KARYA TERPILIH
PROGRAM AKUISISI
PENGETAHUAN LOKAL
TIDAK UNTUK DIPERJUALBELIKAN

Kasmiatun et al.

The Bugs of Jambi:
Insights from a Hemiptera Collection in the Lowlands of Sumatra, Indonesia



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Nymphs of leaf-footed bugs (Hemiptera: Heteroptera: Coreidae) gathered around their eggs along with an adult.

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Insights from a Hemiptera Collection in the Lowlands of Sumatra, Indonesia

KASMIATUN, RIZKY NAZARRETA, BONAULI PAKPAHAN, AKHMAD RIZALI, PURNAMA HIDAYAT, DAMAYANTI BUCHORI, STEFAN SCHEU, & JOCHEN DRESCHER

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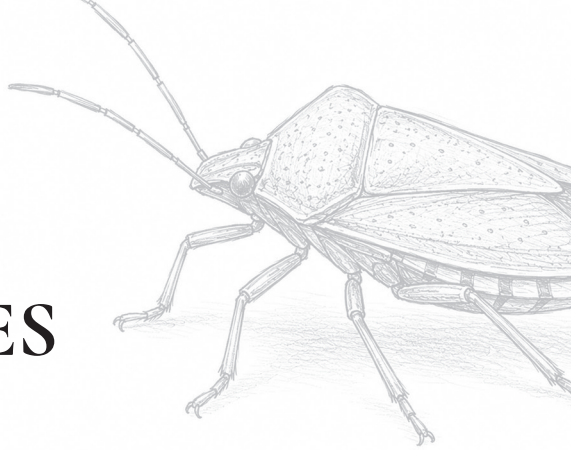
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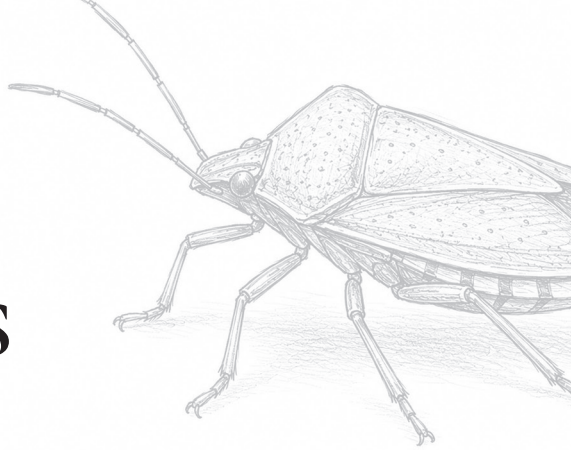
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The Bugs of Jambi – Insights from a Hemiptera Collection in the Lowlands of Sumatra, Indonesia

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Contributions

All Hemiptera morphospecies images and taxonomic revision were taken by Kasmiatun under supervision of Stefan Scheu and Jochen Drescher. Initial identification by Brawijaya University's students under supervision of Akhmad Rizali, Purnama Hidayat, and Damayanti Buchori, finalized by Kasmiatun. Hemiptera illustrations by Bonauli Pakpahan. Sampling and EFForTS project design by Jochen Drescher, Damayanti Buchori, and Stefan Scheu. Text, layout, and compilation by Kasmiatun, Rizky Nazarreta and Jochen Drescher.

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Photo: I Putu Sudiarta (2013)

Nymphs and eggs of stink bugs (Hemiptera: Heteroptera: Pentatomidae).

PUBLISHER'S NOTE

As a scientific publisher, BRIN Publishing is committed to continuously providing high-quality scientific publications. This effort represents BRIN Publishing's duty to contribute to developing superior human resources and educating the nation, as mandated in the preamble of the 1945 Constitution of the Republic of Indonesia.

The Bugs of Jambi: Insights from a Hemiptera Collection in the Lowlands of Sumatra, Indonesia presents a photographic and taxonomic overview of Hemiptera collected via canopy fogging across rainforests, jungle rubber, and monoculture plantations in Jambi Province. Focusing on two major suborders, Heteroptera (true bugs) and Auchenorrhyncha (cicadas, leafhoppers, treehoppers, planthoppers, and spittlebugs), this book documents nearly 400 morphospecies across 33 families with detailed habitat distribution records and high-resolution imagery. Developed under the collaborative Indonesian-German EFForTS project, this book bridges a significant taxonomic gap in tropical entomology. It serves as an essential identification guide and scientific baseline for entomologists, ecologists, agricultural scientists, and students dedicated to insect conservation and biodiversity research in Southeast Asia.

We hope that the presence of this book will serve as a valuable reference to broaden insight and knowledge for all readers. Finally, we would like to express our gratitude to all parties who have contributed to the publication of this book.

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Photo: Danny Radius (2017)

An adult and eggs of leaf-footed bugs (Hemiptera: Heteroptera: Coreidae).

FOREWORD

As a unique ecosystem in Sumatra, the lowlands in the region of Bukit Duabelas National Park and Harapan Rainforest in Jambi Province still keep many mysteries. Although a number of studies have been conducted in the region, our knowledge of the biodiversity in this area is still very limited. The existing studies on the flora and fauna (especialy birds, mammals, reptiles, and amphibies) have contributed greatly to land management of the lowlands in Jambi. Nevertheless, studies on insects and invertebrates as well as microorganisms of the region are still limited; consequently, we have very limited knowledge about their actual biodiversity and population densities as well as their ecological functions in this unique tropical region.

Arthropods and other invertebrates are often considered to be of little importance by the general public. This, however, is in stark contrast to the role that they play on our planet. The total global biomass of terrestrial arthropods, for example, is more than three times that of humans, almost 30 times that of wild mammals and more than 100 times that of wild birds. The late E.O. Wilson famously termed invertebrates as "the little things that run the world", pollinating virtually all vegetables and fruits we humans consume, and forming the soil in which those plants grow. In fact, the vast majority of ecosystem services we humans rely on for our everyday life are in one way or another linked to invertebrates (and arthropods specifically), while not the same can be said about vertebrates, let alone mammals.

This book is a taxonomic glimpse into the Hemiptera in tree canopies of rainforest and agroforest systems in the lowlands of Jambi Province, focusing on the "true bugs", the Heteroptera, and the cicadas, leafhoppers, treehoppers, plant hoppers and spittlebugs as groups of the Auchenorrhyncha. The book forms part of the scientific output of the EFForTS project, an Indonesian-German scientific collaboration which has been running since 2012. Apart from showcasing the beauty (and the repulsiveness) of some of those critters, this book sets a standard by which the largely unknown Hemiptera biodiversity in Sumatra can be studied. This is a crucial first step into understanding their diversity but also their roles in both natural and agricultural ecosystems.

Hemiptera are still commonly seen as problematic by farmers, as many of their members are plant pests, either by damaging plants directly or transmitting diseases. At the same time, however, Hemiptera are also predators (sometimes of other Hemiptera), as well as resource for a large number of vertebrate taxa, including birds, fish, bats, and other insectivorous species. Increasing the knowledge on Hemiptera (and other seemingly "unimportant" invertebrates) is a crucial step

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in understanding how they interact with our lives, without which our social and political decisions regarding the use of natural resources will always be based on extremely limited information.

This book will be a very useful tool for students, researchers, and other scientists who are interested in Hemiptera diversity. It can function as a simple guide in understanding the kinds of Hemiptera in this area as well as a challenge for the next generations to study this important, yet little understood group of invertebrates.

Bogor, March 2025
Prof. Dr. Hari Sutrisno
A systematic entomologist,
National Research and Innovation Agency BRIN, Indonesia

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Photo: Danny Radius (2017)
An adult and eggs of stink bugs (Hemiptera: Heteroptera: Pentatomidae).

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PREFACE

We here present a guide book for the Hemiptera of the lowlands of Jambi, specifically the Heteroptera (true bugs) and Auchenorrhyncha (cicadas, planthoppers, treehoppers, and leafhoppers). This book is an outcome of the intensive research collaboration between the Department of Plant Protection, IPB University, and the Animal Ecology Group, University of Göttingen, in the framework of the EFForTS project. EFForTS investigates the ecological and socio-economic effects of rainforest transformation to smallholder plantations of rubber and oil palm within and surrounding the Bukit Duabelas National Park and Harapan Rainforest in Jambi Province, Sumatra, Indonesia.

During 12 years of study and five individual sampling campaigns, we collected nearly 1.5 million individuals of arthropods, both from the canopy and the forest floor. With more than 70,000 collected individuals, the Hemiptera were one of the more abundant groups within our collection. The lack of taxonomic literature for tropical regions, particularly Southeast Asia, posed a significant challenge in our sorting process. This is not only due to the disregard of the fundamental value that taxonomy has for our understanding of biodiversity, but also because arthropod collections in the tropics contain a large proportion of undescribed species. Here, with this book, we aim to address these issues by documenting the systematic sorting of almost 400 morphospecies of Heteroptera (true bugs) and Auchenorrhyncha (leafhoppers, cicadas, and more) from more than 30 families, complete with taxonomic information and high resolution photographs.

We hope this book will be a useful resource for both professional and amateur scientists who are interested in the Hemiptera of the region. We also hope this guidebook can inspire students in related fields and other readers to study Hemiptera, especially those in other parts of Indonesia.

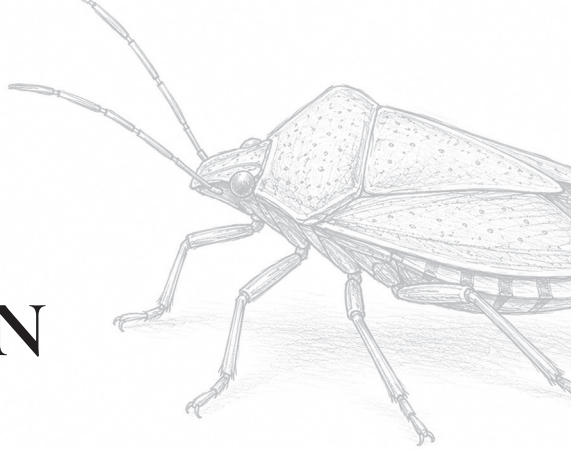
April 2025

The Authors

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Photo: Rizky Nazarreta (2013)
Treehopper (Hemiptera: Auchenorrhyncha: Membracidae)



CHAPTER I
INTRODUCTION

"Bugs" (scientifically: Hemiptera, from Ancient Greek hemipterus, "half-winged") are one of the most diverse groups of insects, both in terms of morphology as well as ecology. They can be recognized by their sucking mouthparts with four piercing stylets, including two mandibular and two maxillary, which distinguish them from other insect orders (Triplehorn & Johnson, 2005). These proboscis structures enable them to extract fluids from plants, animals, or other insects. Historically, the "Hemiptera" of now were organized in two different orders, the Hemiptera (bugs) and the Homoptera (cicadas, planthoppers, treehoppers, leafhoppers, aphids, white flies, etc.) (Gullan & Cranston, 2014). Recent systematic adjustments have dissolved the Homoptera as an individual order, and included their subdivisions within the Hemiptera which now contain four suborders: Heteroptera (true bugs), Auchenorrhyncha (cicadas, planthoppers, treehoppers, and leafhoppers), Sternorrhyncha (aphids, whiteflies, and scales), and Coleorrhyncha (primitive, single family - Peloridiidae) (Gullan & Cranston, 2014; Triplehorn & Johnson, 2005).

More than 100,000 species of Hemiptera are described worldwide (GBIF, 2026), but many more species await formal description. Most Hemiptera are found in terrestrial ecosystems, where they inhabit a wide range of habitats, from the canopy to belowground. Some species live in the freshwater, such as giant water bugs (Belostomatidae), water striders (Gerridae), and other species of Nepomorpha, while groups of Leptodomorpha occupy marine environments (Schuh & Weirauch, 2020). Hemiptera have a diverse range of body shapes and adaptations related to their ecological niches. For example, cicadas (Cicadidae) have enlarged abdomens to support their sound-producing organs (Ehlers et al., 2022). Treehoppers (Membracidae) often have bizarre shapes and muted colors, resembling thorns or other plant structures for effective camouflage (Dietrich, 2004). Bed bugs (Cimicidae), have flattened bodies that allow them to squeeze into tight spaces near their hosts (Reinhardt & Siva-Jothy, 2007). Those morphological characteristics highlight the remarkable adaptability of Hemiptera to various ecological conditions.

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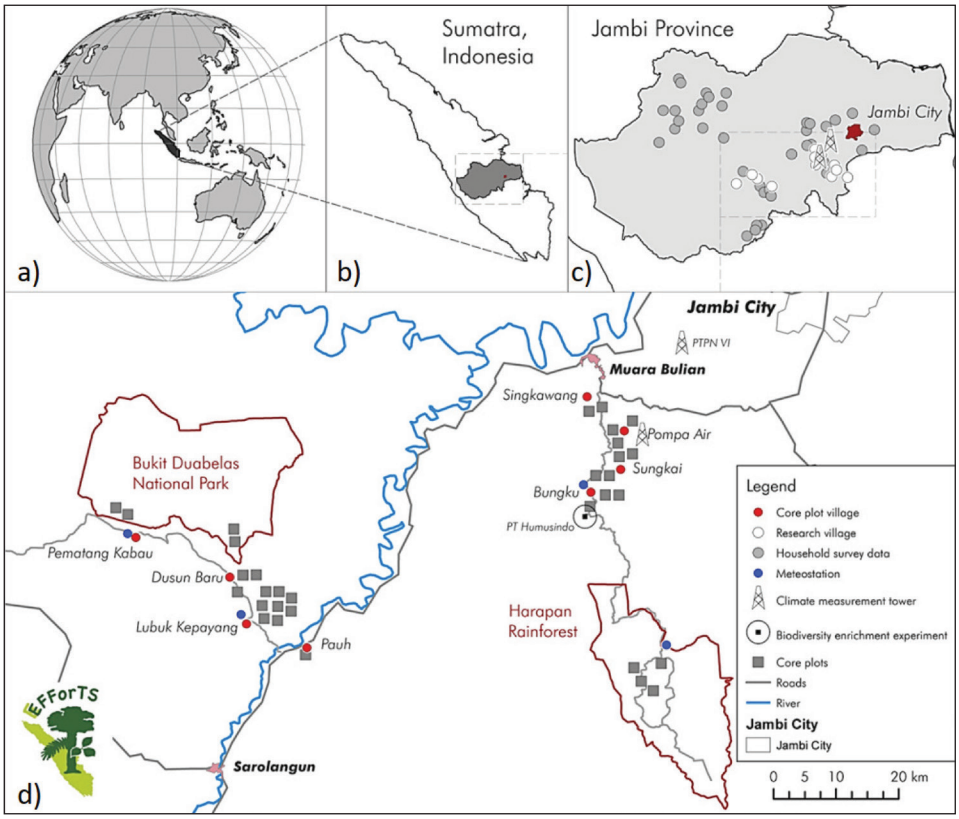
Hemiptera are hemimetabolous or paurometabolous, lacking larval and pupal stages, developing from eggs through a series of nymphs adults (Triplehorn & Johnson, 2005). The majority of Hemiptera are herbivores. Many species use piercing-sucking mouthparts to extract carbohydrates and proteins from the phloem sap of the plants they inhabit (Kehr, 2006). Some groups, however, have parasitic or predatory lifestyles: Assassin bugs (Reduviidae), for example, feed on the hemolymph of other arthropods and bed bugs (Cimicidae) feed on vertebrate blood to obtain the necessary protein to develop through larval stages (Schuh & Weirauch, 2020; Triplehorn & Johnson, 2005).

Recent findings indicate that the Auchenorrhyncha are more closely related to the Heteroptera than to the Sternorrhyncha because of their wings (Schuh & Weirauch, 2020). However, there are some differences in the morphological characteristics of their wings. The front wings of Heteroptera are usually leathery and hardened in the basal half and membranous in the distal half, while the front wings of both Auchenorrhyncha and Sternorrhyncha are more uniformly textured, either somewhat thickened or entirely membranous (Schuh & Weirauch, 2020). Furthermore, the wings of heteropterans usually fold flat over the back when at rest, while Auchenorrhyncha often keep their wings more tent-like. Mouthparts in Heteroptera emerge from the front and lower parts of the head (anteroventral), while in Auchenorrhyncha emerge from the back and lower parts of the head (posteroventral) (Triplehorn & Johnson, 2005).

While research on Hemiptera in temperate zones is abundant, research on this group in Southeast Asia, especially Indonesia, remains scarce. Tropical regions typically have dense canopy cover and high species diversity (Beck, 2019), contributing to the likely vast number of formally undescribed Hemiptera. In Indonesia, large systematic arthropod collections hardly exist, particularly from tree canopies. This is concerning as Indonesia is known to harbor vast amounts of undescribed biodiversity, which vanishes before our eyes as rampant deforestation of the lowland rainforests continues. But limited research funding and preference of the applied rather than basic sciences, contributes to the disappearance of Indonesian arthropod biodiversity before it is even known to science. To remedy this, we present images of Hemiptera collected by canopy fogging in a little studied region of Indonesia, Jambi Province. Research was conducted in the framework of an interdisciplinary German-Indonesian research collaboration, funded by the German Research Foundation DFG, the CRC990-EFForTS project (www.uni-goettingen.de/en/310995.html).

All documented specimens in this book were collected from Jambi, Sumatra, Indonesia, within and nearby two patches of relatively intact lowland rainforest: Bukit Duabelas National Park and Harapan Rainforest (Figure 1.1). These two lowland rainforest remnants lie in between vast peat swamps and Mangrove forests to the east and extended mid- and high mountain ranges to the west. Jambi Province covers a land area of 50,160 km^2 and stretches from the Barisan mountain range

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Note: (a-d) including sites for hourhold surveys; (c) and 32 permanent research plots in four land-use systems; (d) alongside four main reference meteostations, a climate measurements tower and the biodiversity enrichment experiment platform

Source: Drescher *et al*. (2016).

Figure 1.1 Research design of the EFForTS project in Jambi Province, Sumatra, Indonesia.

in the west across extensive lowlands towards the southern Malacca Strait in the east. The climate in Jambi's lowlands is tropical humid with two peak rainy seasons around March and December and a dryer period during July-August (Drescher *et al*., 2016). Jambi's rainforests have a long history of exploitation including traditional agroforestry systems and the extraction of timber and non-timber products. As of 2014 (the time of sample collection), >650,000 ha of rubber and >590,000 ha of oil palm were cultivated by smallholders in Jambi Province; ten years later, smallholder monocultures of rubber and oil palm cover ca. 593,000 ha and 638,000 ha, respectively (BPS, 2024). When company estates are added, rubber is currently cultivated on ca. 622,000 ha and oil palm on more than 1 million hectares (BPS, 2024).

The Hemiptera presented here were collected in a 2013 canopy fogging campaign in four major land uses in Jambi Province: rainforest, jungle rubber (low intensity management rubber agroforestry) and smallholder plantations of

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Note: (A) Primary degraded lowland rainforest (here: Harapan Rainforest); (B) jungle rubber (extensively used rubber agroforestry); and smallholder monocultures of (C) rubber and (D) oil palm.

Figure 1.2 The four land use systems investigated in the framework of *EFForTS*

rubber (*Hevea brasiliensis*) and oil palm (*Elaeis guineensis*) (Fig. 1.2). Sampling was conducted using via canopy fogging, in 32 permanent research plots, eight for each land use. Per each individual plot, three subplot samples using canopy fogging were taken. For each subplot sample, 50 ml DECIS 25 EC® (Bayer Crop Science, 25 g / L deltamethrin) mixed in four liters of petroleum oil ("white oil") were applied to the canopy using a Swingfog SN50 (Swingtec GmBH, Germany). Underneath the canopy in each subplot, conical collection traps measuring 1 m × 1 m were placed (Fig. 1.3), with each trap fitted connected to a 250 ml polyethylene bottle filled with 100 ml of 96% ethanol. Two hours after application of the insecticide, the sixteen PE flasks of each subplot were removed and combined into a single sample. Canopy fogging campaigns in the EFForTS research plots were conducted

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four times to date, three times in the dry seasons of 2013, 2017, and 2021, and once in the rainy season 2013/2014. Over all sampling campaigns, Hymenoptera (mostly ants) dominated numerically, followed by Collembola (springtails), Diptera (flies), and Coleoptera (beetles), while in biomass, canopy fogging samples were dominated by Orthoptera (grasshoppers and crickets), Araneae (Spiders), and Blattodea (cockroaches) (Pollierer *et al.*, 2023).



Note: (A) collection vials containing ethanol. (B) homemade collection traps, each 1 m × 1 m, hung from ropes between height adjustable tent poles. (C) Collection traps were grouped around target trees or canopies, here in oil palm.

Figure 1.3 Canopy fogging setup

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Hemiptera were intermediate in both abundance and biomass across canopy fogging collections, cumulatively contributing about 45,000 specimens to the campaigns of 2013, 2013/2014, and 2017 (in a total of >1.5 million arthropod specimens). A subset of about 5,000 specimens from the 2013 collection, i.e. the Heteroptera and Auchenorrhyncha, were sorted to almost 400 morphospecies from 33 families. Only very few species presented here carry full Latin names, meaning that the vast majority of the morphospecies documented here are undescribed species. This is a considerable problem, as without formally described species, communication between researchers as to the biology of certain species is impossible, and thus, no understanding of their ecology can be generated. In an attempt to set first standards, we here photographically document over 160 morphospecies of the Auchenorrhyncha and >230 morphospecies of the Heteroptera, determined to the deepest taxonomic level possible and then assigned morphospecies based on their general habitus. We first present the general morphology of the Hemiptera, then list in detail where certain morphospecies were found (i.e. in rainforest, jungle rubber, rubber, oil palm, or a combination of the four). Then, we show high-resolution images of Auchenorrhyncha and Heteroptera morphospecies, grouped by taxonomic family with a short introduction into the morphology and biology of the families.

We hope this book will reach a wide audience of nature enthusiasts, scientists, and students, and succeed in highlighting the immense biodiversity that is found in Southeast Asia. We also hope this book convinces readers of the urgent necessity to close the vast taxonomic gap in arthropods in general and Hemiptera in particular, to foster biological and ecological research of this agriculturally massively important group of insects in Indonesia.

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Hemiptera Morphology

Hemiptera typically have a segmented body divided into three parts: head, thorax, and abdomen (Fig. 1.4, Fig. 1.5). The body size can be varied, from a few millimeters to several centimeters. One of the defining characteristics of Hemiptera is their piercing-sucking mouthparts. Unlike chewing insects, Hemiptera lack mandibles and maxillae which are used for biting. Instead, they possess a modified proboscis, the rostrum (Triplehorn & Johnson, 2005). This structure, formed from needle-like stylets, allows them to pierce plant or animal tissues and extract fluids. The rostrum itself can be segmented and often folds neatly beneath the head when not in use (Triplehorn & Johnson, 2005). Most Hemiptera have two pairs of wings. The forewings, known as hemelytra, are usually thickened and leathery at the base, and membranous at the tips, while the hindwings are typically membranous (Triplehorn & Johnson, 2005; CSIRO, 1991). Hemiptera usually have compound eyes, which provide them with broad vision and the ability to detect movement. Some species also have ocelli, which are simple eyes used to sense light intensity. Moreover, the thorax is divided into three segments, i.e. prothorax, mesothorax, and metathorax. Each segment has two legs, whereas the mesothorax and metathorax both have a pair of wings (Triplehorn & Johnson, 2005). The legs of Hemiptera are adapted to their specific behavior. For instance, aquatic species have modified legs for walking on the water surface, while terrestrial species have adapted legs for grasping, walking, or jumping, such as leafhoppers, which use their legs to avoid predators. The abdomen of Hemiptera typically consists of 11 segments, although the number of visible segments may vary among different species. Many Hemiptera have scent glands on the abdomen, which produce defensive chemicals and can emit strong odors (Schuh & Weirauch, 2020).

Here, we focus on two of the four suborders of Hemiptera, the Auchenorrhyncha and the Heteroptera. The two remaining orders, Coleorrhyncha ("moss bugs") and Sternorrhyncha (aphids, whiteflies, and scale insects) are not included because (a) the former only occurs with *Nothofagus* trees in Australia, New Zealand, New Caledonia, and South America, and (b) the latter is hampered by very low taxonomic resolution in the tropics and the high proportion of immature nymphs in field samples. The Auchenorrhyncha, including the cicadas, leafhoppers, treehoppers, planthoppers, and spittlebugs, and the Heteroptera ("true bugs") differ in key morphological characteristics. Those include, but are not limited to, their mouthparts, wing structure, wing position at rest, and the scutellum (Table 1.1). Ecologically, the Auchenorrhyncha are dominated by phloem feeders, while the Heteroptera also include predatory taxa such as the "assassin bugs" of the Family Reduviidae.

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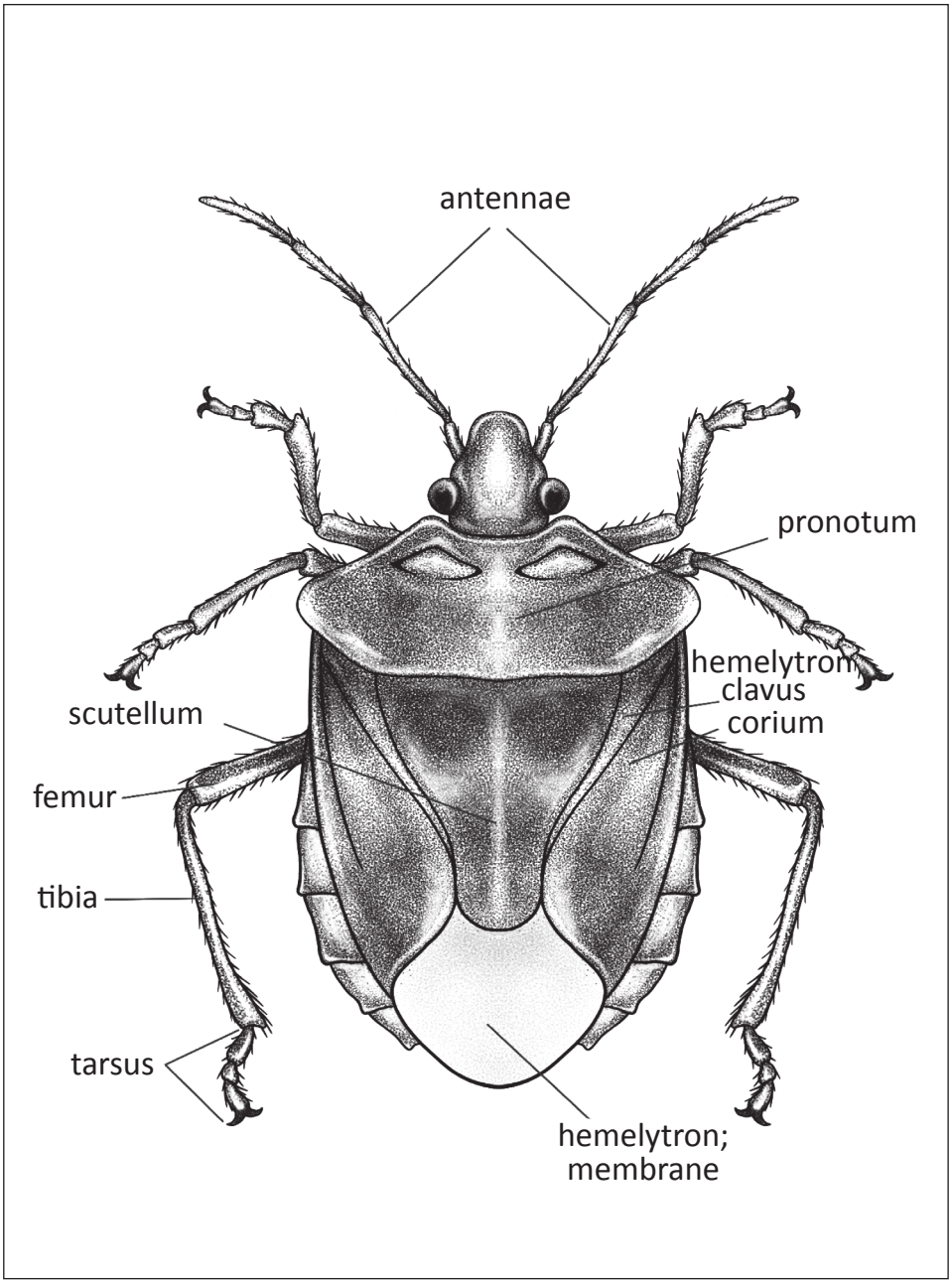


Figure 1.4 Morphological dorsal view of Family Pentatomidae

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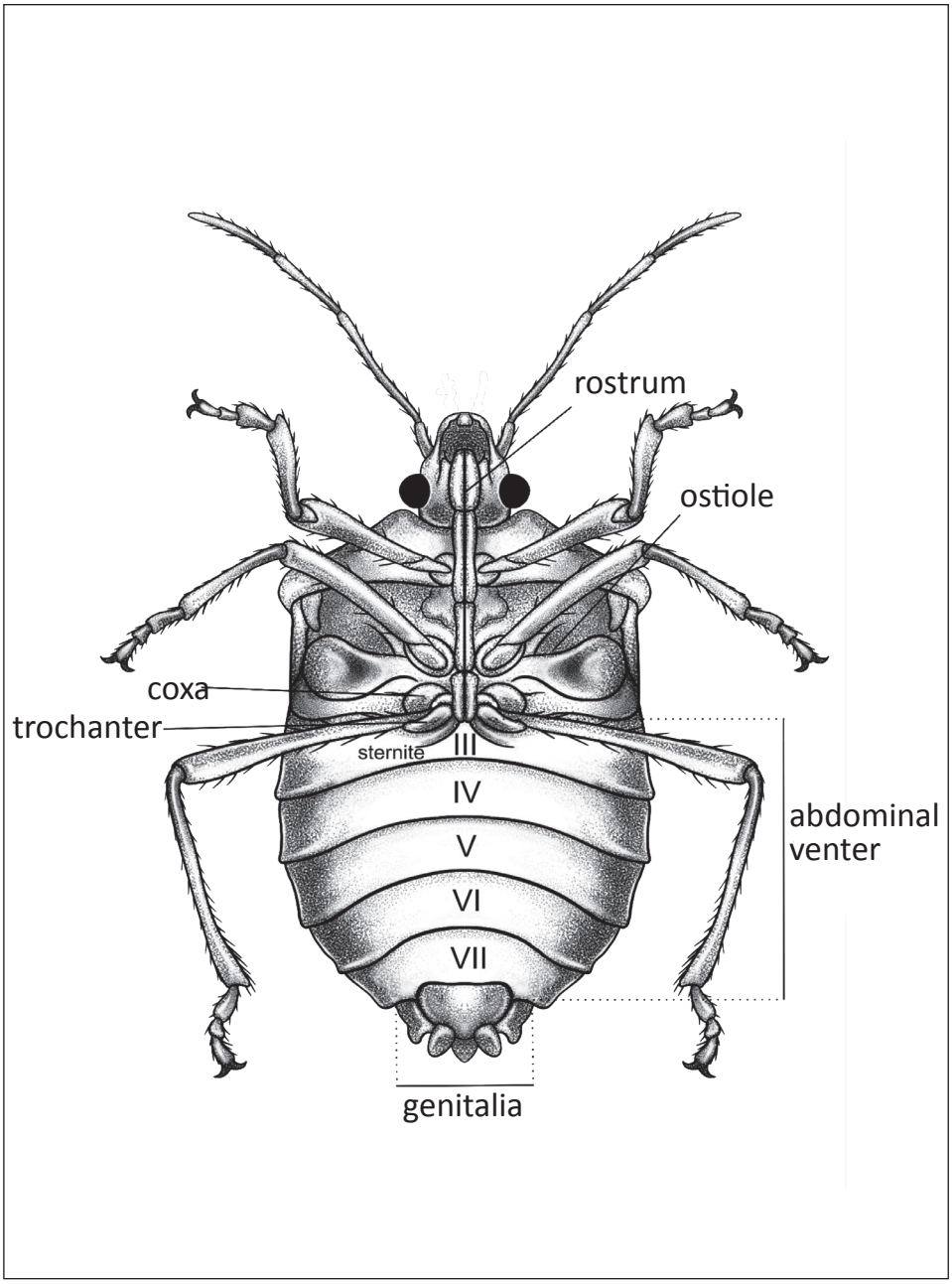
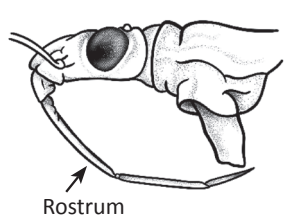
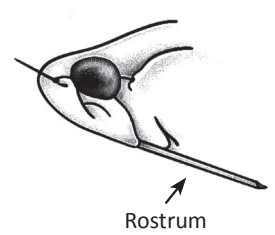
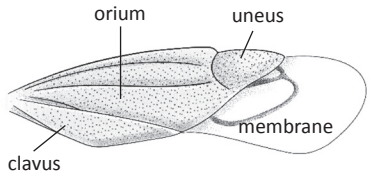
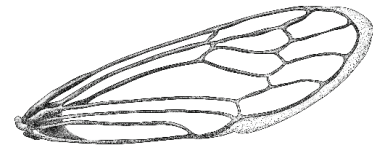
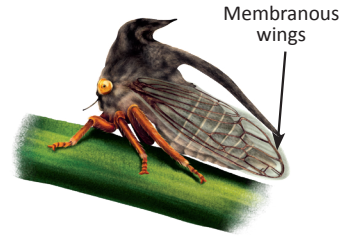
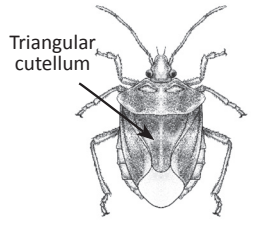
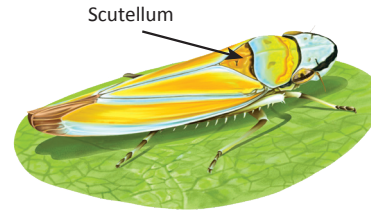


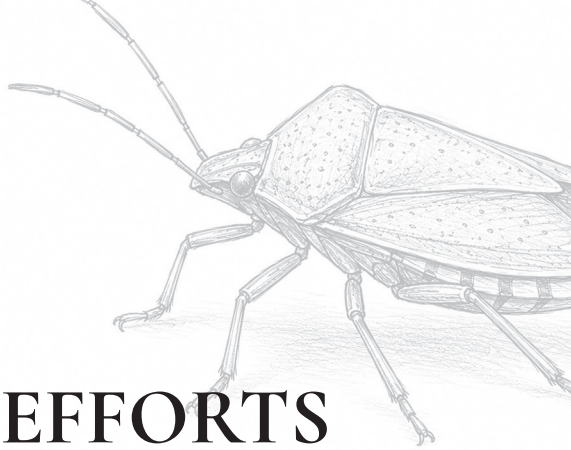
Figure 1.5 Morphological ventral view of Family Pentatomidae

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Table 1.1 Differences in the morphology of two Hemiptera suborders, the Heteroptera and the Auchenorrhyncha. The drawings as well as the selection of characters are based on Triplehorn & Johnson (2005) and Schuh & Weirauch (2020).

Main Characters	Suborder	
	Heteroptera	Auchenorrhyncha
Mouthparts	Rostrum develops from the anteroventral (front) part of the head 	Rostrum develops from the posteroventral (back) part of the head 
Wings	The basal half of the forewings is leathery and hardened, while the distal half is membranous  	Forewings are more homogenous texture, either slightly thickened or entirely membranous  
Position of the wings at rest	Flatter over the back 	Arched (tent-like) over the back 
Scutellum	The triangular scutellum is prominent 	Lack of scutellum 

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CHAPTER II

HEMIPTERA CHECKLIST OF EFFORTS MORPHOSPECIES

Hemiptera : Auchenorrhyncha

The Auchenorrhyncha are one of the four suborders of the Hemiptera, and include cicadas, leafhoppers, planthoppers, treehoppers, froghoppers, and spittlebugs (Triplehorn & Johnson, 2005). The Auchenorrhyncha are distinct from other Hemiptera taxa due to the presence of a complex tymbal acoustic system, which produces sound for communication, as well as an aristoid antennal flagellum for sensory perception (CSIRO, 1991). The Auchenorrhyncha typically have a robust and elongated body, ranging from small to large size. The head is usually prognathous, with prominent compound eyes, and several species have ocelli as well. The antennae are usually short and bristle-like, consisting of four segments (Triplehorn & Johnson, 2005).

Unlike heteropterans, where the rostrum arises from the front of the head, the rostrum of Auchenorrhyncha emerges from the back, known as bent-beak (Schuh & Weirauch, 2020). This structure allows them to pierce plant vascular tissue and extract nutrient-rich sap, which makes them abundant in terrestrial habitats. The majority of Auchenorrhyncha families are well-jumped and have extensively spinose hind legs, except for Cicadoidea (CSIRO, 1991). Some species have modified legs for clinging to plant surfaces. Similar to other suborders, Auchenorrhyncha have two pairs of wings whose venation is fully developed. Wings can be held roof-like over the body when at rest, which distinguishes them from other groups (Triplehorn & Johnson, 2005).

