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# Investigating leaf beetles (Coleoptera, Chrysomelidae) on the west coast islands of Sabah via checklist-taking and DNA barcoding

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Sabah, northern Borneo is one of the world's most well-recognized biodiversity hotspots famous for the incredible diversity of its flora and fauna. Plenty of studies of leaf beetle fauna from this region have been conducted over the past 30 years. Yet, our knowledge of the leaf beetle fauna from island habitats remains scarce despite Sabah having the highest number of islands in Malaysia (*ca*. 500 islands). In this study, we collected leaf beetle fauna from 13 islands off the west coast of Sabah between January 2016 and March 2017. All specimens were identified to species level. Species names were assigned when the specimens fitted the description of species in the literature and morpho-species were assigned when the species names could not be determined. In addition, DNA barcodes – mitochondarial COI gene – of the species were sequenced. A total of 68 species from 31 genera and 5 subfamilies were collected with 12 species name being determined. From the data it was established that Pulau Gaya has the highest species richness (42 species), followed by Pulau Tiga (22 species) and Pulau Sapangar (18 species). Furthermore, a total of 64 Barcode Index Numbers consisting of 101 DNA barcodes were obtained from 60 leaf beetle species. The mean intraspecific and interspecific distances were determined as 0.77 % and 16.11 %, respectively. In addition, DNA barcoding also reveals phenotypic variation in leaf beetle species, particularly in the case of the subfamily Galerucinae. This study provides baseline knowledge and information about the DNA barcodes of leaf beetle species on Sabah's island habitats for use in future studies.

# Investigating leaf beetles (Coleoptera, Chrysomelidae) on the west coast islands of Sabah via checklist-taking and DNA barcoding

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## Abstract

Sabah, northern Borneo is one of the world's most well-recognized biodiversity hotspots famous for the incredible diversity of its flora and fauna. Plenty of studies of leaf beetle fauna from this region have been conducted over the past 30 years. Yet, our knowledge of the leaf beetle fauna from island habitats remains scarce despite Sabah having the highest number of islands in Malaysia (*ca*. 500 islands). In this study, we collected leaf beetle fauna from 13 islands off the west coast of Sabah between January 2016 and March 2017. All specimens were identified to species level. Species names were assigned when the specimens fitted the description of species in the literature and morpho-species were assigned when the species names could not be determined. In addition, DNA barcodes – mitochondarial COI gene – of the species were sequenced. A total of 68 species from 31 genera and 5 subfamilies were collected with 12 species name being determined. From the data it was established that Pulau Gaya has the highest species richness (42 species), followed by Pulau Tiga (22 species) and Pulau Sapangar (18 species). Furthermore, a total of 64 Barcode Index Numbers consisting of 101 DNA barcodes were obtained from 60 leaf beetle species. The mean intraspecific and interspecific distances were determined as 0.77 % and 16.11 %, respectively. In addition, DNA barcoding also reveals phenotypic variation in leaf beetle species, particularly in the case of the subfamily Galerucinae. This study provides baseline knowledge and information about the DNA barcodes of leaf beetle species on Sabah's island habitats for use in future studies.


Keywords: Barcoding of Life Data System (BOLD) chrysomelid beetles colour polymorphism cryptic diversity island biodiversity sexual dimorphism species distribution

## Introduction

Chrysomelidae Latreille, 1802 is one of the most diverse beetle families, with 35,000 - 60,000 species around the world (Splipnski, Leschen & Lawrence, 2011; Jolivet, 2015). The study of leaf beetle fauna in Borneo started in the 19th century, with the first valid species described by Suffrian (1854). A brief history of leaf beetle studies in Borneo is discussed in *The Leaf Beetle of Borneo* by Mohamedsaid, Salleh and Hassan (1990). Although Borneo is recognized as one of the world's biodiversity hotspots, taxonomic research on Borneo leaf beetles has been limited to a few publications, possibly due to logistical difficulties and the inaccessibility of forest habitats (Mohamedsaid, Salleh & Hassan, 1990). As of 2004, 635 species of leaf beetle had been recorded in Borneo (Mohamedsaid, 2004).

