Hymenopteran insects and document their distribution through a field survey conducted across selected locations in Chennai. The survey identified 30 families belonging to seven orders: Orthoptera, Coleoptera, Blattodea, Lepidoptera, Diptera, Hemiptera, and Odonata. Among these, species belonging to nine families were found to have medicinal significance, as validated through an extensive review of more than 30 peer-reviewed scientific publications. The present field survey provided valuable insights into the medicinal applications of non-Hymenopteran insects, their potential pharmaceutical significance, and their distribution within Chennai's urban habitats.

Materials and Methods

Study Area

Chennai, the capital city of Tamil Nadu, is one of the major cities in India. Chennai is situated in the northeastern part of Tamil Nadu, along the Bay of Bengal on the southeastern coast of India. The city covers approximately 426 km² and is located at 13.04° N latitude and 80.17° E longitude. Chennai experiences hot and humid weather conditions throughout the year, which provide suitable habitats for diverse insect fauna. (Encyclopaedia Britannica, 2026) [8].

Field surveys were conducted at selected locations, including Government Museum (Egmore) complex, Semmozhi Poonga, Guindy Children's Park, Madhavaram Botanical Garden, Perambur Park, Tholkappiyar Poonga, and Government Art College campus and other sites. These locations were selected because all these places are urban green spaces and serve as habitats for various non-Hymenopteran insect species. The geographical distribution of the insect collection sites is shown in Figure 1.