Auchenorrhyncha can be found in diverse habitats, from tropical rainforests to temperate grasslands. Many species are highly adaptable and inhabit various ecological niches (Triplehorn & Johnson, 2005). Auchenorrhyncha are well-known for their loud sounds, which play a crucial role in the mating process and communication with each other (Triplehorn & Johnson, 2005; CSIRO, 1991). For instance, cicadas (Cicadidae), with their specialized tymbal organs, produce

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some of the loudest sounds among insects as signals for attracting mates and establishing territories (Drosopoulos & Claridge, 2005). Some species of leafhoppers (Cicadellidae) and treehoppers (Membracidae) also produce clicks and whistles to communicate with each other (Drosopoulos & Claridge, 2005). Thus, this complex structure allows Auchenorrhyncha to interact with each other effectively and adapt to the environment.

The majority of Auchenorrhyncha are phytophagous and free-living (Triplehorn & Johnson, 2005). Many species feed on the phloem and xylem tissue of angiosperms (CSIRO, 1991). By piercing plant tissue and feeding on plant sap, some species can become agricultural pests by transmitting plant diseases, such as *Xylella fastidiosa*, spread by the group Cicadomorpha, which can cause Pierce's disease (Rodrigues *et al*., 2023). However, some Auchenorrhyncha play a beneficial role in the ecosystem. For example, leafhoppers are food sources for insect predators (Prazaru *et al*., 2021). Honeydew, a sugary waste product produced by some species of Auchenorrhyncha, can also be a food source for ants and other insects (Nelson & Mooney, 2022).

Here we present the list of Auchenorrhyncha we found in four different land use systems in Jambi, Sumatra. Morphospecies were determined to species level where possible, but most were determined at genus, subfamily, and family level. Family (indicated by the suffix -idae), subfamily (indicated by the suffix -inae), and genus (indicated by italic letters) name followed by the species code and number represent morphospecies name for family, subfamily and genus level respectively.

Table 2.1 Auchenorrhyncha morphospecies from four land use systems in Jambi Province, Sumatra, Indonesia.

Family Achilidae						
Morphospecies	**MSp ID**	**Land Use**				**Figure**
Cixidia sp.01	HemAuc117					3.1
Achilidae sp.01	HemAuc161					3.2
Achilinae sp.01	HemAuc013; HemAuc027; HemAuc052					3.3
Achilinae sp.02	HemAuc009; HemAuc031					3.4
Achilinae sp.03	HemAuc138					3.5
Achilinae sp.04	HemAuc148					3.6
Achilinae sp.05	HemAuc090					3.7

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Achilinae sp.06	HemAuc092		3.8
Achilinae sp.07	HemAuc108		3.9
Achilinae sp.08	HemAuc126		3.10

Family Aphrophoridae

Morphospecies	MSp ID	Land Use	Figure
Philaneus spumarius	HemAuc140		3.11
Aphrophoridae sp.01	HemAuc134		3.12

Family Cicadellidae

Morphospecies	MSp ID	Land Use	Figure
Penthimia sp.01	HemAuc006		3.13
Penthimia sp.02	HemAuc084		3.14
Penthimia sp.03	HemAuc129		3.15
Aphrodinae sp.01	HemAuc107		3.16
Aphrodinae sp.02	HemAuc077		3.17
Aphrodinae sp.03	HemAuc065		3.18
Aphrodinae sp.04	HemAuc081		3.19
Cicadellinae sp.01	HemAuc040		3.20
Cicadellinae sp.02	HemAuc045		3.21
Cicadellinae sp.03	HemAuc049		3.22
Cicadellinae sp.04	HemAuc071		3.23
Cicadellinae sp.05	HemAuc072		3.24
Cicadellinae sp.06	HemAuc075		3.25

Buku ini tidak diperjualbelikan.

Cicadellinae sp.07	HemAuc085					3.26
Cicadellinae sp.08	HemAuc089					3.27
Cicadellinae sp.09	HemAuc111					3.28
Cicadellinae sp.10	HemAuc137					3.29
Cicadellinae sp.11	HemAuc093					3.30
Cicadellinae sp.12	HemAuc110					3.31
Coelidiinae sp.01	HemAuc068					3.32
Deltocephalinae sp.01	HemAuc100					3.33
Deltocephalinae sp.02	HemAuc143					3.34
Deltocephalinae sp.03	HemAuc162; HemAuc172					3.35
Deltocephalinae sp.04	HemAuc014; HemAuc016					3.36
Deltocephalinae sp.05	HemAuc057					3.37
Deltocephalinae sp.06	HemAuc149					3.38
Deltocephalinae sp.07	HemAuc088					3.39
Deltocephalinae sp.08	HemAuc097					3.40
Deltocephalinae sp.09	HemAuc103					3.41
Deltocephalinae sp.10	HemAuc132					3.42
Deltocephalinae sp.11	HemAuc174					3.43
Deltocephalinae sp.12	HemAuc128					3.44
Deltocephalinae sp.13	HemAuc123					3.45
Eurymelinae sp.01	HemAuc042					3.46

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Eurymelinae sp.02	HemAuc060; HemAuc142					3.47
Ledrinae sp.01	HemAuc160					3.48
Ledrinae sp.02	HemAuc109					3.49
Ledrinae sp.03	HemAuc136; HemAuc169					3.50
Ledrinae sp.04	HemAuc170					3.51
Ledrinae sp.05	HemAuc141					3.52
Typhlocybinae sp.01	HemAuc050					3.53
Typhlocybinae sp.02	HemAuc040					3.54
Typhlocybinae sp.03	HemAuc175					3.55
Typhlocybinae sp.04	HemAuc032					3.56
Typhlocybinae sp.05	HemAuc033					3.57
Typhlocybinae sp.06	HemAuc041					3.58
Typhlocybinae sp.07	HemAuc047					3.59
Typhlocybinae sp.08	HemAuc059					3.60
Typhlocybinae sp.09	HemAuc076					3.61
Typhlocybinae sp.10	HemAuc096					3.62
Typhlocybinae sp.11	HemAuc106					3.63
Typhlocybinae sp.12	HemAuc145					3.64
Typhlocybinae sp.13	HemAuc152					3.65
Typhlocybinae sp.14	HemAuc155					3.66
Typhlocybinae sp.15	HemAuc163					3.67

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Typhlocybinae sp.16	HemAuc165					3.68
Typhlocybinae sp.17	HemAuc139					3.69
Typhlocybinae sp.18	HemAuc070					3.70
Cicadellidae sp.01	HemAuc007					3.71
Cicadellidae sp.02	HemAuc010					3.72
Cicadellidae sp.03	HemAuc012					3.73
Cicadellidae sp.04	HemAuc017					3.74
Cicadellidae sp.05	HemAuc021					3.75
Cicadellidae sp.06	HemAuc034					3.76
Cicadellidae sp.07	HemAuc166					3.77
Cicadellidae sp.08	HemAuc177					3.78
Cicadellidae sp.09	HemAuc181					3.79
Family Cicadidae						
Morphospecies	**MSp ID**		**Land Use**			**Figure**
Cicadidae sp.01	HemAuc079					3.80
Family Derbidae						
Morphospecies	**MSp ID**		**Land Use**			**Figure**
Apache sp.01	HemAuc147					3.81
Cedusa sp.01	HemAuc019					3.82
Proutista moesta	HemAuc003; HemAuc004; HemAuc159					3.83
Zoraida sp.01	HemAuc037					3.84
Zoraida sp.02	HemAuc044					3.85

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Cedusinae sp.01	HemAuc011					3.86
Cedusinae sp.02	HemAuc023					3.87
Cedusinae sp.03	HemAuc164					3.88
Derbinae sp.01	HemAuc030					3.89
Derbinae sp.02	HemAuc043					3.90
Derbinae sp.03	HemAuc083					3.91
Derbinae sp.04	HemAuc133					3.92
Derbinae sp.05	HemAuc173					3.93
Otiocerinae sp.01	HemAuc001					3.94
Otiocerinae sp.02	HemAuc002					3.95
Otiocerinae sp.03	HemAuc005					3.96
Otiocerinae sp.04	HemAuc008; HemAuc020; HemAuc157					3.97
Otiocerinae sp.05	HemAuc015					3.98
Otiocerinae sp.06	HemAuc116					3.99
Otiocerinae sp.07	HemAuc039					3.100
Otiocerinae sp.08	HemAuc144					3.101
Otiocerinae sp.09	HemAuc154					3.102
Otiocerinae sp.10	HemAuc158					3.103
Otiocerinae sp.11	HemAuc112					3.104
Otiocerinae sp.12	HemAuc153					3.105
Otiocerinae sp.13	HemAuc156					3.106

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Derbidae sp.01	HemAuc095		3.107
Derbidae sp.02	HemAuc043		3.108

Family Dictyopharidae

Morphospecies	MSp ID	Land Use	Figure
Phylloscelis sp.01	HemAuc180		3.109

Family Eurybrachyidae

Morphospecies	MSp ID	Land Use	Figure
Eurybrachyidae sp.01	HemAuc150		3.110

Family Flatidae

Morphospecies	MSp ID	Land Use	Figure
Bythopsyrna copulanda	HemAuc151		3.111
Cerynia sp.01	HemAuc087		3.112
Cyarda sp.01	HemAuc099; HemAuc115		3.113
Cyarda sp.02	HemAuc024		3.114
Laesabes sp.01	HemAuc074		3.115
Massila sp.01	HemAuc036; HemAuc055		3.116
Ormenoides sp.01	HemAuc022		3.117
Ormenoides sp.02	HemAuc053; HemAuc082		3.118
Pseudoflatoides sp.01	HemAuc080		3.119
Siphanta sp.01	HemAuc061		3.120
Flatidae sp.01	HemAuc127		3.121
Flatidae sp.02	HemAuc038		3.122

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Family Issidae

Morphospecies	MSp ID	Land Use	Figure
Hemisphaerus sp.01	HemAuc062		3.123
Hemisphaerus sp.02	HemAuc094		3.124
Hemisphaerus sp.03	HemAuc124		3.125
Hemisphaerus sp.04	HemAuc029		3.126
Thionia sp.01	HemAuc035		3.127
Thionia sp.02	HemAuc054; HemAuc066		3.128
Thionia sp.03	HemAuc130		3.129
Thionia sp.04	HemAuc146		3.130
Issinae sp.01	HemAuc051		3.131
Issinae sp.02	HemAuc064		3.132
Issinae sp.03	HemAuc119; HemAuc121		3.133

Family Meenoplidae

Morphospecies	MSp ID	Land Use	Figure
Nisia sp.01	HemAuc048; HemAuc078		3.134
Nisia sp.02	HemAuc086		3.135
Meenoplidae sp.01	HemAuc056		3.136
Meenoplidae sp.02	HemAuc122		3.137
Meenoplidae sp.03	HemAuc067		3.138
Meenoplidae sp.04	HemAuc105		3.139
Meenoplidae sp.05	HemAuc176		3.140

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Family Membracidae

Morphospecies	MSp ID	Land Use	Figure
Gargara sp.01	HemAuc018		3.141
Gargara sp.02	HemAuc073		3.142
Leptocentrus sp.01	HemAuc028		3.143
Leptocentrus sp.02	HemAuc063		3.144
Leptocentrus sp.03	HemAuc101		3.145
Leptocentrus taurus	HemAuc025		3.146
Centrotinae sp.01	HemAuc026		3.147
Membracidae sp.02	HemAuc168		3.148

Family Ricaniidae

Morphospecies	MSp ID	Land Use	Figure
Pochazia sp.01	HemAuc131		3.149
Ricaniidae sp.01	HemAuc120		3.150

Family Tropiduchidae

Morphospecies	MSp ID	Land Use	Figure
Sogana sp.01	HemAuc098; HemAuc102; HemAuc118; HemAuc135		3.151
Sogana sp.02	HemAuc046		3.152
Sogana sp.03	HemAuc171		3.153
Tambinia sp.01	HemAuc113		3.154
Tropiduchinae sp.01	HemAuc058		3.155
Tropiduchinae sp.02	HemAuc069		3.156

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Tropiduchinae sp.03	HemAuc114		3.157
Tropiduchinae sp.04	HemAuc125		3.158
Tropiduchinae sp.05	HemAuc091	 	3.159
Tropiduchinae sp.06	HemAuc178		3.160

 lowland rainforest;  jungle rubber;  rubber monoculture;  oil palm.

Note: Morphospecies were determined to species level where possible, but most were identified at the family, subfamily or genus level. Morphospecies codes (MSp ID) were created for practical reasons and include order info (Hem) and suborder info (Auc) and a running number. Symbols in the column "Land use" indicate in which land use specimens were found, while "Figure" indicates photos of the specimens.

Hemiptera : Heteroptera

Heteroptera, known as true bugs, were first classified by Linneus as a group of Hemiptera along with thrips, aphids, scale insects, and cicadas based on the characteristics of the wings (Schuh & Weirauch, 2020). However, the advent of molecular biology and genetic sequencing in the latter half of the 20th century has revealed new insights into the evolutionary relationships among different groups within Heteroptera and Hemiptera (Schuh & Weirauch, 2020). Other evidence also indicates that Heteroptera have previously been classified based on the presence of metathoracic scent glands in adults and dorsal abdominal glands in nymphs (Schuh & Weirauch, 2020). These glands are particularly used for defense, communication, and sometimes predation. This group encompasses a wide variety of species, including some well-known groups such as stink bugs (Pentatomidae), assassin bugs (Reduviidae), water striders (Gerridae), and bed bugs (Cimidae) (Triplehorn & Johnson, 2005).

The identical characteristic of Heteroptera is the forewings, which can either have a uniform texture, ranging from tegminal to almost completely membranous, or generally form hemelytra (Schuh & Weirauch, 2020). The hemelytra are separated into a sclerotized (coriaceous/corium) at the proximal portion. It is typically hardened and leathery, providing a protective shield for softer hindwings tucked underneath, and the membrane at the distal portion, the membranous part of the wings, which allows for flight (Schuh & Weirauch, 2020; Triplehorn & Johnson, 2005). The corium is also subdivided by wing fractures into the clavus (posterior to the claval suture). However, in several families, it is separated into three parts, i.e. endocorium (posterior to the medial fracture, anterior to the clavus), exocorium or embolium (anterior to the medial fracture), and cuneus (distal to the coastal

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fracture) (Schuh & Weirauch, 2020). Most Heteroptera have fully developed wings (macropterous), while others have reduced wings (micropterous or apterous) (Schuh & Weirauch, 2020).

The head of Heteroptera varies from barely longer than the compound eyes to elongated both anterior (in front of) and posterior (behind) of the large compound eyes (Triplehorn & Johnson, 2005). In many species, the compound eyes are well developed, with ocelli positioned between them. The majority of heteropterans have four antennal segments, i.e. scape, pedicel, basiflagellomere, and distiflagellomere, although most Pentatomoidea have five (Schuh & Weirauch, 2020). Heteroptera possess a piercing-sucking mouthpart, the proboscis (rostrum). The rostrum is typically jointed and can be folded back under the head when not in use. It functions like a straw, with needle-like stylets that pierce plant or animal tissues and inject enzymes to liquefy food before sucking it. This adaptation allows heteropterans to feed on a variety of food sources, including plant sap, phloem fluid, and vertebrate blood.

At the dorsal part of the thorax (behind the pronotum), specifically between the bases of the wings, there is the scutellum, a prominent characteristic of heteropterans, which is usually triangular or shield-shaped (Schuh & Weirauch, 2020). The scutellum varies significantly in shape and size among different Heteroptera species (Triplehorn & Johnson, 2005). This structure protects the underlying tissues of the thorax, such as the muscles that control the wings and the dorsal blood vessel. Regarding the abdomen, the pregenital abdomen in female Heteroptera includes terga 1–7 and sterna 2–7, while in males it consists of terga 1–8 and sterna 2–8 (Schuh & Weirauch, 2020). Moreover, the structure of Heteroptera legs varies between species, with much of the variety associated with life habits. For example, the water bugs (Nepomorpha) have adapted to aquatic life with modifications of oar-like legs for swimming (Nowińska *et al.*, 2023), also the assassin bugs (Reduviidae), which have powerful forelimbs adapted for grasping prey (Zhang *et al.*, 2016).

Heteroptera are widely distributed on more than one continent and greatly diverse in the tropical region. Most species inhabit terrestrial ecosystems, such as the plant surface, plant tissue, leaf litter, caves, and canopy of trees (Schuh & Weirauch, 2020). Other groups can also be found in the aquatic or water surface, hygropetric or littoral riparian, and even in marine intertidal zones (Schuh & Weirauch, 2020; Panizzi & Gracia, 2015). Many Heteroptera have developed defensive strategies, such as aposematism, mimicry, and camouflage to protect themselves from predators. For instance, the release of foul-smelling chemicals as in stink bugs, or physical adaptations such as myrmecomorphy (ant mimicry) by some species of Miridae (Schuh & Weirauch, 2020).

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Heteropterans, like other insects, found their food sources through olfaction, vision, or a combination of both, and mechanoreception (Freund & Olmstead, 2000). Most species are phytophagous, feeding on phloem sap of a wide range of plants to extract carbohydrates and amino acids. Thus, they can be significant agricultural pests that can also transmit pathogens, including viruses, bacteria, and fungi. Some groups, however, are predacious and haematophagous, such as the water striders (Gerridae), the assassin bugs (Reduviidae), and the bed bugs (Cimidae) (Schuh & Weirauch, 2020).

Here we present the list of Heteroptera we found in four different land use systems in Jambi, Sumatra, at morphospecies level. Morphospecies were determined to species level where possible, but most were determined at genus, subfamily, and family level. Family (indicated by the suffix -idae), subfamily (indicated by the suffix -inae), and genus (indicated by italic letters) name followed by the species code and number represent morphospecies name for family, subfamily and genus level respectively.

Table 2.2 Heteroptera morphospecies from four land use systems in Jambi Province, Sumatra, Indonesia.

Family Alydidae			
Morphospecies	**MSp ID**	**Land Use**	**Figure**
Alydidae sp.01	HemHet219	 	3.161
Alydidae sp.02	HemHet290	 	3.162
Alydidae sp.03	HemHet282	 	3.163
Alydidae sp.04	HemHet169		3.164
Alydidae sp.05	HemHet192		3.165
Alydidae sp.06	HemHet139		3.166
Alydidae sp.07	HemHet262	 	3.167

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Family Anthocoridae

Morphospecies	MSp ID	Land Use	Figure
Anthocorinae sp.01	HemHet037; HemHet041; HemHet042; HemHet043; HemHet050; HemHet221; HemHet228; HemHet241; HemHet243		3.168
Anthocorinae sp.02	HemHet083		3.169
Anthocoridae sp.01	HemHet138		3.170
Anthocoridae sp.02	HemHet159		3.171
Anthocoridae sp.03	HemHet246		3.172

Family Aradidae

Morphospecies	MSp ID	Land Use	Figure
Aradidae sp.01	HemHet005		3.173
Aradidae sp.02	HemHet047; HemHet075		3.174
Aradidae sp.03	HemHet143		3.175
Aradidae sp.04	HemHet232		3.176

Family Berytidae

Morphospecies	MSp ID	Land Use	Figure
Berytidae sp.01	HemHet079; HemHet096		3.177

Family Colobathristidae

Morphospecies	MSp ID	Land Use	Figure
Colobathristidae sp.01	HemHet259		3.178

Buku ini tidak diperjualbelikan.

Family Coreidae

Morphospecies	MSp ID	Land Use	Figure
Coreidae sp.01	HemHet053		3.179
Coreidae sp.02	HemHet266		3.180
Coreidae sp.03	HemHet257		3.181
Coreidae sp.04	HemHet067	 	3.182
Coreidae sp.05	HemHet144	 	3.183
Coreidae sp.06	HemHet058		3.184

Family Enicocephalidae

Morphospecies	MSp ID	Land Use	Figure
Enicocephalidae sp.01	HemHet140		3.185
Enicocephalidae sp.02	HemHet263		3.186

Family Geocoridae

Morphospecies	MSp ID	Land Use	Figure
Geocorinae sp.01	HemHet294	  	3.187

Family Lyctocoridae

Morphospecies	MSp ID	Land Use	Figure
Lyctocorinae sp.01	HemHet074	 	3.188
Lyctocorinae sp.02	HemHet117	 	3.189
Lyctocorinae sp.03	HemHet030; HemHet052	 	3.190
Lyctocorinae sp.04	HemHet105		3.191
Lyctocorinae sp.05	HemHet134		3.192
Lyctocorinae sp.06	HemHet032		3.193

Buku ini tidak diperjualbelikan.

Lyctocorinae sp.07	HemHet251					3.194
Lyctocorinae sp.08	HemHet224					3.195

Family Lygaeidae

Morphospecies	MSp ID	Land Use				Figure
Ischnorhynchinae sp.01	HemHet112					3.196
Ischnorhynchinae sp.02	HemHet274					3.197
Ischnorhynchinae sp.03	HemHet277					3.198
Lygaeinae sp.01	HemHet034					3.199
Lygaeinae sp.02	HemHet038					3.200
Lygaeinae sp.03	HemHet293					3.201
Orsillinae sp.01	HemHet106					3.202
Orsillinae sp.02	HemHet286					3.203
Lygaeidae sp.01	HemHet234					3.204
Lygaeidae sp.02	HemHet173					3.205
Lygaeidae sp.03	HemHet223					3.206
Lygaeidae sp.04	HemHet137					3.207

Family Miridae

Morphospecies	MSp ID	Land Use				Figure
Bruneimetopus simulans	HemHet008; HemHet016; HemHet025					3.208
Helopeltis antonii	HemHet108					3.209
Bryocorinae sp.01	HemHet098					3.210
Bryocorinae sp.02	HemHet302					3.211
Bryocorinae sp.03	HemHet007					3.212

Buku ini tidak diperjualbelikan.

Bryocorinae sp.04	HemHet014				3.213
Bryocorinae sp.05	HemHet024				3.214
Bryocorinae sp.06	HemHet035				3.215
Bryocorinae sp.07	HemHet044				3.216
Bryocorinae sp.08	HemHet065; HemHet107				3.217
Bryocorinae sp.09	HemHet066				3.218
Bryocorinae sp.10	HemHet084				3.219
Bryocorinae sp.11	HemHet093, HemHet095				3.220
Bryocorinae sp.12	HemHet094				3.221
Bryocorinae sp.13	HemHet100; HemHet175				3.222
Bryocorinae sp.14	HemHet110				3.223
Bryocorinae sp.15	HemHet092; HemHet118				3.224
Bryocorinae sp.16	HemHet127				3.225
Bryocorinae sp.17	HemHet133; HemHet152				3.226
Bryocorinae sp.18	HemHet172; HemHet204				3.227
Bryocorinae sp.19	HemHet206				3.228
Bryocorinae sp.20	HemHet239; HemHet240				3.229
Bryocorinae sp.21	HemHet275				3.230
Bryocorinae sp.22	HemHet284				3.231
Deraeocorinae sp.01	HemHet092; HemHet113				3.232
Deraeocorinae sp.02	HemHet130				3.233

Buku ini tidak diperjualbelikan.

Isometopinae sp.01	HemHet029					3.234
Isometopinae sp.02	HemHet088					3.235
Isometopinae sp.03	HemHet099					3.236
Isometopinae sp.04	HemHet198					3.237
Isometopinae sp.05	HemHet205					3.238
Mirinae sp.01	HemHet242					3.239
Mirinae sp.02	HemHet078					3.240
Mirinae sp.03	HemHet120					3.241
Mirinae sp.04	HemHet122					3.242
Mirinae sp.05	HemHet151; HemHet297					3.243
Mirinae sp.06	HemHet156					3.244
Mirinae sp.07	HemHet178					3.245
Mirinae sp.08	HemHet209					3.246
Phylinae sp.01	HemHet001; HemHet002; HemHet057; HemHet070					3.247
Phylinae sp.02	HemHet003; HemHet015; HemHet089; HemHet090; HemHet165					3.248
Phylinae sp.03	HemHet006					3.249
Phylinae sp.04	HemHet009; HemHet017					3.250
Phylinae sp.05	HemHet023; HemHet027; HemHet116; HemHet166; HemHet201					3.251
Phylinae sp.06	HemHet131					3.252
Phylinae sp.07	HemHet051					3.253
Phylinae sp.08	HemHet059; HemHet061					3.254

Buku ini tidak diperjualbelikan.

Phylinae sp.09	HemHet160; HemHet176					3.255
Phylinae sp.10	HemHet062; HemHet227					3.256
Phylinae sp.11	HemHet085; HemHet109; HemHet177					3.257
Phylinae sp.12	HemHet135					3.258
Phylinae sp.13	HemHet060					3.259
Phylinae sp.14	HemHet141; HemHet142					3.260
Phylinae sp.15	HemHet214					3.261
Phylinae sp.16	HemHet171					3.262
Phylinae sp.17	HemHet194					3.263
Phylinae sp.18	HemHet195					3.264
Phylinae sp.19	HemHet196					3.265
Phylinae sp.20	HemHet202					3.266
Phylinae sp.21	HemHet207					3.267
Phylinae sp.22	HemHet208					3.268
Phylinae sp.23	HemHet210; HemHet273					3.269
Phylinae sp.24	HemHet211					3.270
Phylinae sp.25	HemHet213					3.271
Phylinae sp.26	HemHet270					3.272
Phylinae sp.27	HemHet289					3.273
Phylinae sp.28	HemHet186					3.274
Phylinae sp.29	HemHet147; HemHet184; HemHet200					3.275

Buku ini tidak diperjualbelikan.

Miridae sp.01	HemHet115; HemHet174				3.276
Miridae sp.02	HemHet028				3.277
Miridae sp.03	HemHet188; HemHet212				3.278
Miridae sp.04	HemHet252				3.279

Family Nabidae

Morphospecies	MSp ID	Land Use			Figure
Nabidae sp.01	HemHet268				3.280
Nabidae sp.02	HemHet010				3.281
Nabidae sp.03	HemHet300				3.282

Family Pentatomidae

Morphospecies	MSp ID	Land Use			Figure
Asopinae sp.01	HemHet306				3.283
Asopinae sp.02	HemHet076				3.284
Asopinae sp.03	HemHet191				3.285
Asopinae sp.04	HemHet292				3.286
Asopinae sp.05	HemHet304				3.287
Discocephalinae sp.01	HemHet229				3.288
Pentatominae sp.01	HemHet136				3.289
Pentatominae sp.02	HemHet155				3.290
Pentatominae sp.03	HemHet197				3.291
Pentatominae sp.04	HemHet237				3.292
Pentatominae sp.05	HemHet296				3.293

Buku ini tidak diperjualbelikan.

Pentatominae sp.06	HemHet299				3.294
Pentatominae sp.07	HemHet103				3.295
Pentatominae sp.08	HemHet167				3.296
Pentatomidae sp.01	HemHet276				3.297
Pentatomidae sp.02	HemHet004				3.298
Pentatomidae sp.03	HemHet048				3.299
Pentatomidae sp.04	HemHet183				3.300
Pentatomidae sp.05	HemHet193				3.301
Pentatomidae sp.06	HemHet269				3.302

Family Plataspidae

Morphospecies	MSp ID	Land Use			Figure
Plataspidae sp.01	HemHet305				3.303
Plataspidae sp.02	HemHet298				3.304
Plataspidae sp.03	HemHet285				3.305
Plataspidae sp.04	HemHet245				3.306
Plataspidae sp.05	HemHet020				3.307
Plataspidae sp.06	HemHet150				3.308
Plataspidae sp.07	HemHet238				3.309
Plataspidae sp.08	HemHet247				3.310
Plataspidae sp.09	HemHet180				3.311
Plataspidae sp.10	HemHet179				3.312

Buku ini tidak diperjualbelikan.

Family Reduviidae						
Morphospecies	**MSp ID**	**Land Use**				**Figure**
Ectomocoris sp.01	HemHet230					3.313
Emesaya sp.01	HemHet036					3.314
Emesaya sp.02	HemHet216					3.315
Empicoris sp.01	HemHet279					3.316
Empicoris sp.02	HemHet236					3.317
Empicoris sp.03	HemHet101; HemHet250					3.318
Empicoris sp.04	HemHet011					3.319
Empicoris sp.05	HemHet049					3.320
Empicoris sp.06	HemHet055; HemHet225					3.321
Empicoris sp.07	HemHet056					3.322
Empicoris sp.08	HemHet082; HemHet124; HemHet249; HemHet288					3.323
Empicoris sp.09	HemHet086					3.324
Empicoris sp.10	HemHet119					3.325
Empicoris sp.11	HemHet125					3.326
Empicoris sp.12	HemHet220					3.327
Euagoras sp.01	HemHet102; HemHet114					3.328
Lisarda sp.01	HemHet033					3.329
Montina sp.01	HemHet145; HemHet181					3.330
Emesinae sp.01	HemHet111; HemHet126					3.331
Emesinae sp.02	HemHet063; HemHet080; HemHet081					3.332

Buku ini tidak diperjualbelikan.

Hammacerinae sp.01	HemHet064					3.333
Harpactorinae sp.01	HemHet128; HemHet215; HemHet283					3.334
Harpactorinae sp.02	HemHet068; HemHet244; HemHet248; HemHet295					3.335
Harpactorinae sp.03	HemHet018; HemHet168					3.336
Harpactorinae sp.04	HemHet158; HemHet222					3.337
Harpactorinae sp.05	HemHet287					3.338
Harpactorinae sp.06	HemHet199					3.339
Harpactorinae sp.07	HemHet189					3.340
Harpactorinae sp.08	HemHet278					3.341
Harpactorinae sp.09	HemHet148					3.342
Harpactorinae sp.10	HemHet217					3.343
Harpactorinae sp.11	HemHet254; HemHet255					3.344
Harpactorinae sp.12	HemHet253					3.345
Harpactorinae sp.13	HemHet303					3.346
Harpactorinae sp.14	HemHet154					3.347
Harpactorinae sp.15	HemHet301					3.348
Harpactorinae sp.16	HemHet161					3.349
Harpactorinae sp.17	HemHet190					3.350
Holoptilinae sp.01	HemHet170					3.351
Holoptilinae sp.02	HemHet264					3.352
Peiratinae sp.01	HemHet185					3.353

Buku ini tidak diperjualbelikan.

Physoderinae sp.01	HemHet164				3.354
Physoderinae sp.02	HemHet260				3.355
Reduviidae sp.01	HemHet256				3.356

Family Rhyparochromidae

Morphospecies	MSp ID	Land Use			Figure
Rhyparoclava sp.01	HemHet271				3.357
Rhyparochrominae sp.01	HemHet054				3.358
Rhyparochrominae sp.02	HemHet021				3.359
Rhyparochrominae sp.03	HemHet069				3.360
Rhyparochrominae sp.04	HemHet087				3.361
Rhyparochrominae sp.05	HemHet123				3.362
Rhyparochrominae sp.06	HemHet132				3.363
Rhyparochrominae sp.07	HemHet146				3.364
Rhyparochrominae sp.08	HemHet218				3.365
Rhyparochrominae sp.09	HemHet272				3.366
Rhyparochrominae sp.10	HemHet235			 	3.367
Rhyparochrominae sp.11	HemHet226			 	3.368
Rhyparochromidae sp.01	HemHet071				3.369
Rhyparochromidae sp.02	HemHet267				3.370
Rhyparochromidae sp.03	HemHet281				3.371
Rhyparochromidae sp.04	HemHet291				3.372
Rhyparochromidae sp.05	HemHet233				3.373

Buku ini tidak diperjualbelikan.

Rhyparochromidae sp.06	HemHet121					3.374
Rhyparochromidae sp.07	HemHet012					3.375

Family Schizopteridae

Morphospecies	MSp ID	Land Use				Figure
Schizopteridae sp.01	HemHet022; HemHet031; HemHet045; HemHet091					3.376
Schizopteridae sp.03	HemHet046; HemHet150					3.377

Family Scutelleridae

Morphospecies	MSp ID	Land Use		Figure
Chrysocoris iris	HemHet104			3.378
Chrysocoris stollii	HemHet019; HemHet026			3.379

Family Tessaratomidae

Morphospecies	MSp ID	Land Use		Figure
Tessaratomidae sp.01	HemHet153			3.380
Tessaratomidae sp.02	HemHet203			3.381

Family Tingidae

Morphospecies	MSp ID	Land Use				Figure
Tinginae sp.01	HemHet163					3.382
Tinginae sp.02	HemHet077; HemHet162					3.383
Tinginae sp.03	HemHet039					3.384
Tinginae sp.04	HemHet013; HemHet097					3.385
Tinginae sp.05	HemHet040					3.386
Tinginae sp.06	HemHet072; HemHet073					3.387
Tinginae sp.07	HemHet129					3.388

Buku ini tidak diperjualbelikan.

Tinginae sp.08	HemHet149		3.389
Tinginae sp.09	HemHet157; HemHet265		3.390
Tinginae sp.10	HemHet182		3.391
Tinginae sp.11	HemHet280		3.392

Note:  lowland rainforest;  jungle rubber;  rubber monoculture;  oil palm.

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CHAPTER III

IMAGES OF HEMIPTERA FROM JAMBI

During canopy fogging collections from 2013, 2013/2014, and 2017, more than 45,000 specimens of Hemiptera were collected. A subset of about 5,000 individuals from the Suborders Auchenorrhyncha and Heteroptera from the 2013 collection were sorted to 33 families, and subsequently to family and then to 393 morphospecies. The following images showcase some of the most prominent morphospecies we found in our collection, shown from various angles. Images of the collection were arranged into chapters, alphabetically by family. Systematic information about families are largely derived from www.GBIF.org, while the biological and ecological information we give in the following chapters is predominantly sourced from "The Insects of Australia: A Textbook for Students and Research Workers" (CSIRO, 1991), Borror and DeLong's Introduction to the "The Study of Insects" (chapter "Auchenorrhyncha" by Triplehorn & Johnson, 2005), and "True Bugs of The World (Hemiptera: Heteroptera): Classification and Natural History" by Schuh & Weirauch (2020).

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A. Suborder: Auchenorrhyncha

1. Family Achilidae – *Bark Bugs*

The Achilidae, commonly known as bark bugs, is a group of Auchenorrhyncha within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea (Triplehorn & Johnson, 2005). This family comprises 186 genera and 526 species worldwide (GBIF, 2026). Achilid nymphs are fungus feeders and live under bark or in cavities of dead wood (Bartlett & Wilson, 2023). For example, *Corticium atrovirens* or *caeruleum* feeds on Basidiomycetes, and unidentified species of fungi were found in nymphs of *Synecdoche nemoralis*, which were collected under rocks, the bark of dead pine, standing dead trees, deep in a rotten log, and redwood duff (O'Brien, 1971). Meanwhile, most adults are herbivores, feed on woody plants, and are associated more often with gymnosperms than other families (Wilson *et al.*, 1994). Bark bugs can be identified by their folded-flat forewings, which partially overlap while at rest, whereas some species are tectiform (CSIRO, 1991). The head is elongated and broad with prominent compound eyes, while the antennae are short and bristle-like, with the base often inserted into a groove on the side of the head. The clavus is relatively short, and the second hind tarsomere has a row of spines (Bartlett & Wilson, 2023). Achilids are generally small to medium-sized with body lengths ranging from 4 to 10 mm (Triplehorn & Johnson, 2005).