Over the past a decade and a half, the number of leaf beetle species in Borneo has increased significantly, with more than 100 new species originating from Sabah (Takizawa, 2005, 2011, 2012, 2013, 2014, 2017, Mohamedsaid, 2006, 2010; Beenen, 2007; Medvedev, 2016a,b; Doberl, 2007; Medvedev, 2007, 2009, 2010, 2013; Borowiec, 2009; Moseyko, 2012; Borowiec, Takizawa & Swietojańska, 2013; Mahadimenakbar & Takizawa, 2013; Bezděk, Romantsov & Medvedev, 2014; Medvedev & Romantsov, 2014, 2015, 2017a; Takizawa & Mohamedsaid, 2015). Most of these new species were discovered in mainland habitats on the west coast district of Sabah. Although Sabah has the highest number of islands in Malaysia, leaf beetle species diversity on islands has been little explored. In view of the fact that island habitats are generally known to have high species endemism (Kier et al., 2009), and that many of the islands on the west coast of Sabah are experiencing a rapid growth in tourism and economic development (Phung, Yu & Liew, 2017), it is important to document leaf beetle species diversity now to obtain baseline biodiversity knowledge.

The above mentioned recent taxonomic works are based on morphological characteristics (Mohamedsaid, 2006; Beenen, 2007; Doberl, 2007; Moseyko, 2012; Medvedev, 2016a; Medvedev & Romantsov, 2017b). Using this conventional taxonomic approach alone is challenging because sexual dimorphism and colour pattern variants or phenotypic polymorphism are common, especially in relation to variables within the subfamily Galerucinae (Crownson, 1981; Helen & Geoff, 2005; Chaboo, 2007; Prado, 2013; Petitpeirre, 2014; Gomez-Zurita et al., 2016). Consequently, DNA barcoding has been added to the taxonomist's toolkit in order to complement the species identifications that are based on morphological characters (Hebert et al., 2003; Pentinsaari, Hebert & Mutanen, 2014; Gomez-Zurita et al., 2016). To date, there are 73 records of leaf beetles with 15 Barcode Index Numbers (BINs) registered in the Barcoding of Life Data system (BOLD), but none of these records are from Sabah or Borneo.

For all the reasons stated above, this study (1) documented the species richness of leaf beetles from 13 selected islands on the west coast of Sabah, and (2) sequenced DNA barcodes of the leaf beetles to provide phenotypic polymorphism information and baseline DNA barcoding knowledge for future taxonomy study.

## Materials and methods

### Leaf beetle sampling and processing

Standard plot sampling was carried out between January 2016 and March 2017 on the thirteen islands along the west coast of Sabah (**Fig. 1**; **Table 1**) under research permit from Sabah Park (TTS/IP/100-6/2 Jld.4 (49)) and permission from Sapangar Naval Base (MWL2.100-2/2/3-(9)). In each 20 m x 20 m plot, 200 sweeps of shrubs and herbaceous vegetation were conducted using an entomological sweep net (Sánchez-Reyes, Niño-Maldonado & Jones, 2014). This was followed by a manual hand-picking search for leaf beetles over two person-hours. Leaf beetles from each plot were kept in separate Falcon Tubes and brought to the laboratory for further processing. It should be noted that specimens from outside the plots were also collected.

Leaf beetle specimens collected were first killed using 70 % ethanol before being sorted into morphological species under the microscope. All morpho-species were identified to genus and species level by the second author based on morphological characteristics. After that, a few representative specimens of each morpho-species were selected and kept in absolute non-denatured ethanol under – 20 °C for further DNA analysis. Photographs for dorsal and ventral habitus were taken for each morpho-species using a Leica Stereoscope M165C acquired with Leica DFC495 camera and Leica Application Suite ver.4.4.0. All the specimens were deposited in the BORNEENSIS collection at the Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah. Specimen information was catalogued in the BORNEENSIS collection database under the accession number BOR/COL ####.

### DNA extraction, PCR amplification, and Sequencing

DNA was extracted from one to three whole legs of the leaf beetles using Qiagen DNeasy Blood and Tissue Kits, following the manufacturer's protocols. After that, all the DNA extracts were stored under – 20 °C prior to PCR amplification.