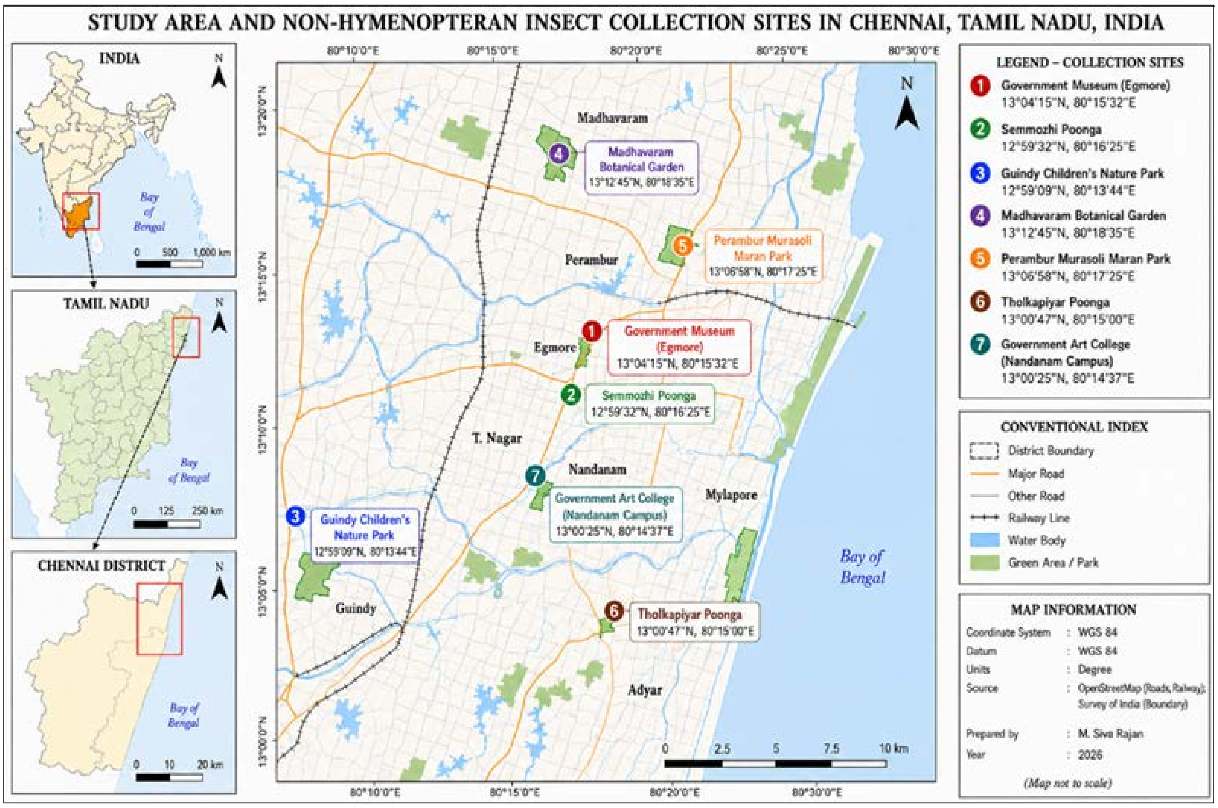

Fig 1: Map of the study area showing the locations of non-Hymenopteran insect collection sites in Chennai, Tamil Nadu, India

Methods of insect collection

Insects were collected from selected locations in Chennai. Each insect group was collected using specific entomological techniques tailored to its respective habitats. Disposable gloves were worn throughout the collection process, and soft forceps were used to minimize physical injury and handling damage to the insects.

Orthopteran insects were collected from grasslands, lawns, and shrub vegetation using sweep nets and the beating tray method. Coleopteran insects (beetles) were collected from leaf litter, decaying wood, tree bark, and soil surfaces using pitfall traps, sweep nets, and soft forceps. Blattodean insects (cockroaches and termites) were collected from leaf litter, fallen logs, tree bark, soil mounds, and human habitations using bait traps, soft forceps, and gloved handling. Lepidopteran insects were collected using aerial nets during daytime surveys. Dipteran insects were collected around flowering plants and in moist habitats using sweep nets and aerial nets. Hemipteran insects were collected from their host plants using sweep nets, the beating tray method, and soft forceps. Odonatan insects were collected near ponds, wetlands, and freshwater habitats using aerial nets. The collection methods employed in the present study followed standard entomological sampling procedures described in established manuals and field guides (Southwood & Henderson, 2000; Triplehorn & Johnson, 2005; Gullan & Cranston, 2014) [11, 27, 29].

Collected specimens were identified to the family or species level based on standard taxonomic characteristics. Identification was based on external morphological characters, including body segmentation, wing morphology, antennal structure, mouthparts, colour patterns, size, and behavioural characteristics. Standard taxonomic keys, identification manuals, and field guides (Triplehorn & Johnson, 2005; Gullan & Cranston, 2014) [11, 29] were consulted to ensure accurate identification. Following taxonomic identification, the medicinal importance of each species was verified through an extensive review of more than 30 peer-reviewed scientific publications, ethnobiological records, and other reliable literature sources.

Results

The field survey recorded insect species belonging to seven orders: Orthoptera, Coleoptera, Blattodea, Lepidoptera, Diptera, Hemiptera, and Odonata. Within Orthoptera, four species were collected, representing the families Acrididae, Gryllidae, Tettigoniidae. Among these, species belonging to Acrididae and Gryllidae were identified as having documented medicinal importance.

Seven families were recorded within Coleoptera, of which only Meloidae and Scarabaeidae were found to have documented medicinal importance. Five species belonging to Blattodea were collected, representing several families, among which Termitidae and Blattidae were identified as medicinally important.

A total of nine Lepidoptera species were collected; however, only Bombycidae was found to have documented medicinal importance. Six Diptera species were recorded, among which only Calliphoridae was identified as having documented medicinal importance. Two Odonata families were recorded, among which only Libellulidae was found to have documented medicinal importance. Finally, four Hemiptera species were collected; however, none of the species were found to have documented medicinal significance.

Table 1: Order-wise distribution of non-Hymenopteran insect species recorded during the present field survey in Chennai, Tamil Nadu, India.

