https://doi.org/10.17576/serangga-2025-3003-14

SPECIES COMPOSITION AND ABUNDANCE OF LEAF BEETLES (COLEOPTERA: CHRYSOMELIDAE) IN SUAQ BALIMBING, GUNUNG LEUSER NATIONAL PARK, SOUTH ACEH, INDONESIA

Citra Dara Mutia, Alia Rizki*, Zuriana Siregar, Syaukani Syaukani & Dalil Sutekad
Department of Biology,
Faculty of Mathematics and Natural Sciences,
Universitas Syiah Kuala, Banda Aceh, Indonesia.
*Corresponding author: *alia_rizki@usk.ac.id*

Received: 22 July 2025; Accepted: 10 November 2025; Published: 15 December 2025

ABSTRACT

Study on leaf beetle (Coleoptera: Chrysomelidae) abundance at Suaq Balimbing Research Station aimed to identify and analyze species abundance patterns. Specimens were collected through exploratory surveys with direct observation along trail transects measuring 1000-1500 meters in length and five meters in width. A total of 260 individuals belonging to 30 genera and 45 species within four subfamilies were identified. The community was strongly dominated by Galerucinae (77.3%), while Eumolpinae, Cassidinae, and Criocerinae were comparatively less represented, contributing 10.4%, 9.6%, and 2.7% of the overall abundance. We documented 260 individuals representing 30 genera and 45 species, classified into four subfamilies. Galerucinae was the most abundant subfamily with 201 individuals, accounting for 77.3% of total abundance in the study area, followed by Eumolpinae (10.4%), Cassidinae (9.6%), and finally Criocerinae (2.7%). The highest species abundance was represented by *Acrocrypta aureipennis* (16.54%) and *Pseudosastra sulcicollis* (15%). These leaf beetle abundance data provide baseline information for ecological monitoring and conservation in the area.

Keywords: Leaf beetle; Chrysomelidae; abundance; Suaq Balimbing Research Station; diversity

ABSTRAK

Kajian kelimpahan kumbang daun (Coleoptera: Chrysomelidae) di Stesen Penyelidikan Suaq Balimbing bertujuan untuk mengenalpasti dan menganalisis corak kelimpahan spesies. Spesimen dikumpulkan melalui tinjauan penerokaan dengan pemerhatian langsung di sepanjang transek jejak sepanjang 1000–1500 meter dan selebar lima meter. Sebanyak 260 individu yang terdiri daripada 30 genera dan 45 spesies dalam empat subfamili telah dikenal pasti. Komuniti ini didominasi oleh Galerucinae (77.3%), manakala Eumolpinae, Cassidinae, dan Criocerinae masing-masing menyumbang 10.4%, 9.6%, dan 2.7% daripada keseluruhan kelimpahan. Kelimpahan spesies tertinggi diwakili oleh *Acrocrypta aureipennis* (16.54%) dan

Pseudosastra sulcicollis (15%). Data kelimpahan kumbang daun ini menyediakan maklumat asas untuk pemantauan ekologi dan pemuliharaan di kawasan tersebut.

Kata Kunci: Kumbang daun; chrysomelidae; kelimpahan; Stesen Penyelidikan Suaq Balimbing; kepelbagaian

INTRODUCTION

Coleoptera (beetles) represent the largest and most diverse group of insects in the class Insecta (Peris 2020). Approximately 450,000 species have been identified (Goczal et al. 2024), accounting for nearly 40% of all documented insect species (Gressit 2024). Beetles inhabit virtually all terrestrial and freshwater habitats worldwide, with the exception of marine ecosystems and polar regions (Banerjee 2014). The majority of beetles are phytophagous during both larval and adult stages (Gillot 2005). This phytophagy defines a critical ecological role as herbivores (Pravitarani & Putra 2022), contributing to ecosystem equilibrium through interactions with plants, predators, and nutrient cycling (Rizkawati et al. 2021).

Chrysomelidae, commonly known as leaf beetles, constitute a family of Coleoptera comprising over 36,000 described species classified into 12 subfamilies and approximately 2,000 genera worldwide (Bouchard et al. 2017). These beetles primarily inhabit herbaceous and shrub strata and are exclusively phytophagous (Jolivet 1988), feeding on leaves, fruits, stems, roots, seeds, and flowers (Bienkowski 2010). Like most herbivorous insects, leaf beetles exhibit specific host plant associations, which provide essential resources for offspring development (egg–larval stages) and adult nutrition (Fernandez & Hilker 2007). Their host range encompasses nearly all vascular plants across terrestrial ecosystems (Amrulloh et al. 2022).

The Suaq Balimbing Research Station encompasses a tropical peat swamp forest ecosystem within Gunung Leuser National Park (GLNP). As a protected conservation area, this site exhibits significant habitat heterogeneity characterized by diverse vegetation structures (Lailan et al. 2022). These environmental conditions support robust leaf beetle (Chrysomelidae) assemblages consistent with established ecological principles whereby chrysomelid diversity correlates strongly with floristic richness (Lanuza-Garay et al. 2022) and is further mediated by habitat area and structural complexity (Teles et al. 2019).

As herbivores, the presence of leaf beetles is pivotal in natural ecosystems, contributing to nutrient cycling processes (Iannacone & Alvariño 2006) and serving as important components in trophic networks (Basset & Samuelson 1996). The existence of leaf beetles can also function as a bioindicator of biodiversity and ecological interactions in tropical ecosystems (Gómez-Zurita et al. 2016). The presence of leaf beetles at the Suaq Balimbing Research Station can provide important insights into the area's ecological condition. However, specific data on their species composition and abundance in this location have not been documented. This study aims to identify the species and analyze the abundance patterns of leaf beetles at the study site. The findings are expected to contribute additional data and insights into the diversity of leaf beetle species.

MATERIALS AND METHODS

Study Site and Duration

This study was conducted at Suaq Balimbing Research Station, Gunung Leuser National Park, South Aceh (Figure 1). Leaf beetle specimens were collected along 16 transects: A, C, E, G, H, J, K, Ps, R, U, W, X, Y, Z, L, and Bukit (Figure 2) over an 18-day period from October to November 2024.