The mitochondrial gene region, cytochrome c oxidase subunit I (COI) was PCR-amplified using universal primer LCO 1490 and HCO 2198 (Folmer et al., 1994). The 25 µl PCR reaction mixtures contained 2.5 µl of 10 X GoTaq® PCR buffer with 15 mM $MgCl_2$, 1.5 µl of 25 mM $MgCl_2$, 0.5 µl of 2.5 mM dNTP mix, 0.5 µl of 10 pmol each primer, 0.25 µl of 5 u/µl Taq DNA polymerase, 1 µl DNA template and 18.25 µl $ddH_2O$. PCR amplification was performed in Bio-Rad T100 Thermal Cycler following thermal cycling, an initial denaturation at 94 °C for 3 min, followed by 35 cycles of denaturation at 94 °C for 30 s, annealing at 47 °C for 45 s, extension at 72 °C for 60 s, and a final extension at 72 °C for 5 min. PCR products were checked for successful amplicon using the 1 % agarose gel with TBE buffer. Successful PCR amplicons were sent to Genomics BioScience and Technology Co., Ltd. (Taipei, Taiwan) for sequencing.

### Data analysis

Sequences were checked visually with Bioedit v7.1.9 (Hall, 1999). All the complete sequences were uploaded, registered and managed in the Barcoding of Life Data System, BOLD (Ratnasingham & Hebert, 2007) together with the information about taxonomy and collection, voucher deposition details, original sequence trace files and photographs of the specimens. Each sequence was assigned the Barcode Index Number (BIN) in BOLD (Ratnasingham & Hebert, 2013). Barcode Gap Analysis and distance summary for intraspecific and interspecific distance base on Kimura 2-parameter (K2P) distance model (Kimura, 1980) were performed in BOLD. The nucleotide contents of the sequences are shown in **Table 2**.

In addition, all sequences were compared to the records in the National Center for Biotechnology Information GenBank using the Basic Local Alignment Search Tool, BLAST (Altschul et al., 1990) in Geneious free trial v11.0.3 (Kearse et al., 2012) to search for similar DNA sequences in the database and to obtain tentative taxa identities. Resulting BLAST top-hits for all the sequences are shown in **Table 3**.

**DNA barcodes**

The barcode index numbers (BIN) for each specimen were listed. The intraspecific and interspecific distances of the species were generated using the sequence analysis in BOLD. For intraspecific distance, only species with more than one individual sequence were shown and for interspecific distance, only two or more species under the same genus were shown in the checklist. The "Mean" represents the mean distance, "Max" represents the maximum distance, and abbreviation "N/A" represents data that are not available.

**Species checklist**

This checklist is comprised of information about the generic diagnosis of the genus: examined materials in BORNEENSIS, species distribution in west coast islands of Sabah, DNA barcode and general remarks on the species (or morphospecies, e.g. Galerucinae sp.). Taxonomy classification of the species in this checklist followed the modified Seeno & Wilcox (1982) system's as proposed in Bouchard *et al.* (2011). Morphospecies that could not be identified to genus level were named after the subfamily (e.g. Galerucinae sp.). Photos of dorsal and ventral habitus for each of the species were included.

The generic diagnosis were done using literatures of the original description of the genus, other studies mentioning generic diagnosis characters, or the identification key to the genus level (Baly, 1860, 1865; Clark, 1865; Fairmaire, 1881; Jacoby, 1884, 1908; Lefevre, 1884; Sharp, 1904; Maulik, 1919, 1926, 1936; Laboissiere, 1933; Gressitt & Kimoto, 1963; Samuelson, 1969; Gressitt, 1969; Kimoto & Gressitt, 1979, 1981, 1982; Kimoto, 1989; Mohamedsaid, 1994; Medvedev, 2009; Hazmi & Wagner, 2010; Blanco & Konstantinov, 2013; Borowiec, Takizawa & Swietojańska, 2013; Reid & Beatson, 2015). Then, the distribution of each species on the sampled islands was summarised**.** Additional information on each of the species such as morphological characteristics, comparison with other species, sampled habitat, phenotypic variation, and possible host plants were provided as remarks.