S.No.	Order	Species Name	Number of species	Percentage %
1.	*Orthoptera*	*Oxya chinensis, Gryllus bimaculatus, Spathosternum prasiniferum, Tettigoniidae spp.*	4	4/40 × 100 = 10.00%
2.	*Coleoptera*	*Mylabris spp., Oryctes rhinoceros, Anthia sexguttata, Aulacophora foveicollis, Jansenia dasiodes, Lampyris noctiluca, Anobium punctatum*	7	7/40 × 100 = 17.50%
3.	*Blattodea*	*Macrotermes spp., Odontotermes obesus, periplaneta americana, Therea petiveriana, Neostylopyga rhombifolia*	5	5/40 × 100 = 12.50%
4.	*Lepidoptera*	*Bombyx mori, Amata passalis, Danaus chrysippus, Acraea terpsicore, Borbo cinnara, Apantesis arge, papilio demoleus, cephonodes hylas, Pelopidas mathias,*	9	9/40 × 100 = 22.50%
5.	*Diptera*	*Lucilia sericata, Chrysomya megacephala, Promachus asilidae, Sacrophaga carnaria, Hydrotaea diabolus, Pachygaster leachii*	6	6/40 × 100 = 15.00%
6.	*Hemiptera*	*Probergrothius sanguinolens, Coridius ianus, Dysdercus cingulatus, Chrysocoris stollii*	4	4/40 × 100 = 10.00%
7.	*Odonata.*	*Crocothemis servilia, Diplacodes trivialis, Ceriagrion coromandelianum, Brachythemis contaminata, Trithemis festiva,*	5	5/40 × 100 = 12.50%
Total	*7 orders*		40	100.0