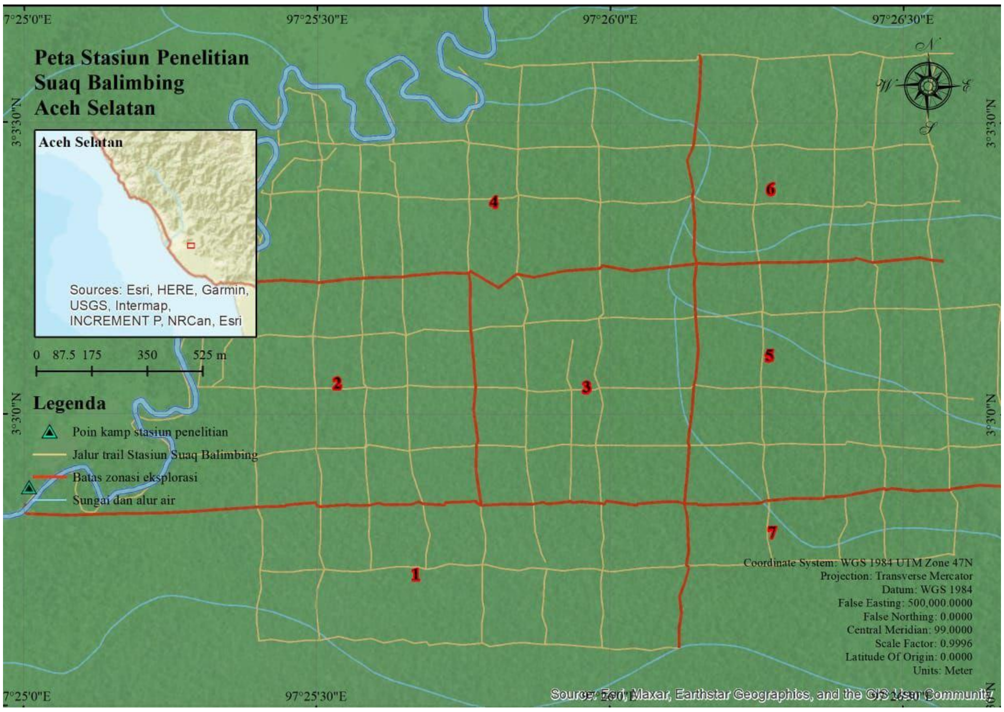


Figure 1. Research Location Map at Suaq Balimbing Research Station

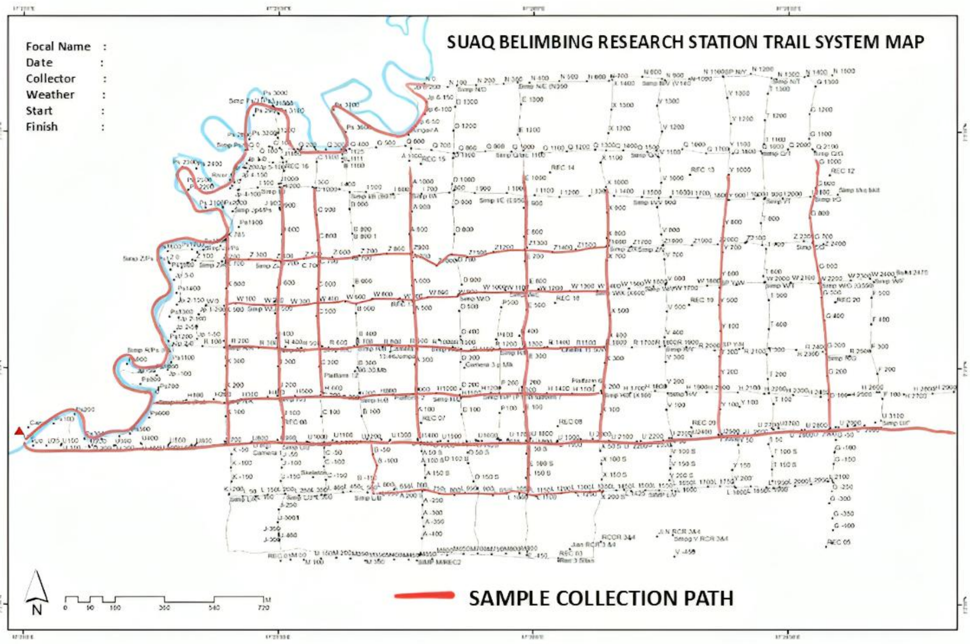


Figure 2. Trail System Suaq Balimbing Research Station

Sampling and Identification

This study employed an explorative survey method using visual encounter surveys (Hinolan et al. 2018) along 16 transects. Each transect spanned 1000–1500 m with a sampling width of 2.5 m on each side. Collectors walked the predetermined routes while systematically scanning vegetation for leaf beetles within the established boundaries. Specimens were captured using a combination of sweep-netting and manual collection (hand-picking) techniques, following established entomological methods for active collection of chrysomelids (Hinolan et al. 2018). Each transect was surveyed once during the study period. Each transect was surveyed once during the study period, with collection activities conducted daily between 09:00-15:00 hours. Environmental parameters (temperature, humidity, light intensity) were recorded hourly at each transect to account for abiotic factors influencing beetle activity. At each beetle occurrence site, the number of individuals and geographical coordinates were recorded. The host plant on which the leaf beetle was found was then photographed and its identity documented. Captured leaf beetles were placed into sample bottles containing 70% alcohol and labeled. Samples collected from the field were then brought to the Biosystematics Laboratory, FMIPA Biology, Syiah Kuala University for identification.

Leaf beetle specimens collected from the field were identified based on morphological characteristics such as elytra shape and texture, antenna shape, and mouthpart shape using an electron microscope. Morphometric measurements of external morphology were conducted through two approaches, namely absolute measurements (total body length, elytra length, maximum width of both elytra, and pronotum length and width) and relative measurements (ratio of pronotum length to width, maximum width of both elytra to elytra length, length difference between the second and third antennal segments, and length difference between the third and fourth antennal segments). Leaf beetle identification was based on identification keys from Lawrence & Britton (1994), Hangay and Zborowski (2010), and several journals: Kimoto and Gressit (1979), Mohamedsaid (2004), Bouchard et al. (2011), and Debbarma and Patel (2020).

Data Analysis

Data on leaf beetle (Chrysomelidae) collected in this study were analyzed descriptively and presented in table and figures. Quantitative analysis was performed by calculating the relative abundance using the Krebs (1989) formula. Diversity indices were not calculated as they are most ecologically meaningful when comparing multiple distinct sites or sampling periods, which was beyond the scope of this baseline study.

Relative Abundance (Krebs 1989)

$$\text{RA} = \frac{\text{Number of Individuals of a species}}{\text{Total number of individuals of all species}} \times 100\%$$

Relative abundance index values were classified into three categories:

>20% = High
15–20% = Medium
<15% = Low

RESULTS AND DISCUSSION

A total of 260 leaf beetle individuals (Coleoptera: Chrysomelidae) were identified from the Suaq Balimbing Research Station, representing four subfamilies, 30 genera, and 45 species/morphospecies (Table 1). The identified subfamilies included Cassidinae with 4 species (Figure 3), Criocerinae with 3 species (Figure 4), Eumolpinae with 7 species (Figure 5), and Galerucinae with 31 species as the most dominant (Figure 6). A total of 31 species (68.9%) were confirmed to the species level, while the remaining 14 species (31.1%) were only identified to the genus level. The subfamily Galerucinae was the most abundant with 201 individuals (77.3% of total abundance). Lower abundances were recorded for Eumolpinae with 27 individuals (10.4%), Cassidinae with 25 individuals (9.6%), and lastly Criocerinae with the fewest number of individuals, 7 (2.7%). The species with the highest abundance were *Acrocrypta aureipennis* (16.54%) and *Pseudosastra sulcicollis* (15%) of the total individuals.