Cixidia sp. (Hemiptera: Auchenorrhyncha: Achilidae)

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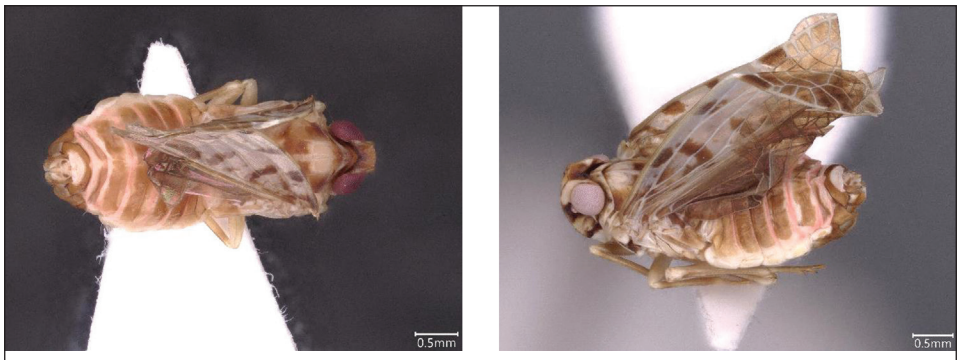
Note: Dorsal

Figure 3.1 *Cixidia* sp.01 – HemAuc117



Note: Dorsal

Figure 3.2 Achilidae sp.01 – HemAuc161



(A) (B)

Note: (A) Dorsal and (B) Ventral

Figure 3.3 Achilinae sp.01 – HemAuc052

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.4 Achilinae sp.02 – HemAuc009



Note: Dorsal

Figure 3.5 Achilinae sp.03 – HemAuc138



(A) (B)

Note: (A) Dorsal and (B) Ventral

Figure 3.6 Achilinae sp.04 – HemAuc148

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.7 Achilinae sp.05 – HemAuc090



(A) (B)

Note: (A) Dorsal and (B) Ventral

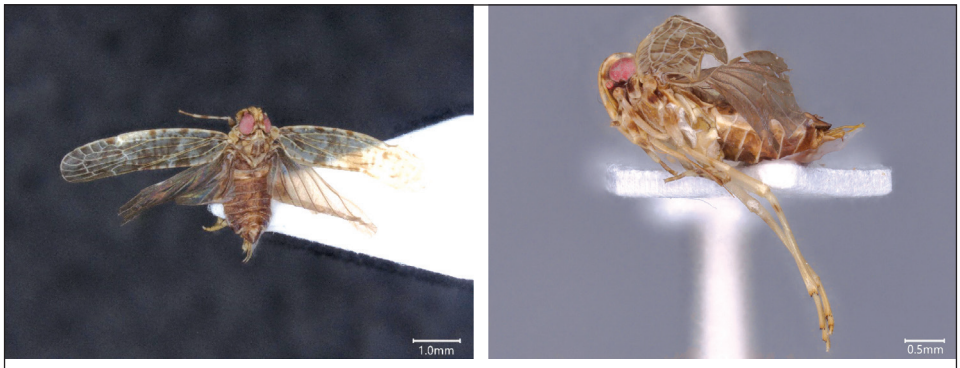
Figure 3.8 Achilinae sp.06 – HemAuc092

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Note: Dorsal

Figure 3.9 Achilinae sp.07 – HemAuc108



(A) (B)

Note: (A) Dorsal and (B) Ventral

Figure 3.10 Achilinae sp.08 – HemAuc126

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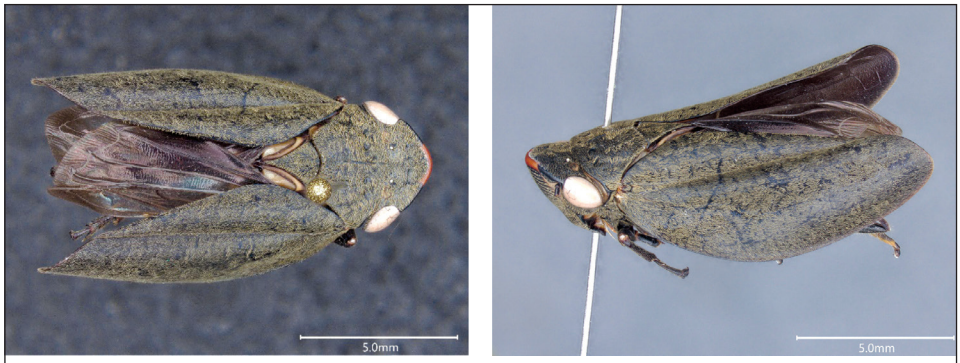
2. Family Aphrophoridae – *True Spittlebugs*

Within the Infraorder Cicadomorpha and the Superfamily Cercopoidea, Aphrophoridae are a group of Auchenorrhyncha which are commonly known as spittlebugs (Triplehorn & Johnson, 2005). The Aphrophoridae are a cosmopolitan group with 174 genera and 1,016 described species worldwide (GBIF, 2026). This family is well-known for their nymphal stage. The nymphs can produce masses of froth mixed with air bubbles, which resemble spittle. It provides a humid microclimate for developing nymphs, regulates temperature, prevents dehydration, discourages parasites, and protects from predators such as ants and spiders (CSIRO, 1991). The majority of nymphs can be spotted on shrubs or small trees, while the adults are free-living. Aphrophoridae typically exhibit a robust and compact body, a somewhat rounded and humped appearance, with lengths ranging from 5 to 13 mm. This group is beetle-like, dominated by brown and off-white patterns. The head is usually broad and curved with prominent compound eyes, short and bristle-like antennae, also a wide thorax (CSIRO, 1991).



Philaenus sp. (Hemiptera: Auchenorrhyncha: Aphrophoridae)

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(A) (B)

Note: (A) Dorsal and (B) Ventral

Figure 3.11 *Philaneus spumarius* – HemAuc140



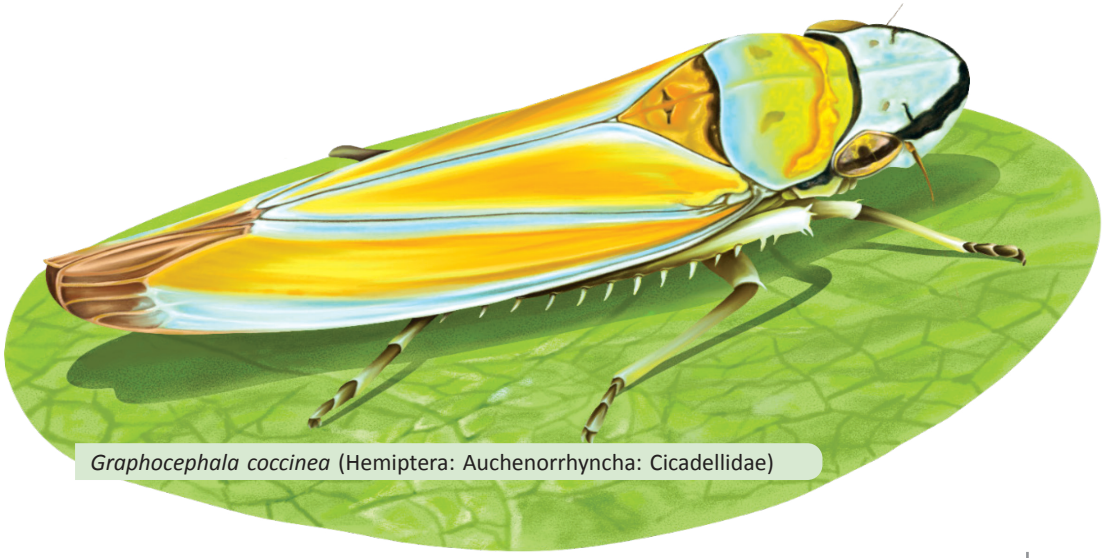
Note: Dorsal

Figure 3.12 Aphrophoridae sp.01 – HemAuc134

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3. Family Cicadellidae – *Leafhopper*

Cicadellidae, generally referred to as leafhoppers, belong to the Infraorder Cicadomorpha and the Superfamily Membracoidea from the Suborder Auchenorrhyncha (Deitz & Dietrich, 1993). This family can be found in both temperate and tropical regions, with 304 genera and 23,070 species currently described worldwide (GBIF, 2026). Cicadellids inhabit a wide range of environments, including forest, shade, orchards, shrubs, grasses, agricultural fields, and garden crops (Triplehorn & Johnson, 2005). Both nymphs and adults usually feed on plant sap, which can cause significant damage to plants, such as stunted growth, leaf curling, and yellowing (Chen & Gilbertson, 2009). Leafhoppers are also important vectors of plant pathogens, including viruses and bacteria. Most cicadellids secrete a liquid through the abdominal glands called "honeydew". While it is a waste product for cicadellids, honeydew is rich in carbohydrates and amino acids, making it valuable food for other groups such as ants in mutualistic relationships known as "trophobioses". Other hymenopterans also collect this resource frequently, either directly from cicadellids, or indirectly by harvesting the residue from leaves and the ground (Triplehorn & Johnson, 2005). Leafhoppers exhibit a wide range of shapes, size, colors, and patterns. However, specific characters distinguish Cicadellidae from other groups of Hemiptera, including the powerful hind legs with rows of spines on each side of the tibiae and short-thickened antennae with bristles at the tip (CSIRO, 1991). The hind tibiae have one or more distinct keels and the tarsi are divided into three segments. The head is generally triangular when viewed from above (dorsal), with prominent compound eyes and 2-3 ocelli present on the front. The forewings are not particularly thick. Leafhoppers typically have a slender and elongated body, with sizes less than 13 mm (Triplehorn & Johnson, 2005).



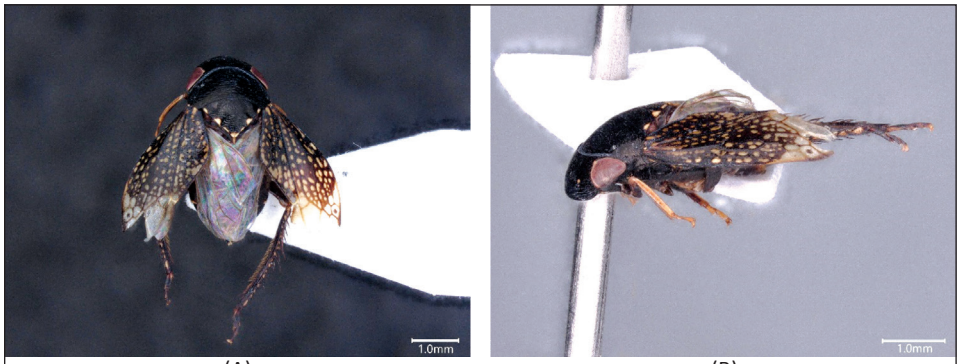
Graphocephala coccinea (Hemiptera: Auchenorrhyncha: Cicadellidae)

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Note: Dorsal

Figure 3.13 *Penthimia* sp.01 – HemAuc006



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.14 *Penthimia* sp.02 – HemAuc084



Note: Dorsal

Figure 3.15 *Penthimia* sp.03 – HemAuc129

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Note: (A) Dorsal and (B) Lateral

Figure 3.16 Aphrodinae sp.01 – HemAuc107



Note: Dorsal

Figure 3.17 Aphrodinae sp.02 – HemAuc077



Note: Dorsal

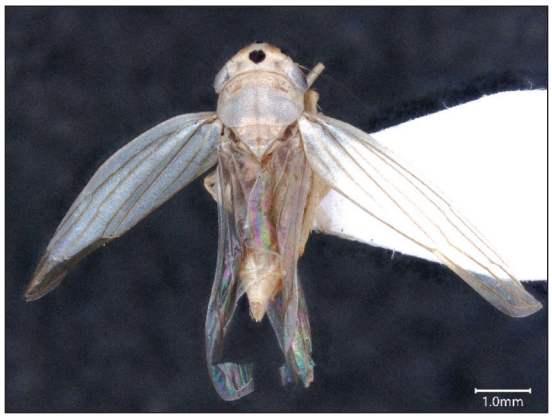
Figure 3.18 Aphrodinae sp.03 – HemAuc065

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.19 Aphrodinae sp.04 – HemAuc081



Note: Dorsal

Figure 3.20 Cicadellinae sp.01 – HemAuc040



Note: Dorsal

Figure 3.21 Cicadellinae sp.02 – HemAuc045

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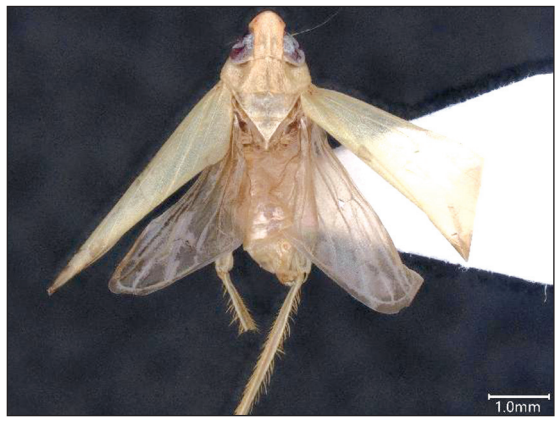
Note: (A) Dorsal and (B) Lateral

Figure 3.22 Cicadellinae sp.03 – HemAuc049



Note: Dorsal

Figure 3.23 Cicadellinae sp.04 – HemAuc071



Note: Dorsal

Figure 3.24 Cicadellinae sp.05 – HemAuc072

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.25 Cicadellinae sp.06 – HemAuc075



Note: Dorsal

Figure 3.26 Cicadellinae sp.07 – HemAuc085



Note: Dorsal

Figure 3.27 Cicadellinae sp.08 – HemAuc089

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.28 Cicadellinae sp.09 – HemAuc111



Note: Dorsal

Figure 3.29 Cicadellinae sp.10 – HemAuc137



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.30 Cicadellinae sp.11 – HemAuc093

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.31 Cicadellinae sp.12 – HemAuc110



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.32 Coelidiinae sp.01 – HemAuc068



Note: Dorsal

Figure 3.33 Deltocephalinae sp.01 – HemAuc100

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.34 Deltocephalinae sp.02 – HemAuc143



Note: Dorsal

Figure 3.35 Deltocephalinae sp.03 – HemAuc162



Note: Dorsal

Figure 3.36 Deltocephalinae sp.04 – HemAuc014

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.37 Deltocephalinae sp.05 – HemAuc057



Note: Dorsal

Figure 3.38 Deltocephalinae sp.06 – HemAuc149



Note: Dorsal

Figure 3.39 Deltocephalinae sp.07 – HemAuc088

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.40 Deltocephalinae sp.08 – HemAuc097



Note: (A) Dorsal and (B) Lateral

Figure 3.41 Deltocephalinae sp.09 – HemAuc103



Note: Dorsal

Figure 3.42 Deltocephalinae sp.10 – HemAuc132

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.43 Deltocephalinae sp.11 – HemAuc17



Note: Dorsal

Figure 3.44 Deltocephalinae sp.12 – HemAuc128



Note: Dorsal

Figure 3.45 Deltocephalinae sp.13 – HemAuc12

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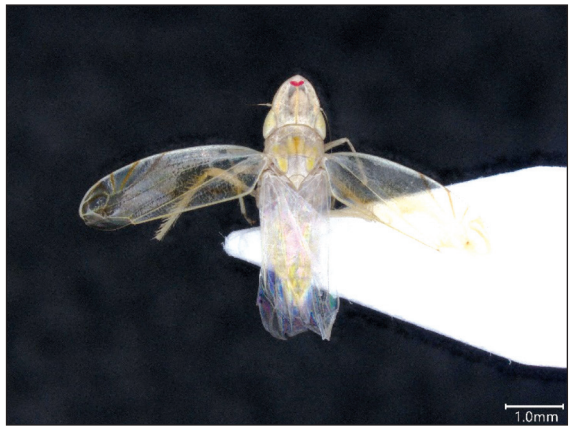
Note: Dorsal

Figure 3.46 Eurymelinae sp.01 – HemAuc042



Note: Dorsal

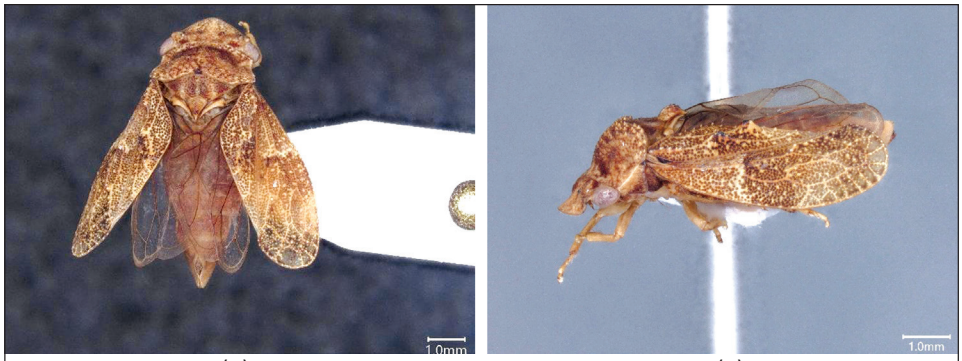
Figure 3.47 Eurymelinae sp.02 – HemAuc060



Note: Dorsal

Figure 3.48 Ledrinae sp.01 – HemAuc16

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

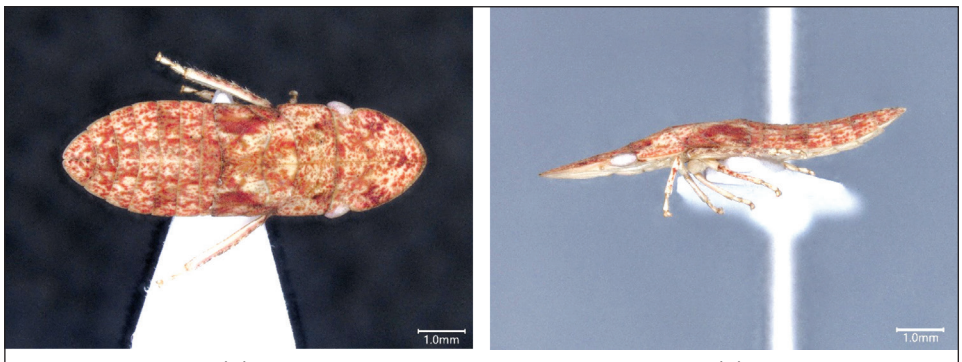
Figure 3.49 Ledrinae sp.02 – HemAuc109



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.50 Ledrinae sp.03 – HemAuc136



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.51 Ledrinae sp.04 – HemAuc170

Buku ini tidak diperjualbelikan.



Note: (A) Dorsal and (B) Lateral

Figure 3.52 Ledrinae sp.05 – HemAuc141



Note: Dorsal

Figure 3.53 Typhlocybinae sp.01 – HemAuc050



Note: Dorsal

Figure 3.54 Typhlocybinae sp.02 – HemAuc040

Buku ini tidak diperjualbelikan.



Note: (A) Dorsal and (B) Lateral

Figure 3.55 Typhlocybinae sp.03 – HemAuc175



Note: Dorsal

Figure 3.56 Typhlocybinae sp.04 – HemAuc032



Note: Dorsal

Figure 3.57 Typhlocybinae sp.05 – HemAuc033

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.58 Typhlocybinae sp.06 – HemAuc041



Note: Dorsal

Figure 3.59 Typhlocybinae sp.07 – HemAuc047



Note: Dorsal

Figure 3.60 Typhlocybinae sp.08 – HemAuc059

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.61 Typhlocybinae sp.09 – HemAuc076



Note: Dorsal

Figure 3.62 Typhlocybinae sp.10 – HemAuc096



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.63 Typhlocybinae sp.11 – HemAuc106

Buku ini tidak diperjualbelikan.



Note: Dorsal

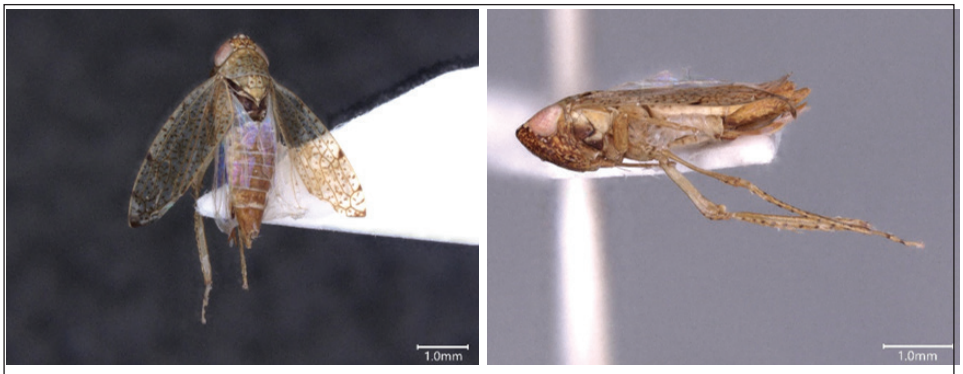
Figure 3.64 Typhlocybinae sp.12 – HemAuc145



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.65 Typhlocybinae sp.13 – HemAuc152



(A) (B)

Note: (A) Dorsal and (B) Lateral

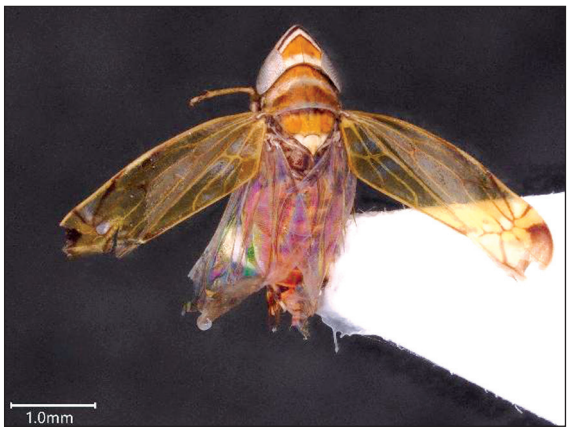
Figure 3.66 Typhlocybinae sp.14 – HemAuc155

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.67 Typhlocybinae sp.15 – HemAuc163



Note: Dorsal

Figure 3.68 Typhlocybinae sp.16 – HemAuc165



Note: Dorsal

Figure 3.69 Typhlocybinae sp.17 – HemAuc139

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.70 Typhlocybinae sp.18 – HemAuc070



Note: Dorsal

Figure 3.71 Cicadellidae sp.01 – HemAuc007



Note: Dorsal

Figure 3.72 Cicadellidae sp.02 – HemAuc010

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.73 Cicadellidae sp.03 – HemAuc012



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.74 Cicadellidae sp.04 – HemAuc017



Note: Dorsal

Figure 3.75 Cicadellidae sp.05 – HemAuc021

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.76 Cicadellidae sp.06 – HemAuc034



Note: Dorsal

Figure 3.77 Cicadellidae sp.07 – HemAuc166

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.78 Cicadellidae sp.08 – HemAuc177



(A) (B)

Note: (A) Dorsal and (B) Lateral

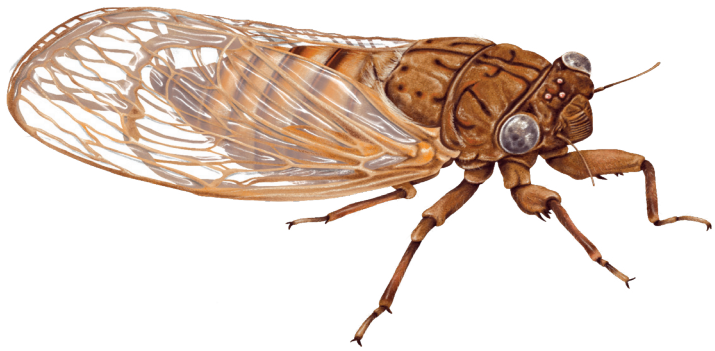
Figure 3.79 Cicadellidae sp.09 – HemAuc181

Buku ini tidak diperjualbelikan.

4. Family Cicadidae – *True Cicadas*

Within the Infraorder Cicadomorpha and the Superfamily Cicadoidea, the Family Cicadidae, better known as cicadas, represents a captivating group of Auchenorrhyncha for their loud, buzzing songs, and complex life cycles (Triplehorn & Johnson, 2005). The Cicadidae comprise more than 3,330 species from over 504 genera worldwide (GBIF, 2026). The majority of cicadas species can be found in the tropics and subtropics. Many inhabit forest and grassland, and are often found on trees in the garden or backyard. Cicadas are plant-feeders. The nymphs live underground for several years and feed on sap from the roots of trees and shrubs. Those nymphs undergo several molts before emerging from the soil as adults, then climb onto nearby vegetation and shed the nymphal exoskeleton (Smith & Hasiotis, 2008). The adults are active during the day, typically robust with broad abdomens and well-developed wings (Triplehorn & Johnson, 2005). Moreover, cicadas serve as a crucial food source for other animals, such as birds, mammals, and some reptiles (Pons, 2020; Capinera, 2010). The molted exoskeletons also provide nutrients to the soil, and the nymph feeding behavior can aerate the soil to improve nutrient cycling (Speer *et al.*, 2010).

Morphologically, cicadas are distinguished by long membranous wings, short bristly antennae, a broad head, prominent compound eyes, and ocelli in a triangular pattern on the heads (CSIRO, 1991). Cicadas are well-known for producing shrill noise with a pair of the tymbals, which are modified membranes located on the abdomen (CSIRO, 1991). The song of cicadas is a remarkable adaptation for attracting mates and establishing territories (Cocroft & Pogue, 1996). Commonly, these sounds are made by males, thus it is known as male calling songs (Hou *et al.*, 2022). In North America, synchronized spawning of millions, and sometimes trillions, of cicadas are one of nature's most enigmatic spectacles, and subject of lively research in ecology and evolution (Simon *et al.*, 2022).

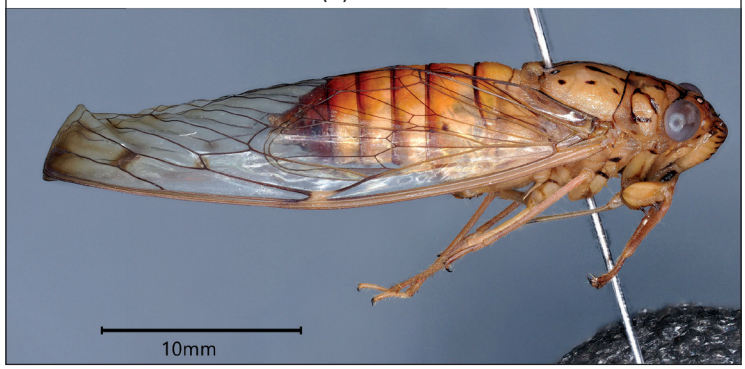


Cicadidae sp.01 (Hemiptera: Auchenorrhyncha: Cicadidae)

Buku ini tidak diperjualbelikan.



(A)



(B)

Note: (A) Dorsal and (B) Lateral

Figure 3.80 Cicadidae sp.01 – HemAuc079

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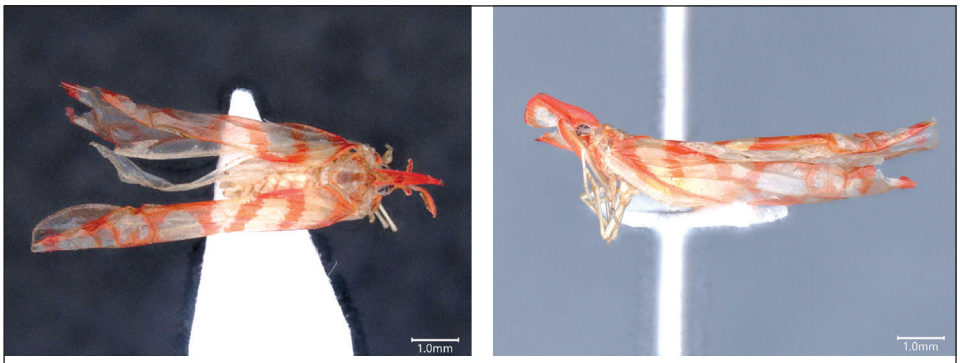
5. Family Derbidae – *Derbid Planthoppers*



Apache sp. (Hemiptera: Auchenorrhyncha: Derbidae)

The Family Derbidae, within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea, is a group of Auchenorrhyncha known as derbid planthoppers (Triplehorn & Johnson, 2005). A total of 1,708 species of Derbidae from 166 genera are described worldwide (GBIF, 2026). Many species occur in temperate and subtropical regions; however, species diversity is particularly high in the tropics (Triplehorn & Johnson, 2005). In the southeast of Mexico, 13 genera and 55 species are described, but the low number suggests this family is inconsistently reported in the literature, and records are notably scarce in some states (Bartlett & Wilson, 2023). Derbids are found in a variety of habitats, including forests, grasslands, and agricultural fields. Unlike other groups of the Auchenorrhyncha, most derbid species feed on wood fungi. However, some species feed on plant sap and can be vectors of plant diseases (Triplehorn & Johnson, 2005). Derbid planthoppers are distinguished by their unusual appearance, including compressed heads with prominent compound eyes and long wings that exceed the abdomen (CSIRO, 1991). Wings are usually held roof-like over the body in the resting position, but some species hold their wings spread out in a moth-like stance (Bartlett & Wilson, 2023). Derbidae have a row of spines on the rear leg and a short segment at the tip of the beak. This family typically has a slender and elongated body with an average size of 8-11 mm (Triplehorn & Johnson, 2005).

Buku ini tidak diperjualbelikan.



(A) (B)

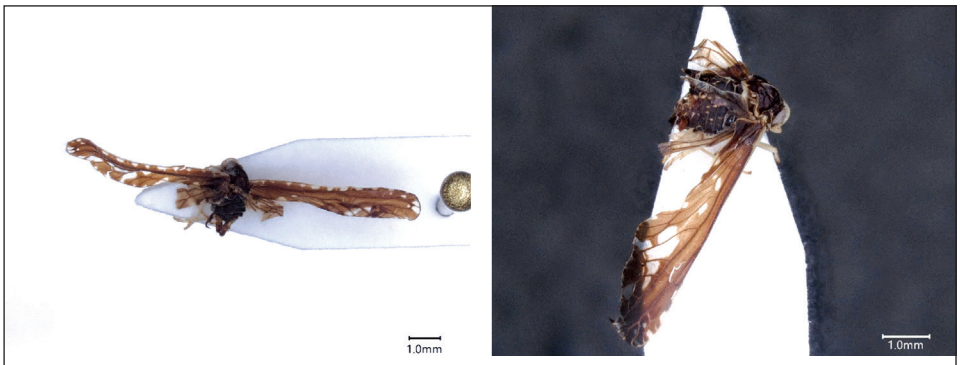
Note: (A) Dorsal and (B) Lateral

Figure 3.81 *Apache* sp.01 – HemAuc147



Note: Dorsal

Figure 3.82 *Cedusa* sp.01 – HemAuc019



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.83 *Proutista moesta* – HemAuc003

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.84 *Zoraida* sp.01 – HemAuc037



Note: (A) Dorsal and (B) Lateral

Figure 3.85 *Zoraida* sp.02 – HemAuc044



Note: Dorsal

Figure 3.86 Cedusinae sp.01 – HemAuc011

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.87 Cedusinae sp.02 – HemAuc023



Note: Dorsal

Figure 3.88 Cedusinae sp.03 – HemAuc164



Note: Dorsal

Figure 3.89 Derbinae sp.01 – HemAuc030

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Note: Dorsal

Figure 3.90 Derbinae sp.02 – HemAuc043



Note: Dorsal

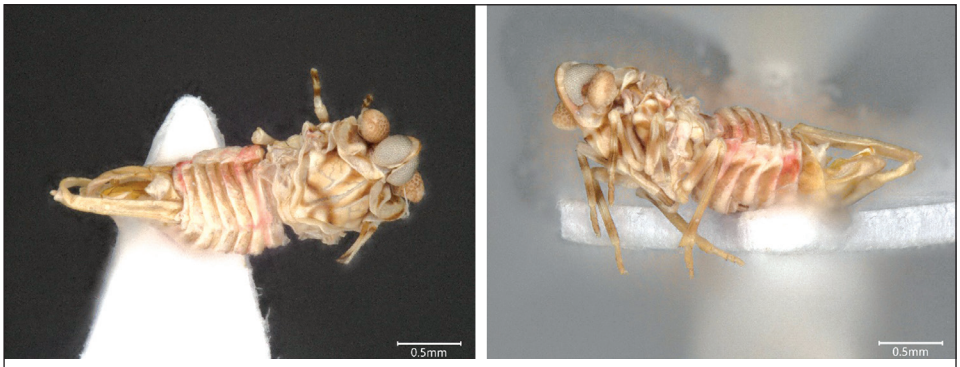
Figure 3.91 Derbinae sp.03 – HemAuc083



Note: Dorsal

Figure 3.92 Derbinae sp.04 – HemAuc133

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(A) (B)

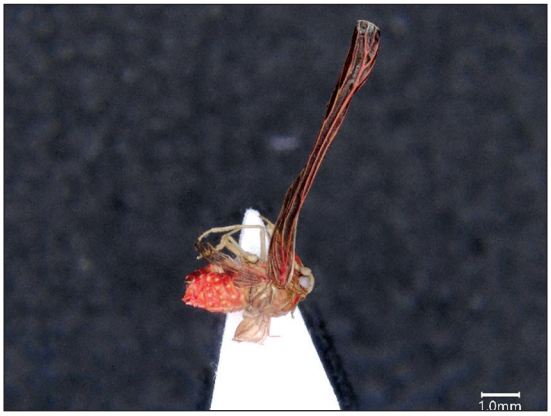
Note: (A) Dorsal and (B) Lateral

Figure 3.93 Derbinae sp.05 – HemAuc173



Note: Dorsal

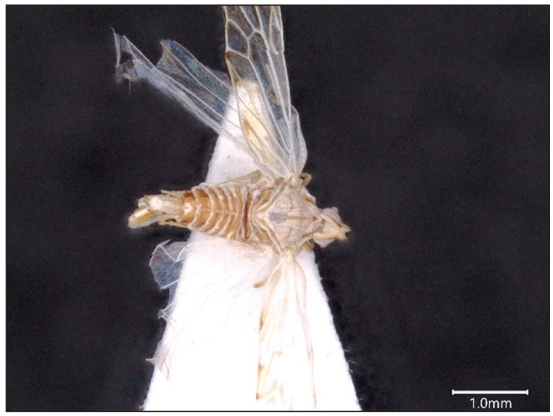
Figure 3.94 Otiocerinae sp.01 – HemAuc001



Note: Dorsal

Figure 3.95 Otiocerinae sp.02 – HemAuc002

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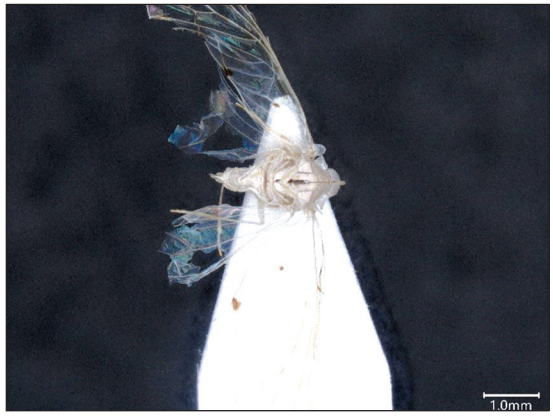
Note: Dorsal

Figure 3.96 Otiocerinae sp.03 – HemAuc005



Note: Dorsal

Figure 3.97 Otiocerinae sp.04 – HemAuc008



Note: Dorsal

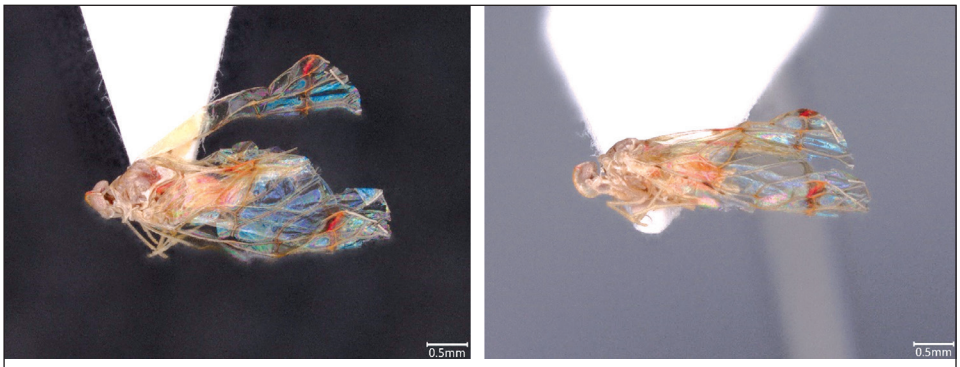
Figure 3.98 Otiocerinae sp.05 – HemAuc015

Buku ini tidak diperjualbelikan.



Note: Dorsal

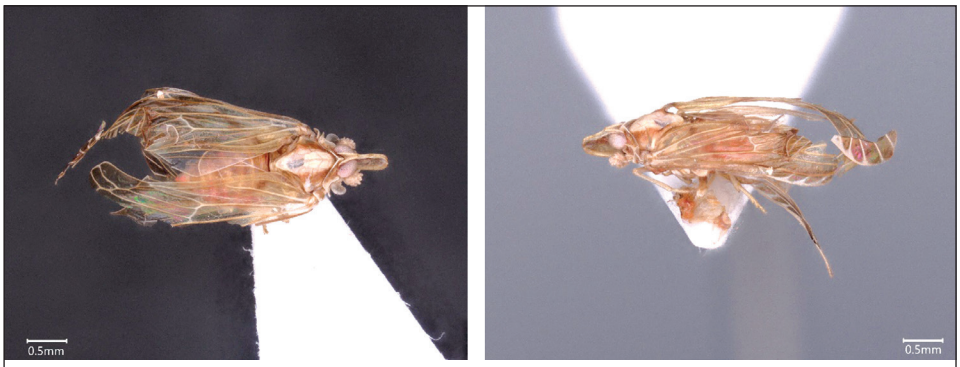
Figure 3.99 Otiocerinae sp.06 – HemAuc116



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.100 Otiocerinae sp.07 – HemAuc039



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.101 Otiocerinae sp.08 – HemAuc144

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.102 Otiocerinae sp.09 – HemAuc154



Note: Dorsal

Figure 3.103 Otiocerinae sp.10 – HemAuc158



Note: Dorsal

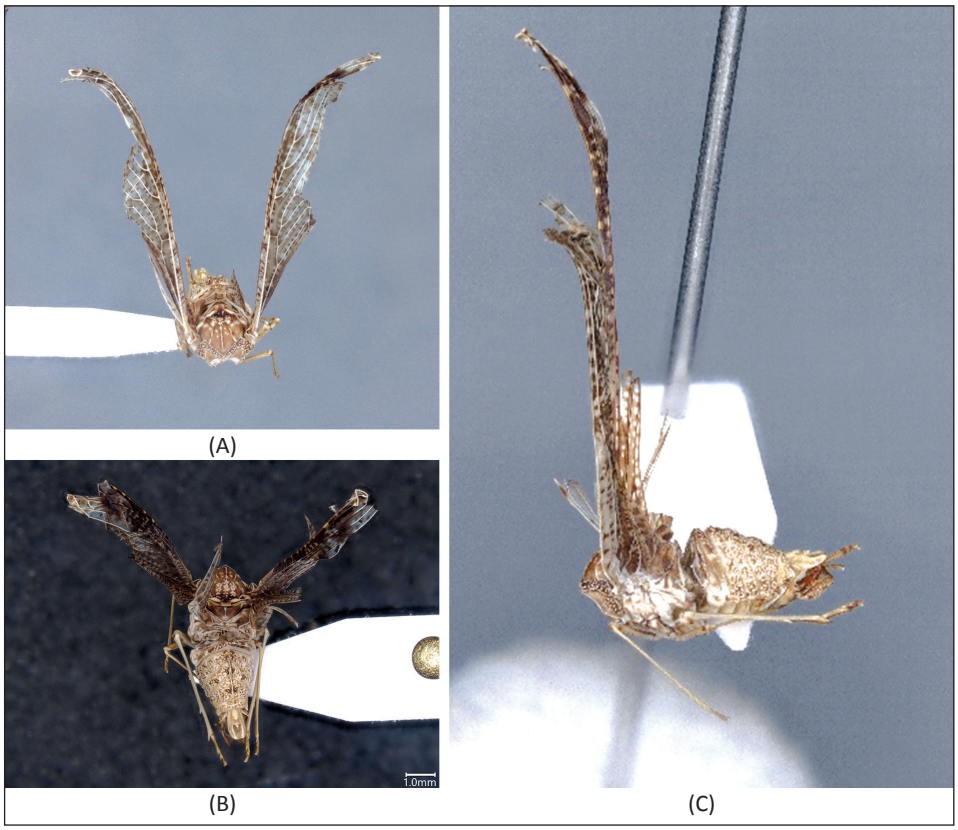
Figure 3.104 Otiocerinae sp.11 – HemAuc112

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.105 Otiocerinae sp.12 – HemAuc153



Note: (A) Ventral, (B) Dorsal and (C) Lateral

Figure 3.106 Otiocerinae sp.13 – HemAuc156

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.107 Derbidae sp.01 – HemAuc095



Note: Dorsal

Figure 3.108 Derbidae sp.02 – HemAuc043

Buku ini tidak diperjualbelikan.