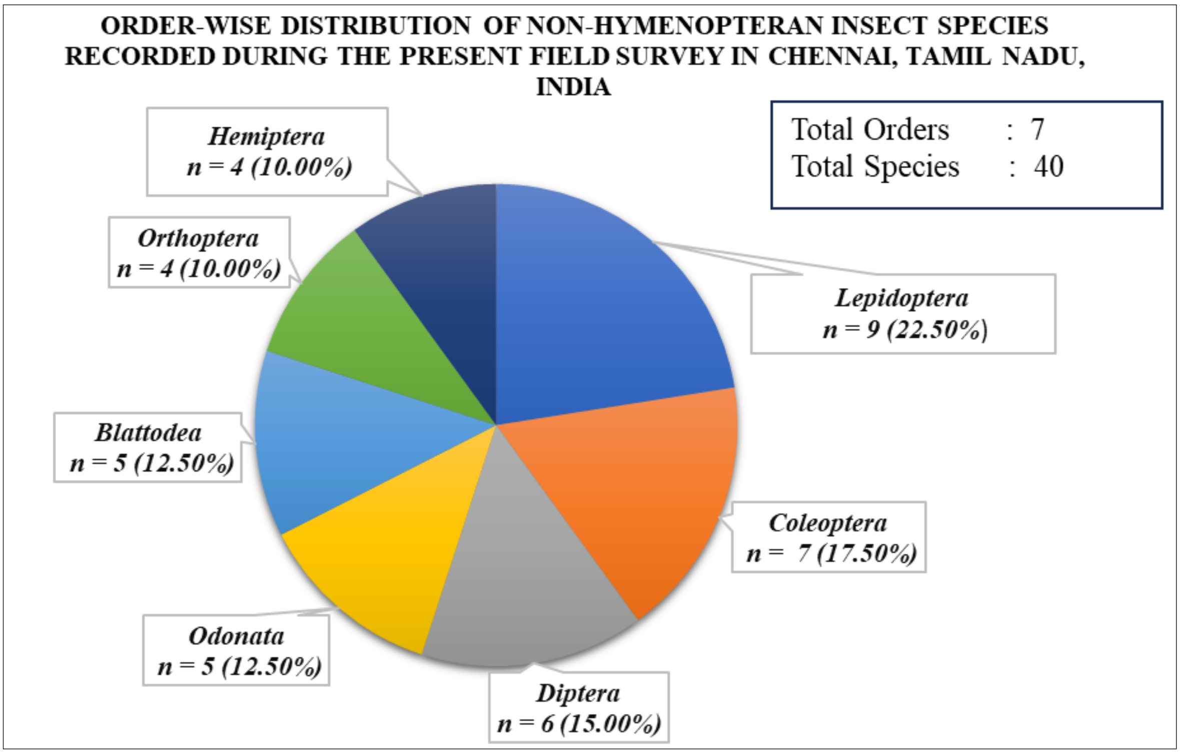

Fig 2: Order-wise distribution of non-Hymenopteran insect species recorded during the present field survey conducted in Chennai, Tamil Nadu, India. Lepidoptera showed the highest species richness (9; 22.5%), followed by Coleoptera (7; 17.5%), Diptera (6; 15.0%), Blattodea and Odonata (5; 12.5% each), and Orthoptera and Hemiptera (4; 10.0% each).

Table 2: Family-wise distribution of medicinally important non-Hymenopteran insect families and the corresponding medicinal insect species recorded during the present field survey in Chennai, Tamil Nadu, India.

Order	Medicinal Insects Family	Medicinally Important Insects Species	No. of Medicinally Important Species
Orthoptera	*Acrididae*	*Oxya chinensis, Spathosternum prasiniferum*	2
Orthoptera	*Gryllidae*	*Gryllus bimaculatus*	1
Coleoptera	*Meloidae*	*Mylabris spp.*	1
Coleoptera	*Scarabaeidae*	*Oryctes rhinoceros*	1
Blattodea	*Blattidae*	*Periplaneta americana*	1
Blattodea	*Termitidae*	*Macrotermes spp., Odontotermes obesus*	2
Lepidoptera	*Bombycidae*	*Bombyx mori*	1
Diptera	*Calliphoridae*	*Lucilia sericata*	1
Odonata	*Libellulidae*	*Crocothemis servilia, Diplacodes trivialis*	2
Total	9 families	12 species	12 species