Table 1. Leaf beetle abundance at Suaq Balimbing Research Station

No	Subfamily	Genus	Species	Total	RA (%)
1.	Cassidinae	*Aspidimorpha*	*Aspidimorpha sanctaecrucis*	1	0,38
2.		*Callispa*	*Callispa dimidiatipennis*	1	0,38
3.		*Dactylispa*	*Dactylispa aspera*	17	6,54
4.		*Malayocassis*	*Malayocassis hilaris*	6	2,31
5.	Criocerinae	*Lema*	*Lema rufotestacea*	5	1,92
6.			*Lema cyanea*	1	0,38
7.			*Lema* sp.	1	0,38
8.	Eumolpinae	*Aulexis*	*Aulexis* sp.	11	4,23
9.		*Basilepta*	*Basilepta subcostata*	6	2,31
10.		*Cleoporus*	*Cleoporus* sp.	1	0,38
11.		*Colaspoides*	*Colaspoides* sp.1	1	0,38
12.			*Colaspoides* sp.2	2	0,77
13.		*Heteraspis*	*Heteraspis granulosa*	5	1,92
14.		*Nodina*	*Nodina malayana*	1	0,38
15.	Galerucinae	*Acrocrypta*	*Acrocrypta aureipennis*	43	16,54
16.			*Acrocrypta incisa*	16	6,15
17.			*Acrocrypta geiseri*	3	1,15
18.			*Acrocrypta purpufea*	1	0,38
19.		*Arcastes*	*Arcastes biplagiata*	10	3,85
20.			*Arcastes sutualis*	6	2,31
21.		*Amphimela*	*Amphimela* sp.	11	4,23
22.		*Aphthona*	*Aphthona* sp.	2	0,77
23.		*Aulocophora*	*Aulocophora lewisii*	1	0,38
24.		*Chabria*	*Chabria* sp.	1	0,38
25.		*Chaloenus*	*Chaloenus westwoodi*	1	0,38
26.		*Dercetina*	*Dercetina tsoui*	1	0,38
27.		*Hemipyxis*	*Hemipyxis* sp.	2	0,77
28.		*Hoplosainidea*	*Hoplosainidea abdomenalis*	1	0,38

No	Subfamily	Genus	Species	Total	RA (%)
29.			*Hoplosainidea capitata*	1	0,38
30.			*Hoplosainidea* sp. 1	1	0,38
31.			*Hoplosainidea* sp. 2	1	0,38
32.		*Metrioidea*	*Metrioidea borneensis*	1	0,38
33.		*Monolepta*	*Monolepta semicostata*	4	1,54
34.			*Monolepta jacobyi*	1	0,38
35.		*Paleosepharia*	*Paleosepharia zakrii*	15	5,77
36.			*Paleosepharia emeiensis*	11	4,23
37.			*Paleosepharia malaysiana*	3	1,15
38.		*Nonarthra*	*Nonarthra cyanea*	5	1,92
39.		*Palpoxena*	*Palpoxena antonini*	1	0,38
40.		*Pseudosastra*	*Pseudosastra sulcicollis*	39	15
41.		*Theopea*	*Theopea faimairei*	2	0,77
42.		*Schenklingia*	*Schenklingia* sp. 1	10	3,85
43.			*Schenklingia* sp. 2	2	0,77
44.			*Schenklingia* sp. 3	4	1,54
45.		*Hesperopenna*	*Hesperopenna medvedevi*	1	0,38
Total				**260**	

As shown in Table 1, the leaf beetle community at the study site was dominated by the subfamily Galerucinae, comprising 31 of the 45 identified species. The Galerucinae subfamily consisted of 19 distinct genera, with *Acrocrypta* (4 species), *Hoplosainidea* (4 species), *Paleosepharia* (3 species), and *Schenklingia* (3 species) being the primary contributors to this diversity. Meanwhile, the subfamily Eumolpinae had one genus (*Colaspoides*) contributing two species. The Criocerinae subfamily included only one genus but represented three species, whereas Cassidinae comprised four genera, each represented by only one species. Overall, eight genera were recorded as representing more than one species, while the remaining 22 genera each contained only a single species. Thus, of the 45 observed species, 22 were unique as the sole representatives of their genus, while the remaining 23 species were concentrated within eight genera particularly *Acrocrypta*, *Hoplosainidea*, *Paleosepharia*, and *Schenklingi*a, which together accounted for 14 species.

The subfamily Galerucinae dominated (77.3%) the total number of leaf beetle individuals collected at the Suaq Balimbing Research Station. This dominance indicates that Galerucinae is the most commonly encountered group in the area. The subfamily Criocerinae was recorded as the subfamily with the lowest abundance, with only 7 individuals (2.7%) identified out of the total 260 leaf beetle specimens collected. This low number contrasts sharply with dominant subfamilies such as Galerucinae (77.3%) or even other subfamilies like Eumolpinae (10.4%) and Cassidinae (9.6%).

A few species dominated the community, while most were represented by very few individuals. *Acrocrypta aureipennis* and *Pseudosastra sulcicollis* (Galerucinae) were the two most dominant, with relative abundances of 16.53% and 15%, respectively, followed by a few other species exceeding 5% abundance. In contrast, the majority (26 species) contributed less than 1% to the total number of individuals collected.

The uneven distribution of species numbers indicates an imbalanced species composition, where most species diversity is concentrated within only a few specific genera. This skewed distribution may be attributed to the adaptive traits of certain species, the selective abundance of host plants, or a sampling period that did not cover the complete life cycles of some species. Regarding the sampling period, this study was conducted during the rainy season (October–November). The rainy season is known to favor the subfamily Galerucinae, explaining why genera within this group dominated species diversity. This aligns with the findings of Bouzan et al. (2015), who reported that environmental conditions during the rainy season support development and enhance host plant quality for Galerucinae. However, the limitation of sampling exclusively during the rainy season may have resulted in the underrepresentation of species more active in the dry season, potentially contributing to the observed disparity in species distribution at the Suaq Balimbing Research Station.

In this inventory, only 31 out of 45 species (68.9%) were successfully identified to the species/morphospecies level, while the remaining 14 species (31.1%) were identified only to the genus level. This taxonomic limitation primarily stems from the complexity of diagnostic characters in leaf beetles, where accurate identification often requires detailed morphological examination through genitalia dissection, comparison with type specimens in entomological museums, or even DNA barcoding analysis to verify morphological findings (Yeong et al. 2018). These advanced methods could not be implemented within the scope of this study due to limitations in facilities, time, and funding.