6. Family Dictyopharidae – *Lantern Bugs*

Dictyopharidae, often referred to as lantern bugs or long-nosed planthoppers, are a group of Auchenorrhyncha within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea (Triplehorn & Johnson, 2005). Dictyopharids are a cosmopolitan family with 157 genera and 745 species described worldwide (GBIF, 2026). This family inhabits a wide range of habitat and is often found in meadow areas. Both nymphs and adults are present above-ground and feed on plant sap (Bartlett & Wilson, 2023). Most Dictyopharidae are phytophagous, associated with dicotyledonous plants from several families (Wilson *et al*., 1994). For example, *Taosa langula* feeds specifically on the water hyacinth *Eichhornia crassipes* (Hernández *et al*., 2011). While feeding on plants, dictyopharids usually stand in an unusual upright position. Dictyopharid planthoppers are characterized by long-legged and long-narrow wings that cover the abdomen, though a few species have several tergites exposed (CSIRO, 1991). Another distinctive feature is the elongated and slender head, which is produced into a snout-like extension, known as the long nose. Prominent compound eyes and ocelli are present, with antennae emerging from the side of the head. Dictyopharids typically have an elongated body, ranging from 6 to 10 mm.

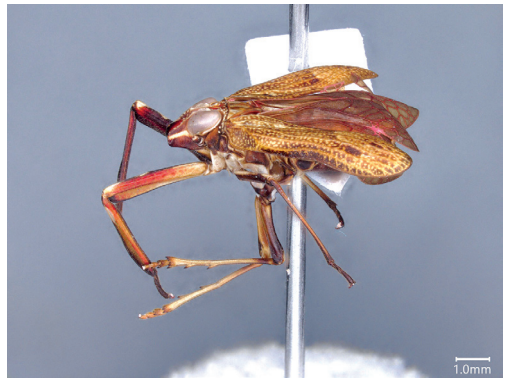
Dictyopharidae (Hemiptera: Auchenorrhyncha: Dictyopharidae)



Buku ini tidak diperjualbelikan.



(A)



(B)

Note: (A) Dorsal and (B) Lateral

Figure 3.109 *Phylloscelis* sp.01– HemAuc180

Buku ini tidak diperjualbelikan.

7. Family Eurybrachidae – *Pointy Head Leafhoppers*



Eurybrachyidae sp.01 (Hemiptera: Auchenorrhyncha: Eurybrachyidae)

Within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea, the Family Eurybrachidae, also known as pointy head leafhoppers, are a group of Auchenorrhyncha that have remarkable adaptations in camouflage and mimicry due to their colorful and elaborately patterned wings (Bourgoin & Szwedo, 2023). Eurybrachidae consist of 42 genera and 206 species worldwide (GBIF, 2026). Most of the Eurybrachidae are found in Australia, Asia, and Africa. Eurybrachids inhabit a wide range of habitats, including forests and agricultural fields. Both nymphs and adults feed on plant sap from a variety of host plants, including trees and shrubs. Females lay their eggs in clusters on bark or the undersides of leaves, shielding them with a white capsule to protect them against predators (Bartlett & Wilson, 2023). Many species exhibit mimicry or camouflage to avoid predation, particularly nymphs, which are less agile than adults. The wing patterns even allow them to mimic leaves, bark, lichens, or their surroundings, complete with vein-like patterns and color variations that provide an extra attract ants, which protects them from predators and parasitoids (Constant, 2024). Eurybrachids are characterized by large, elaborate, and colorful wings, which hide their broad abdomen. The head is usually broad and flat anteriorly, with large, prominent compound eyes. The body sizes are medium to large, ranging from 1 to more than 3 cm long when mature, and often are brown or green (Picker *et al.*, 2003).

Buku ini tidak diperjualbelikan.



(A)



(B)

Note: (A) Dorsal and (B) Anterior

Figure 3.110 Eurybrachyidae sp.01 – HemAuc150

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8. Family Flatidae – *Butterfly Cicadas*



Bythopsyrna copulanda (Hemiptera: Auchenorrhyncha: Flatidae)

The Family Flatidae, within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea, is a group of Auchenorrhyncha referred to as butterfly cicadas. The Flatidae are a cosmopolitan family consisting of 287 genera and 1,373 species distributed worldwide (GBIF, 2026). Both nymphs and adults are commonly found on the above-ground parts of various woody and semi-woody plants (Bartlett & Wilson, 2023). Similar to other planthoppers, flatids usually suck the phloem sap of plants on vines, shrubs, and trees (Bartlett & Wilson, 2023; Triplehorn & Johnson, 2005). Some species can communicate using vibrations through the plant stems. Those interactions occur between mates or ants that tend to the nymphs, protecting them and collecting honeydew (Pfeiffer & Linsenmair, 2007).

Butterfly cicadas are recognized by their forewings, known as tegmina. The tegmina are usually thickened, broad, triangular, and steeply tectiform, forming a protective shield over the abdomen (Bartlett & Wilson, 2023). The tegmina features bright colors and numerous cross veins in the costal area. The hindwings are membranous and usually used for flight. The wings are held parallel or tent-like to the body when at rest (Triplehorn & Johnson, 2005). Flatids have flattened, laterally compressed bodies, which help them camouflage or mimic plant surfaces. Most flatids are either pale green or dark brown. Body sizes range from 5 mm to about 2 cm in length. The head is generally short, with well-developed compound eyes and two ocelli. Antennae are filiform (thread-like), small, and short. The nymphs generally have a tail of waxy filaments (Triplehorn & Johnson, 2005). Based on body characteristics, flatids are differentiated into two subfamilies: Flatinae and Flatoidinae. The body of Flatinae is usually flattened laterally with tent-like tegmina. While Flatoidinae are not laterally compressed, and the tegmina are sometimes held horizontally rather than tent-like (Bartlett & Wilson, 2023).

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.111 *Bythopsyrna copulanda* – HemAuc151



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.112 *Cerynia* sp.01 – HemAuc087

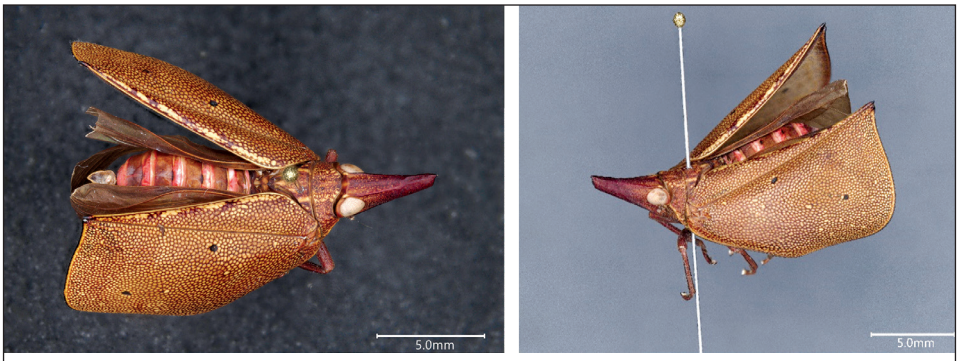


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.113 *Cyarda* sp.01 – HemAuc099

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(A) (B)

Note: (A) Dorsal and (B) Lateral

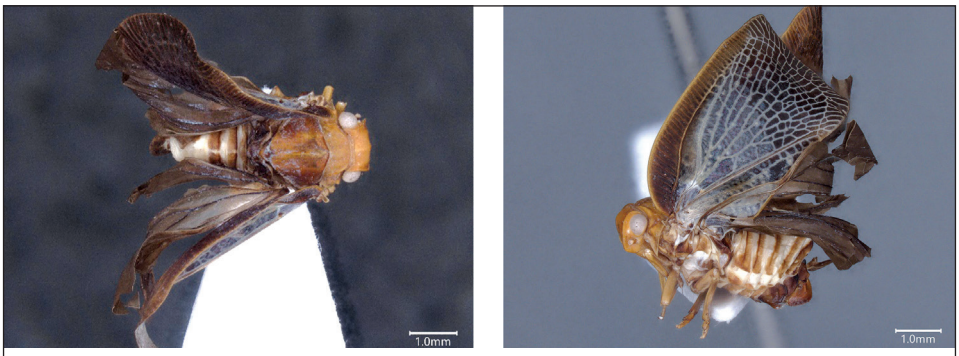
Figure 3.114 *Cyarda* sp.02 – HemAuc024



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.115 *Laesabes* sp.01 – HemAuc074



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.116 *Massila* sp.01 – HemAuc036

Buku ini tidak diperjualbelikan.



Note: (A) Dorsal and (B) Lateral

Figure 3.117 *Ormenoides* sp.01 – HemAuc022



Note: Dorsal

Figure 3.118 *Ormenoides* sp.02 – HemAuc053



Note: Dorsal

Figure 3.119 *Pseudoflatoides* sp.01 – HemAuc080

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(A) (B)

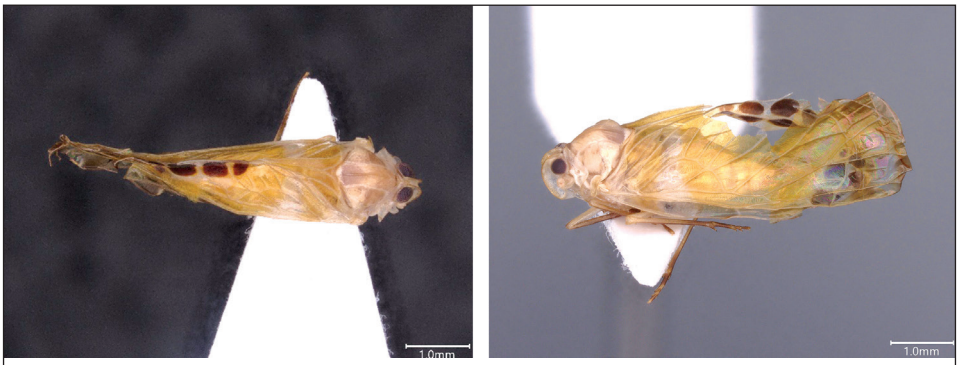
Note: (A) Dorsal and (B) Lateral

Figure 3.120 *Siphanta* sp.01 – HemAuc061



Note: Dorsal

Figure 3.121 Flatidae sp.01 – HemAuc127



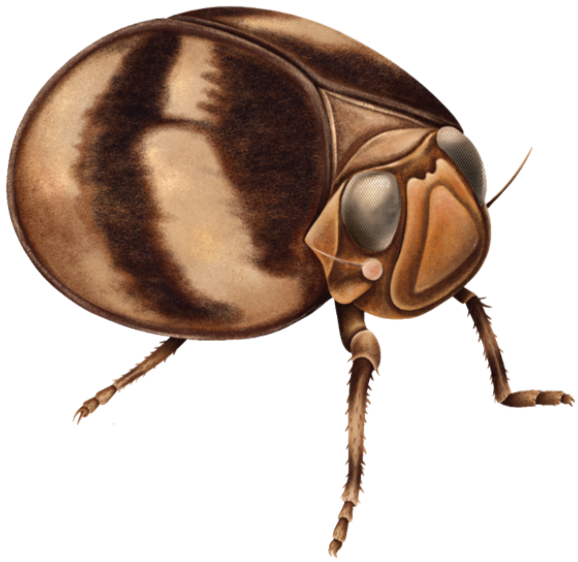
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.122 Flatidae sp.02 – HemAuc038

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9. Family Issidae – *Beetle Hoppers*



Hemisphaerus sp. (Hemiptera: Auchenorrhyncha: Issidae)

Issidae is a group of Auchenorrhyncha within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea, often referred to as issids or beetle-like planthoppers (Triplehorn & Johnson, 2005). Issid planthoppers are a cosmopolitan family of 1,067 species from 210 genera described globally (GBIF, 2026). This family has frequently been revised and become subject of systematic investigation. Originally, Issidae encompassed a large group of planthoppers. However, in recent years, systematic revisions have led to the separation of several subfamilies into distinct families, including Caliscelidae, Nogodinidae, and Tropiduchidae (Wang *et al.*, 2016). Issids inhabit a diverse range of habitats, including forests, grasslands, wetlands, and agricultural fields. Both nymphs and adults are usually associated with woody plants and have been described as monophagous (Wilson *et al.*, 1994; CSIRO, 1991). Issids are mostly found on the above-ground parts of plants, with nymphs and adults having the same host plants (CSIRO, 1991). The majority of Issidae are dull-colored and typically have stout and compact bodies. The body is often oval or elongated with hardened forewings (tegmina) and can appear somewhat humped, resembling beetles. Wings are often shortened or convex with a rough texture. The head is generally broad with a short and slightly rounded anterior. Compound eyes and ocelli are present, along with a weevil-like snout (Triplehorn & Johnson, 2005; CSIRO, 1991).

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.123 *Hemisphaerus* sp.01 – HemAuc062



Note: Dorsal

Figure 3.124 *Hemisphaerus* sp.02 – HemAuc094



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.125 *Hemisphaerus* sp.03 – HemAuc124

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Note: Dorsal

Figure 3.126 *Hemisphaerus* sp.04 – HemAuc029



Note: Dorsal

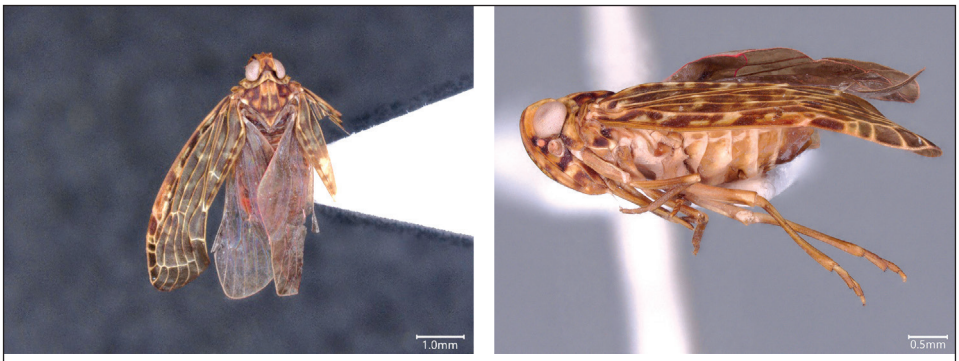
Figure 3.127 *Thionia* sp.01 – HemAuc035



Note: Dorsal

Figure 3.128 *Thionia* sp.02 – HemAuc054

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(A) (B)

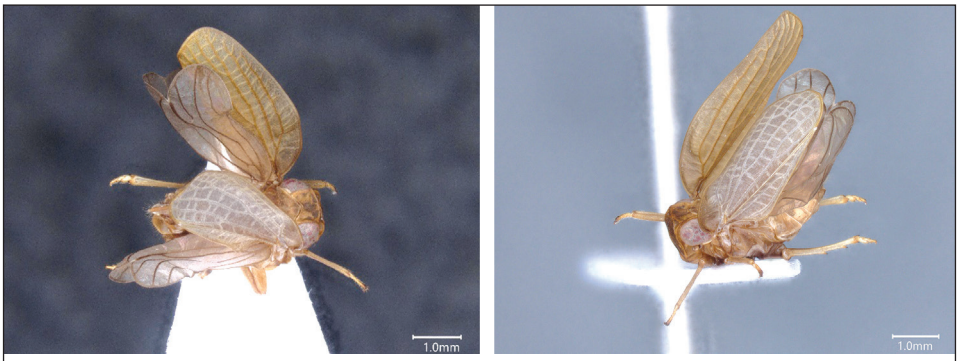
Note: (A) Dorsal and (B) Lateral

Figure 3.129 *Thionia* sp.03 – HemAuc130



Note: Dorsal

Figure 3.130 *Thionia* sp.04 – HemAuc146



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.131 Issinae sp.01 – HemAuc051

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.132 Issinae sp.02 – HemAuc064



Note: Dorsal

Figure 3.133 Issinae sp.03 – HemAuc119

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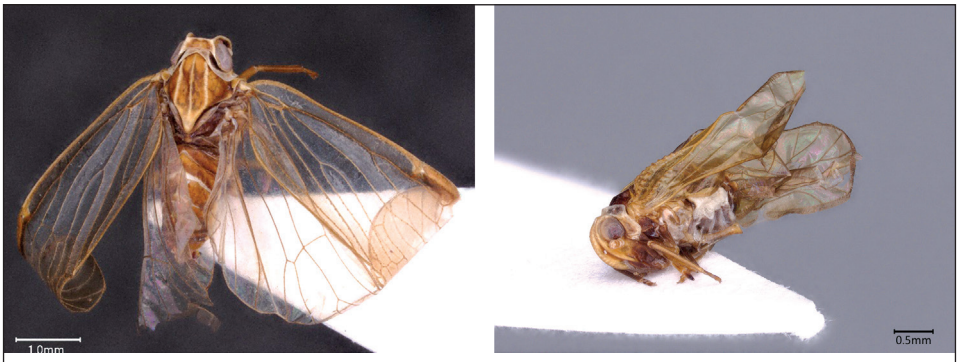
10. Family Meenoplidae – *Meenoplid Planthoppers*



Meenoplidae (Hemiptera: Auchenorrhyncha: Meenoplidae)

The Meenoplidae (Auchenorrhyncha: Fulgoromorpha: Fulgoroidea) are a small group of planthoppers with 168 species from 24 genera (GBIF, 2026). Meenoplids occupy a wide range of habitats, such as tropical forests, wetlands, and grasslands. Nymphs are usually found around the soil, whereas adults are on the plant surface. Some species can mimic plant stems or leaves to avoid predation. Both nymphs and adults feed mostly on monocots (Tsaur *et al*., 1986). Meenoplid planthoppers are closely related to the Kinnaridae and look similar to the Derbidae; however, they can be distinguished by wing veins (Wilson, 2010). Unlike most planthoppers with smooth wing veins, meenoplids are identified by the presence of claval veins, which are veins on the hardened leading edge of the forewing, covered in granular sensory pits along their length. Meenoplidae are generally small, having a tightly compressed body with a body length of 2–7 mm. The vertex and frons of the head are typically broad, and the lateral carinae are significantly raised. Antennae are short with prominent compound eyes and a median ocellus located on the vertex of the head. The thorax is generally broad and large, with the carinae indistinct (Wilson, 2010; Tsaur *et al*., 1986).

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(A) (B)

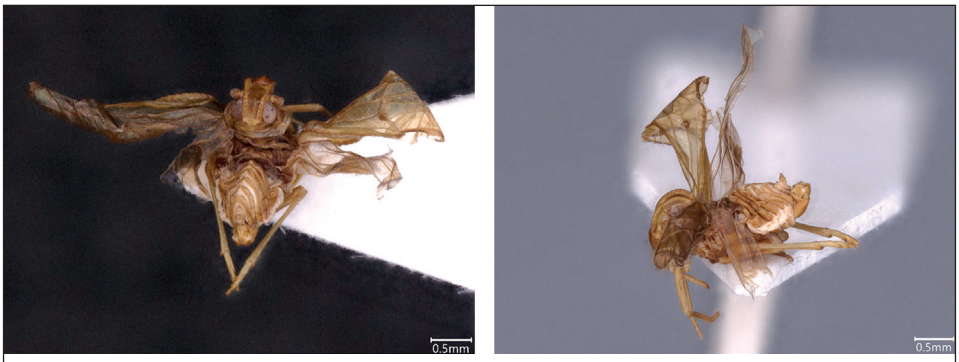
Note: (A) Dorsal and (B) Lateral

Figure 3.134 *Nisia* sp.01 – HemAuc078



Note: Dorsal

Figure 3.135 *Nisia* sp.02 – HemAuc086



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.136 Meenoplidae sp.01 – HemAuc056

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.137 Meenoplidae sp.02 – HemAuc122



Note: Dorsal

Figure 3.138 Meenoplidae sp.03 – HemAuc067

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.139 Meenoplidae sp.04 – HemAuc109



Note: Dorsal

Figure 3.140 Meenoplidae sp.05 – HemAuc176

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11. Family Membracidae – *Treehoppers*



Leptocentrus taurus (Hemiptera: Auchenorrhyncha: Membracidae)

Membracidae, also known as treehoppers, is a distinctive and fascinating group within the Infraorder Cicadomorpha and the Superfamily Membracoidea (Deitz & Dietrich, 1993). This family consists of 429 genera and 3,506 species distributed around the world (GBIF, 2026). Similar to other families of the Auchenorrhyncha, treehoppers produce vibrating songs to communicate with each other through the stems and leaves of their host plants (CSIRO, 1991). Membracidae are sap-suckers, feeding on trees and shrubs. The majority of membracids are polyphagous, except in the Nearctic (CSIRO, 1991). The nymphs are usually found on herbaceous shrubs and grasses, while the adults are often found on hardwood tree species (CSIRO, 1991). Treehoppers can also secrete honeydew that can be consumed by other groups such as ants, bees, and wasps. Thus, mutualism with ants provides "house cleaning" services and can protect them from predators (Dietrich, 2004).

The treehoppers can be distinguished by their large and unique pronotum. This structure is highly modified, covers the head, reaches back over the abdomen, and is often bizarrely shaped (CSIRO, 1991). Many species have a humpbacked appearance (Dietrich, 2004). Others have spines, horns, or keels on the pronotum, while some species have thorn-like forms. The bizarre shapes and muted colors serve a crucial purpose for treehoppers to camouflage. By mimicking their surroundings, treehoppers blend seamlessly with the host plants, making them less conspicuous to predators such as spiders and birds. Membracidae have a small to medium body size of around 10 to 12 mm. The head is usually small with prominent compound eyes and ocelli, while the antennae are short and bristle-like. The wings are membranous and sometimes concealed by the pronotum when viewed dorsally (Triplehorn & Johnson, 2005).

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.141 *Gargara* sp.01 – HemAuc018



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.142 *Gargara* sp.02 – HemAuc073



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.143 *Leptocentrus* sp.01 – HemAuc028

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.144 *Leptocentrus* sp.02 – HemAuc063



Note: Dorsal

Figure 3.145 *Leptocentrus* sp.03 – HemAuc101



(A) (B)

Note: (A) Dorsal and (B) Lateral

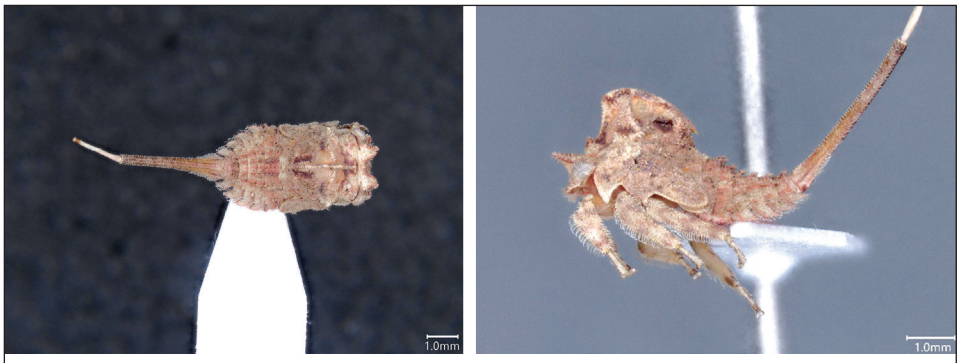
Figure 3.146 *Leptocentrus taurus* – HemAuc025

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Note: Dorsal

Figure 3.147 Centrotinae sp.01 – HemAuc026



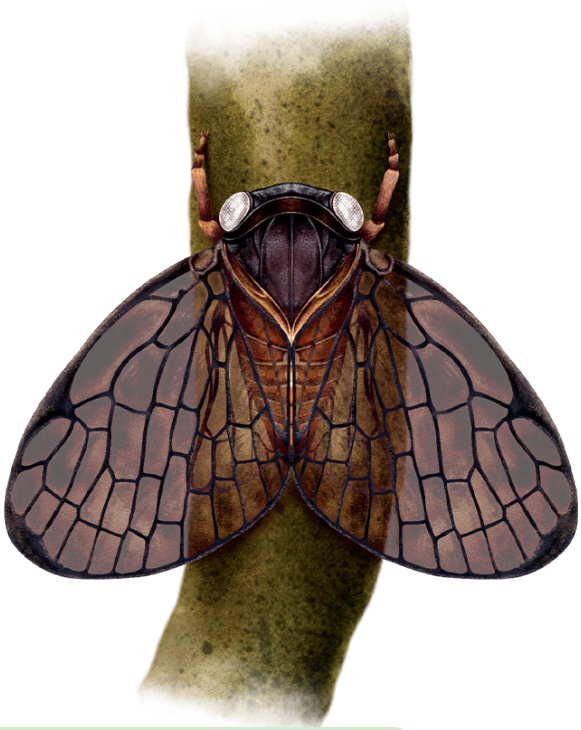
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.148 Membracidae sp.02 – HemAuc168

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12. Family Ricaniidae – *Ricaniid Planthoppers*



Ricanula sp. (Hemiptera: Auchenorrhyncha: Ricaniidae)

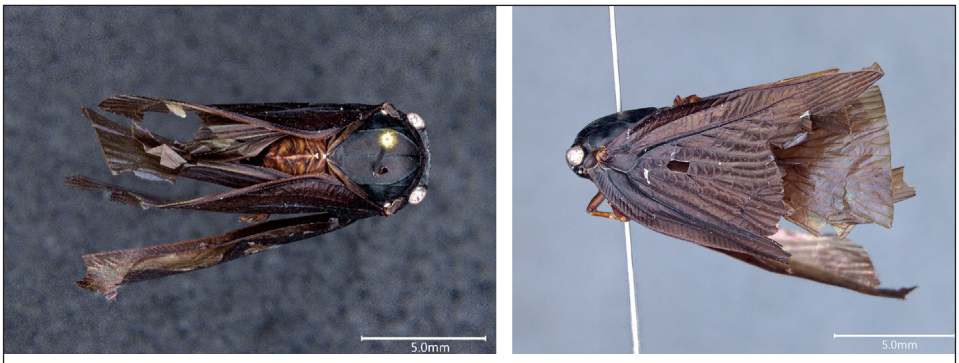
Ricaniidae, commonly known as ricaniid planthoppers, is a group of Auchenorrhyncha within the Infraorder Fulgoromorpha and the Superfamily Fulgoroidea (Fletcher, 2008). Ricaniids comprise 65 genera and 435 species worldwide (GBIF, 2026). This family includes a variety of broad-winged planthoppers, which are mostly found in tropical and warm temperate regions. The Ricaniidae are similar to some other families of Fulgoroidea, including Flatidae, Eurybrachidae, Lophopidae, and Caliscelidae, related to their morphological characters and genetic traits (Zhang *et al.*, 2022). Ricaniids colonize a variety of habitats, including forests, semi-deserts, and agricultural fields. Both nymphs and adults feed on plant sap from a variety of host plants including both herbaceous and woody plants. Ricaniidae are typically brown or black in color with moth-like forms. The majority of Ricaniidae possess triangular wings that can be either opaque or delicate with lacy brown patterning, while some species have glassy-clear wings (Fletcher, 2008). Most species have large forewings in relation to their body size; however, a few species are relatively small, with less than 6 mm.

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Note: Dorsal

Figure 3.149 *Pochazia* sp.01 – HemAuc131



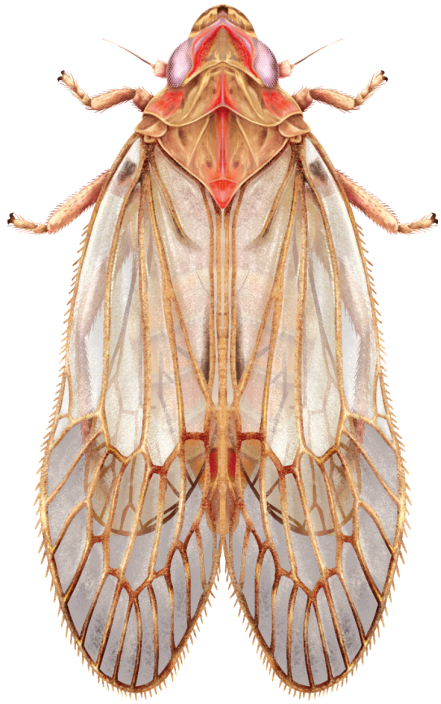
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.150 Ricaniidae sp.01 – HemAuc120

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13. Family Tropiduchidae – *Mosquito Cicadas*



Sogana sp.01 (Hemiptera: Auchenorrhyncha: Tropiduchidae)

The Tropiduchidae (Auchenorrhyncha: Fulgoromorpha: Fulgoroidea) are well-known as a tropical group of planthoppers, 688 species from 197 genera worldwide (GBIF, 2026). Tropiduchids are generally distributed across islands in Southeast Asia and the Pacific, although several species are also found in the subtropics (Triplehorn & Johnson, 2005). Most species inhabit areas with diverse vegetation, such as forests and shrubs, but also agricultural fields. Both nymphs and adults feed on shrubs and dwell on the above-ground portion of woody dicots (Wilson *et al*., 1994). Tropiduchids are characterized by their wing patterns. Similar to other families of planthoppers, the teeth on the second tarsomere of the hind leg are reduced to lateral pairs (Bartlett & Wilson, 2023). Most species typically have elongated bodies, while some are flattened, ranging from 3 to over 10 mm in length. The head is generally short, with a broad thorax and prominent compound eyes and ocelli. Tropiduchidae are divided into two subfamilies, the Tropiduchinae and the Elicinae. Trophiduchinae are characterized by flattened forms with a nodal flexion in the tegmina and distal reticulate venation. In contrast, Elicinae have body shapes similar to those of the Issidae (Gnezdilov, 2013).

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.151 *Sogana* sp.01 – HemAuc102



Note: Dorsal

Figure 3.152 *Sogana* sp.02 – HemAuc046



Note: Dorsal

Figure 3.153 *Sogana* sp.03 – HemAuc171

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.154 *Tambinia* sp.01 – HemAuc113



Note: Dorsal

Figure 3.155 Tropiduchinae sp.01 – HemAuc058



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.156 Tropiduchinae sp.02 – HemAuc069

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Note: Dorsal

Figure 3.157 Tropiduchinae sp.03 – HemAuc114



Note: Dorsal

Figure 3.158 Tropiduchinae sp.04 – HemAuc125

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Note: Dorsal

Figure 3.159 Tropiduchinae sp.05 – HemAuc091



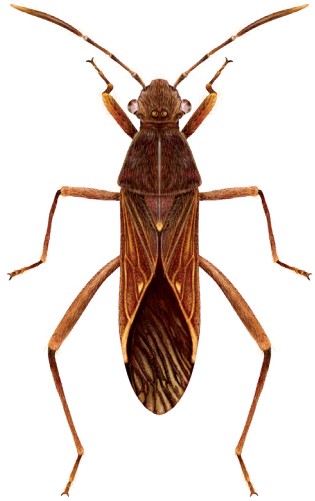
Note: Dorsal

Figure 3.160 Tropiduchinae sp.06 – HemAuc178

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B. Suborder Heteroptera

1. Family Alydidae – *Broad-headed Bugs*

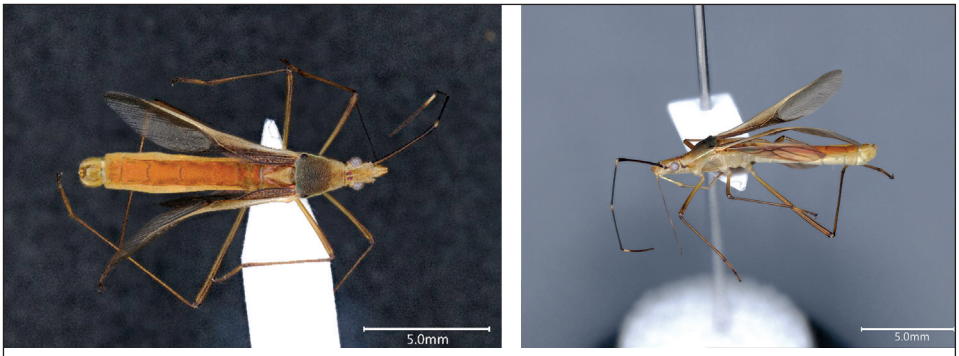


Alydus sp. (Hemiptera: Heteroptera: Alydidae)

The Alydidae, known as broad-headed bugs, are a group of Heteroptera within the Infraorder Pentatomorpha and the Superfamily Coreoidea, with 64 genera and 307 species worldwide (GBIF, 2026). Alydidae inhabit a wide range of habitats, including forests, grasslands, and agricultural fields. Whereas a few species can be found on the ground among stem litter, many species are commonly found about a meter above the ground, on the foliage or twigs of low shrubs, weeds, and ferns (Schuh & Weirauch, 2020). Adults laid their eggs singly or in groups on either plant leaves or seeds (Panizzi & Grazia, 2015). Nymphs are myrmecomorphic (ant-mimicking), particularly in the Subfamily Alydinae (Schuh & Weirauch, 2020). Whereas adults with reduced wings are often remarkably antlike, macropterous adults closely resemble pompilid wasps (Hymenoptera: Pompilidae) (Schuh & Weirauch, 2020). Most species of alydids are phytophagous, feeding on both cultivated and non-cultivated legumes, Solanaceae, and other plant groups, such as *Leptocorisa*, including *L. oratoria, L. acuta,* and *L. lepida* are well-known as major pests in paddy fields (Lahari *et al*., 2024).

The defining morphological characteristic of Alydidae lies in their heads. Unlike the more streamlined heads of many Heteroptera, Alydidae possesses a broad, often triangular-shaped head. Alydids are known as broad-headed bugs due to their broad head which is nearly as wide as the pronotum (Schuh & Weirauch, 2020). Most Alydidae are brown and black, with a red stripe across the middle of the dorsal side of the abdomen in certain black species. This family has scent glands similar to the Pentatomidae, sometimes referred to as "stink bugs" (Triplehorn & Johnson, 2005). The Alydidae are usually elongated and slender, with their size ranging from 8-20 mm (Schuh & Weirauch, 2020). Compound eyes and ocelli with globular structure are present. The antennae are long, slender, and composed of four segments, often longer than the head and pronotum combined (Schuh & Weirauch, 2020). Moreover, the last antennal segment is elongated and curved. The legs are long and slender, adapted for running from predators such as birds and insectivorous mammals.