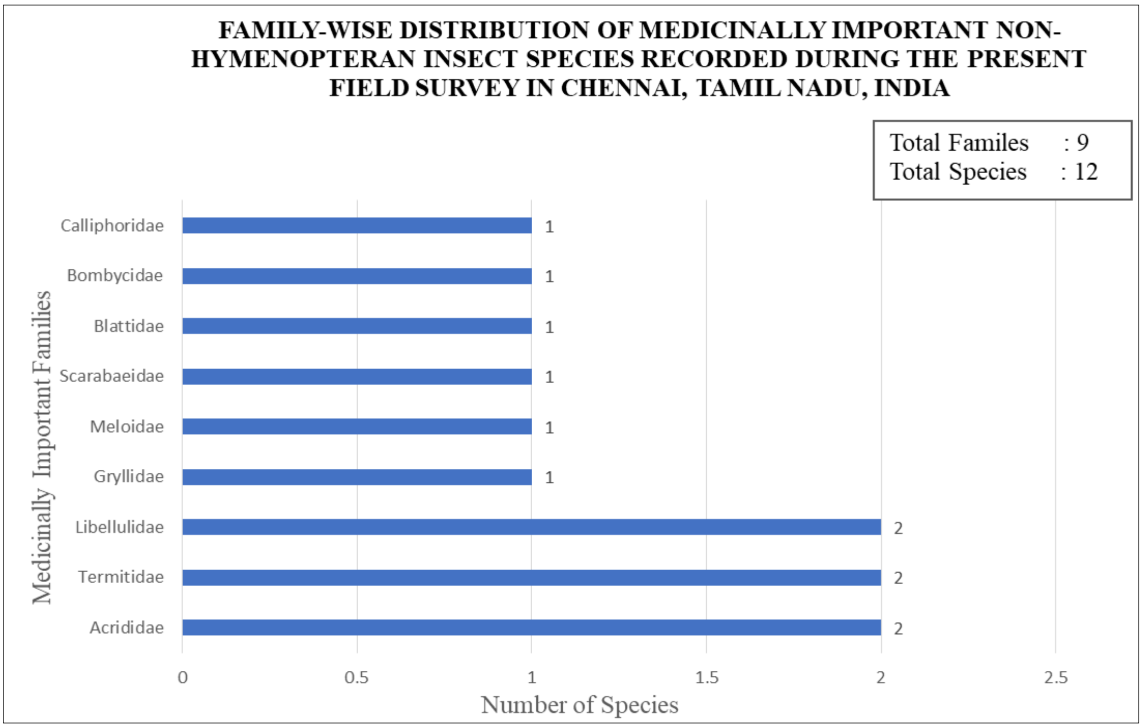

Fig 3: Family-wise distribution of medicinally important non-Hymenopteran insect families and their corresponding medicinal insect species recorded during the present field survey in Chennai, Tamil Nadu, India: Acrididae (Oxya chinensis, Spathosternum prasiniferum); Gryllidae (Gryllus bimaculatus); Meloidae (Mylabris spp.); Scarabaeidae (Oryctes rhinoceros); Blattidae (Periplaneta americana); Termitidae (Macrotermes spp., Odontotermes obesus); Bombycidae (Bombyx mori); Calliphoridae (Lucilia sericata); and Libellulidae (Crocothemis servilia, Diplacodes trivialis).

The protein isolated from Oxya chinensis (Orthoptera: Acrididae) has been reported to play important roles in cancer detection, dendritic cell activation, and inhibition of tumor growth (Kim *et al*., 2020) [15]. Similarly, Gryllus bimaculatus and several orthopteran species have been recognized for their anticancer potential and protein-based medicine application. Cantharidin ($C_{10}H_{12}O_4$), isolated from Mylabris spp. (Coleoptera: Meloidae) exhibits potent anticancer properties and is widely used in dermatology (Rauh *et al*., 2007) [22]. Similarly, the rhinoceros beetle Oryctes rhinoceros (Coleoptera) has been reported to possess antifungal and anti-allergic properties (Tomie *et al*., 2003) [28].

Termites, including Macrotermes spp. and Odontotermes obesus, have also been used in both ancient and modern medicine for centuries; they are reported to aid in treating iron deficiency and possess antioxidant, anti-inflammatory, anti-cancer, and antiviral properties (Cheseto *et al*., 2024) [3]. The American cockroach, Periplaneta americana (Blattodea: Blattidae), also possesses significant medicinal value; extracts derived from this species, particularly Kangfuxin (KFX), have been widely used in traditional Chinese medicine. Previous studies have revealed that its extract exhibits anti-cancer effects (Zhao *et al*., 2017) [35].

Among Lepidoptera, the silkworm Bombyx mori (Lepidoptera) has been used in wound dressings (Aramani *et al*., 2025) [1]. Lucilia sericata (Diptera: Calliphoridae) is widely used in wound cleaning and healing (Yan *et al*., 2018) [30]. The present field survey conducted across selected locations in Chennai documented several non-Hymenopteran insect species of medicinal importance. Table 3 summarizes the medicinal insect species recorded during the present study, together with their scientific names, taxonomic classification, common names, local names, period of occurrence, medicinal parts used, documented medicinal applications, and supporting references.

Table 3: Taxonomic classification, common names, seasonal availability, medicinal parts used, and medicinal and therapeutic applications of insect species recorded in Chennai, Tamil Nadu, India.