In the context of Suaq Balimbing, these incomplete identifications may potentially represent undescribed new taxa. The discovery of 45 leaf beetle species at the Suaq Balimbing Research Station, despite incomplete species-level identification for some specimens, does not alter the fact that this area is suitable and supportive for sustaining Chrysomelidae communities. Although an uneven distribution was observed, with certain genera dominating, this pattern more likely reflects natural competitive dynamics and specific adaptations rather than habitat unsuitability. Overall, the environmental conditions at the Suaq Balimbing Research Station remain optimal for maintaining the leaf beetle community in this area.

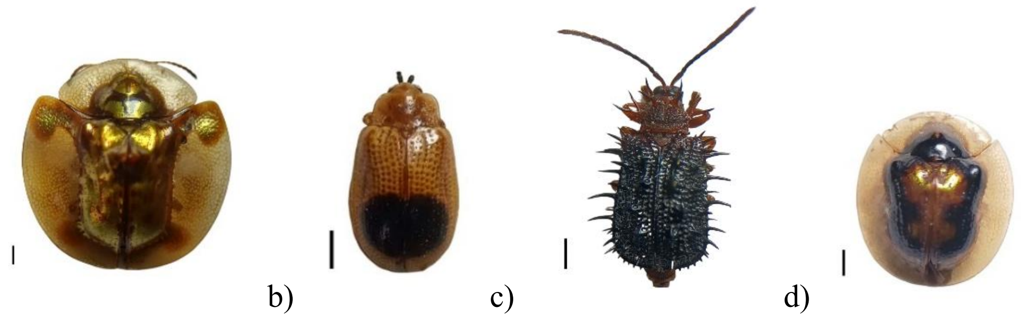


Figure 3. Subfamily Cassidinae. a) *Aspidimorpha sanctaecrucis*; b) *Callispa dimidiatipennis*; c) *Dactylispa aspera*; d) *Malayocassis hilaris*. (*Scale bar* = 1 mm)

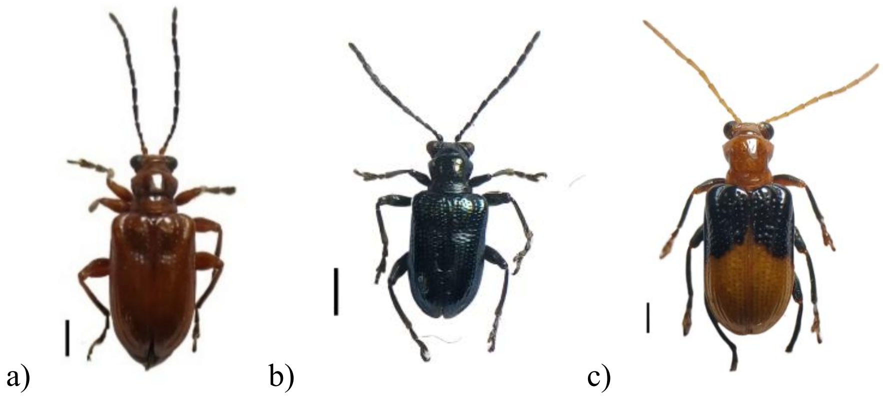


Figure 4. Subfamily Criocerinae. a) *Lema rufotestacea*; b) *Lema cyanea*; c) *Lema* sp. (*Scale bar* = 1 mm)

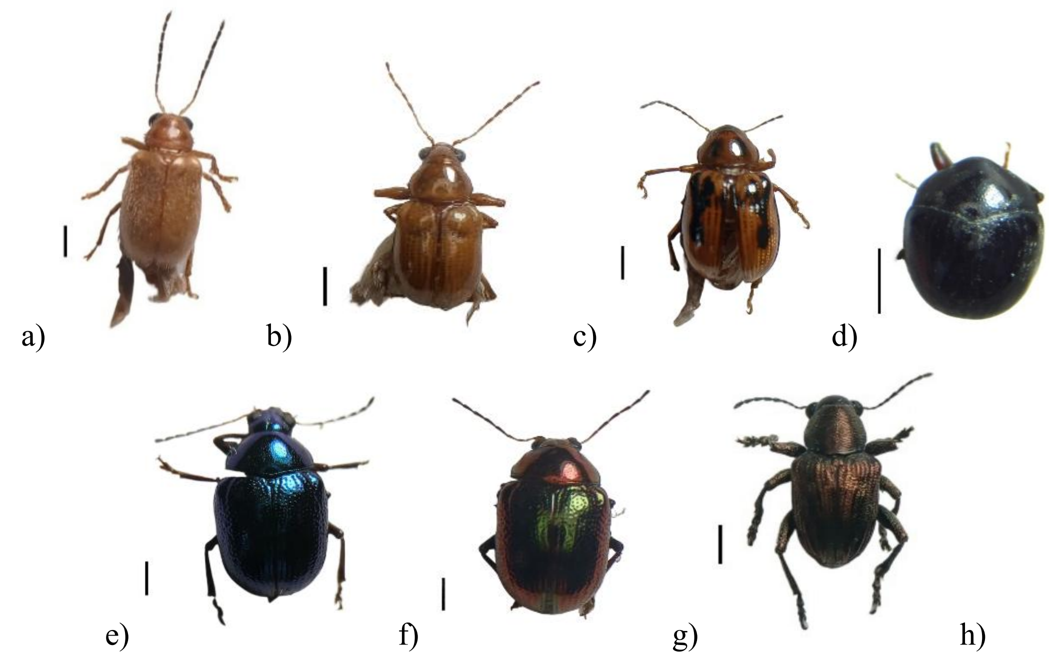
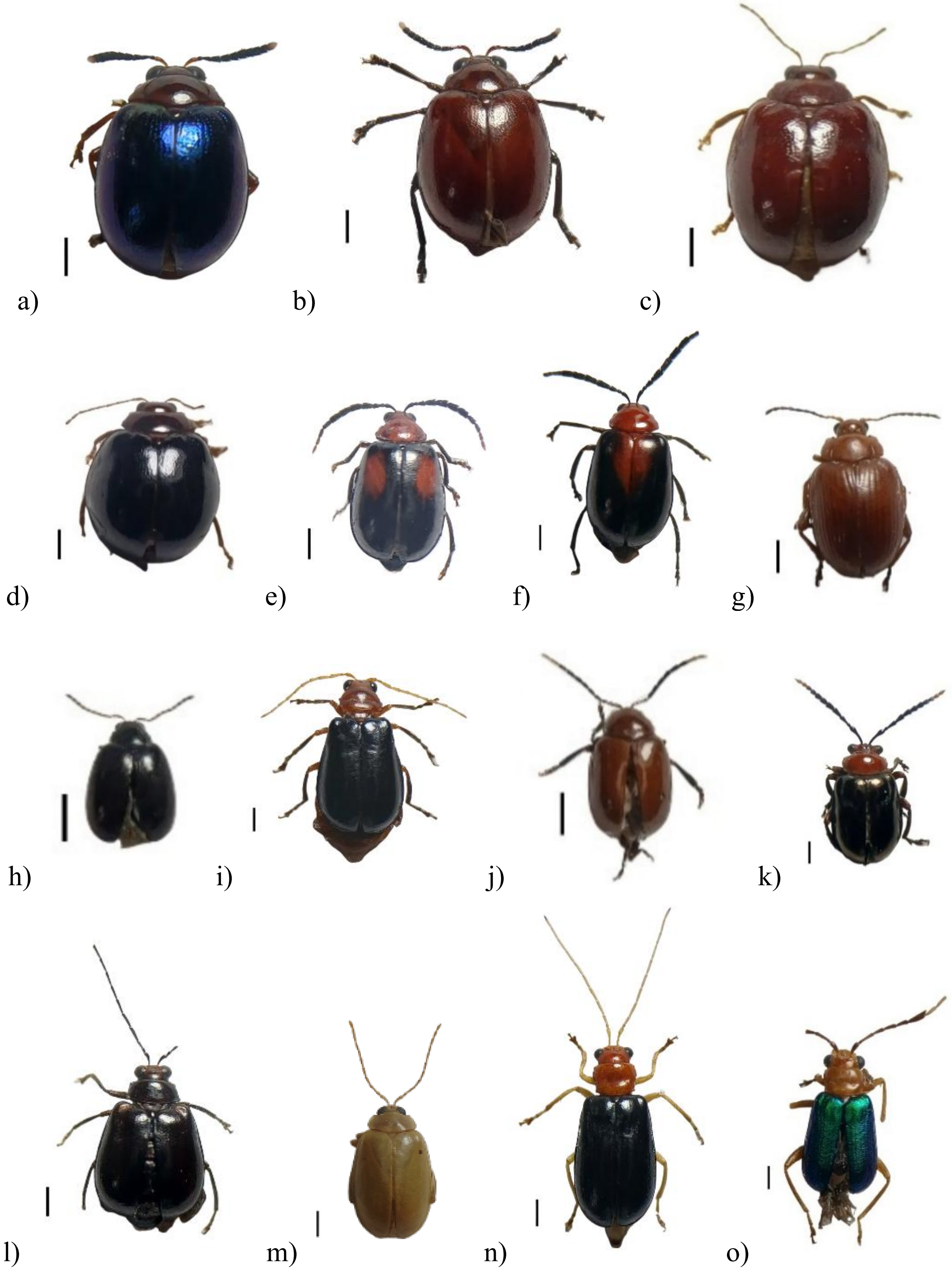