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.161 Alydidae sp.01 – HemHet219



Note: Dorsal

Figure 3.162 Alydidae sp.02 – HemHet290

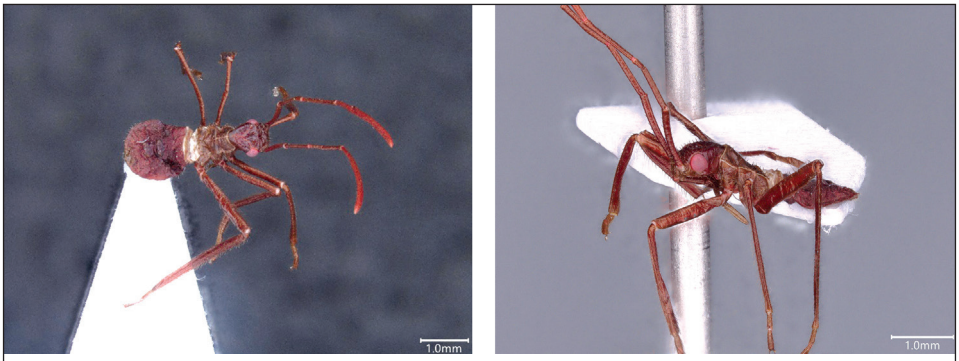


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.163 Alydidae sp.03 – HemHet282

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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.164 Alydidae sp.04 – HemHet169



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.165 Alydidae sp.05 – HemHet192

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.166 Alydidae sp.06 – HemHet139



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.167 Alydidae sp.07 – HemHet262

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2. Family Anthocoridae – *Minute Pirate Bugs*

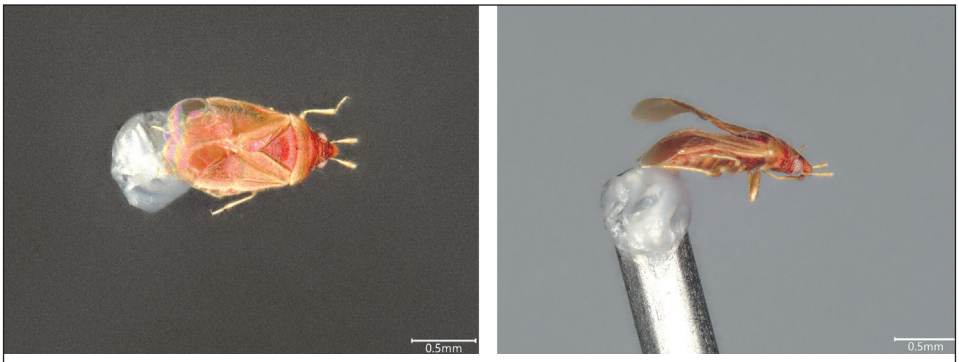


Amphiareus sp. (Hemiptera: Heteroptera: Anthocoridae)

The Anthocoridae, also known as flower bugs or minute pirate bugs, are a group of Heteroptera within the Infraorder Cimicomorpha and the Superfamily Cimicoidea (Schuh & Weirauch, 2020). Anthocorids comprise 392 species from 63 genera around the world (GBIF, 2026). This group can be found on leaves, flowers, dead or decomposing plant tissue, under loose bark, or in decaying fungi. Some species can also be found in bird nests to prey on Psocoptera (Schuh & Weirauch, 2020). Anthocoridae primarily feed on various small insects, including eggs and larvae. However, a few species within the Tribes Anthocorini and Orinii feed on plant matter, particularly pollen, as well as animals (Schuh & Weirauch, 2020). Anthocorids are often considered beneficial natural enemies of agricultural insect pests. For example, *Orius insidiosus* is used to control aphids and thrips in greenhouse cultures (Xu *et al*., 2006). A few species can also bite humans and cause a range of effects, from minor swelling to serious irritations.

Anthocoridae are small insects that typically range in length from 1.4 to 4.5 mm (Schuh & Weirauch, 2020). Anthocorid bodies are flattened and elongated to oval. Many species in this family have black, white-transparent patterns. The head is relatively small, with large well-developed compound eyes. Antennae are long and slender, composed of four segments. The Anthocoridae look similar to Miridae, where cuneus is present. However, both families are different by the presence of ocelli, an apparent 3-segmented labium, and a hemelytra membrane with no vein (Schuh & Weirauch, 2020).

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.168 Anthocorinae sp.01 – HemHet243



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.169 Anthocorinae sp.02 – HemHet083



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.170 Anthocoridae sp.01 – HemHet138

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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.171 Anthocoridae sp.02 – HemHet159



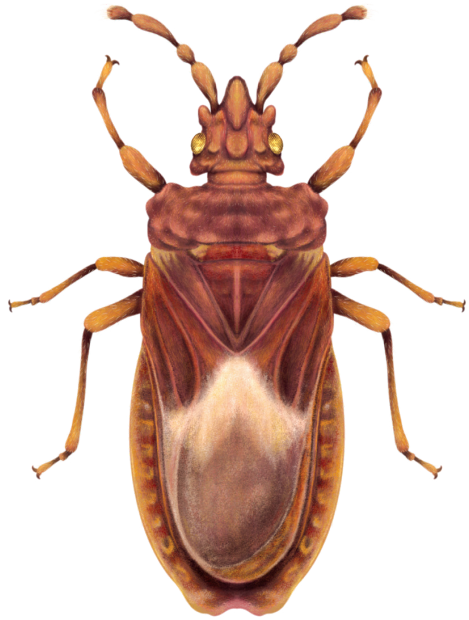
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.172 Anthocoridae sp.03 – HemHet246

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3. Family Aradidae – *Flat Bugs*

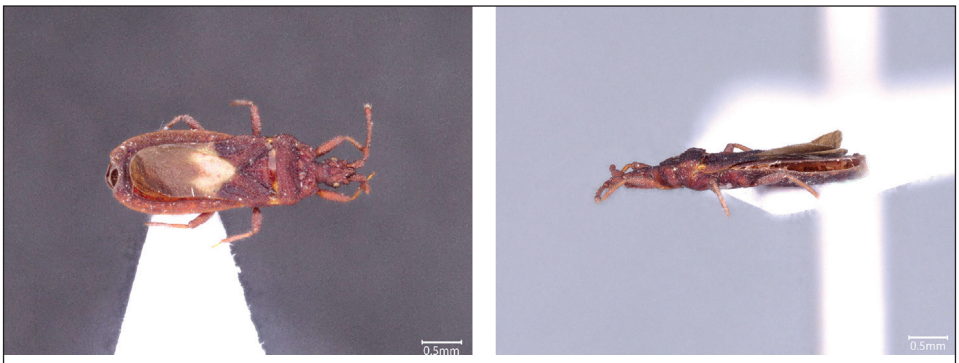


Aradidae sp.01 (Hemiptera: Heteroptera: Aradidae)

Aradidae, commonly referred to as flat bugs, are a family of Heteroptera, which belongs to the Infraorder Pentatomorpha and the Superfamily Aradoidea (Schuh & Weirauch, 2020). This family comprises 615 species from 152 genera around the world (GBIF, 2026). Their common name flat bugs refers to their extremely flattened bodies, which allow them to inhabit narrow crevices under bark and in leaf litter. Aradids are highly diverse in regions with high humidity and dense vegetation, such as in the tropics. Both nymphs and adults are often found in the same habitats, including under the bark of dead trees, bark chips, twigs, or debris on the forest floor, and sometimes in caves. Many species are mycophagous, feeding on fungal spores and mycelium (Schuh & Weirauch, 2020). However, a species of aradids, *Aradus cinnamomeus*, feeds on the phloem, xylem, and cambium of living *Pinus* and *Larix* spp., causing stunted growth of these trees (Heliövaara, 1982). Some species are also associated with termites, such as *Mezira reducta* or *Aspisocoris termitophilus*. Yet other species inhabit bird nests, rodent nests, and the galleries of wood boring beetles (Schuh & Weirauch, 2020).

Aradidae are characterized by dorsoventrally flattened bodies and somber colors, such as black and brown, that blend into habitat. The bodies are elliptical, oval, or rectangular in shape, ranging from 3 to 20 mm. The head is typically small, with prominent compound eyes and often lacks ocelli. The antennae are stout, quite long, and composed of four segments. The wings are often reduced in size, and many tropical species are wingless, leading to flightless adults (Schuh & Weirauch, 2020).

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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.173 Aradidae sp.01 – HemHet005



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.174 Aradidae sp.02 – HemHet047



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.175 Aradidae sp.03 – HemHet143

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(A)



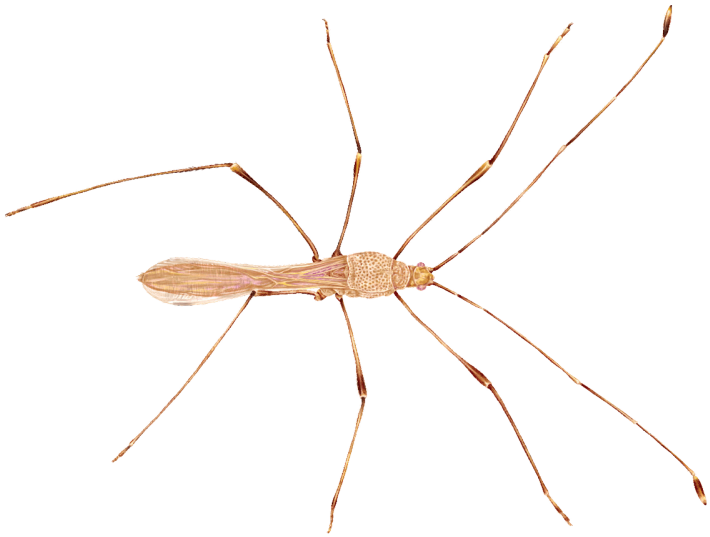
(B)

Note: (A) Dorsal and (B) Lateral

Figure 3.176 Aradidae sp.04 – HemHet232

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4. Family Berytidae – *Stilt Bugs*



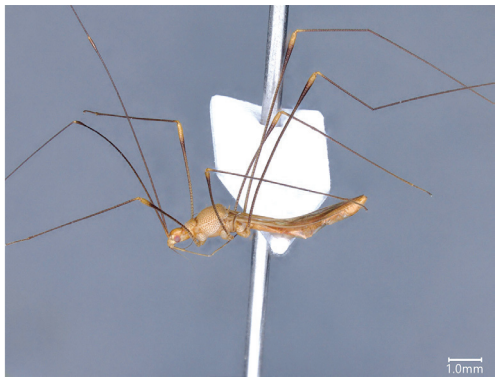
Jalysus sp. (Hemiptera: Heteroptera: Berytidae)

The Berytidae are a group of Heteroptera in the Infraorder Pentatomorpha and the Superfamily Lygaeoidea, commonly known as stilt bugs or thread bugs (Schuh & Weirauch, 2020). This family comprises 192 species from 40 genera worldwide (GBIF, 2026). Their common name stilt bugs refers to their extremely long and slender legs, which resemble members of the Hydrometridae, a group of semi-aquatic insects. The long legs of berytids also resemble one of the groups of arachnids, the harvestman or daddy longlegs (Opiliones). This group is also similar to the Subfamily Emesinae (Heteroptera: Reduviidae). However, berytids can be distinguished by the lack of elongate head and thorax, as well as lack of raptorial forelegs. The biology of most Berytidae is unclear, but it is assumed that the majority of species are phytophagous and live above the ground on plants, while others are geophilous. Some species, however, may be predators or kleptoparasites (Schuh & Weirauch, 2020). Berytids have very slender and elongated bodies, typically ranging from 2.5 – 11 mm in length, combined with threadlike legs. The long legs are important to navigate through dense vegetation, keeping the bodies clear of potential obstructions while searching for food. Most species are dull yellowish or reddish brown and mutic. The head is small, narrow, and subspherical, with prominent compound eyes. The antennae are four segments, usually short and fusiform. Some species have spines and other protuberances on the head and pronotum (Schuh & Weirauch, 2020).

Buku ini tidak diperjualbelikan.



(A)



(B)

Note: (A) Dorsal and (B) Lateral

Figure 3.177 *Jalysus spinosus* – HemHet079

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5. Family Colobathristidae – *Colobathristid Bugs*



Colobathristidae sp.01 (Hemiptera: Heteroptera: Colobathristidae)

The Colobathristidae are a family of Heteroptera within the Infraorder Pentatomomorpha and the Superfamily Lygaeoidea (Schuh & Weirauch, 2020). Colobathristidae are generally little studied and only comprise 26 genera and 98 species worldwide (GBIF, 2026). Colobathristids can be found in forests, grasslands, and agricultural areas. Most species are sap feeders that feed on grasses, sugar cane, or even bamboo (Schuh & Weirauch, 2020). Similar to Berytidae, colobathristids typically have slender and elongated bodies, legs, and antennae. The antennae are composed of four segments. The body size ranges from 6 to 20 mm in length (Schuh & Weirauch, 2020). The head is usually broad, with prominent compound eyes and ocelli. The scutellum is slender and elongated, sometimes with spines. The forewings are narrowed, and the lateral margins are weakly concave and lack membrane veins. The abdomen is slender and elongated, and constricted at the base. Colobathristids are generally brown or black in color.

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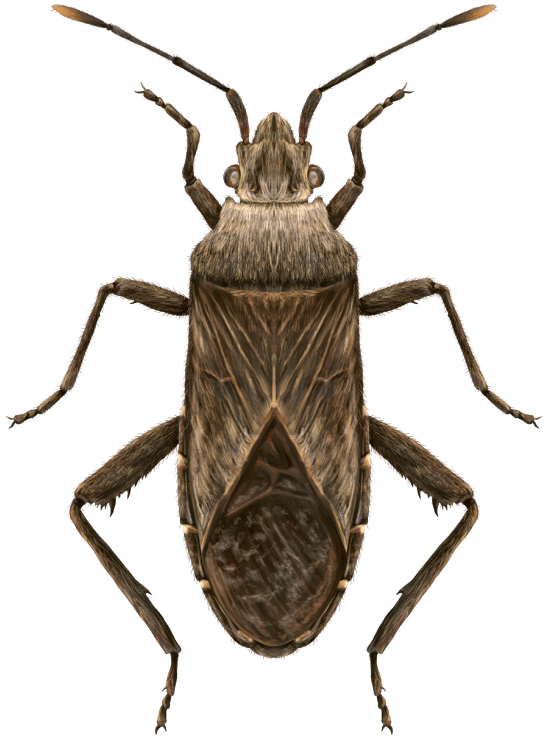


Note: Dorsal

Figure 3.178 Colobathristidae sp.01 – HemHet259

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6. Family Coreidae – *Leaf-footed Bugs*



Acanthocephala sp. (Hemiptera: Heteroptera: Coreidae)

Coreidae is a group of Heteroptera within the Infraorder Pentatomomorpha and the Superfamily Coreoidea (Schuh & Weirauch, 2020). This family is a cosmopolitan group with 466 genera and 2,687 species distributed worldwide (GBIF, 2026). Coreids are commonly known as leaf-footed bugs due to the bizarre expansions of the hind tibiae, which are often leaflike (Schuh & Weirauch, 2020). Sometimes this group is referred to as squash bugs since some species are pests on squash and other cucurbit plants (Schuh & Weirauch, 2020). Moreover, in some places, coreids are also called twig-wilters or tip-wilters due to some species feeding on young twigs (CSIRO, 1991). Coreids are abundant in the tropical and subtropical regions, where some species are among the largest and most bizarre Heteroptera (Schuh & Weirauch, 2020). The majority of Coreidae inhabit areas with dense vegetation, and are often found on the underside of leaves, stems, and within flower clusters. Some large male coreids defend territories on flower heads and vigorously fight with other males attempting to enter their territories (Schuh & Weirauch, 2020). Some coreids may even occasionally lay their eggs on the back of males, among other places, such as the golden-egg bug *Phyllomorpha laciniata* (Reguera & Gomendio, 1999). Eggs carried by another adult bug have higher survival rates, despite egg-carrying

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individuals being more vulnerable to bird predation under experimental conditions (Reguera & Gomendio, 1999). All coreids are phytophagous, feeding on many types of vascular plants, including angiosperms and gymnosperms, as well as Gramineae and herbaceous legumes (Schuh & Weirauch, 2020). Some are an important pest in agricultural crops, such as *Acanthocoris scabrator*, which sucks on vegetables in India (Shameem *et al*., 2023) and *Leptoglossus occidentalis*, an invasive species that attacks pine seeds across Europe (Farinha *et al*., 2021).

Coreids are characterized by robustly elongated or broadly elliptical bodies, along with leaf-like hind tibiae. Hind femora or tibiae on males are often larger than females and equipped with a series of large, sharp spines. Coreids are generally medium to large size, ranging from 7 to 45 mm. Most species are dull-colored, either brown or black, while some are brightly colored. Other colorations are likely deflective, often featuring metallic hues, which are primarily found in tropical species. The head is narrower and shorter than the pronotum, with large compound eyes. The antennae are of four segments, with antennal segments 2 and 3 sometimes dilated and flattened (Schuh & Weirauch, 2020). Additionally, coreids have well-developed scent glands on the sides of the thorax, between the middle and hind coxae, which can emit a strong odor when touched (Triplehorn & Johnson, 2005).



Note: Dorsal

Figure 3.179 Coreidae sp.01 – HemHet053

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Note: Dorsal

Figure 3.180 Coreidae sp.02 – HemHet266



Note: Dorsal

Figure 3.181 Coreidae sp.03 – HemHet257



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.182 Coreidae sp.04 – HemHet067

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Note: Dorsal

Figure 3.183 Coreidae sp.05 – HemHet144



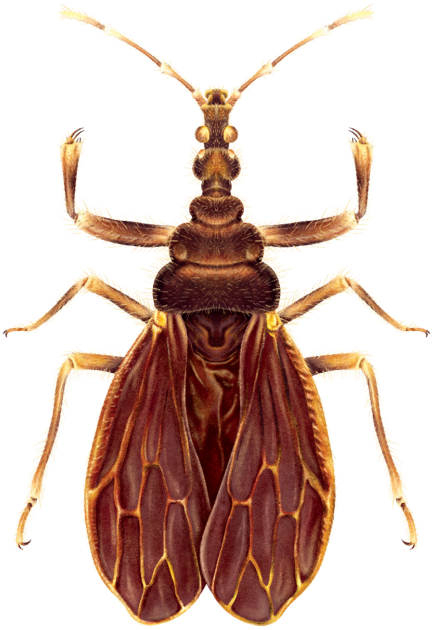
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.184 Coreidae sp.06 – HemHet058

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7. Family Enicocephalidae – *Unique-headed Bugs*



Enicocephalidae (Hemiptera: Heteroptera: Enicocephalidae)

The Enicocephalidae is a group of Heteroptera in the Infraorder Enicocephalomorpha and the Superfamily Enicocephaloidea (Schuh & Weirauch, 2020). Enicocephalids are generally referred to as unique-headed bugs, comprising 51 genera and 316 species distributed worldwide (GBIF, 2026). Enicocephalidae primarily inhabit the humid tropics and subtropics. Many species are found in leaf litter, loose soil, moss, rotting wood, under bark, and other similar microhabitats. However, species from arid zones and temperate regions likely inhabit soil crevices (Schuh & Weirauch, 2020). All enicocephalids are predaceous (Schuh & Weirauch, 2020). Many species feed on small, soft-bodied insects and other arthropods, such as flies (Diptera) and dipluran Campodeidae, as well as ant larvae and pupae (Panizzi & Gracia, 2015). In Malaysian Borneo, *Oncylocotis inexpectatus* inhabits nests of the highly aggressive Yellow Crazy Ant *Anoplolepis gracilipes* (Štys *et al.*, 2010).

Enicocephalidae can be distinguished from other groups, particularly Aenictopecheidae, by the pronotum, which is usually subdivided into three distinct lobes, except for *Megenicocephalus* and *Alienates* (Schuh & Weirauch, 2020). This modification makes enicocephalids appear to have elongated heads; hence, they are called "unique-headed" bugs. Wing polymorphism is common, with males sometimes macropterous and females ranging from brachypterous to apterous (Schuh & Weirauch, 2020). Some species swarm and fly like gnats or midges (Triplehorn & Johnson, 2005). Enicocephalidae are generally small to medium-sized insects, ranging from 2 to 15 mm in length (Schuh & Weirauch, 2020). The bodies are elongated, sometimes flattened dorsoventrally. The elongated head possesses large compound eyes and long, slender antennae that are segmented into four parts. Most Enicocephalidae are dull-colored, either yellowish or brown to blackish, while a few species have bright color patterns (Schuh & Weirauch, 2020).

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.185 Enicocephalidae sp.01 – HemHet140



Note: Dorsal

Figure 3.186 Enicocephalidae sp.02 – HemHet263

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8. Family Geocoridae – *Big-eyed Bugs*

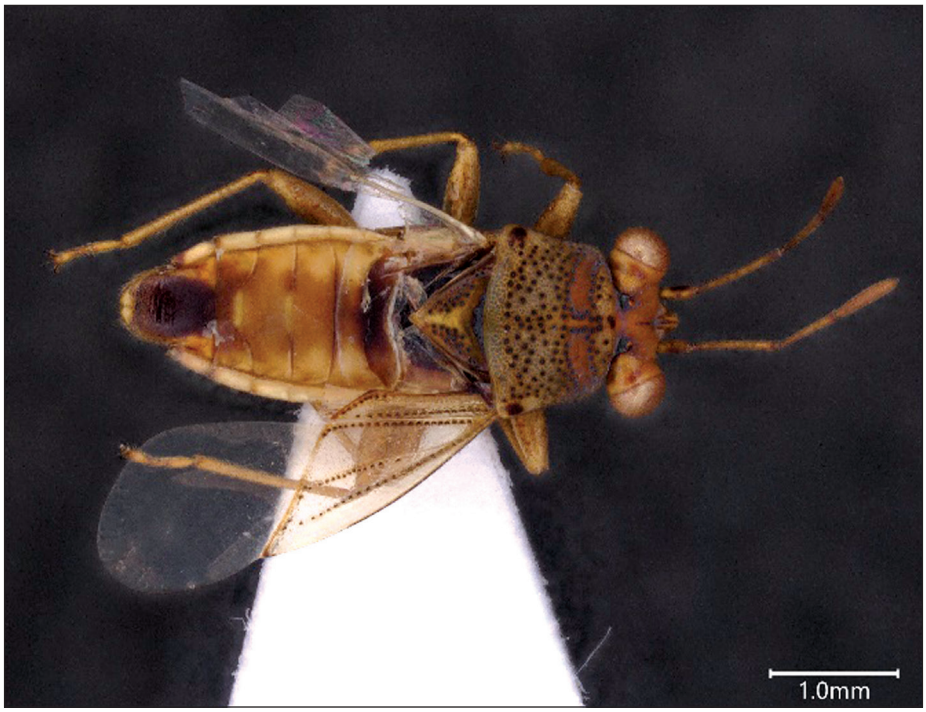


Geocorinae sp. (Hemiptera: Heteroptera: Geocoridae)

The Geocoridae, generally known as big-eyed bugs, are a family of Heteroptera within the Infraorder Pentatomomorpha and the Superfamily Lygaeoidea (Schuh & Weirauch, 2020). This family comprises 311 species from 35 genera worldwide (GBIF, 2026). Geocoridae inhabit a wide range of habitats with abundant prey populations, including forests, grasslands, agricultural fields, and gardens. Many species are found on plant surfaces, within leaf litter, and on the ground. Geocoridae are generalist predators (Schuh & Weirauch, 2020). Both nymphs and adults feed on small arthropods such as aphids, mites, whiteflies, or even insect eggs. Their predatory behavior helps control populations of agricultural pests, such as *Geocoris punctipes*, which can control the whitefly *Trialeurodes vaporariorum*, but also attacks the parasitic wasp *Eretmocerus eremicus* (Bao-Fundora *et al*., 2016).

Their common name, big-eyed bugs, refers to their large, reniform (kidney-shaped), and sometimes stalked eyes. The eyes often project backward and sometimes overlap the anterolateral pronotal angles. The body is typically stout and ranges from ovoid to rectangular, sometimes moderately elongated, and occasionally strongly ant-mimetic (Schuh & Weirauch, 2020). This is particularly in the Pamphantinae, which occur in the tropical forest canopy in South America, Borneo, and India (Malipatil & Scudder, 2018; Malipati, 2017; Slater & Henry, 1999). The head and pronotum are usually broad, with four segmented antennae. The body size ranges from 3-6 mm in length, with black, gray, and sometimes brown colors.

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.187 Geocorinae sp.01 – HemHet294

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9. Family Lyctocoridae – *Lyctocorid Bugs*



Lyctocorinae sp. (Hemiptera: Heteroptera: Lyctocoridae)

The Lyctocoridae, or "lyctocorid bugs", are a group of Heteroptera within the Infraorder Cimicomorpha and Superfamily Cimicoidea. Lyctocoridae were formerly treated as a subfamily under the Family Anthocoridae, which only consists of one genus, *Lyctocoris*; however, 27 *Lyctocoris* species were identified recently (Schuh & Weirauch, 2020). Lyctocoridae can be found in decaying vegetable matter and under bark (Schuh & Weirauch, 2020; Kelton, 1967). For example, *Lyctocoris nidicola* lives in bird nests, while *Lyctocoris campestris* lives in small rodent nests and burrows. The majority of Lyctocoridae are predaceous, feeding on other small insects and mites (Schuh & Weirauch, 2020). One species, *Lyctocoris beneficus,* is a potential control agent for the rice stem borer *Scirpophaga incertulas* in Japan (Schuh & Weirauch, 2020; Chu, 1969). However, a few species also suck blood of humans and domestic animals (Schuh & Weirauch, 2020).

Lyctocoridae have an oval and sometimes flattened body, ranging from 2–6 mm in length. The head is porrect (extending horizontally), with prominent compound eyes and short antennae. Lyctocoridae lack many of the specific characteristics of the Anthocoridae, Cimicidae, and Polyctenidae. The left paramere is not used as a copulatory organ. Instead, the endosoma, modified into an acus (injection needle), penetrates the female's abdominal wall. The female has an apophysis internally on the anterior margin of sternum 7, and the seminal conceptacles are formed by the epithelium of the genital duct rather than in the peritoneal sheath of the ovariole, as in other Cimicoidea (Schuh & Weirauch, 2020).

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(A) (B)

Note: (A) Dorsal and (B) Lateral

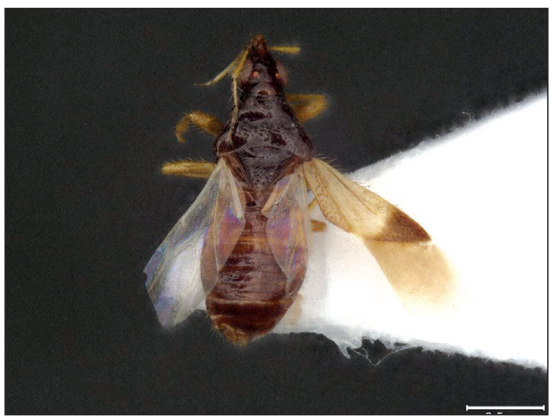
Figure 3.188 Lyctocorinae sp.01 – HemHet074



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.189 Lyctocorinae sp.02 – HemHet117



Note: Dorsal

Figure 3.190 Lyctocorinae sp.03 – HemHet030

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(A) (B)

Note: (A) Dorsal and (B) Lateral

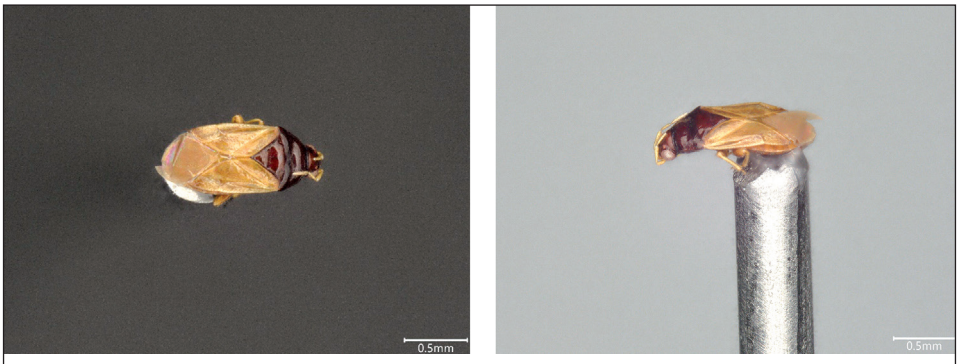
Figure 3.191 Lyctocorinae sp.04 – HemHet105



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.192 Lyctocorinae sp.05 – HemHet134



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.193 Lyctocorinae sp.06 – HemHet032

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Note: Dorsal

Figure 3.194 Lyctocorinae sp.07 – HemHet251



Note: Dorsal

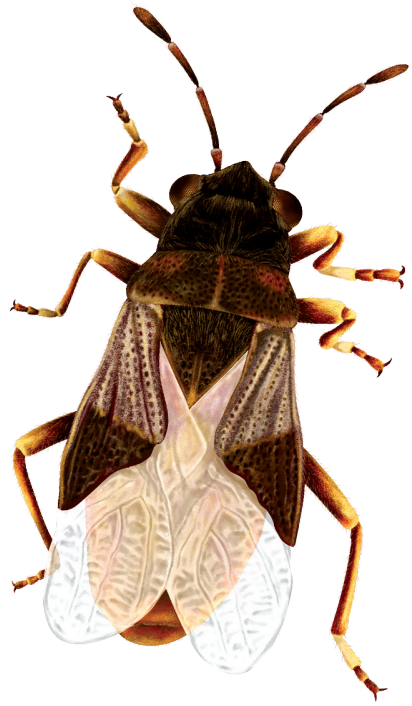
Figure 3.195 Lyctocorinae sp.08 – HemHet224

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10. Family Lygaeidae – *Seed Bugs*

Within the Infraorder Pentatomomorpha and the Superfamily Lygaeoidea, Lygaeidae are a group of Heteroptera, generally known as seed bugs (Schuh & Weirauch, 2020). This family consists of 1,029 species from 122 genera worldwide (GBIF, 2026). Lygaeids inhabit tropical and temperate regions, while some species of the Subfamily Orsillinae occupy oceanic islands. Many species of the Genus *Nysius* (Lygaeidae: Orsillinae) are generalists, while some are specialists. Those species often live on tree seeds, including *Belonochilus numenius*, which inhabits *Platanus* spp. in North America, and *Hyalonysius pallidomaculatus*, which lives on *Buddleia* spp. in South Africa (Schuh & Weirauch, 2020). Some species rely on mature seeds for reproductive success and enhanced dispersal abilities to find new plants with mature seeds. Meanwhile, other species can reproduce on the host plant regardless of seed presence, and such species are generally more sedentary. Most species feed above the ground, although many inhabit ground litter when the host plants produce an abundance of seeds, such as lygaeines. The majority of lygaeids are seed feeders, while a few species may feed on other plant parts, including stems, leaves, and flowers. Additionally, many species of the Subfamily Lygaeinae feed on toxic or unpalatable plants (Schuh & Weirauch, 2020).

Lygaeids are varied in size, typically ranging from 4–12 mm. The bodies are elongated to oval, with aposematic coloration. Species within the Subfamilies Ischnorhynchinae and Orsillinae tend to be smaller and have somber colors, while many species of the Lygaeinae exhibit bright red or yellow and black aposematic coloration. The head is relatively small, with well-developed compound eyes. The ocelli are present, which distinguishes them from Miridae. The antennae are four segments, often long and slender. The scutellum usually has a cross-shaped pattern, and the forewing membrane typically has distinct cells, particularly on Lygaeinae (Schuh & Weirauch, 2020).



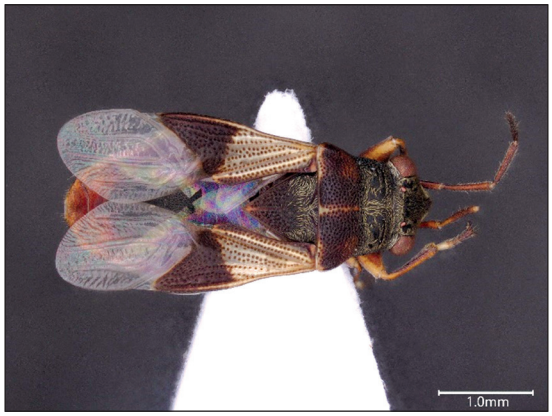
Ischnorhynchinae sp.02 (Hemiptera: Heteroptera: Lygaeoidae)

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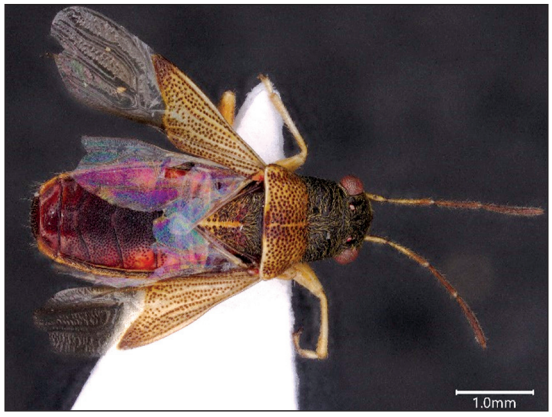
Note: (A) Dorsal and (B) Lateral

Figure 3.196 Ischnorhynchinae sp.01 – HemHet112



Note: Dorsal

Figure 3.197 Ischnorhynchinae sp.02 – HemHet274



Note: Dorsal

Figure 3.198 Ischnorhynchinae sp.03 – HemHet277

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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.199 Lygaeinae sp.01 – HemHet034



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.200 Lygaeinae sp.02 – HemHet038



(A) (B)

Note: (A) Dorsal and (B) Lateral

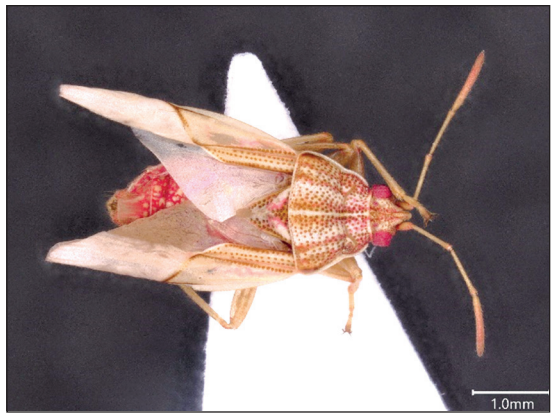
Figure 3.201 Lygaeinae sp.03 – HemHet293

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Note: Lateral

Figure 3.202 Orsilinae sp.01 – HemHet106



Note: Dorsal

Figure 3.203 Orsilinae sp.02 – HemHet286



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.204 Lygaeidae sp.01 – HemHet234

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.205 Lygaeidae sp.02 – HemHet173



Note: Dorsal

Figure 3.206 Lygaeidae sp.03 – HemHet223



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.207 Lygaeidae sp.04 – HemHet137

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11. Family Miridae – *Plant Bugs*

The Miridae, known as plant bugs in the United States and Canada, capsids in Britain, and Blindwanzen in German-speaking countries, belong to the Infraorder Cimicomorpha and the Superfamily Miroidea (Schuh & Weirauch, 2020). This family is the most species-rich among the Heteroptera, comprising more than 12,000 species from at least 1,630 genera worldwide (GBIF, 2026). Miridae are diverse in tropical and temperate regions. In temperate regions, eclosion in Miridae typically occurs from early to late spring in phytophagous species, aligning with the growth and flowering periods of their host plants (Schuh & Weirauch, 2020). Meanwhile, predatory species frequently have life cycles that are synced with their

Helopeltis antonii (Hemiptera: Heteroptera: Miridae)



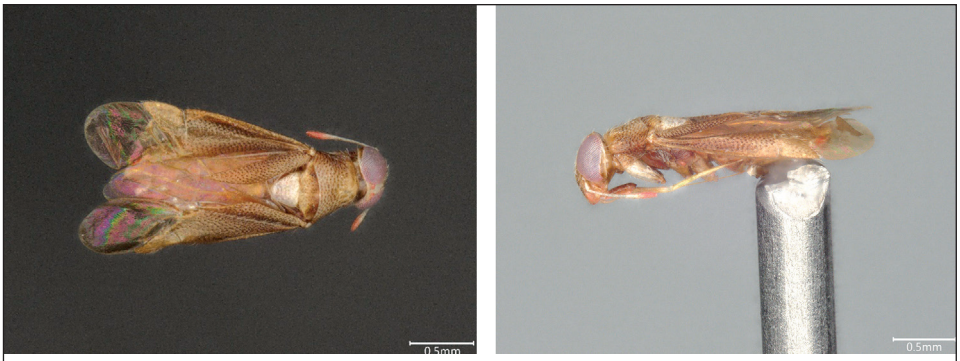
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preferred prey and usually emerge later in the season compared to phytophagous species (Schuh & Weirauch, 2020). Some tropical species (e.g., *Monalonion*) exhibit bimodal seasonal population fluctuations, which are associated with maximum rainfall and plant growth (Schuh & Weirauch, 2020). Plant bugs are often found on the plant surface, flowers, within leaf litter, and on the ground.

The majority of Miridae are phytophagous, generally feed on the mesophyll of young leaves, flowers, fruits, and sometimes pollen (Schuh &Weirauch, 2020). Mirids have a variety of host plants, including rosid and eudicot angiosperms, as well as monocotyledons. For example, members of the Tribe Mecistoscelini (Miridae: Mirinae) feed on bamboo, while Tribe Stenodemini (Miridae: Mirinae) and Genus *Irbisia* (Miridae: Mirinae: Mirini) feed on grasses, and members of the two genera feed on palms, including *Loulucoris* (Miridae: Orthotylinae) from Hawai (Asquith, 1995) and *Parasthenaridea* (Miridae: Phylinae) from Malaysia (Schuh, 1984). Moreover, in Africa and the Arabian Peninsula, the pilophorine Genus *Aloea* feeds on foliar structures of *Aloe* (Liliaceae) (Linnavouri, 1975). Other species of Miridae that are not associated with angiosperms feed on other seed plants, while some feed on fern spores and fungi (Schuh & Weirauch, 2020). Members of the Tribe Dicyphini (Miridae: Bryocorinae) and Pilophorini (Miridae: Phylinae) have been described as oligophagous, feeding on both plant and animal material (Schuh & Weirauch, 2020). In addition, a few species are predatory, feeding on scale insects (Wheeler Jr., 2001).