S.No	Scientific Name	Order and Family	Common Name	Tamil Name	Season Of High Availability	Medicinal Parts Used	Documented Medicinal and Therapeutic Uses
1.	*Oxya chinensis* (Lee *et al*., 2017) [16] (Zhang & Zhang, 2019) [33]	*Orthoptera: Acrididae*	Rice field grasshopper	நெல் வெட்டுக்கிளி	June to November	Whole dried insect	Used for cough, whooping cough, asthma, bronchitis, paralysis, seizures; reported to have anti-thrombotic, anti-platelet, immunostimulatory, anti-cancer related activity
2.	*Gryllus bimaculatus* (Park & Han, 2021) [21] (Lim & Byun, 2021) [18]	*Orthoptera: Gryllidae*	Field cricket	சிள்வண்டு	Throughout the year	Whole insect extract	Reported to have anti-diabetic, anti-inflammation, anti-cancer
3.	*Spathosternum prasiniferum* (Das & Mandal, 2013) [4]	*Orthoptera: Acrididae*	Asian grasshopper	வெட்டுக்கிளி	June to November	Whole dried insect and	Used for nutrition and protein-based medicine

						powder	
4.	*Mylabris spp* (Epstein & Kligman, 1958) [9] (Ren & Kinghorn, 2021) [23]	*Coleoptera: Meloidae*	Blister beetles	கொப்புள வண்டு	June to November	Whole dried insect and powder	Reported for anti-cancer properties used to treat molluscum contagiosum and stubborn warts; anti-bacterial activity
5.	*Oryctes rhinoceros* (Deyrup *et al.*, 2021) [6]	*Coleoptera: Scarabaeidae*	Coconut rhinoceros beetles	காண்டாமிரு க வண்டு	June to August	Hemolymph and crude protein	Reported for anti-fungal, anti-allergic, and antioxidant activity
6.	*Macrotermes spp.* (Zhou *et al.*, 2021) [36] (Mahdi *et al.*, 2020) [19] (Foti, 1994) [10]	*Blattodea: Termitidae*	Large mound-building termite	மண் புற்று கரையான்	March to September	Adult, crude raw extract, and mounds	Used as a nutrient supplement; reported antioxidant, anti-inflammatory, anti-cancer and antiviral
7.	*Odontotermes obesus* (Das *et al.*, 2021) [5] (Singh *et al.*, 2026) [26]	*Blattodea: Termitidae*	Indian white termite	வெள்ளைக் கரையான்	April to July	Adult, crude raw extract, and mounds	Reported for anti-inflammatory, antioxidant, antimicrobial, Pain relief, gastric ulcer
8.	*Periplaneta americana (Zeng et al., 2019)* [31] (Li *et al.*, 2019) [17]	*Blattodea: Blattidae*	American cockroach	அமெரிக்ககர ப்பான்பூச்சி	Throughout the year	whole insect extracts and tissue lysates	Reported for wound and mucosal repair, anti-inflammatory, antioxidative, antibacterial, antiviral, anti-tumor, and tissue-repair activities
9.	*Bombyx mori (Katsikari et al., 2025)* [12] *(Biganeh et al., 2022)* [2] *(Khosropanah et al., 2022* [14]	*Lepidoptera: Bombycidae*	Silkworm	பட்டுப்புழு	May to October	Eggs, larvae, pupae, cocoon, silk fibroin, sericin, and hemolymph	Reported for anti-inflammatory, antioxidant, antibacterial, antidiabetic, anticoagulant, anti-cancer, wound-healing, tissue-regeneration, antihyperglycemic potential
10.	*Lucilia sericata (Kerridge et al., 2005)* [13] *(Zhang et al., 2010)* [14]	*Diptera: Calliphoridae*	Common green bottle fly	பச்சை ஈ	Throughout the year	Larva	Used for chronic wound cleaning and healing, antibacterial activity
11.	*Crocothemis servilia* (Mozhui *et al.*, 2021) [20]	*Odonata: Libellulidae*	Scarlet skimmer	சிவப்பு தட்டான் பூச்சி	July to November	Boiled Nymph	Used for body ache, cold, vision, operational wound healing
12.	*Diplacodes trivialis* (Mozhui *et al.*, 2021) [20]	*Odonata: Libellulidae*	Chalky percher	தட்டான் பூச்சி	July to November	Boiled Nymph	Vision disorders, operational wound healing