Figure 5. Subfamily Eumolpinae. a) *Aulexis* sp. b) *Basilepta subcostata* c) *Cleoporus* sp. d) *Nodinamalayana*; e) *Colaspoides* sp. 1; f); *Colaspoides* sp. 2 g) *Heteraspis granulosa* (*Scale bar* = 1 mm).


a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l)
m)
n)
o)

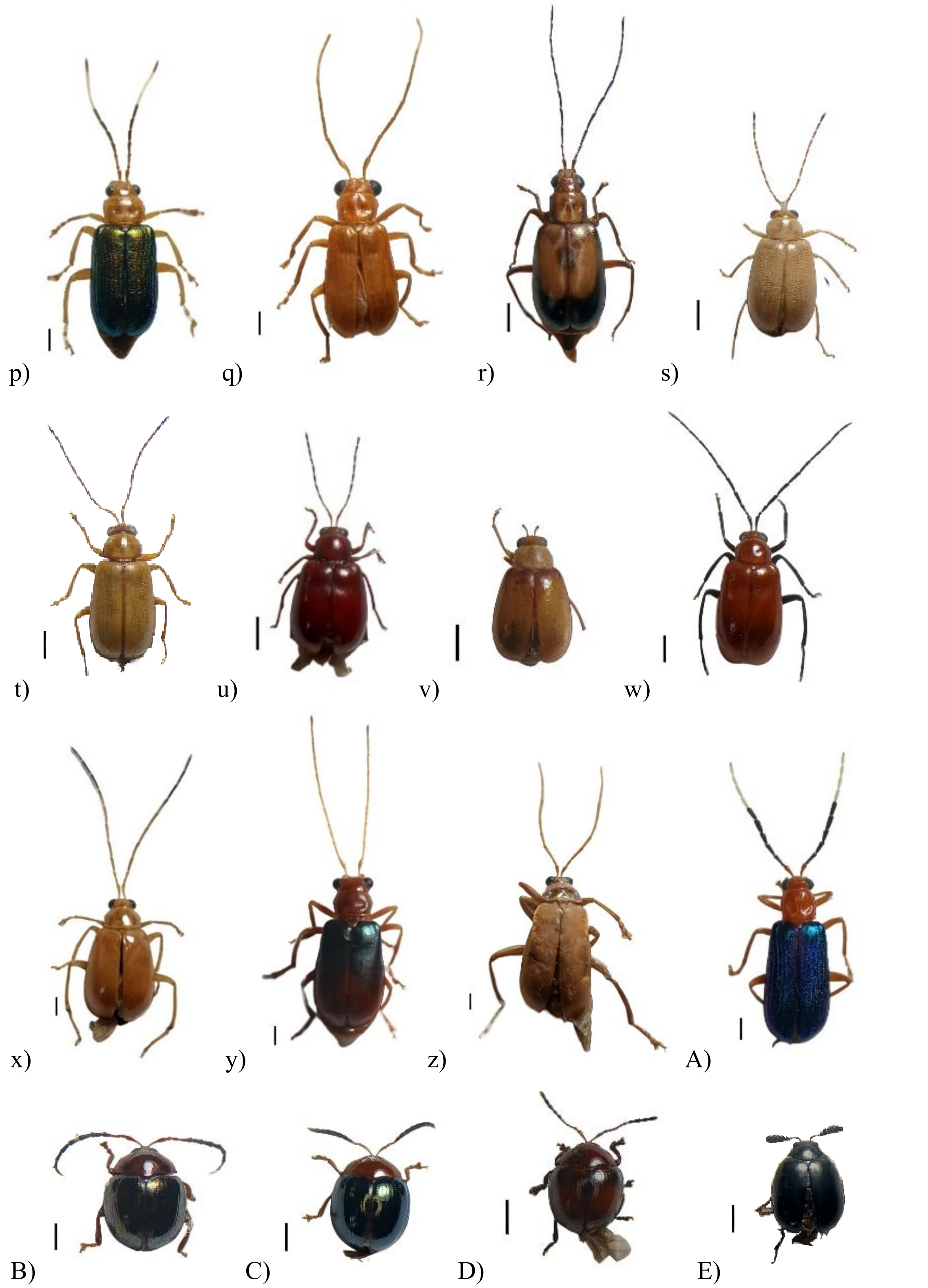


Figure 6. Subfamily Galerucinae. a) *Acrocrypta aureipennis*; b) *Acrocrypta incisa*; c) *Acrocrypta geiseri*; d) *Acrocrypta purpufea*; e) *Arcastes biplagiata* f) *Arcastes sutualis*; g) *Amphimela* sp.; h) *Aphthona* sp. i) *Aulocophora lewisii*; j) *Chabria* sp.; k) *Chaloenus westwoodi*; l) *Dercetina tsoi*; m) *Hemipyxis* sp.; n) *Hoplosainidea abdomenalis*; o) *Hoplosainidea capitata*; p) *Hoplosainidea* sp. 1; q) *Hoplosainidea* sp. 2; r) *Paleosepharia zakrii*; s) *Paleosepharia emeiensis*;

t) *Monolepta semicostata*; u). *Paleosepharia malaysiana*; v) *Monolepta jacobyi*; w) *Metrioidea borneensis*; x) *Hesperopenna medvedevi*; y) *Palpoxena antonini*; z) *Pseudosastra sulcicollis*; A) *Theopea faimairei*; B) *Schenklingia* sp.1; C) *Schenklingia* sp. 2; D) *Schenklingia* sp. 3; E) *Nonarthra cyanea*. (*Scale bar* = 1 mm)