Miridae typically range in size from < 2 mm to approximately 15 mm (Schuh & Weirauch, 2020). Many species have ovoid or elongate bodies, whereas others are myrmecomorphic. Some species of Miridae that are ant-mimicking, including *Formicopsella regneri* and *Pangania fasciatipennis* from South Africa (Schuh, 1974) and *Pilophorus* spp. from Thailand (Yasunaga & Schuh, 2013). The head is relatively small, with prominent compound eyes but lacks ocelli. The antennae consist of four segments, with segments 3 and 4 being slightly narrower in diameter compared to segment 2. The forewings typically have a conspicuous costal fracture and cuneus (Schuh & Weirauch, 2020). Mirids are varied in color, including brown, black, and combinations with brightly marked colors such as yellow, red, orange, green, and white.

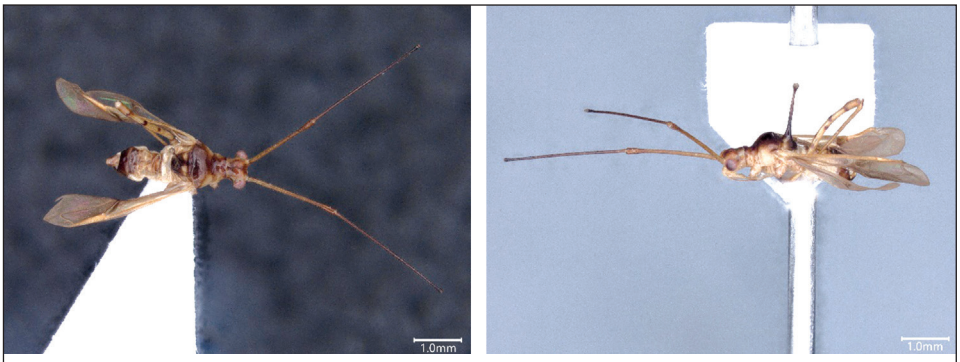
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(A) (B)

Note: (A) Dorsal and (B) Lateral

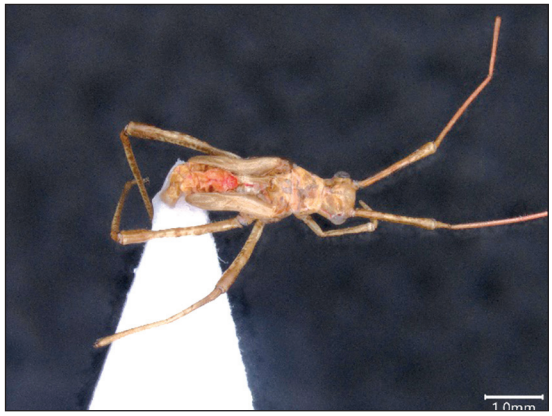
Figure 3.208 *Bruneimetopus simulans* – HemHet008



(A) (B)

Note: (A) Dorsal and (B) Lateral

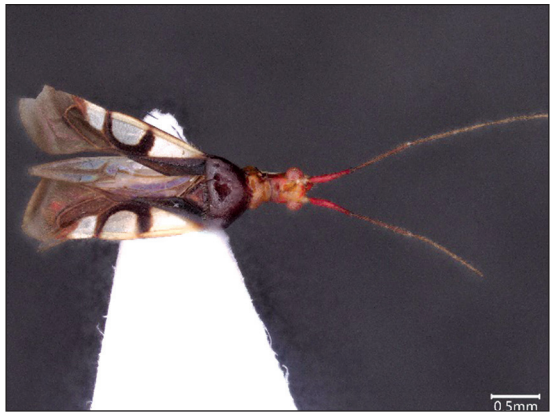
Figure 3.209 *Helopeltis antonii* – HemHet108



Note: Dorsal

Figure 3.210 Bryocorinae sp.01 – HemHet098

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Note: Dorsal

Figure 3.211 Bryocorinae sp.02 – HemHet302



Note: Dorsal

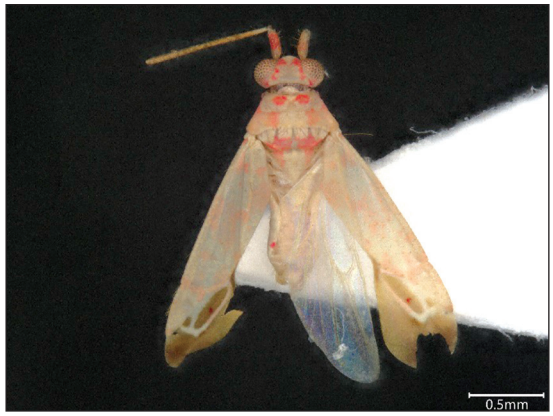
Figure 3.212 Bryocorinae sp.03 – HemHet007



Note: Dorsal

Figure 3.213 Bryocorinae sp.04 – HemHet014

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Note: Dorsal

Figure 3.214 Bryocorinae sp.05 – HemHet024



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.215 Bryocorinae sp.06 – HemHet035



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.216 Bryocorinae sp.07 – HemHet044

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.217 Bryocorinae sp.08 – HemHet065



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.218 Bryocorinae sp.09 – HemHet066



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.219 Bryocorinae sp.10 – HemHet084

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.220 Bryocorinae sp.11 – HemHet093



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.221 Bryocorinae sp.12 – HemHet094

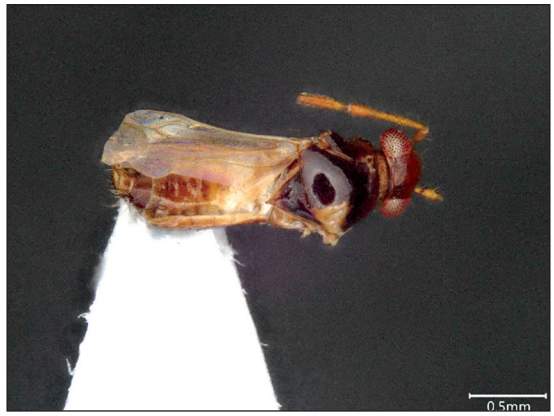


(A) (B)

Note: (A) Dorsal and (B) Lateral

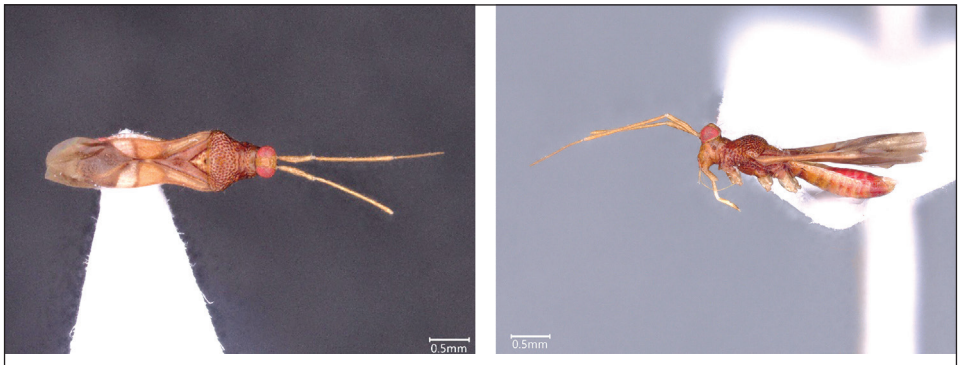
Figure 3.222 Bryocorinae sp.13 – HemHet100

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.223 Bryocorinae sp.14 – HemHet110



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.224 Bryocorinae sp.15 – HemHet118

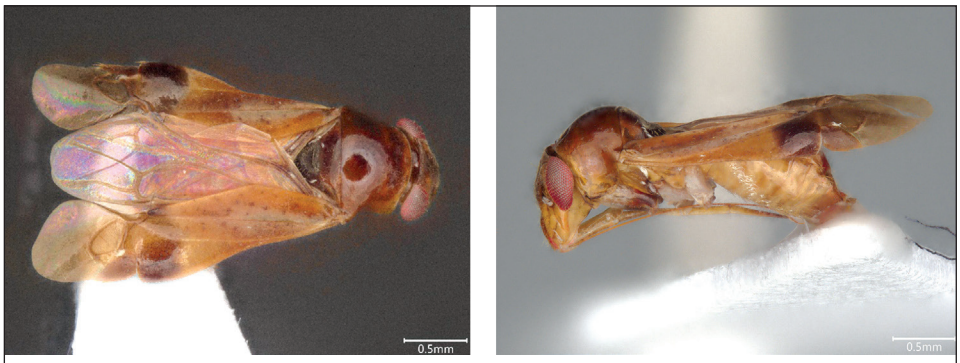


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.225 Bryocorinae sp.16 – HemHet127

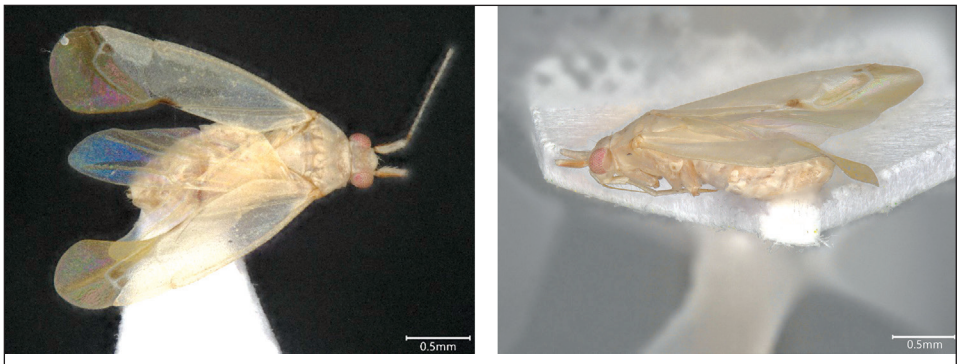
Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.226 Bryocorinae sp.17 – HemHet133



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.227 Bryocorinae sp.18 – HemHet172



Note: Dorsal

Figure 3.228 Bryocorinae sp.19 – HemHet206

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

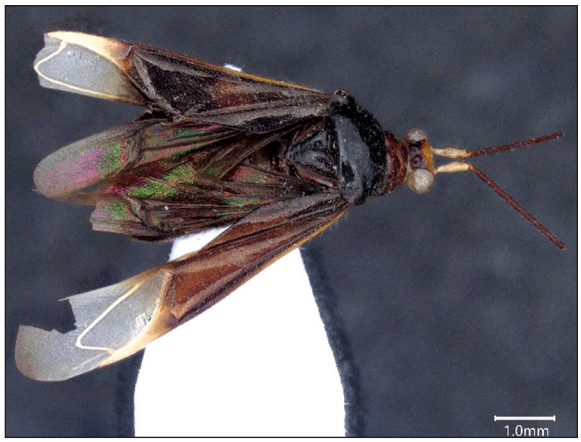
Figure 3.229 Bryocorinae sp.20 – HemHet239



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.230 Bryocorinae sp.21 – HemHet275



Note: Dorsal

Figure 3.231 Bryocorinae sp.22 – HemHet284

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.232 Deraeocorinae sp.01 – HemHet092



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.233 Deraeocorinae sp.02 – HemHet130



(A) (B)

Note: (A) Dorsal and (B) Lateral

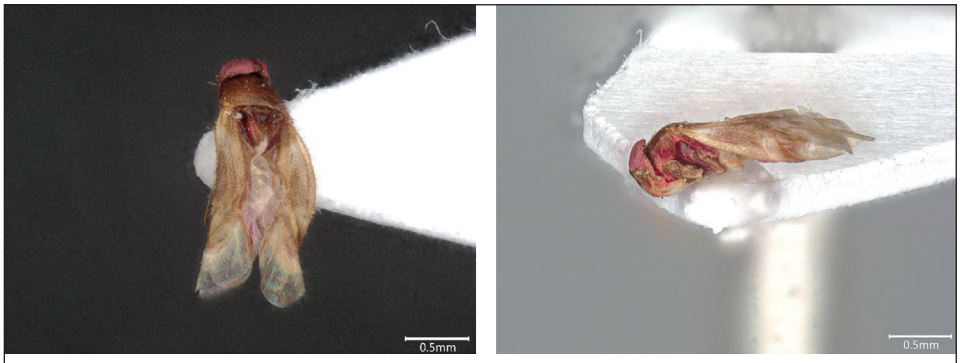
Figure 3.234 Isometopinae sp.01 – HemHet029

Buku ini tidak diperjualbelikan.



Note: Dorsal

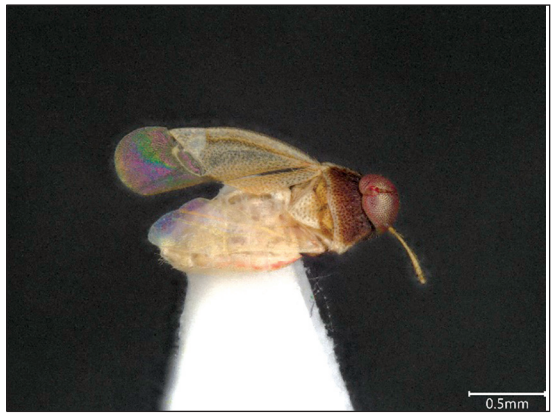
Figure 3.235 Isometopinae sp.02 – HemHet088



(A) (B)

Note: (A) Dorsal and (B) Lateral

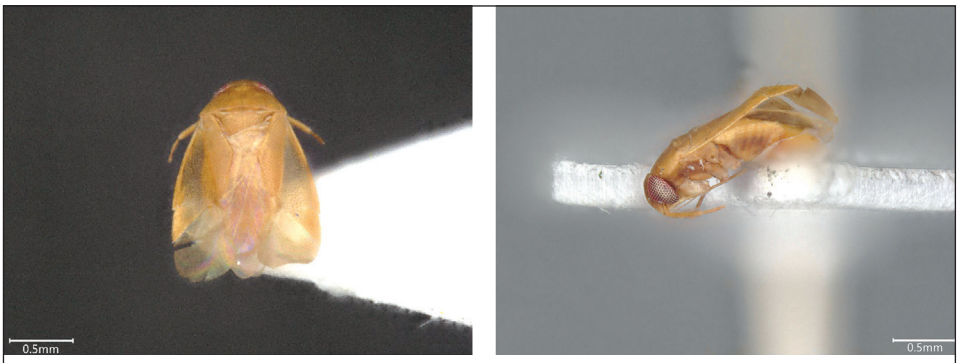
Figure 3.236 Isometopinae sp.03 – HemHet099



Note: Dorsal

Figure 3.237 Isometopinae sp.04 – HemHet198

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.238 Isometopinae sp.05 – HemHet205



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.239 Mirinae sp.01 – HemHet242



(A) (B)

Note: (A) Dorsal and (B) Lateral

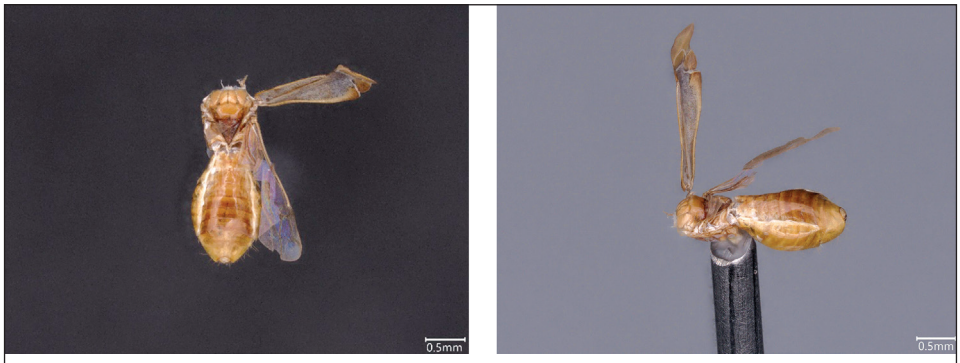
Figure 3.240 Mirinae sp.02 – HemHet078

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.241 Mirinae sp.03 – HemHet120



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.242 Mirinae sp.04 – HemHet122



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.243 Mirinae sp.05 – HemHet151

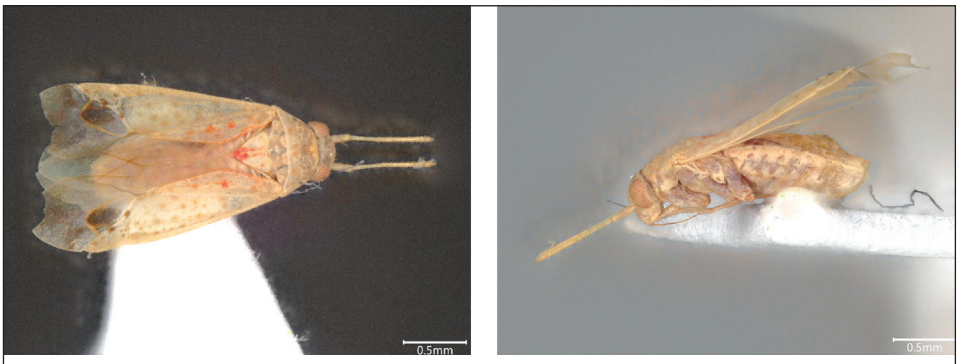
Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.244 Mirinae sp.06 – HemHet156



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.245 Mirinae sp.07 – HemHet178



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.246 Mirinae sp.08 – HemHet209

Buku ini tidak diperjualbelikan.



Note: Dorsal

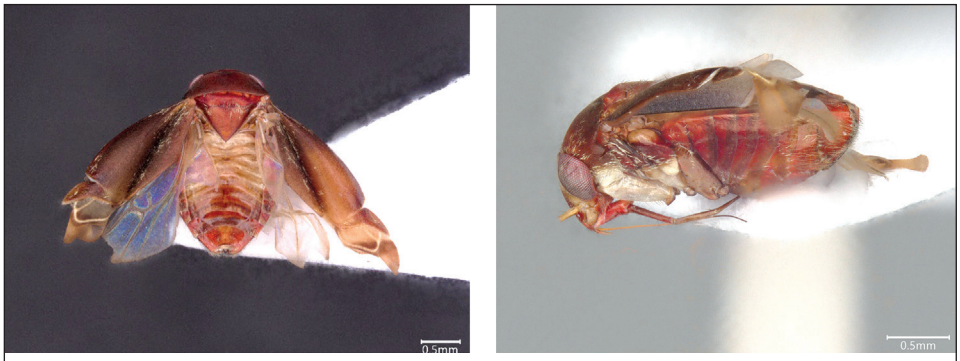
Figure 3.247 Phylinae sp.01 – HemHet001



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.248 Phylinae sp.02 – HemHet003



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.249 Phylinae sp.03 – HemHet006

Buku ini tidak diperjualbelikan.



Note: Dorsal

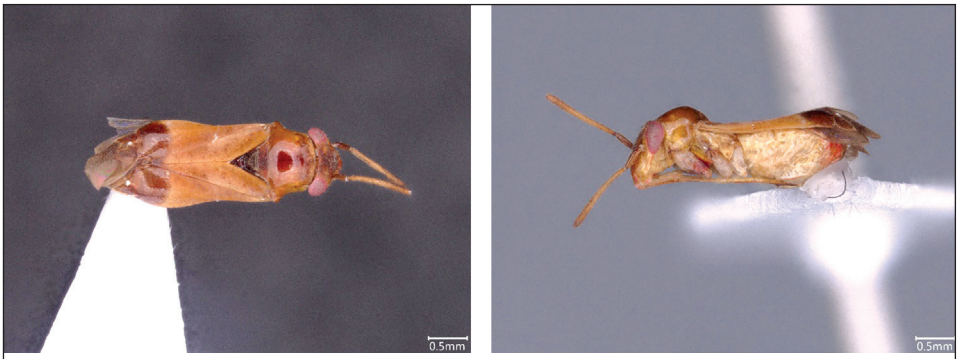
Figure 3.250 Phylinae sp.04 – HemHet009



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.251 Phylinae sp.05 – HemHet023



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.252 Phylinae sp.06 – HemHet131

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.253 Phylinae sp.07 – HemHet051



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.254 Phylinae sp.08 – HemHet059

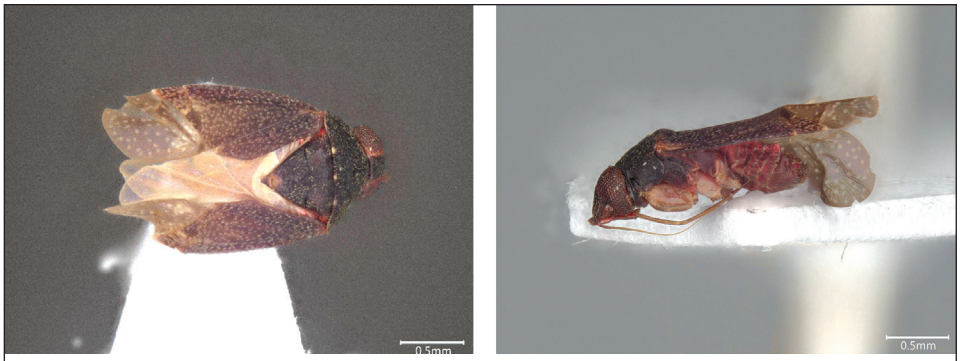


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.255 Phylinae sp.09 – HemHet160

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

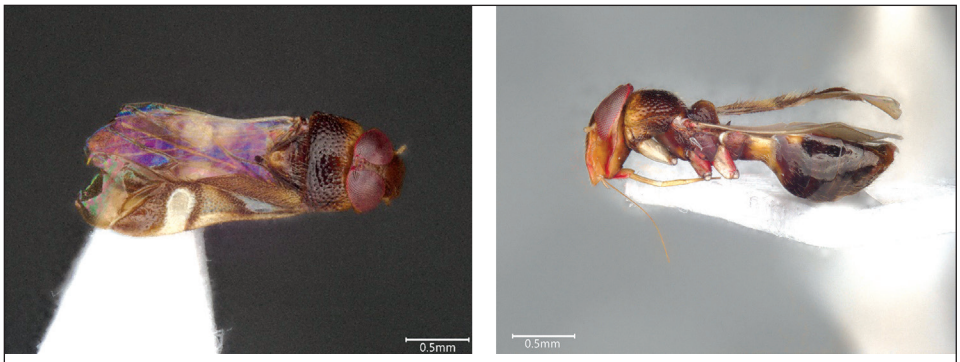
Figure 3.256 Phylinae sp.10 – HemHet062



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.257 Phylinae sp.11 – HemHet085



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.258 Phylinae sp.12 – HemHet135

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.259 Phylinae sp.13 – HemHet060



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.260 Phylinae sp.14 – HemHet141



Note: Dorsal

Figure 3.261 Phylinae sp.15 – HemHet214

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.262 Phylinae sp.16 – HemHet171



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.263 Phylinae sp.17 – HemHet194

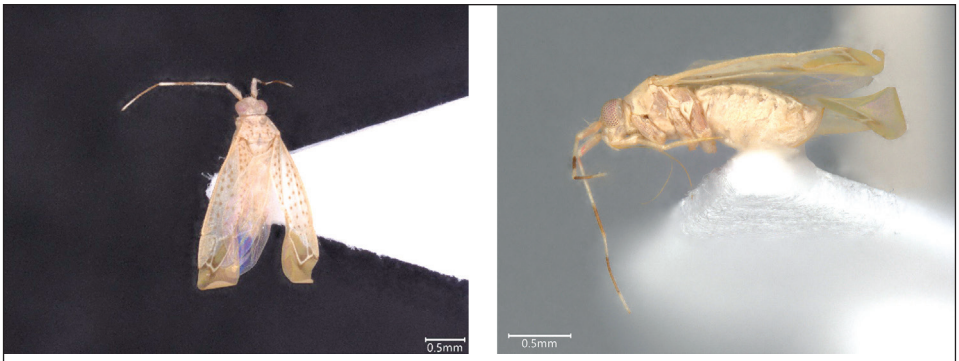


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.264 Phylinae sp.18 – HemHet195

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.265 Phylinae sp.19 – HemHet196



Note: Dorsal

Figure 3.266 Phylinae sp.20 – HemHet202



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.267 Phylinae sp.21 – HemHet207

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.268 Phylinae sp.22 – HemHet208



Note: Dorsal

Figure 3.269 Phylinae sp.23 – HemHet210



Note: Dorsal

Figure 3.270 Phylinae sp.24 – HemHet211

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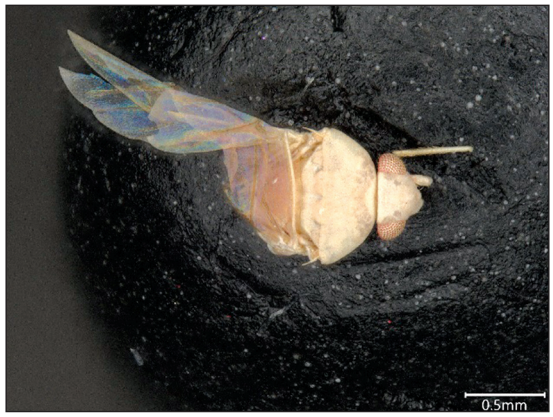
Note: Dorsal

Figure 3.271 Phylinae sp.25 – HemHet213



Note: Dorsal

Figure 3.272 Phylinae sp.26 – HemHet270



Note: Dorsal

Figure 3.273 Phylinae sp.27 – HemHet289

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

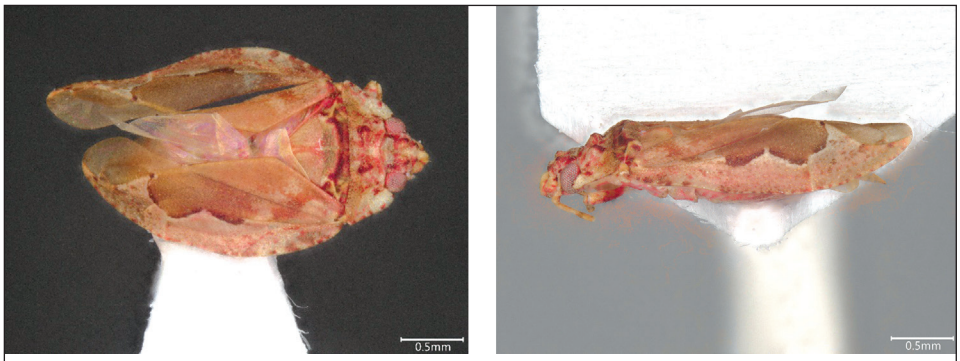
Figure 3.274 Phylinae sp.28 – HemHet186



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.275 Phylinae sp.29 – HemHet147



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.276 Miridae sp.01 – HemHet115

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Note: Dorsal

Figure 3.277 Miridae sp.02 – HemHet028



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.278 Miridae sp.03 – HemHet188



Note: Dorsal

Figure 3.279 Miridae sp.04 – HemHet252

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12. Family Nabidae – *Damsel Bugs*

The Nabidae, sometimes known as damsel bugs, are a group of Heteroptera in the Infraorder Cimicomorpha and the Superfamily Naboidea (Schuh & Weirauch, 2020). This family consists of 25 genera and 200 species around the world (GBIF, 2026).

Nabidae (Hemiptera: Heteroptera: Nabidae)



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Nabidae are abundant in tropical and temperate regions, such as *Alloeorhynchus* (Nabidae: Prostemmatinae), which can be found in Africa (Krüger, 2019), Mexico (Brailovsky & Barrera, 2017), and Japan (Souma & Ishikawa, 2023). Most species are found in forests, grasslands, and agricultural areas, typically on vegetation and within leaf litter. Meanwhile, species of the Genus *Arachnocoris* live in spider webs and scavenge on trapped insects (Schuh & Weirauch, 2020). The majority of Nabidae are generalist predators, feeding on a variety of small arthropods such as aphids, mites, and caterpillars. However, some species of Prostemmatinae prey specifically on other Heteroptera, particularly *Alloeorhynchus*, which feeds on *Stilbocoris* from the Rhyparochromidae (Heteroptera) (Peredo, 2004). A few species can sometimes cannibalize each other when prey is unavailable.

Damsel bugs can be recognized by the enlarged tibiae and femora of their first leg pair, which are adapted for grasping prey similar to praying mantis (Triplehorn & Johnson, 2005). In the Subfamily Prostemmatinae, those structures are equipped with heavy spines. Nabidae are generally moderate in size, rarely exceeding 10 mm (Schuh & Weirauch, 2020). The head is relatively narrow with large, prominent compound eyes, and antennae prepedicellite. The bodies are elongated and dull coloration, while others are more robust and sometimes possess striking red and black patterns. Nabid bugs possess modified mouthparts designed for predation. The mandibles and maxillae are highly specialized, adapted for piercing and slicing, allowing the damsel bugs to access the fluids inside their prey. Additionally, the four segments of labium are flexible, typically curved, and extend onto the prothorax or mesothorax (Schuh & Weirauch, 2020). Once the stylets have penetrated the prey, the Nabidae use a siphoning mechanism to extract the fluid. This involves the use of specialized muscles to create suction.

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Note: Dorsal

Figure 3.280 Nabidae sp.01 – HemHet268



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.281 Nabidae sp.02 – HemHet010

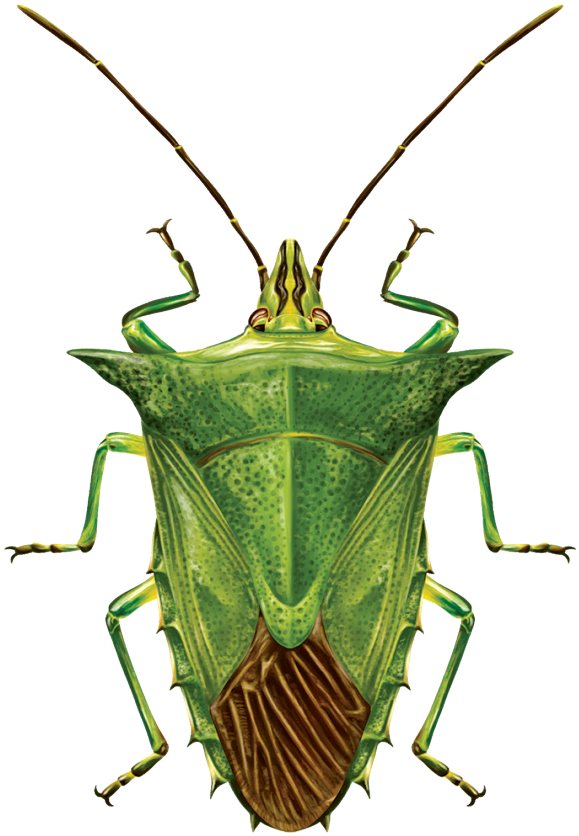


Note: Dorsal

Figure 3.282 Nabidae sp.03 – HemHet300

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13. Family Pentatomidae – *Stink Bugs*



Nezara viridula (Hemiptera: Heteroptera: Pentatomidae)

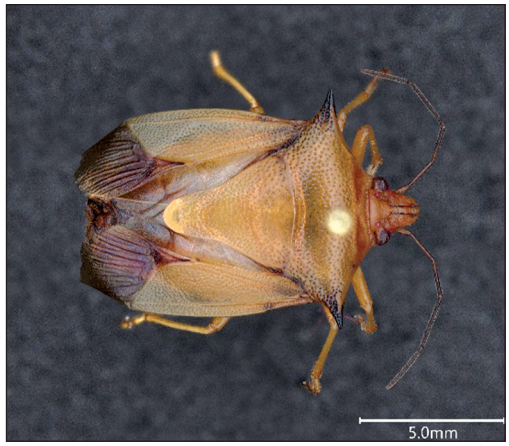
The Pentatomidae, commonly known as stink bugs in America and shield bugs in Britain, are a group of Heteroptera within the Infraorder Pentatomomorpha and the Superfamily Pentatomoidea (Schuh & Weirauch, 2020). This family comprises almost 2,000 species from more than 400 genera (GBIF, 2026). Many species are found on the plant surface, sometimes sheltering under bark. Species that live on bark often have bizarre shapes and highly cryptic patterns (Schuh & Weirauch, 2020). For example, most species of Cyrtocorinae have greatly expanded pronotum and abdomen, and cover themselves with a dense brownish-white secretion, making them almost invisible on the bark of their primary host plants. Many other genera also exhibit cryptic coloring and may resemble tree bark. A remarkable biological trait of several Pentatomidae is the maternal care of eggs by females (Schuh & Weirauch, 2020). This behavior is highly developed, with the adult female not only fending off predators, but also moving her body side to side to prevent small parasitic

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wasps from laying their eggs. The majority of Pentatomidae are herbivorous, with a distinct preference for immature fruit and seeds, while others feed on the plant vascular system. However, several species are predaceous, particularly from the Subfamily Asopinae (Schuh & Weirauch, 2020). Some phytophagous species, including *Cyrtocoris egeris*, feed on *Acalifa diversifolia* (Euphorbiaceae), and species of *Aphylum* that occupy *Eucalyptus* bark. *Aphylum syntheticum* found under the bark of *Eucalyptus camaldulensis* resembles leaf beetles (Chrysomelidae) from the genus *Paropsis* (Schuh & Weirauch, 2020; Gross, 1975).

Stink bugs are well-known for their distinctive shield-shaped bodies and the ability to produce a foul-smelling odor as a defense mechanism. The bodies are typically oval or broadly elliptical. However, there are several species that are more elongated and slender, particularly those associated with grasses (Schuh & Weirauch, 2020). Pentatomidae are varied in size, ranging from 4–20 mm. The defining characteristic of pentatomid bugs lies in the scutellum (pronotum), which is broad, large, and often triangular or sub-triangular, resembling a shield. However, in many species of the Subfamilies Aphylinae and Podopinae, the enlarged scutellum covers almost the entire abdomen. The head is relatively small compared to the scutellum, with prominent compound eyes and ocelli. Most species have five-segmented antennae, while a few have four segments. Tarsi are three segments in many Pentatomidae, except in the Subfamily Cyrtocorinae and Stirotarsinae (Schuh & Weirauch, 2020). Pentatomidae are diverse in coloration, from dull brown and green that blend seamlessly with foliage to vibrant yellow, orange, brown, and even black with white patterns. Some may even change color, such as *Thyanta calceata*, which is of a green color with short pubescence in the summer generation and a brown color with long pubescence in the autumnal generation (Schuh & Weirauch, 2020).