## Results

### Species Diversity of Leaf Beetle

A total of 1104 leaf beetle specimens were collected in this study, including 68 species in 33 genera and five subfamilies, with subfamily Galerucinae having the highest number of genera and species recorded (17 genera, 42 species), followed by subfamily Eumolpinae (nine genera, 16 species), subfamily Cassidinae (four genera, seven species), subfamily Chrysomelinae (two genera, two species), and subfamily Criocerinae (one genus, one species). Of all the genera collected, genus *Monolepta* was the most speciose with 18 species collected, followed by genus *Hoplosaenidea* with seven species and genus *Basilepta* with six species. Besides that, in terms of the islands, Pulau Gaya has the highest number of species recorded (42 species), followed by Pulau Tiga (22 species), Pulau Sapangar (18 species), Pulau Dinawan and Pulau Sapi (nine species), Pulau Mantukod and Pulau Manukan (eight species), Pulau Mengalum (seven species), Pulau Mamutik and Pulau Udar Besar (six species), Pulau Udar Kecil (five species), Pulau Peduk (four species), and Pulau Sulug (two species).

### DNA barcoding

Whereas DNA from a total of 68 leaf beetle species was extracted, only 60 of these were successfully sequenced resulting in 100 barcode compliant sequences and one non-barcode compliant sequence. These 101 sequences were uploaded and assigned to 64 BINs in BOLD (available at: dx.doi.org/10.5883/DS-BCHRY18). Details of the sequenced leaf beetle species, number of specimens, and respective BINs are listed in the Supplementary file, **Table S1**. A neighbour-joining tree was constructed based on these 101 sequences via BOLD (**Fig. 2**), to shows the relationship between these sequences.

From the sequence nucleotide composition analysis in BOLD, the average percentage of all the sequences G, C, A, and T were 16.38 % (14.58 – 18.13 %), 17.19 % (13.23 – 24.02 %), 29.86 % (27.11 – 33.13 %) and 36.57 % (30.66 – 40.99 %), respectively (See **Table 2**). The overall mean AT content of the 101 sequences was 66.43% (57.85 –71.66 %) and strongly AT biased at the third codon position with mean AT content of 85.09 % (63.64 – 96.51%). Intraspecific and interspecific K2P distances were easily distinguishable from each other, with overall means 0.77 % (range 0 - 1.99 %) and 16.11 % (range 4.71 – 24.6 %), respectively. Further details of the intraspecific and interspecific distances are available in the Supplement File **Table S2** and **Table S3**.

All the 101 sequences submitted to GenBank through BLAST to search for identical results and the top-hit results was shown in **Table 3**. The pairwise identity percentage of the 101 sequences with records in GenBank ranges from 82.6 % - 100 %. These BLAST top-hits results were summarized and grouped into two categories (≥ 90 % and < 90%) based on their pairwise identity percentages, as shown in **Table 4**. Of the 101 sequences, 21 sequences (15 species) match existing sequences in Genbank with pairwise identity percentage higher than 90 % whereas 80 sequences (47 species) with pairwise identity percentages below 90 %. However,

those 21 with high pairwise identity percentages can only be identified into subfamily (three records) or genus (nine records) based on the taxonomic information available for the records in the Genbank. For the remaining 80 sequences, two records can be identified to family level and 29 records identified to subfamily level.

## Discussion

### Species Diversity of Leaf Beetle

The dominant leaf beetle on these islands are species of subfamily Galerucinae (excluding Tribe Alticini) and subfamily Eumolpinae which is accordant to the general trend throughout the Oriental region (Kimoto, 1988). It seems that leaf beetle species richness is greater on islands situated closer to the mainland and with a larger land area.

Although this study sampled only 13 islands out of the 500 islands (~3 %) from Sabah, the checklist documented 68 species, comprising 9 % of the current known leaf beetle species in Borneo. This suggests that species richness on the islands is comparable to that on mainland habitats and that more species remain to be discovered. In addition, this checklist also reveals the distribution of agricultural pest species on the islands, which is vital for the control of their dispersal. For example, *Brontispa longissima*, one of the coconuts pests in the Pacific region, is commonly found on the sampled islands noted for human habitation, tourist activities and resorts.