The discovery of 260 leaf beetle (Chrysomelidae) individuals at Suaq Balimbing Research Station demonstrates a well-established leaf beetle community within the study area. This number provides preliminary insight into the population size of this herbivorous insect group in the region. The abundance of leaf beetles at Suaq Balimbing Research Station was influenced by the availability of host plants as their primary food source. As a primary forest with high vegetation diversity, this area offers diverse and optimal host plant resources. This finding aligns with Merrill et al. (2008), who stated that the abundance of phytophagous insects depends on the quality and distribution of host plants.

Furthermore, the unique environmental conditions at Suaq Balimbing Research Station - including waterlogged peat soil, natural water table fluctuations, low light intensity (12.7-88.9 lux) due to dense canopy cover, stable temperatures (25-28°C), and high humidity (77-95%) create an ideal niche for leaf beetles. According to Lucio-Garcia et al. (2022), environmental temperatures within 16-35°C range and humidity >70% provide optimal conditions for supporting diverse leaf beetle communities, particularly in tropical habitats. The complex interaction of these abiotic factors established an optimal environment for larval development, imago reproduction, and protection from environmental stressors, thereby supporting the presence and abundance of leaf beetles at Suaq Balimbing Research Station. Consequently, the presence of 260 leaf beetle individuals represents more than just a numerical value; it serves as tangible evidence of a healthy, productive forest ecosystem with high plant diversity, indicating a rich host plant community at Suaq Balimbing Research Station.

The abundance analysis revealed a clear disparity among subfamilies. The high dominance of the Galerucinae subfamily can be attributed to favorable environmental conditions and their polyphagous adaptive capabilities. This polyphagous nature enables Galerucinae to utilize a wide host range, reducing dependence on specific plant species. Field observations documented these beetles on plants from the families Asteraceae, Fabaceae, Anacardiaceae, Tetrameristaceae, Rubiaceae, Annonaceae, Sapindaceae, Moraceae, Dipterocarpaceae, Euphorbiaceae, Araliaceae, Lauraceae, Polypodiaceae, Myrtaceae, Araceae, and Cyperaceae. Among these, Asteraceae and Fabaceae were confirmed as Galerucinae host plants in Salvi et al. (2019), while Anacardiaceae was reported in Iannella et al. (2021). The availability of diverse host plants enhances their survival, thereby increasing population resilience and abundance. This finding aligns with Bouzan et al. (2015), who stated that Galerucinae can utilize multiple host species, supporting their year-round survival and reproduction. This polyphagous trait allows Galerucinae to exploit various available resources, reduce intraspecific competition, and improve environmental stress tolerance, ultimately contributing to their dominance in the peat swamp forest ecosystem of Suaq Balimbing Research Station.

The low abundance of the Criocerinae subfamily suggests the presence of limiting factors for their population, particularly noteworthy given this group's globally recognized diversity. Vencl & Leschen (2014) report that Criocerinae diversity encompasses approximately 1,200-1,500 species. Although this subfamily is generally common in tropical regions, its poor representation in our collections may be attributed to several factors. According to Novotný & Basset (2000), these factors may include collection methods employed, specialized feeding habits, or naturally low population densities. Therefore, interpretations regarding environmental unsuitability at Suaq Balimbing Research Station must consider more complex methodological and ecological factors. However, field observations suggested that specific local conditions appeared to play a key role in this subfamily's low abundance.

The scarcity of Criocerinae in Suaq Balimbing is primarily influenced by local factors. Generally, Criocerinae are monophagous, meaning they rely solely on specific host plants. However, the high plant diversity in the Suaq Balimbing research area makes it difficult for leaf beetles in this subfamily to locate their specific host plants for reproduction. High competition with other subfamilies, particularly Galerucinae, further reduces Criocerinae's chances of obtaining resources. Additionally, Criocerinae appear to prefer open habitats with ample sunlight, whereas Suaq Balimbing has a dense canopy. The two species collected in this study were found in open areas: one along river edges and another in a swamp forest with a sparse canopy. Most Criocerinae species have small body sizes, consistent with the statement by Vencl et al. (2004) that most members of this subfamily are indeed small and adept at flying. This combination of physical characteristics makes Criocerinae leaf beetles relatively difficult to collect in the field.

The relative abundance per species (Table 1) reveals more extreme variations in the leaf beetle (Chrysomelidae) community at the Suaq Balimbing Research Station. This pattern indicates a community structure dominated by a few key species, which, according to Avolio et al. (2019), are species with high abundance compared to others in a community and proportionally influence environmental conditions, community diversity, and ecosystem functioning. Meanwhile, most species act as ecological minorities with potentially specialized or limited roles. Dominance by certain species may be driven by factors such as asymmetric competition, limited resource availability, or superior adaptations of dominant species to environmental conditions at the Suaq Balimbing Research Station. Additionally, the high number of species with abundances below 1% suggests this community's vulnerability to environmental changes.

The Galerucinae subfamily not only dominates at the subfamily level (77.3%), but also contains two highly abundant species: *Acrocrypta aureipennis* (16.54%) and *Pseudosastra sulcicollis* (15%). Collectively, these two species account for 31.54% of the total community a proportion that exceeds the combined contribution of either the entire Eumolpinae (10.4%) or Criocerinae (2.7%) subfamilies. These species exhibit superior adaptations to the environmental conditions at the Suaq Balimbing Research Station, suggesting strong competitive dominance over other species. Both *Acrocrypta aureipennis* and *Pseudosastra sulcicollis* display polyphagous adaptations, enabling them to utilize a wide range of host plants. This finding aligns with Lucio-Garcia et al. (2022), who reported that polyphagy allows leaf beetle species to occupy broader ecological niches, thereby classifying them as generalist species.

Although the total number of individuals collected (260) may not yet reflect maximum diversity, the number of identified species suggests considerable biodiversity potential worthy of further exploration. This count is relatively lower compared to the study by Nuraini et al. (2025) at Soraya Research Station (RS), which reported 370 individual leaf beetles. However, it's important to note the significant difference in sampling duration: this study was conducted for only 18 days (October-November), whereas the Soraya RS research spanned 6 months (August-February). Interestingly, within this shorter timeframe, Suaq Balimbing RS managed to collect 70% of the total leaf beetles found at Soraya RS. These results suggest that extending the collection period could potentially increase the number of individuals significantly, possibly even surpassing the leaf beetle count at Soraya RS.