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Note: Dorsal

Figure 3.283 Asopinae sp.01 – HemHet306



Note: Dorsal

Figure 3.284 Asopinae sp.02 – HemHet076

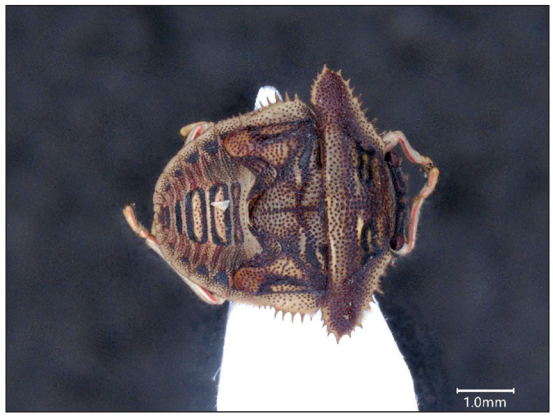


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.285 Asopinae sp.03 – HemHet191

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.286 Asopinae sp.04 – HemHet292



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.287 Asopinae sp.05 – HemHet304



Note: Dorsal

Figure 3.288 Discocephalinae sp.01 – HemHet229

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.289 Pentatominae sp.01 – HemHet136



Note: Dorsal

Figure 3.290 Pentatominae sp.02 – HemHet155



Note: Dorsal

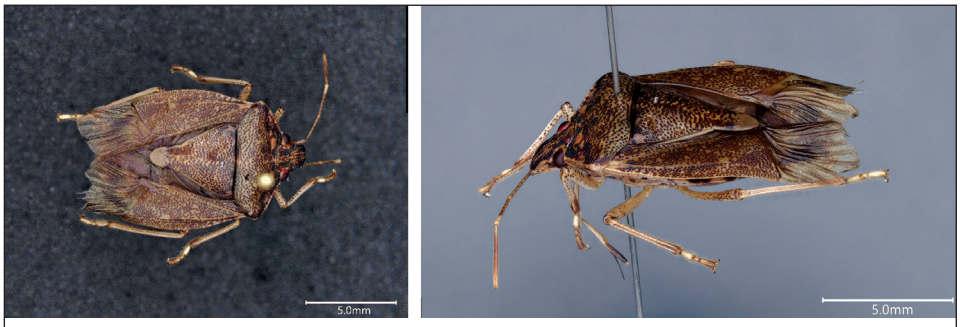
Figure 3.291 Pentatominae sp.03 – HemHet197

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Note: Dorsal

Figure 3.292 Pentatominae sp.04 – HemHet237



Note: (A) Dorsal and (B) Lateral

Figure 3.293 Pentatominae sp.05 – HemHet296



Note: Dorsal

Figure 3.294 Pentatominae sp.06 – HemHet299

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Note: Dorsal

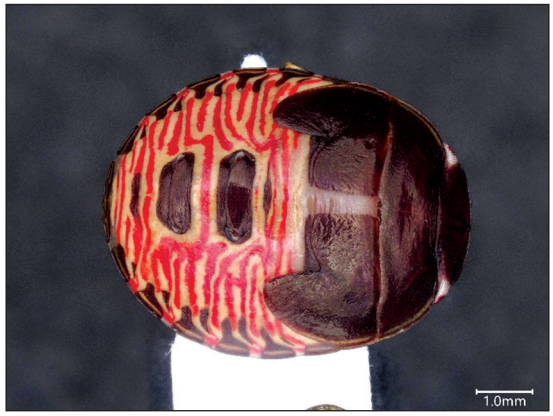
Figure 3.295 Pentatominae sp.07 – HemHet103



(A) (B)

Note: (A) Dorsal and (B) Lateral

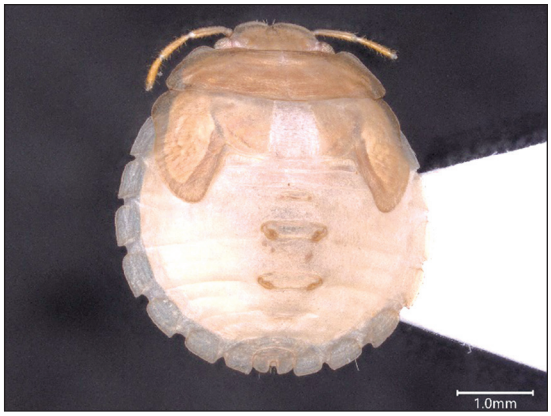
Figure 3.296 Pentatominae sp.08 – HemHet167



Note: Dorsal

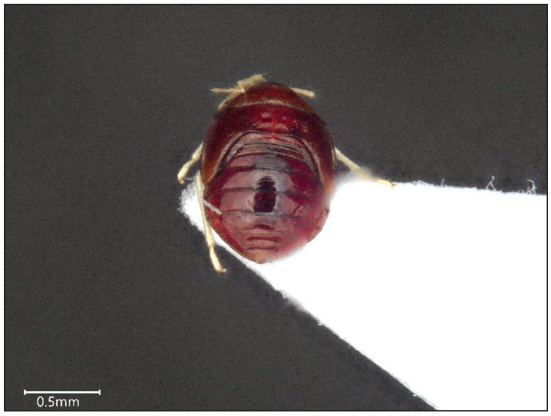
Figure 3.297 Pentatomidae sp.01 – HemHet276

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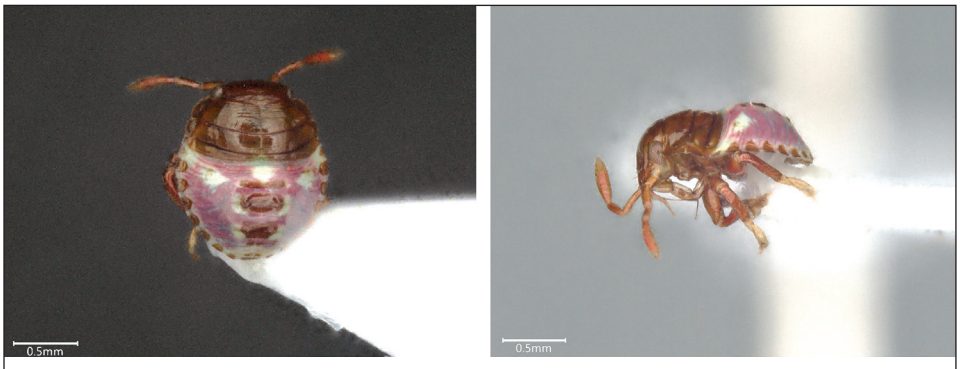
Note: Dorsal

Figure 3.298 Pentatomidae sp.02 – HemHet004



Note: Dorsal

Figure 3.299 Pentatomidae sp.03 – HemHet048



(A) (B)

Note: (A) Dorsal and (B) Lateral

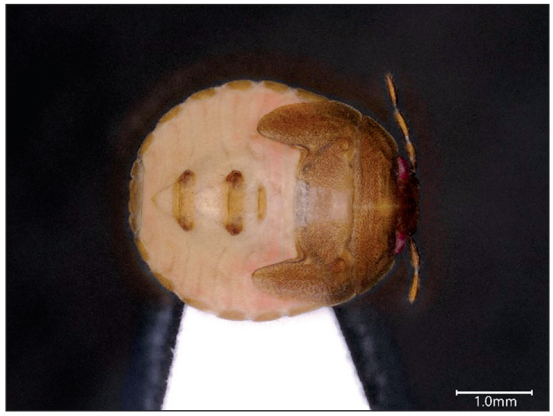
Figure 3.300 Pentatominae sp.04 – HemHet183

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Note: Dorsal

Figure 3.301 Pentatomidae sp.05 – HemHet193



Note: Dorsal

Figure 3.302 Pentatomidae sp.06 – HemHet269

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14. Family Plataspidae – *Pill Bugs*

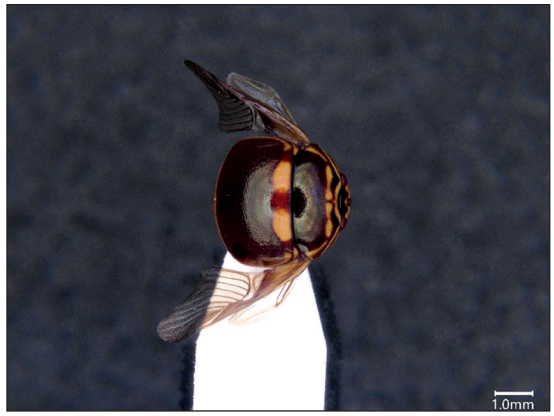


Plataspidae sp.03 (Hemiptera: Heteroptera: Plataspidae)

The Plataspidae are a group of Heteroptera within the Infraorder Pentatomomorpha and the Superfamily Pentatomoidea, generally referred to as pill bugs (Schuh & Weirauch, 2020). Plataspids consist of 12 genera and 44 species around the world (GBIF, 2026). This family is mainly confined to the tropics and subtropics; however, some species of the Genus *Coptosoma* inhabit the temperate Paleartic (Schuh & Weirauch, 2020). Plataspidae live gregariously in large groups, such as *Coptosoma lyncea*, which was observed on several broadleaf trees in one monsoon forest area in northern Australia (Monteith, 1982). Most species are found on the underside of leaves and other parts of plants. Other species may have close associations to other insects, such as *Tropidotylus* spp. which forms symbiotic relationships with the ant *Meranoplus mucronatus* (Maschwitz *et al.*, 1987). Plataspidae are primarily phloem feeders on trees or legumes, and some species may be mycetophagous (Schuh & Weirauch, 2020).

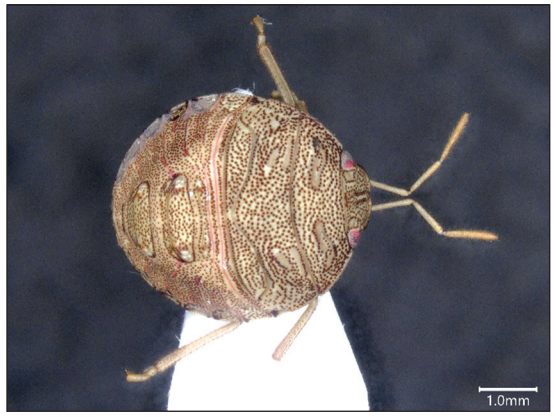
The pill bugs resemble beetles, having an oval or suborbicular shape and a strongly convex body. The scutellum is enlarged and covers almost the whole abdomen (Schuh & Weirauch, 2020). Most species are wider than long, with lengths ranging from 2 to 20 mm. The head is flattened and keeled, featuring prominent compound eyes and ocelli. The antennae consist of four segments and the tarsi have two segments. Wings are significantly longer than the body, while the hind wings are adapted to fold beneath the scutellum through transverse constrictions (Schuh & Weirauch, 2020).

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Note: Dorsal

Figure 3.303 Plataspidae sp.01 – HemHet305



Note: Dorsal

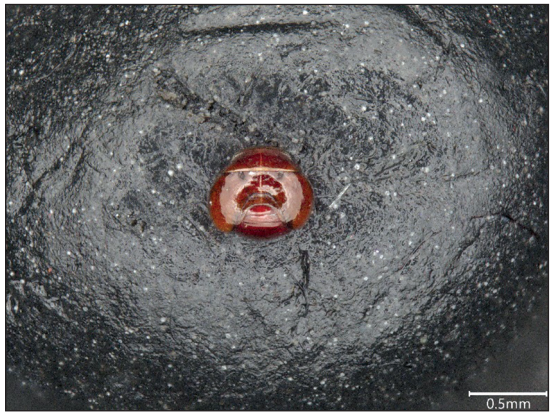
Figure 3.304 Plataspidae sp.02 – HemHet298



Note: (A) Dorsal and (B) Lateral

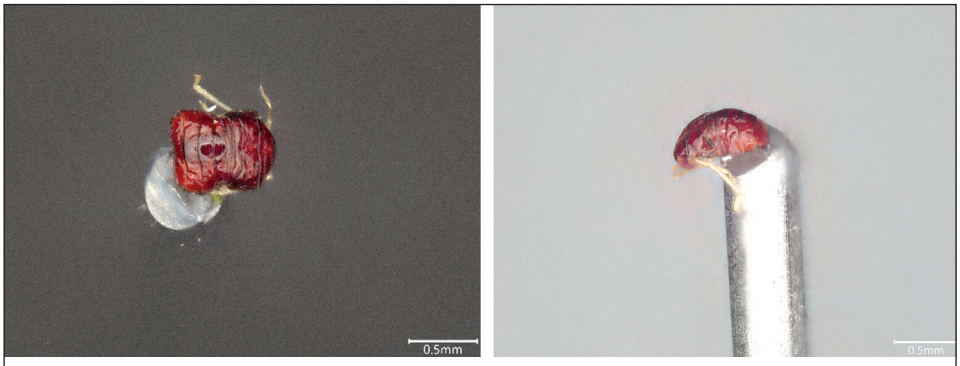
Figure 3.305 Plataspidae sp.03 – HemHet285

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.306 Plataspidae sp.04 – HemHet245



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.307 Plataspidae sp.05 – HemHet020

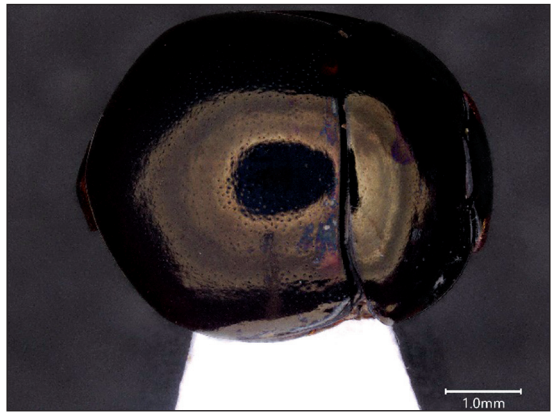


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.308 Plataspidae sp.06 – HemHet150

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.309 Plataspidae sp.07 – HemHet238



Note: Dorsal

Figure 3.310 Plataspidae sp.08 – HemHet247



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.311 Plataspidae sp.09 – HemHet180

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.312 Plataspidae sp.10 – HemHet179

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15. Family Reduviidae – *Assassin Bugs*



Rhynocoris annulatus (Hemiptera: Heteroptera: Reduviidae)

The Reduviidae, commonly known as assassin bugs, are a group of Heteroptera within the Infraorder Cimicomorpha and the Superfamily Reduvioidea (Schuh & Weirauch, 2020). This family comprises nearly 8,000 species in more than a thousand genera globally (GBIF, 2026). Reduviidae inhabit a variety of habitats, from forests, grasslands, and agricultural fields to human dwellings. This group can be found in vegetation, within leaf litter, under rocks and fallen logs, caves, animal nests, and settlements. For example, many species of the Subfamily Phytaminae are

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well camouflaged on vegetation, lying in wait for prey (Schuh & Weirauch, 2020). Other groups, including Emesinae, live in litter, under stones, or in living or dead vegetation, such as hanging ferns or palm fronds. Moreover, most species of the Subfamily Ectrichodiinae are nocturnal and inhabit leaf litter. Meanwhile, most species of the Subfamily Triatominae, another nocturnal group, are usually found in the nests of their hosts, such as rodents, chicken coops, thatched roofs of rustic buildings, or various dark places in more modern structures (Schuh & Weirauch, 2020; Louis, 1974). Additionally, some species of the Subfamily Triatominae can also be found in caves, hollow trees, palm fronds, under fallen logs, and in bromeliads (Schuh & Weirauch, 2020).

Reduviidae are exclusively predators. Both nymphs and adults feed on a variety of other insects, making them important to control pest populations in agricultural fields. However, some species are known to feed on the blood of vertebrates, including humans. This behavior is most notable in the Subfamily Triatominae, also known as kissing bugs (Gurgel-Gonçalves *et al*., 2021). Triatominae are the main vectors of Chagas disease, also known as American trypanosomiasis, is a potentially life-threatening illness caused by the protozoan parasite *Trypanosoma cruzi* (Eutsey *et al*., 2023). These kissing bugs feed on blood and can transmit the parasite to humans through their feces.

The remarkable features of Reduviidae are the elongated head and constricted space behind the eyes, giving the appearance of a neck-like structure (Schuh & Weirauch, 2020). Reduviids possess a distinctive, segmented proboscis (labium or rostrum) that is curved, short, and composed of only three segments, typically held beneath the body when not in use. The assassin bugs vary in size, generally small to large, with lengths ranging from 4 to almost 40 mm. Reduviids are varied in color, including black, brown, red, yellow, or other bright colors. The bodies are elongated and robust. Compound eyes are prominent, with two ocelli. Antennae frequently have filiform flagellomeres and rarely fusiform (Schuh & Weirauch, 2020). The legs are adapted to capture and hold onto struggling prey, such as in the group of Emesinae, which form a raptorial leg that extends well beyond the body, suited for grabbing prey from webs or preying on spiders (Wignall & Taylor, 2010).

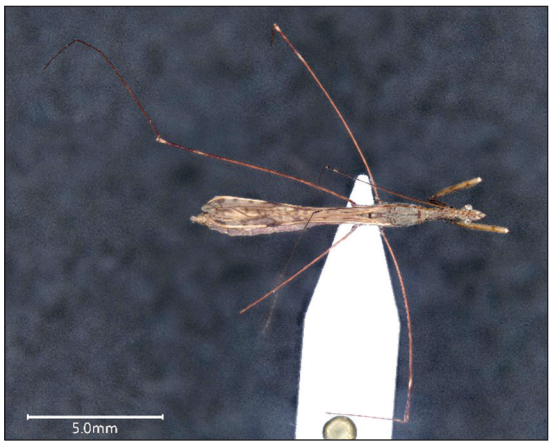
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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.313 *Ectomocoris* sp.01 – HemHet230



Note: Dorsal

Figure 3.314 *Emesaya* sp.01 – HemHet036



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.315 *Emesaya* sp.02 – HemHet216

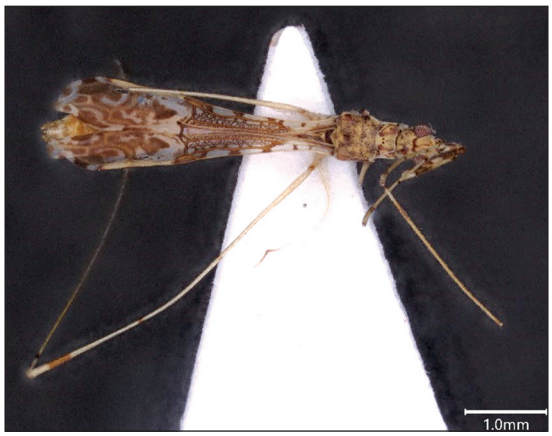
Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.316 *Empicoris* sp.01 – HemHet279



Note: Dorsal

Figure 3.317 *Empicoris* sp.02 – HemHet236



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.318 *Empicoris* sp.03 – HemHet101

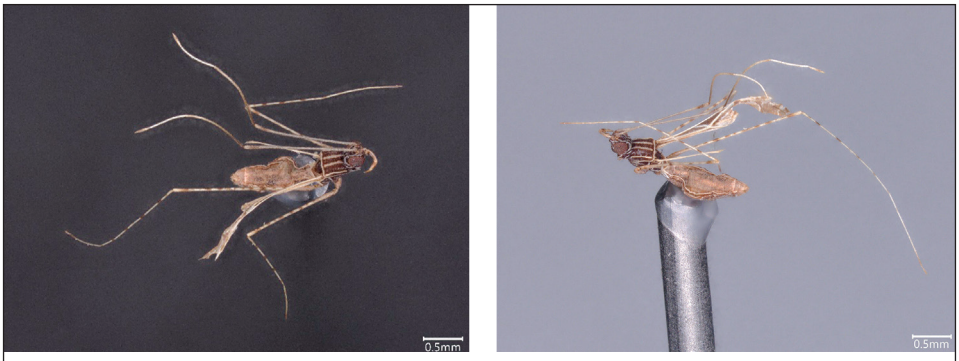
Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.319 *Empicoris* sp.04 – HemHet011



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.320 *Empicoris* sp.05 – HemHet049

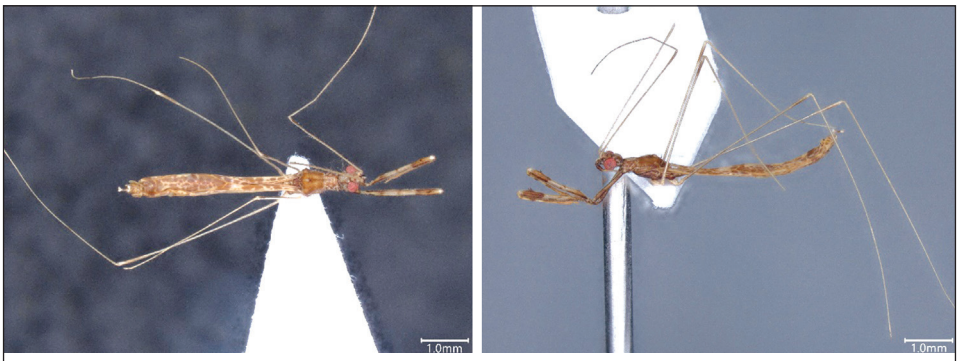


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.321 *Empicoris* sp.06 – HemHet055

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.322 *Empicoris* sp.07 – HemHet056



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.323 *Empicoris* sp.08 – HemHet082



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.324 *Empicoris* sp.09 – HemHet086

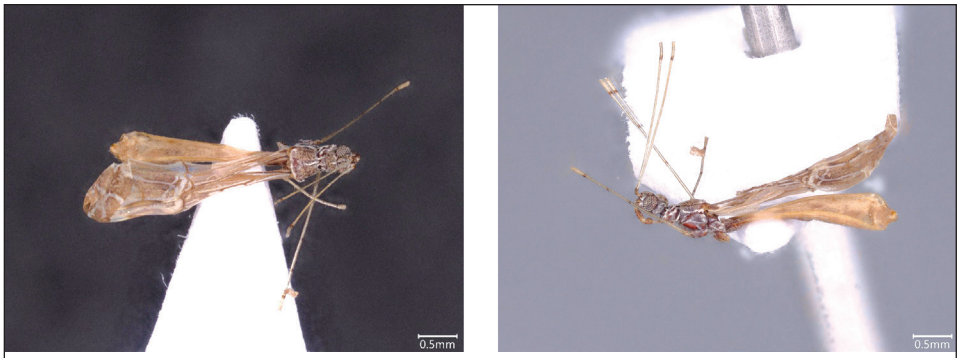
Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

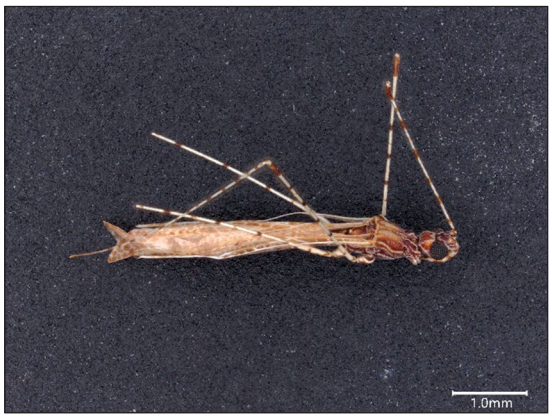
Figure 3.325 *Empicoris* sp.10 – HemHet119



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.326 *Empicoris* sp.11 – HemHet125



Note: Dorsal

Figure 3.327 *Empicoris* sp.12 – HemHet220

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Note: Dorsal

Figure 3.328 *Euagoras* sp.01 – HemHet102



Note: Dorsal

Figure 3.329 *Lisarda* sp.01 – HemHet033



Note: Dorsal

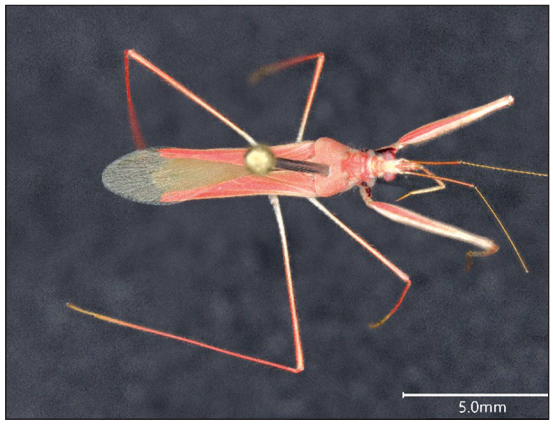
Figure 3.330 *Montina* sp.01 – HemHet145

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Note: (A) Dorsal and (B) Lateral

Figure 3.331 Emesinae sp.01 – HemHet111



Note: Dorsal

Figure 3.332 Emesinae sp.02 – HemHet063



Note: Dorsal

Figure 3.333 Hammacerinae sp.01 – HemHet064

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Note: Dorsal

Figure 3.334 Harpactorinae sp.01 – HemHet128



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.335 Harpactorinae sp.02 – HemHet068

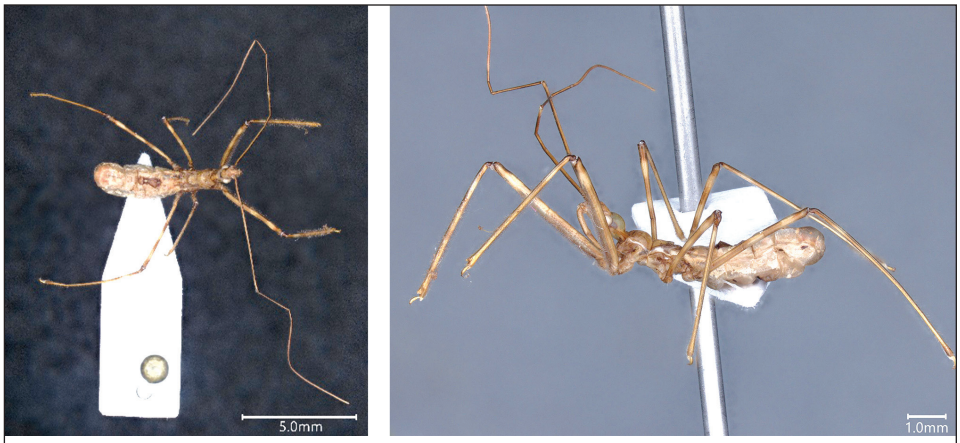


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.336 Harpactorinae sp.03 – HemHet018

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(A) (B)

Note: (A) Dorsal and (B) Lateral

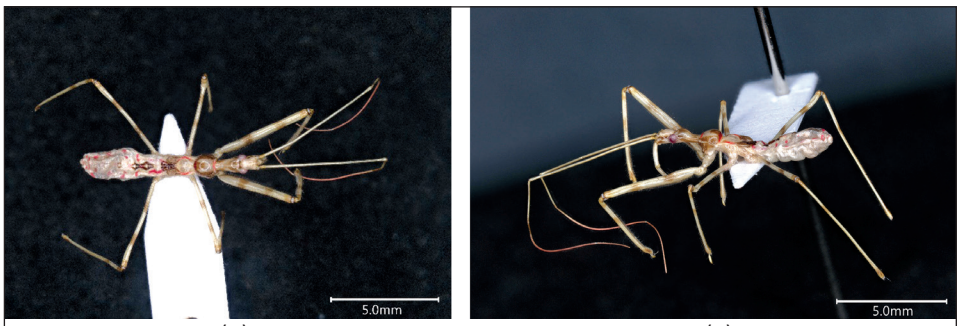
Figure 3.337 Harpactorinae sp.04 – HemHet158



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.338 Harpactorinae sp.05 – HemHet287



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.339 Harpactorinae sp.06 – HemHet199

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Note: Dorsal

Figure 3.340 Harpactorinae sp.07 – HemHet189



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.341 Harpactorinae sp.08 – HemHet278

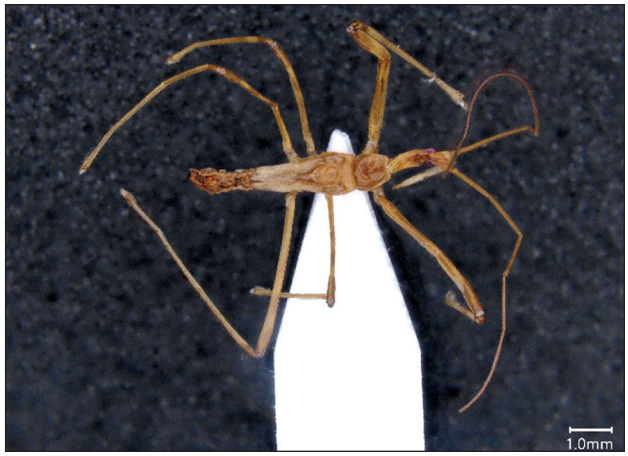


(A) (B)

Note: (A) Dorsal and (B) Lateral

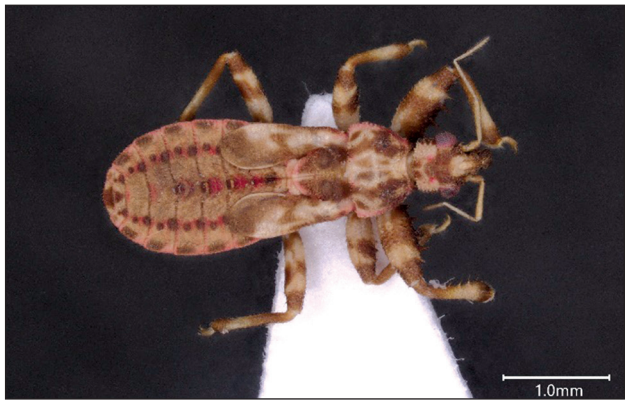
Figure 3.342 Harpactorinae sp.09 – HemHet148

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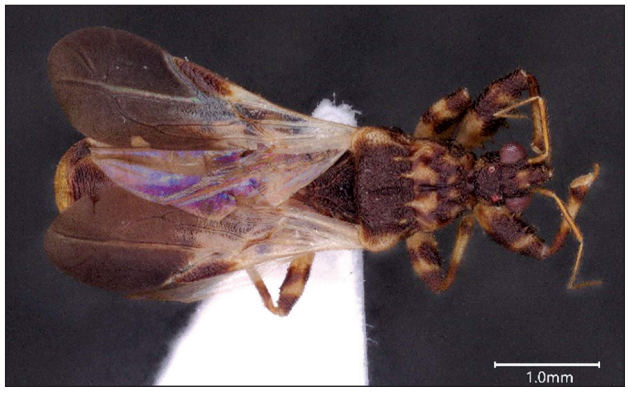
Note: Dorsal

Figure 3.343 Harpactorinae sp.10 – HemHet217



Note: Dorsal

Figure 3.344 Harpactorinae sp.11 – HemHet254



Note: Dorsal

Figure 3.345 Harpactorinae sp.12 – HemHet253

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Note: Dorsal

Figure 3.346 Harpactorinae sp.13 – HemHet303



Note: Dorsal

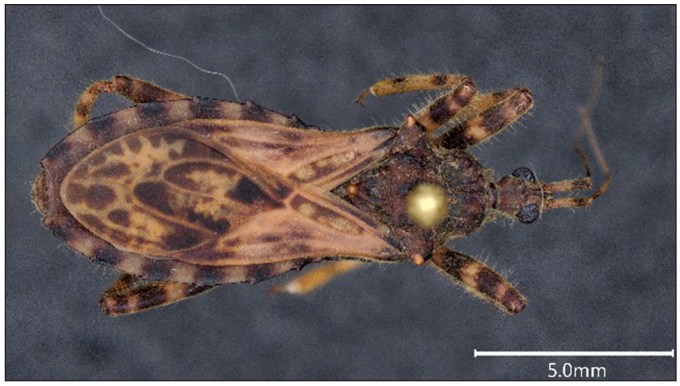
Figure 3.347 Harpactorinae sp.14 – HemHet154



Note: Dorsal

Figure 3.348 Harpactorinae sp.15 – HemHet301

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Note: Dorsal

Figure 3.349 Harpactorinae sp.16 – HemHet161



Note: Dorsal

Figure 3.350 Harpactorinae sp.17 – HemHet190



Note: (A) Dorsal and (B) Lateral

Figure 3.351 Holoptilinae sp.01 – HemHet170

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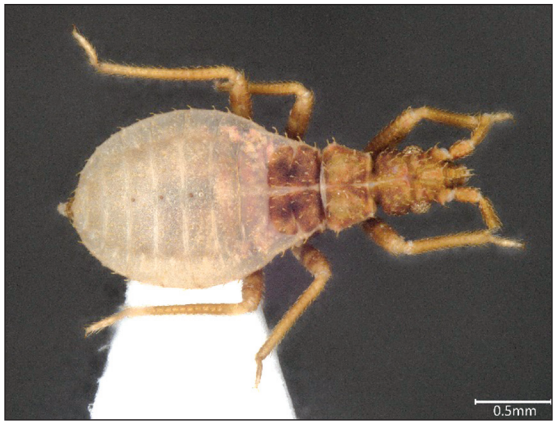
Note: Dorsal

Figure 3.352 Holoptilinae sp.02 – HemHet264



Note: Dorsal

Figure 3.353 Peiratinae sp.01 – HemHet185



Note: Dorsal

Figure 3.354 Physoderinae sp.01 – HemHet164

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.355 Physoderinae sp.02 – HemHet260



Note: Dorsal

Figure 3.356 Reduviidae sp.01 – HemHet256

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16. Family Rhyparochromidae – *Dirt-colored Seed Bugs*



Rhyparochrominae sp. (Hemiptera: Heteroptera: Rhyparochromidae)

The Rhyparochromidae, generally referred to as seed bugs, are a group of Heteroptera under the Infraorder Pentatomomorpha and the Superfamily Lygaeoidea (Schuh & Weirauch, 2020). This family comprises 2,197 species from 434 genera worldwide (GBIF, 2026). Rhyparochromids only consist of two subfamilies, Rhyparochrominae and Plinthisinae (Schuh & Weirauch, 2020). This group occurs in many types of habitats, particularly areas with abundant seeds and vegetation, including forests, grasslands, and agricultural fields. Most species inhabit leaf litter, living plants, and under rocks or logs. Additionally, *Laticlerada monteithi* and *Laticlerada nidicola* (Rhyparochrominae: Cleradini) live in the nest of the ringtail possum, *Pseudocheirus peregrinus*, while *Cligenes subcavicola* (Rhyparochrominae: Antillocorini) lives in

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caves (Schuh & Weirauch, 2020). The name "seed bug" suggests a singular diet, which primarily feeds on mature seeds. Some species dwell on the ground, feeding on fallen seeds, while others live in the forest canopy, climbing vegetation when mature seeds are accessible. For example, species of *Cnemodus* (Rhyparochrominae: Myodochini) feed on *Pinus* spp. (Pinaceae) seeds in the southeastern United States (Wheeler Jr. & Stoops, 2010) and also on fig in Mexico (Peredo & Gámez-Virués, 2005). However, some species of *Lipostemmata* (Rhyparochrominae: Lethaeini) feed on the leaf tissue of the aquatic fern *Salvinia auriculata* (Pteridophyta: Salviniaceae) (Baranowski & Bennett, 1979), while the group of Cleradini feed on the blood of *Pseudocheirus peregrinus* (Schuh & Weirauch, 2020).

The majority of rhyparochromids are myrmecomorphic, which mimics ants by morphology. The bodies are generally elongated, ranging from less than 2 to 20 mm. Most species are dull-colored, either brown or black, with contrasting pale or white spots or mottled patterns. The head is relatively broad, with prominent compound eyes and four segmented antennae. Forefemora are typically enlarged and spinose, give a raptorial appearance. Those structures are used either for holding and manipulating seeds or for aiding in dragging through enclosed spaces (Schuh & Weirauch, 2020).

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.357 Rhyparoclava sp.01 – HemHet271



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.358 Rhyparochrominae sp.01 – HemHet054



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.359 Rhyparochrominae sp.02 – HemHet021

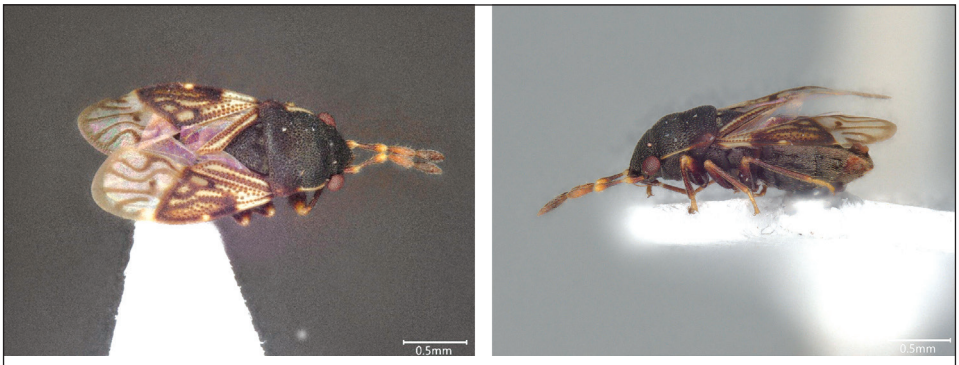
Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.360 Rhyparochrominae sp.03 – HemHet069



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.361 Rhyparochrominae sp.04 – HemHet087



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.362 Rhyparochrominae sp.05 – HemHet123

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(A) (B)

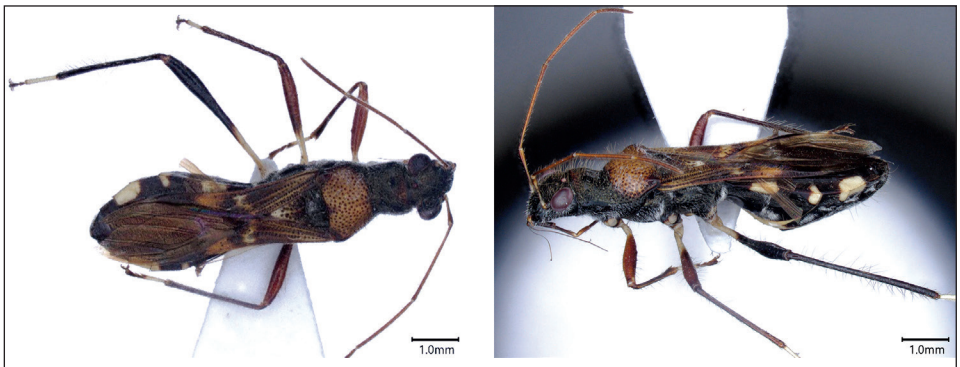
Note: (A) Dorsal and (B) Lateral

Figure 3.363 Rhyparochrominae sp.06 – HemHet132



Note: Dorsal

Figure 3.364 Rhyparochromidae sp.07 – HemHet146



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.365 Rhyparochrominae sp.08 – HemHet218

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.366 Rhyparochromidae sp.09 – HemHet272



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.367 Rhyparochrominae sp.10 – HemHet235



Note: Dorsal

Figure 3.368 Rhyparochromidae sp.11 – HemHet226

Buku ini tidak diperjualbelikan.



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.369 Rhyparochromidae sp.01 – HemHet071



Note: Dorsal

Figure 3.370 Rhyparochromidae sp.02 – HemHet267



Note: Dorsal

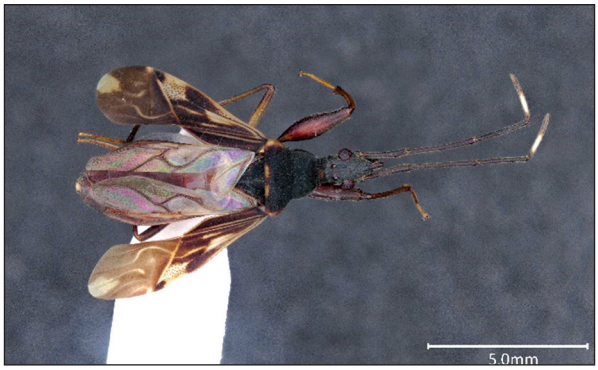
Figure 3.371 Rhyparochromidae sp.03 – HemHet281

Buku ini tidak diperjualbelikan.