### DNA barcoding

Out of the 64 generated BINs, 60 unique BINs are new to BOLD and 4 non-unique BINs are existing records in BOLD. As compared to the existing 73 records and 15 BINs of Chrysomelidae from Malaysia in BOLD, all the 101 sequences and 64 BINs from this study are new to Malaysia. Through the Barcode Gap Analysis and distance summary analysis in BOLD, six sequenced *Nodina* sp. specimens were revealed to be five different species. However, these five species are morphologically hard to distinguish from one another and thus, all these five species are collectively treated as a single species (Kishimoto-Yamada, Takizawa & Mahadimenakbar, 2016) and excluded from the overall mean intraspecific and interspecific distance analysis.

Barcode Gap Analysis in BOLD also revealed those leaf beetle species with phenotypic variation through the distribution of distances within each species and the distance to the nearest neighbour of each species (Puillandre et al., 2012). All the leaf beetle species that exhibited phenotypic variation in the study are from the subfamily Galerucinae, which corroborates previous reports (Maulik, 1936; Beenen, 2007; Prado, 2013). Referring to the neighbour joining tree (see **Fig. 2**), leaf beetles with phenotypic variation (highlighted in red colour) are genus indet. nr. *Monolepta* (Figs. 8G, 8H, 9A), *Hoplosaenidea* sp. 5 (Figs. 5A – 5B), *Monolepta* sp. 5 (Figs. 6A – 6D), and *Monolepta* sp. 14 (Figs. 7E – 7F) with mean intraspecific distances of 0.2 %, 0 %, 0.96 %, and 0.41 %, respectively. The *Hoplosaenidea* sp. 5 and *Monolepta* sp. 14 are possibly sexual dimorphics, and genus indet. nr. *Monolepta* and *Monolepta* sp. 5 are possibly

colour polymorphics, yet, further investigations are needed before conclusions can be made. The phenotypic variation for both sexual dimorphism and colour polymorphism in leaf beetles is possibly caused by genetics, environment or a combination of both factors (Jolivet, Petitpierre & Hsiao, 1988).

Nonetheless, 97 % of the sequences obtained from this study are new to GenBank. On top of that, out of the 21 analysed sequences with pairwise identity percentage higher than 90 %, only five sequences were identified to species level in BLAST top-hits results. These are *Brontispa longissima*, *Altica birmanensis*, and *Altica engstroemi* with pairwise identity percentages of 100 %, 99.2 %, and 99.0 %, respectively (see **Table 3**). However, both *Altica birmanensis* and *Altica engstroemi* were previously not recorded in Borneo and the latter species' known distribution was only from northern Europe (Mohamedsaid, 2004; Reid & Beatson, 2015; GBIF, 2017). This has become complicated by the fact that the pairwise identity percentage of these two species sequences in GenBank is 99.5 %, suggesting that they should be the same species, and that they were possibly misidentified as the locality of both record specimens were from Karala, India. This conforms with previous reports on the poor quality of taxonomic identifications in GenBank (Bridge et al., 2003; Vilgalys, 2003; James Harris, 2003; Kristiansen et al., 2005).

## SPECIES CHECKLIST

### SUBFAMILY GALERUCINAE

#### Tribe ALTICINI Newman 1835

**Genus *Altica* Geoffroy, 1762.**
Refer to **Appendix A**, page 1 for the generic diagnosis of this genus.
***Altica aenea* (Olivier, 1808)**
(Fig. 3A)
**Examined materials (4).** *Pulau Tiga*: BOR/COL 8071. *Pulau Gaya*: BOR/COL 8166, BOR/COL 8173, BOR/COL 9444.
**Distribution in Sabah.** Pulau Tiga, Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:AAP8616
**Intra-specific distance (%).** Mean: 0 Max: 0
**Remarks.** BLAST top-hit result shows 99 % similarity with *Altica bermanensis* and *Altica engstromi*. However, both species not recorded in Sabah (Mohamedsaid, 2004; Reid & Beatson, 2015). So, the records in GenBank probably misidentified.