The primary constraints likely stem from the combination of transect walk methods with the challenging peat swamp terrain, characterized by dense vegetation, unstable ground, and limited access to potential microhabitats. Additionally, environmental factors must be considered, given that Suaq Balimbing Research Station is a primary peat swamp forest with ecological productivity distinct from the habitat at Soraya Research Station. Although both studies employed the same methodology, differences in environmental conditions including humidity, temperature, light intensity, vegetation type, and host availability may potentially influence leaf beetle abundance. Thus, the collection of 260 leaf beetle individuals within this short timeframe not only demonstrates collection efficiency but also suggests high habitat carrying capacity.

The abundance of leaf beetles at Suaq Balimbing Research Station highlights their crucial role in maintaining ecological balance. As herbivores, their activity indirectly trains plants to develop chemical and physical defenses a process of selecting superior specimens capable of survival. Leaf beetles also contribute to nutrient cycling through organic matter fragmentation and the release of nutrients back into the soil. This functional role aligns with Uma et al. (2023), who state that leaf-eating insects, including beetles, significantly contribute to nutrient recycling. However, the extent of leaf beetles' influence on forest generation or long-term nutrient cycles requires further investigation through more comprehensive studies. At the trophic level, leaf beetles serve as a food source for predators such as spiders, small birds, and lizards, thereby transferring energy from plant producers to higher-level consumers in the food chain.

The sensitivity of leaf beetles to even minor environmental changes makes them an effective early warning system at Suaq Balimbing Research Station, a conservation area for Sumatran orangutans. Declines in leaf beetle populations signal ecological disturbances that could threaten the habitat long before impacts become visible on orangutans. Monitoring leaf beetle populations can serve as a proactive conservation measure, potentially preventing permanent habitat damage while simultaneously preserving the environment for Sumatran orangutans at Suaq Balimbing Research Station.

CONCLUSIONS

This study documented a total of 260 leaf beetle (Chrysomelidae) individuals at the Suaq Balimbing Research Station, comprising four subfamilies, 30 genera, and 45 species. The highest subfamily abundance was recorded for Galerucinae with 201 individuals, representing 77.3% of the total abundance. Meanwhile, the species exhibiting the highest abundance were *Acrocrypta aureipennis* (16.54%) and *Pseudosastra sulcicollis* (15%) relative to the total number of individuals. Therefore, this research provides critical baseline data on leaf beetle diversity and pin points key species that could serve as bioindicators of ecosystem health. To advance this knowledge, future studies should focus on investigating thehost plants and ecological roles of these dominant species, employing molecular approaches (e.g., DNA barcoding) for taxonomic confirmation, and comparing this community with those in disturbed habitats to assess the conservation value of the area.

ACKNOWLEDGEMENT

We gratefully acknowledge the institutional guidance and support that facilitated this study. We thank Balai Besar Taman Nasional (BB-TNGL), Yayasan Ekosistem Leuser (YEL), and the National Park Management Section (BPTN) Region 1 Tapaktuan for providing research permits and logistical support at the Suaq Balimbing Research Station. We also appreciate the assistance of field personnel involved in specimen collection. Laboratory access and the use of research facilities were kindly provided by the Biosystematics and Zoology Laboratories, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Syiah Kuala.

AUTHORS DECLARATIONS

Funding Statement
This study received no external funding.

Conflict of Interest
The authors declare no conflict of interest.

Ethics Declarations
All necessary permits for this research, including entry into the conservation area and collection of samples, were secured from the Gunung Leuser National Park Agency. The study complied with all permit regulations, utilized non-destructive methods, and ensured no harm to protected species.

Author's Contributions
Mutia, C.D. was involved in methodology development, investigation, formal analysis, data curation, validation, visualization, and the writing of both the original draft and the revised manuscript. Rizki, A. contributed to conceptualization, funding acquisition, methodology development, validation, supervision, and the review and editing of the manuscript. Siregar, Z. was involved conceptualization, methodology development, and the review and editing of the manuscript. Syaukani, S. and Sutekad, D. contributed to the review and editing of the manuscript.

REFEENCES

Amrulloh, R., Noerdjito, W.A., Istiaji, B., Hidayat, P. & Buchori, D. 2022. Keanekaragaman dan kelimpahan kumbang daun (Coleoptera: Chrysomelidae) pada empat tipe penggunaan lahan yang berbeda di Taman Nasional Bukit Duabelas dan Hutan Harapan, Provinsi Jambi. *Jurnal Entomologi Indonesia* 19(2): 147-163.

Avolio, M.L., Forrestel, E.J., Chang, C.C., Pierre, K.J.L., Burghardt, K.T. & Smith, M.D. 2019. Demystifying dominant species. *New Phytologist* 223(3): 1106-1126.

Banerjee, M. 2014. Diversity and composition of beetles (Order: Coleoptera) of Durgapur, West Bengal, India. *Psyche: A Journal Entomology* 2014: 1-6.

Basset, Y. & Samuelson, G.A. 1996. Ecological characteristics of an arboreal community of Chrysomelidae in Papua New Guinea. In. Jolivet, P.H.A. & Cox, M.L. (eds.). *Chrysomelidae Biology Volume 2: Ecological Studies*, pp. 243-262. Amsterdam: SPB Academic Publishing

Bienkowski, A.O. 2010. Feeding behavior of leaf beetles (Coleoptera, Chrysomelidae). *Entomological Review* 90(1): 1-10.

Bouchard, P., Smith, A.B.T., Douglas, H., Gimmel, M.L., Brunke, A.J. & Kanda, K. 2017. Biodiversity of coleoptera. *Insect Biodiversity: Science and Society* 1: 337–417.

Bouchard, P., Bousquet, Y., Davies, A.E., Alonso-Zarzaga, M.A., Lawrence, J.F., Lyal, C.H. C., Newton, A.F., Reid, C.A.M., Schmitt, M., Slipinski, S.A. & Smith, A.B.T. 2011. Family-group names in Coleoptera (Insecta). *ZooKeys* 88: 1-972.

Bouzan, A.M., Flinte, V., Macedo, M. V. & Monteiro, R.F. 2015. Elevation and temporal distributions of Chrysomelidae in southeast Brazil with emphasis on the Galerucinae. *Zookeys* 547: 103-117.

Debbarma, R. & Patel, S.R. 2020. Leaf beetles diversity of Navsari Agricultural University campus in relation to their morphological characteristics. *Journal of Entomology and Zoology Studies* 8(5): 613-619.

Fernandez, P. & Hilker, M. 2007. Host plant location by Chrysomelidae. *Basic and Applied Ecology* 8(2): 97-116.