Note: Dorsal

Figure 3.372 Rhyparochromidae sp.04 – HemHet291



Note: Dorsal

Figure 3.373 Rhyparochromidae sp.05 – HemHet233

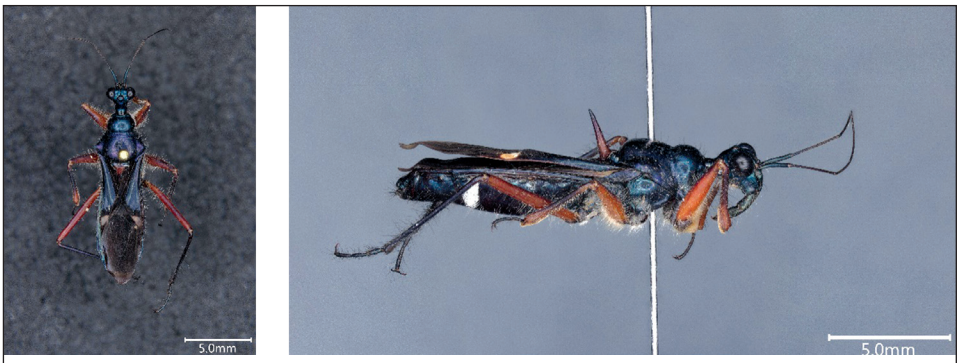


(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.374 Rhyparochromidae sp.06 – HemHet121

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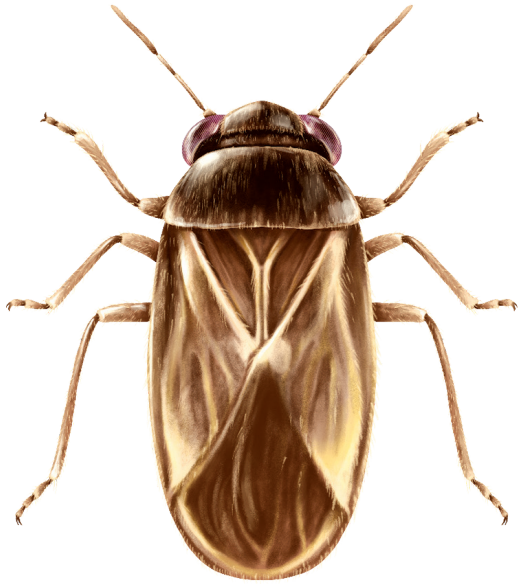
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.375 Rhyparochromidae sp.07 – HemHet012

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17. Family Schizopteridae – *Minute Litter Bugs*

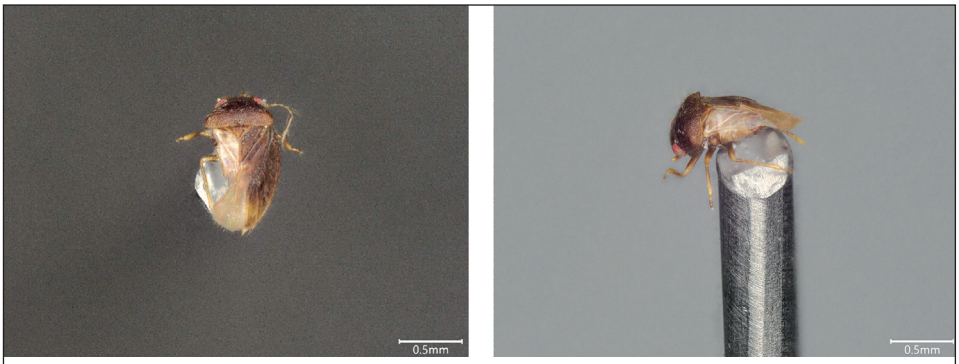


Schizopteridae (Hemiptera: Heteroptera: Schizopteridae)

The Schizopteridae are a group of Heteroptera within the Superfamily Dipsocoroidea. This family is generally referred to as minute litter bugs, along with other families of the Infraorder Dipsocoromorpha. Schizopteridae consist of 67 genera and 459 species (GBIF, 2026), distributed globally but with highest diversity in the tropics and australian regions. There are also a few species in northern Africa and Asia, including Egypt, Japan, and China. Schizopteridae usually inhabit ground and litter dwellings with high humidity, such as leaf litter, under bark and logs, within moss, and in other concealed microhabitats. Some species, however, are also found in low herbaceous vegetation (Schuh & Weirauch, 2020). The diet of the Schizopteridae is not well-documented, but is believed to include plant matter, fungi, and possibly other tiny invertebrates or detritus.

The Schizopteridae have a beetle-like appearance and often resemble intertidal dwarf bugs, Omaniidae. This group can be distinguished by its very small size, ranging from 0.3-3.0 mm, with a compact and rotund body shape (Schuh & Weirauch, 2020). Most species are black, while a few are light to dark brown. The head is small, and the compound eyes can vary from relatively small to large. Ocelli are sometimes present and sometimes absent in adults. The antennae are very short in segments 1 and 2, which are nearly equal in length. In some species, forewings have a coleopteroid appearance (Schuh & Weirauch, 2020).

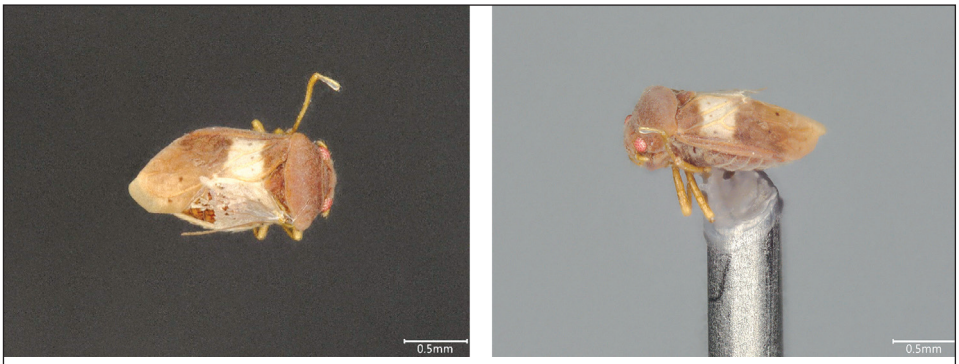
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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.376 Schizopteridae sp.01 – HemHet022



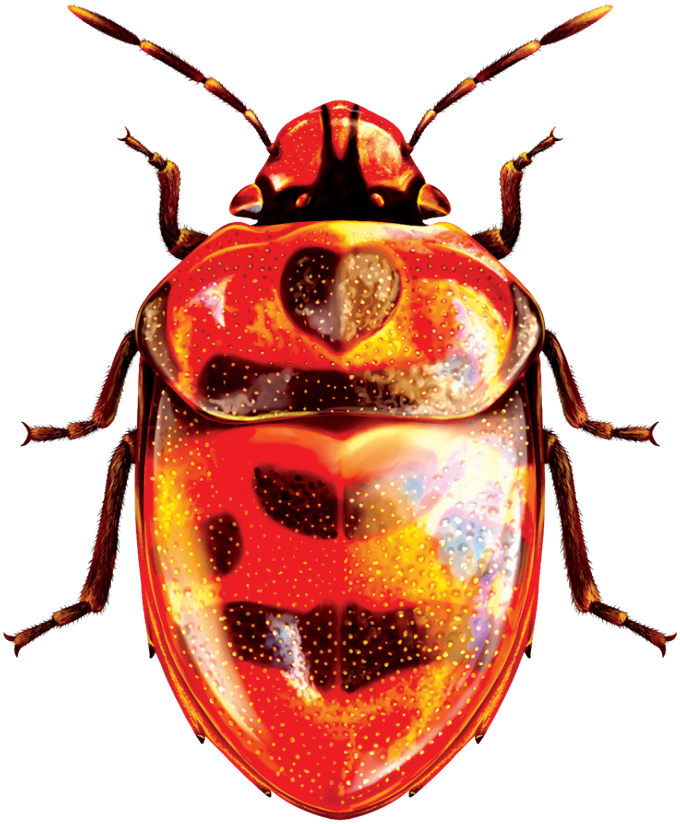
(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.377 Schizopteridae sp.03 – HemHet046

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18. Family Scutelleridae – *Jewel Bugs*



Schizopteridae (Hemiptera: Heteroptera: Schizopteridae)

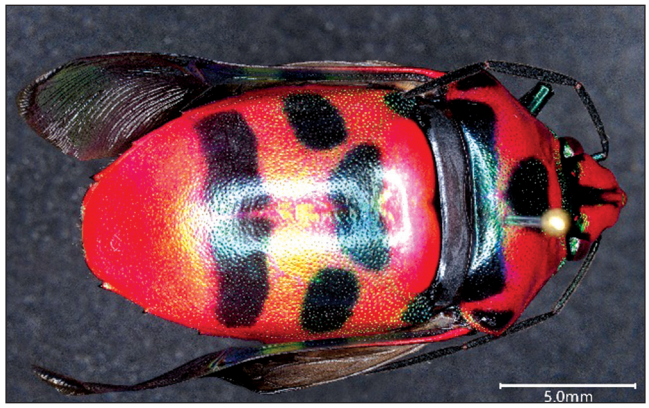
The Scutelleridae are a group of Heteroptera within the Infraorder Pentatomomorpha and the Superfamily Pentatomoidea. In North America, Scutelleridae are known as shield bugs, even though this name is also common for the Pentatomidae (Schuh & Weirauch, 2020). Scutelleridae are also called jewel bugs due to their striking coloration compared to other heteropterans. This family comprises 201 species from 56 genera worldwide (GBIF, 2026). Scutelleridae are distributed across all faunal regions, but mostly inhabit tropical and subtropical regions (Schuh & Weirauch, 2020). Most species are found on the plant surface, often associated with flowering plants, grasses, and shrubs. One species, *Tectocoris diophthalmus*, has a distinctive behavior, which is egg guarding by females to protect from predators (Giffney & Kemp, 2014). Most Scutelleridae are plant feeders. Some species are generalist feeders, while others are specialists, exhibiting a preference for specific plant families

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or even individual plant parts like seeds or fruits. The majority of Scutelleridae is associated with Euphorbiaceae, while a few species feed on Lamiaceae, Malvaceae, and Casuarinaceae. For example, some species of *Eurygaster* are well-known as grass-feeding species that negatively affect agricultural crops, such as barley and wheat (Syromyatnikov *et al*., 2017; Gul *et al*., 2006). Another species, *Austrotichus rugosus*, feeds specifically on the seed of *Allocasuarina*, which is a plant endemic to Australia (Cassis & Vanags, 2006). In India, the nymphs and adults of *Cantao ocellatus* feed on the fruits of *Mallotus repandus* (Patel *et al*., 2024). Moreover, besides being herbivorous, a few species of scutellerids feed on decomposing snakes and carrion fish (Panizzi & Gracia, 2015; Chérot *et al*., 1998).

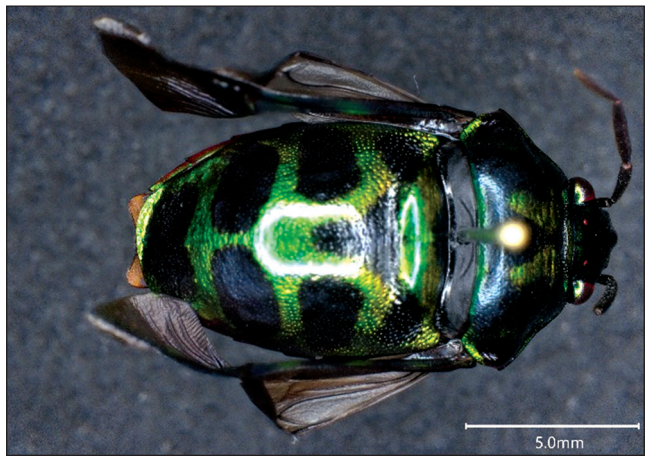
Scutelleridae have a beetle-like appearance and look similar to stink bugs (Pentatomidae). Scutelleridae are characterized by an expanded and convex scutellum that is shield-like and covers almost the entire abdomen and wings, hence the name shield bugs. Many species, especially tropical species, are brightly colored with metallic markings, usually striking combinations of contrasting red, blue, orange, and yellow. Other species, however, may be dull brown or green that blend seamlessly with the foliage. The bodies are oval to elongated, ranging from 5 to 20 mm in length. The head is dorsally triangular with prominent compound eyes. The antennae are typically five-segmented, sometimes three or four in a few species, while tarsi have three segments (Schuh & Weirauch, 2020). The membrane of the hemelytra often features numerous veins. Similar to other groups, scutellerids can emit a stinky odor from glands on the sides of the thorax to defend predators (de Melo *et al*., 2020).

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Note: Dorsal

Figure 3.378 *Chrysocoris iris* – HemHet104



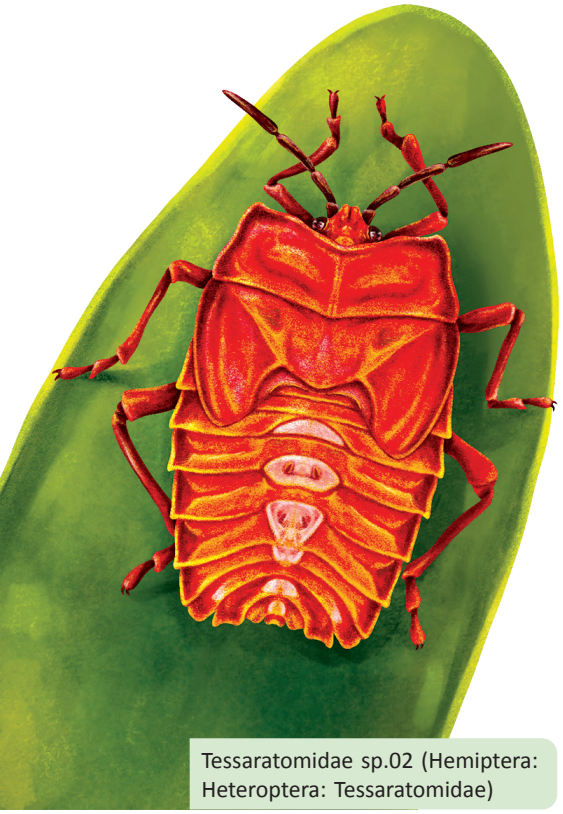
Note: Dorsal

Figure 3.379 *Chrysocoris stollii* – HemHet019

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19. Family Tessaratomidae – *Tessaratomid Bugs*

Tessaratomidae, a family of Heteroptera with no specific common name, is a group within the Infraorder Pentatomomorpha and the Superfamily Pentatomoidea (Schuh & Weirauch, 2020). Tessaratomid bugs are widely distributed in the tropics and subtropics, comprising 60 genera and 265 species (GBIF, 2026). Many species inhabit areas with diverse plants, including forests, woodlands, and agricultural fields, which can provide food and ideal habitats. Tessaratomidae can be found on the plant surface, particularly on the host plant. Nymphs are usually in bright color and tend to form aggregations (Schuh & Weirauch, 2020). Similar to other pentatomoids, females of the *Pygoplatys* (Tessaratomidae: Tessaratominae) provide egg guarding and transportation of first instar nymphs (Gogala *et al.*, 1998). The majority of Tessaratomidae are phytophagous. Many species feed on cultivated crops. For example, *Tessaratoma javanica* (Tessaratomidae: Tessaratominae) attacks litchi/lychee crops (*Litchi chinensis*) in India, causing high economic losses (Parveen *et al.*, 2015; Choudhary *et al.*, 2013). In Africa, the edible tessaratomid, *Encosternum delegorguei* (Tessaratomidae: Natalicolinae) feeds on *Combretum* spp. (Combretaceae) and *Peltophorum africanum* (Fabaceae) (Dzerefos *et al.*, 2009). It is commonly used as an alternative protein source in the diet of cichlid fish, *Oreochromis mossambicus*, in South Africa (Nephale *et al.*, 2023), as well as a traditional food for some ethnic groups in northeastern South Africa and southern Zimbabwe (Dzerefos *et al.*, 2014).



Tessaratomidae sp.02 (Hemiptera: Heteroptera: Tessaratomidae)

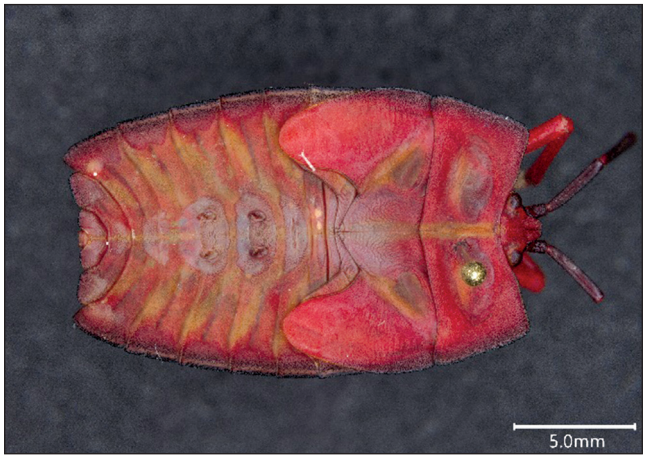
Tessaratomidae are relatively large, typically more than 15 mm in body length. The bodies are robust, elongated to ovoid, rectangular, and flattened in some species. The head is triangular and relatively small compared to the body, with prominent compound eyes. Antennae comprise 4 segments, sometimes 5 segments, while tarsi are 2 to 3 segments. Tessaratomids generally possess six pairs of abdominal spiracles, with the second segment being prominently exposed, different from other Pentatomoidea (Schuh & Weirauch, 2020).

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Note: Dorsal

Figure 3.380 Tessaratomidae sp.01 – HemHet153

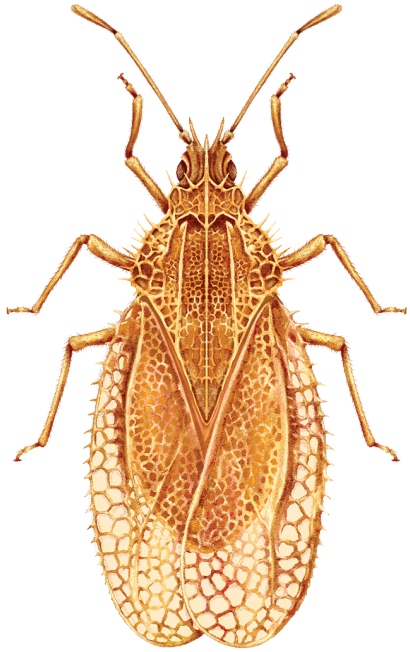


Note: Dorsal

Figure 3.381 Tessaratomidae sp.02 – HemHet203

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20. Family Tingidae – *Lace Bugs*



Tinginae sp. (Hemiptera: Heteroptera: Tingidae)

The Tingidae, commonly known as lace bugs, are a group of Heteroptera within the Infraorder Cimicomorpha and the Superfamily Miroidea (Schuh & Weirauch, 2020). This family consists of 2,899 species from 345 genera around the world (GBIF, 2026). Similar to other hemipterans, Tingidae are abundant in tropical and subtropical regions. Many species inhabit forests, grasslands, and agricultural fields, which mostly found on the host plant, understory, and leaf litter. The majority of Tingidae are free-living, particularly nymphs which usually gregarious. Females of *Gargaphia decoris*, exhibit egg guarding, which is controlled by juvenile hormone (Guidoti *et al*., 2015). Meanwhile, other species in the Subfamily Vianaidinae are myrmecophilous, such as *Anommatocoris coleoptratus*, which inhabits the nest of *Acromyrmex lundi* (Schuh & Weirauch, 2020; Kormilev, 1955). Lace bugs are phytophagous, usually feeding on the undersides of leaves, sometimes on the roots, stems, or pollen (Schuh & Weirauch, 2020). Most species feed on angiosperms and dicotyledonous plants, while a few species feed on monocotyledonous plants. For example, in Australia, *Nethersia* feeds on phyllodinous *Acacia* spp. (Cassis *et al*., 2017), *Inoma* on *Lamiales* (Cassis & Symonds, 2008), and *Epimixia* on Casuarinaceae (Cassis *et al*., 2019).

Tingidae are identified by their intricately ornate pronotum and forewings, which feature a delicate and complicated network that resembles a lace-like structure. Lace bugs are small heteropterans, typically ranging from 2 to 8 mm in length. The body shapes are varied, sometimes ovoid, slender, or flattened. The head varies from short to elongate, with small compound eyes and a lack of ocelli. Some parts of the body, such as the dorsum and hemelytra, highly punctate and bulbous (Schuh & Weirauch, 2020).

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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.382 Tinginae sp.01 – HemHet163



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.383 Tinginae sp.02 – HemHet077



Note: Dorsal

Figure 3.384 Tinginae sp.03 – HemHet039

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(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.385 Tinginae sp.04 – HemHet013



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.386 Tinginae sp.05 – HemHet040



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.387 Tinginae sp.06 – HemHet072

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(A) (B)

Note: (A) Dorsal and (B) Lateral

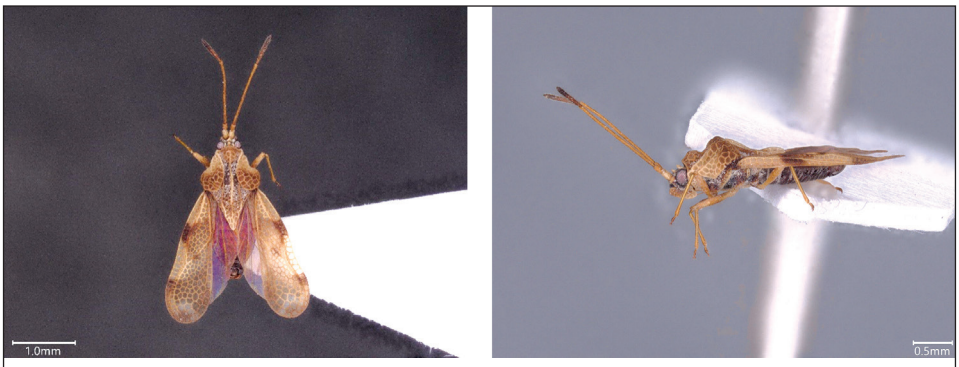
Figure 3.388 Tinginae sp.07 – HemHet129



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.389 Tinginae sp.08 – HemHet149



(A) (B)

Note: (A) Dorsal and (B) Lateral

Figure 3.390 Tinginae sp.09 – HemHet157

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(A) (B)

Note: (A) Dorsal and (B) Lateral

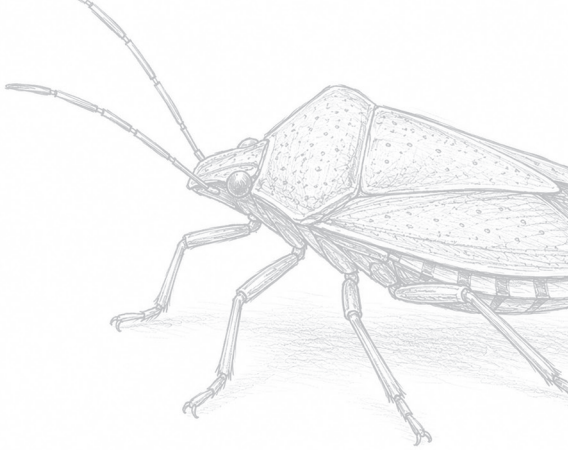
Figure 3.391 Tinginae sp.10 – HemHet182



Note: Dorsal

Figure 3.392 Tinginae sp.11 – HemHet280

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CHAPTER IV

EPILOGUE

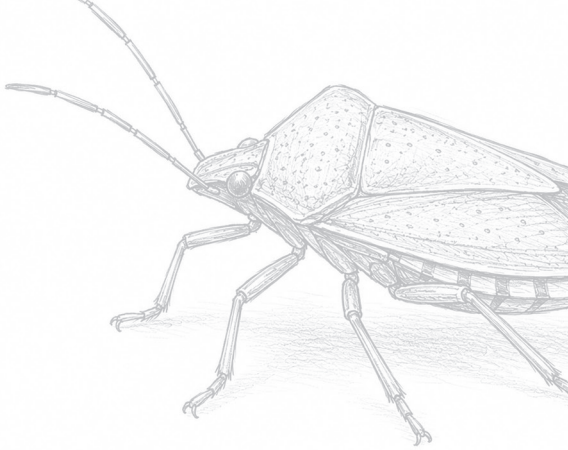
Hemiptera are an ecologically highly important arthropod taxon. They link energy channels of plants with those of various vertebrates and invertebrates by feeding on plant phloem or seeds and either exuding honeydew or being preyed upon. Hemiptera also heavily influence agricultural production by feeding on plants we use for feed and fiber, as well as transmitting viral or bacterial diseases while boring into host plant structures. Worldwide, more than 100,000 species of Hemiptera are described, with Indonesia contributing only slightly over 1,000 species. This number is very unlikely to represent the true diversity of Hemiptera in Indonesia.

In this book, we showcase almost 400 morphospecies from a very spatially and methodologically limited collection, of which only about 2% of the morphospecies were assigned described species. If this ratio of known species to unknown species from our collection can be applied to the entire country, there could be as many as 50,000 species of Hemiptera in Indonesia, if not more. This book thus highlights the urgent need for intensified taxonomic work on Hemiptera (and others) in Indonesia. Not to fulfill basic scientific curiosity alone, but to be able to begin studying the biology and ecology of local and regional Hemipterans, without which it is quite impossible to understand how they impact human needs in agriculture or conservation.

This book represents a first step into that direction by showcasing almost 400 species of Hemiptera from a local collection in Jambi Province, Sumatra, Indonesia. May this book be an inspiration for future scientists to collect Hemiptera in other regions, cross-reference collections and start describing species to enable a better understanding of the intricate links between their world and ours in future.

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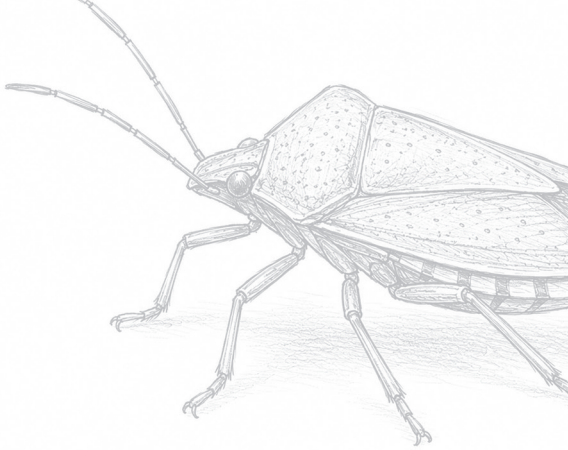
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GLOSSARY

Acus, or aculeus	:	A sting, prickle, or spine
Alary	:	Related to wings, particularly the muscles needed to operate them
Antennal flagellum	:	Group of segments at the end of the antennae, which separate from the other five basal peduncle segments by a distinct bend
Apterous	:	Wingless
Aristoid	:	Related to the antennae, particularly the form of antennal flagellum which is hair-like
Brachypterous	:	Short or reduced wings and incapable of flight
Carinae (plural)	:	An external ridge or keel of the integument, usually as a raised line; carina (noun), carinate (adjective)
Chorion	:	The outer shell of the egg for protection and waterproofing
Claval	:	A vein in clavus
Clavus	:	The hard part of forewing, which is a narrow strip next to the scutellum
Cuneus	:	An irregular triangle-shaped region at the tip of the leathery portion of the forewing, primarily found in the Miridae
Dimorphism	:	Having two forms related to two different genetic variations, such as the color and size of a species in the same population
Distal reticulate venation	:	Vein formations located far away from the center
Ductus seminis / seminalis	:	A secretory duct, typically narrow and membraneous which the sperm are discharged

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Eclosion	:	The process of an insect emerging from its pupal case or hatching from an egg
Femur (singular)	:	The third segment of Hemiptera leg between the trochanter and tibia which is often thicker and stouter than other segments; femora (plural)
Genopore	:	A genital pore or an opening where eggs and sperm are released
Geophilous	:	Organisms that live on or within the soil.
Haematophagous	:	Feeding on blood
Hemelytron (singular)	:	Modified forewings for flight with the thickened basal half and membranous distal half; hemelytral (plural)
Kleptoparasites	:	Organisms that steal food or other resources gathered by another organism, typically from a different species
Labium (singular)	:	A lower mouthpart of hemipteran that is formed by the second pair of maxillae joined in the middle line, which functions in grasping, manipulating, and retaining food; labia (plural)
Lacerate-flush feeders	:	A feeding mechanism that involves repeatedly inserting and with drawing the stylet into plant tissue where the cells pierced by the stylets are liquefied, and then using saliva to flush the ruptured cell contents into the sucking mouthpiece for ingestion
Lobes	:	Part of the body with rounded projections
Macropterous	:	Long wings and usually capable of flight
Mandible	:	Paired jaws or appendages near the mouthpart that are used to grasp, cut, or crush food, and can also be used to against predators
Maxilla (singular)	:	Paired pincers behind the mandibles that are used to hold and manipulate food so that the mandibles can cut and crush it; maxillae (plural)
Mycetophagous	:	Feeding on fungi
Myrmecomorphic	:	Hemipterans that mimic the morphology and behavior of ants
Nodal flexion	:	The lines of the wings, which are formed of short segments, and can allow for flexibility during flight

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Ocellus (singular)	:	Simple eyes located on the top of the head as sensors of ambient light intensity; ocelli (plural)
Paramere	:	Side parts of the external reproductive organs of male
Pedicel	:	A large globular structure on the second segment of the antenna (stem) between the scape/scapus and flagellum that contains sensory cells (Johnston's organ)
Phallus	:	Male genitalia organ where the genopore is located or terminal portion of the ejaculatory duct
Polymorphism	:	Having multiple forms, refers to variation in genetically determined traits, such as color and the number of attributes within a single species
Prognathous	:	Forward-projecting mouthparts
Pronotum	:	A prominent plate-like structure behind the head that covers the dorsal surface of the thorax
Rostrum	:	The piercing mouthparts projected from the heads of hemipteran, also known as the beak, consists of four segments
Scutellum	:	The triangular thorax plate which is located behind the pronotum and between the forewing bases
Spinose	:	Having spines or thorns, usually on the legs of hemipterans
Spiracles	:	Respiratory openings located along the thorax and abdomen of hemipterans
Spitte	:	Spittle, saliva; producing when air enters the ventral abdominal channel and is expelled posteriorly through a coating of anal excreta, resulting in the formation of bubbles
Sternum, or sternite	:	The ventral plate of abdomen which closes the exoskeleton of each thoracic segment
Stylet	:	One part of the sucking mouthparts, which are modified in tubular shape and have a hard, slender, and flexible structure
Sulcus	:	A deep groove or suture that creates the frontal ridge at the margin of sclerites or between segments
Tarsomere	:	Any individual segment of the tarsus

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Tarsus (noun)	:	The last section of the leg, which typically has five segments called tarsomeres with one or two claws at the end; tarsi (plural), tarsal (adjective)
Tentorium	:	Internal skeleton of the head capsule of Hemiptera
Tegmen (singular)	:	The thickened forewings, which can be used to protect the delicate hindwings; tegmina (plural)
Tergite	:	A subdivision of a definitive tergum or one of several sclerites in the dorsum of a body segment
Tergum, or notum	:	The dorsal sclerotization of a body segment, particularly in the thorax
Tibia	:	The fourth segment of Hemiptera's leg, which is located between the femur and tarsus
Trichobothrium (singular)	:	Filiform sensory hairs to respond to air movements which can be found on the head, antennae, abdomen, or legs of a hemipteran; trichobothria (plural)
Tymbal	:	Modified parts of the exoskeleton which used to produce sounds in Hemiptera species
Zoophagous	:	Feeding on other animals (carnivorous)

ABOUT AUTHORS



KASMIATUN is an entomology researcher in the Plant Protection Division of the Indonesian Oil Palm Research Institute (IOPRI). She began her career as researcher in the oil palm plantation since July 2025. Prior to this role, Kasmiatun was actively involved as research assistant for seven years in EFForTS project, a collaborative research between Indonesia and Germany. She started her research career in 2018, the same year she obtained her Bachelor's degree in Agriculture from the Department of Plant Protection, Faculty of Agriculture, IPB University. Her undergraduate thesis, conducted as part of the EFForTS project, focused on the diversity and species composition of click beetles (Coleoptera: Elateridae) across four land use systems in Jambi, Sumatra. Since then, she has remained consistently engaged in research and continues to contribute to scientific publications. Her deep interest in insects drives her commitment to supporting fundamental research in Indonesia, particularly in the field of entomology, taxonomy, and insect ecology.



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BONAULI PAKPAHAN is an illustrator who lives and works in Jambi Province, Indonesia. His distinctive personal style is concerned with fine art, digital art, surrealism, organic forms in the natural world, and expresses the vibrant spirit. Naturally, he was drawn to painting by self-taught and the interest was cultivated during his childhood. Throughout his life, he has always been fascinated by images and how the world is represented through the eyes of painted. In March 2022, he joined the EFForTS project as a spider illustrator in the subproject Z02 which is assigned to the monitoring of aboveground biodiversity along the land-use change gradient studied in EFForTS.

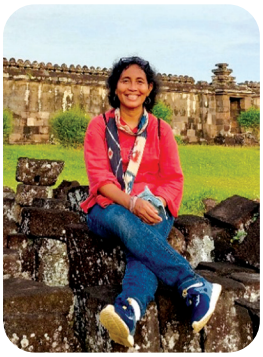


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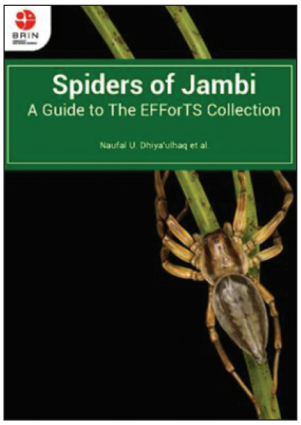
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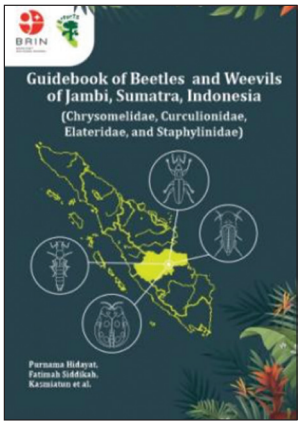
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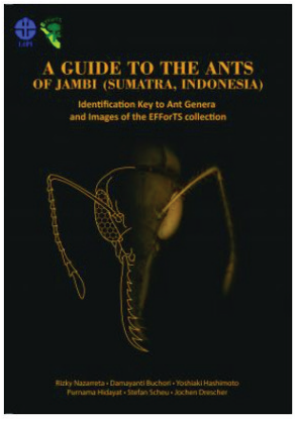
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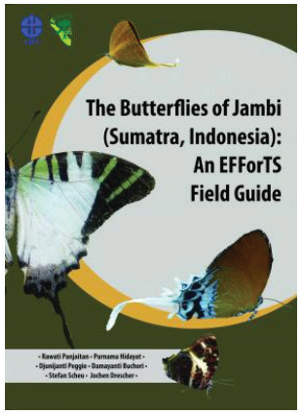
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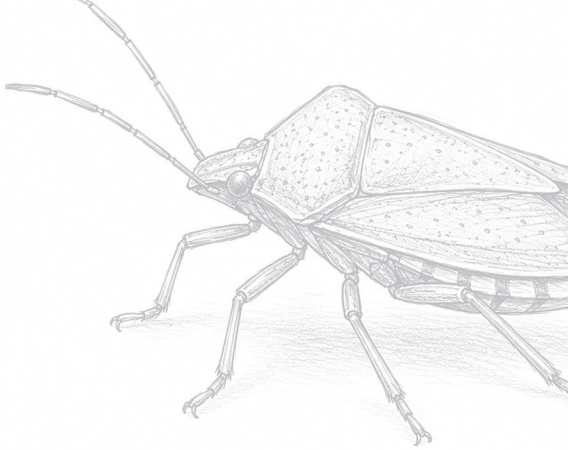
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Tropical rainforest canopies in Sumatra harbor vast, yet largely undocumented, biodiversity. While studies on vertebrates have guided regional land management, insects—especially canopy-dwelling Hemiptera—remain critically understudied despite playing vital ecological roles as pollinators, herbivores, predators, and prey.

Hemiptera in the Canopy of Lowland Rainforest and Agroforest Systems in Jambi, Sumatra presents a photographic and taxonomic overview of Hemiptera collected via canopy fogging across rainforests, jungle rubber, and monoculture plantations in Jambi Province. Focusing on two major suborders, Heteroptera (true bugs) and Auchenorrhyncha (cicadas, leafhoppers, treehoppers, planthoppers, and spittlebugs), this book documents nearly 400 morphospecies across 33 families with detailed habitat distribution records and high-resolution imagery.

Developed under the collaborative Indonesian-German EFForTS project, this book bridges a significant taxonomic gap in tropical entomology. It serves as an essential identification guide and scientific baseline for entomologists, ecologists, agricultural scientists, and students dedicated to insect conservation and biodiversity research in Southeast Asia.

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