**Genus *Aphthona* Chevrolat, 1837.**
Refer to **Appendix A**, page 1 for the generic diagnosis of this genus.
***Aphthona* sp.**

(Fig. 3B)
**Examined materials (1).** *Pulau Mamutik*: BOR/COL 9602.
**Distribution in Sabah.** Pulau Mamutik.
**Barcode Index Number (BIN).** BOLD:ADH3773
**Intraspecific distance (%).** N/A
**Remarks.** Only found in Pulau Mamutik.

**Genus *Argopistes* Motschulsky, 1860.**
Refer to **Appendix A**, page 1 for the generic diagnosis of this genus.
***Argopistes* sp. 1**
(Fig. 3C)
**Examined materials (11).** *Pulau Udar Kecil*: BOR/COL 8442 – 8446, BOR/COL 9894 – 9895. *Pulau Gaya*: BOR/COL 9813, BOR/COL 9915 – 9917.
**Distribution in Sabah.** Pulau Udar Kecil, Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH5650
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.38 Max: 15.38
**Remarks.** Differentiate from *Argopistes* sp. 2 by black dorsum and yellow venter.

***Argopistes* sp. 2**
(Fig. 3D)
**Examined materials (2).** *Pulau Mamutik*: BOR/COL 9608 – 9609.
**Distribution in Sabah.** Pulau Mamutik.
**Barcode Index Number (BIN).** BOLD:ADH5651
**Intraspecific distance (%).** N/A
**Interspecific distance (%).**Mean: 15.38 Max: 15.38
**Remarks.** Found near *Citrus* plant. Dorsal and ventral dark red in colour.

**Genus *Erystus* Jacoby, 1885.**
Refer to **Appendix A**, page 1 & 2 for the generic diagnosis of this genus.
***Erystus villicus* (Weise, 1892)**
(Fig. 3E)
**Examined materials (37).** *Pulau Gaya*: BOR/COL 8134 – 8141, BOR/COL 8334 – 8341, BOR/COL 9332 – 9334, BOR/COL 9394 – 9395, BOR/COL 9400 – 9416.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH6322
**Intraspecific distance (%).** N/A
**Remarks.** Usually found on *Hibiscus tiliaceus* near the beach with a great number of individuals. Heavily defoliate the host plant.

**Genus *Hemipyxis* Chevrolat, 1836.**
Refer to **Appendix A**, page 2 for the generic diagnosis of this genus.
***Hemipyxis* sp.**
(Fig. 3F)

**Examined materials (10).** *Pulau Gaya*: BOR/COL 8187, BOR/COL 8213, BOR/COL 8236, BOR/COL 8325 – 8326, BOR/COL 9397, BOR/COL 9814 – 9815, BOR/COL 9924, BOR/COL 9961.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Only collected from Pulau Gaya. Body is yellow in colour.

**Genus *Hyphasis* Harold, 1877**
Refer to **Appendix A**, page 2 for the generic diagnosis of this genus.
***Hyphasis* sp.**
(Fig. 3G)
**Examined materials (1).** *Pulau Dinawan*: BOR/COL 8449.
**Distribution in Sabah.** Pulau Dinawan.
**Barcode Index Number (BIN).** BOLD:ADH5610
**Intraspecific distance (%).** N/A
**Remarks.** Only found in Pulau Dinawan, near to deforested area.

**Genus *Lanka* Maulik, 1926.**
Refer to **Appendix A**, page 2 & 3 for the generic diagnosis of this genus.
***Lanka* sp.**
(Fig. 3H)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 8097.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH7255
**Intraspecific distance (%).** N/A
**Remarks.** Collected from a plant near to the river in Pulau Gaya.

**Genus *Schenklingia* Csiki & Heikertinger, 1940**
Refer to **Appendix A**, page 3 for the generic diagnosis of this genus.
***Schenklingia* sp.**
(Fig. 4A)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 9429.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH3903
**Intraspecific distance (%).** N/A
**Remarks.** Body colour dark red, first three and 11$^{th}$ antennal segment orange-brown colour and remaining antennal segments black in colour.

**Tribe LUPERINI Leng 1920**
**Subtribe AULACOPHORINA Wilcox 1972**
**Section Aulacophorites Chapius 1875**

**Genus Aulacophora Dejean, 1835**

Refer to **Appendix A**, page 3 for the generic diagnosis of this genus.