Gressit, J.L. 2024. Coleoptera. https://www.britannica.com/animal/beetle [28 June 2024].

Gillot, C. 2005. *Entomology*. Dordrecht: Spinger Science & Business Media.

Goczal, J., Beutel, R.G., Gimmel, M.L. & Kundrata, R. 2024. When a key innovation becomes redundant: Patterns, drivers, and consequences of elytral reduction in Coleoptera. *Systematic Entomology* 49: 193-220.

Gómez-Zurita, J., Cardoso, A., Coronado, I., Cadena, G.D., Jurado-Rivera, J.A., Mas, J-M., Montelongo, T., Nguyen, D.T. & Papadopoulou, A. 2016. High-hroughtput biodiversity analysis: Rapid assessment of species richness and ecological interactions of Chrysomelidae (Coleoptera) in the tropics. *ZooKeys* 597: 3-26.

Hangay, G. & Zborowski, P. 2010. *A Guide to the Beetles of Australia*. Victoria: CSIRO Publishing.

Hinolan, J.D., Curva, M.D.F., Ong, M.B.P., Alaijos, O.R. & Carpio Jr., A.P. 2018. The leaf beetle (Coleoptera: Chrysomelidae) fauna of Mt. Manalmon in San Miguel, Bulacan, Philippines with reference to their host plants. *Journal of Biodiversity and Environmental Sciences (JBES)* 12(5): 414-423.

Jolivet, P. 1988. Food habits and food selection of Chrysomelidae: Bionomic and evolutionary perspectives. In. Jolivet, P., Petitpierre, E. & Hsiao, T.H. (eds.). *Biologyof Chrysomelidae*, pp. 1-24. Dordrecht: Kluwer Academic Publishers.

Kimoto, S. & Gressit, J.L. 1979. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos, and Vietnam. *Pacific Insects* 20(2-3): 191-256.

Krebs, C.J. 1989. *Ecological Methodology*. New York: Harper & Row Publishers Inc,

Lailan, I., Ruskhanidar. & Rahmi, E. 2022. Karakter dan keragaman jenis pohon sarang orangutan Sumatera (*Pongo abelii*) di Stasiun Riset Suaq Balimbing Taman Nasional Gunung Leuser. *Jurnal Nusa Sylva* 22(2): 68-76.

Iannacone, J. & Alvariño, L. 2006. Diversidad de la artropofauna terretre en la Reserva Nacional de Junín, Perú. *Ecología Aplicada* 5(1-2): 171-174.

Iannella, M., D'Alessandro, P., Simone, W.D. & Biondi, M. 2021. Habitat specificity, host plants and areas of endemism for the genera group Blepharida s.l. in the afrotropical region (Coleoptera, Chrysomelidae, Galerucinae, Alticini). *Insects* 12(4): 299.

Lanuza-Garay, A., Chirú, L., Farnum-Castro, F., Murgas, A.S. & Godoy, V.M. 2022. Leaf beetles (Chrysomelidae) richness and abundance in San Lorenzo Protector Tropical Rainforest Remnant, Panama. *Revista Científica Semilla Del Este* 5(1): 8-42.

Lawrence, J.F. & Britton, E.B. 1994. *Coleoptera (Beetles) in the Insects of Australia*. Melbourne: Melbourne University Press.

Lucio-Garcia, J.N., Sánchez-Reyes, U.J., Horta-Vega, J.V., Reyes-Munoz, J.M., Clark, S.M. & Nino-Maldonado, S. 2022. Seasonal and microclimatic effect on leaf beetles (Coleoptera: Chrysomelidae) in a tropical forest fragment in northeastern Mexico. *Zookeys* 1080: 21-52.

Merrill, R.M., Gutierrez, D., Lewis, O.T., Gutierrez, J., Diez, S.B. & Wilson, R.J. 2008. Combined effects of climate and biotic interactions on the elevational range of a phytophagous insect. *Journal of Animal Ecology* 77: 145-155.

Mohamedsaid, M.S. 2004. *Catalogue of the Malaysian Chrysomelidae (Insecta: Coleoptera)*. Bulgaria: Pensoft Publisher.

Novotný, V. & Basset, Y. 2000. Rare species in communities of tropical insect herbivores: pondering the mystery of singletons. *Oikos* 89(3): 564-572.

Nuraini, AR., Suwarno. & Rizki, A. 2025. The inventory of leaf beetles (Coleoptera: Chrysomelidae) from Soraya Research Station Leuser Ecosystem, Indonesia. *Jurnal Penelitian Pendidikan IPA (JPPIPA)* 11(10): 94-104.

Pravitarani, F. & Putra, I.L.I. 2022. Keanekaragaman jenis Ordo Coleoptera pada Area Persawahan Desa Tamanan Kecamatan Banguntapan, Kabupaten Bantul. *Jurnal Ilmiah Hijau Cendikia* 8(1): 10-16.

Peris, D. 2020. Coleoptera in amber from Cretaceous resiniferous forest. *Createaceous Research* 113: 104484.

Rizkawati, V., Parikesit. & Kasmara, H. 2021. Layanan ekosistem kumbang pada Tata Guna Lahan Talun Campuran di Lanskap Cijedil, Cianjur. *Bioma* 17(1): 9-18.

Salvi, D., D'Alessandro, P. & Biondi, M. 2019. Host plant associations in Western Palaearctic Longitarsus flea beetles (Chrysomelidae, Galerucinae). *ZooKeys* 856: 101-114.

Teles, T.S., Ribeiro, D.B., Raizer, J. & Linzmeier, A.M. 2019. Richness of Chrysomelidae (Coleoptera) depends on the area and habitat structure in semideciduous forest remnants. *Iheringia, Série Zoologia* 109: e2019040.

Uma, G.S., Sharma, L. & Rathna, V. 2023. The role of insects in nutrient cycling: Unsung heroes of ecosystem health. *Vigyan Varta* 4(9): 40-42.

Vencl, F.V. & Leschen, R.A.B. 2014. Chapter 2.7.6: Criocerinae Lattereille 1807. In. Leschen R.A.B. & Beutel, R.G. (eds.). *Handbook of Zoology, Arthropoda: Insecta, Coleoptera, Beetles. Volume 3: Morphology and Systematics (Phytophaga)*. Berlin/Boston: Walter De Gruyter.

Vencl, F.V., Levy, A., Geeta, R., Keller, G. & Windsor, D.M. 2004. Observations on the natural history, systematics and phylogeny of the Criocerinae of Costa Rica and Panama. In. Jolivet, P., Santiago-Blay, J.A. & Schmitt, M. (eds.). *New developments in the biology of Chrysomelidae*, pp. 423-454. Amsterdam: SPB Academic Publishing, The Hague.

Yeong, K-C., Takizawa, H. & Liew, T-S. 2018. Investigating leaf beetles (Coleoptera: Chrysomelidae) on the west coast islands of Sabah via Checlist-taking and DNA barcoding. *PeerJ* 6: e5811.