Discussion

For centuries, insects have played an indispensable role as food and medicine within various tribal, rural, and traditional healthcare systems. Consequently, they have gained increasing attention in modern therapeutic research due to their rich diversity of bioactive compounds and documented medicinal properties (Siddiqui *et al*., 2023; Devi *et al*., 2023; Mozhui *et al*., 2021) [7, 20, 24, 20].

The present field survey conducted in selected urban green spaces in Chennai has identified and documented numerous non-Hymenopteran insect species. These findings demonstrate that medicinally important insects are not confined to forest ecosystems or remote tribal habitats but are also widely distributed in urban environments, indicating their immense potential for future biomedical and pharmacological research.

The findings of the present study are consistent with previous ethnobiological investigations, which have reported that medicinally important insects are widely distributed across diverse ecological habitats and continue to play an important role in traditional healthcare systems (Mozhui *et al*., 2021; Siddiqui *et al*., 2023) [20, 24].

Across various communities, these insects have been used for centuries to address a range of health issues, including respiratory disorders, skin diseases, wounds, nutritional deficiencies, allergies, microbial infections, and general debility (Siddiqui *et al*., 2023; Devi *et al*., 2023; Mozhui *et al*., 2021) [7, 20, 24]. These traditional practices are gaining renewed credibility through current discoveries, field documentation, and scientific validation. Contemporary research reveals that many of these insects contain bioactive compounds such as proteins, peptides, amino acids, vitamins, minerals, and other pharmacologically active molecules (Siddiqui *et al*., 2023; Zhou *et al*., 2022; Sinha & Choudhury, 2024) [24, 25, 37].

Based on the present field survey and literature review, non-Hymenopteran medicinal insects represent promising biological resources for the development of nutraceuticals, natural antimicrobial agents, and regenerative medicine. However, translating these traditional biological resources into clinically applicable therapeutic products requires further pharmacological investigations, toxicological evaluations, standardization of bioactive compounds, clinical validation, and the development of scientifically validated medicinal formulations (Sinha & Choudhury, 2024; Siddiqui *et al*., 2023) [24, 25].

Conclusion

This field study confirms the presence of medicinally important non-Hymenopteran insects within the urban habitats of Chennai and highlights their significance as valuable biological resources. The present study identified

12 medicinally important insect species representing seven orders and nine families, and their documented medicinal importance was verified through published scientific literature. The findings demonstrate that these insects are widely distributed within urban ecosystems and are not restricted to forest or tribal habitats. Although this study focused exclusively on non-Hymenopteran insects with medicinal potential, it also underscores that they remain an underexplored biological resource. Previous research has confirmed the important role these insects play in treating various diseases and addressing a wide range of therapeutic applications. Furthermore, their abundance in nature, sustainability, and high medicinal value make them promising candidates for the development of natural medicines, functional foods, and bioactive pharmaceutical products.

Given the growing global interest in insect-based therapeutics, there are significant opportunities to expand their applications in public health, pharmacology, and nutraceutical research. However, realizing these benefits fully requires further pharmacological investigations, clinical trials, and standardization of insect-derived bioactive compounds. The present study provides baseline information on the diversity and medicinal significance of non-Hymenopteran insects in Chennai and establishes a scientific foundation for future research on insect-derived therapeutic resources.

Oxya chinensis
Order: Orthoptera

Spathosternum prasiniferum
Order: Orthoptera

Oryctes rhinoceros
Order: Coleoptera

Mylabris spp
Order: Coleoptera

Periplaneta Americana
Order: Blattodea

Lucilia sericata
Order: Diptera

Crocothemis servilia
Order: Odonata

Diplacodes trivialis
Order: Odonata

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