***Aulacophora* sp.**

(Fig. 4B)

**Examined materials (7).** *Pulau Gaya*: BOR/COL 8103, BOR/COL 8184, BOR/COL 8321, BOR/COL 8331, BOR/COL 9462 – 9464.

**Distribution in Sabah.** Pulau Gaya.

**Barcode Index Number (BIN).** BOLD:ADH4212

**Intraspecific distance (%).** N/A

**Interspecific distance (%).** Mean: 14.84 Max: 22.94

**Remarks.** Found on the plants near river area in Pulau Gaya.

**Subtribe LUPERINA Wilcox 1965**

**Section Doryscites Wilcox 1973**

**Genus *Strobiderus* Jacoby, 1884**

Refer to **Appendix A**, page 3 for the generic diagnosis of this genus.

***Strobiderus* sp.**

(Fig. 4C)

**Examined materials (7).** *Pulau Tiga*: BOR/COL 6995 – 6999, BOR/COL 9155, BOR/COL 9156.

**Distribution in Sabah.** Pulau Tiga.

**Barcode Index Number (BIN).** BOLD:ADH6702

**Intraspecific distance (%).** N/A

**Remarks.** Collected from the ventral part of the leaves of plant family Araceae.

**Section Luperites Chapius 1875**

**Genus *Hoplosaenidea* Laboissiere, 1933.**

Refer to **Appendix A**, page 3 & 4 for the generic diagnosis of this genus.

***Hoplosaenidea malayensis* (Jacoby, 1884)**

(Fig. 4D)

**Examined materials (14).** *Pulau Gaya*: BOR/COL 8188 – 8193, BOR/COL 8330, BOR/COL 9854 – 9856. *Pulau Sapangar*: BOR/COL 8425, BOR/COL 9680 – 9681. *Pulau Udar Besar*: BOR/COL 8440.

**Distribution in Sabah.** Pulau Gaya, Pulau Sapangar, Pulau Udar Besar.

**Barcode Index Number (BIN).** BOLD:ADH4031

**Intraspecific distance (%).** Mean: 0.1 Max: 0.15

**Interspecific distance (%).** Mean: 17.70 Max: 22.35

**Remarks.** Whole body yellow in colour, usually found in few of individuals on a single plant.

***Hoplosaenidea* sp. 1**

(Fig. 4E)

**Examined materials (1).** *Pulau Tiga*: BOR/COL 7000.

**Distribution in Sabah.** Pulau Tiga.

**Barcode Index Number (BIN).** BOLD:ADH3897

**Intraspecific distance (%).** N/A

**Interspecific distance (%).** Mean: 17.70 Max: 22.35
**Remarks.** Body completely creamy white in colour.

***Hoplosaenidea* sp. 2**
(Fig. 4F)
**Examined materials (6).** *Pulau Tiga*: BOR/COL 8538. *Pulau Gaya*: BOR/COL 9430 – 9434.
**Distribution in Sabah.** Pulau Tiga, Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH4030
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 17.70 Max: 22.35
**Remarks.** Whole body banana yellow in colour, and elytra with two longitudinally black stripes.

***Hoplosaenidea* sp. 3**
(Fig. 4G)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 8268.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Whole body red-orange in colour.

***Hoplosaenidea* sp. 4**
(Fig. 4H)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 8095.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH4029
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 17.70 Max: 22.35
**Remarks.** Similar to *Hoplosaenidea sp. 6*, different by thorax and elytra colouration, and the 9$^{th}$ antennae segment on basal half white and on apical half black.

***Hoplosaenidea* sp. 5**
(Figs. 5A – 5B)
**Examined materials (2).** *Pulau Mantukod*: BOR/COL 9720 – 9721.
**Distribution in Sabah.** Pulau Mantukod.
**Barcode Index Number (BIN).** BOLD:ADH4033
**Intraspecific distance (%).** Mean: 0 Max: 0
**Interspecific distance (%).** Mean: 17.70 Max: 22.35
**Remarks.** Possible sexual dimorphism, with difference in size and body colour.

***Hoplosaenidea variabilis* (Jacoby, 1894)**
(Fig. 5C)
**Examined materials (1).** *Pulau Udar Besar*: BOR/COL 9638.
**Distribution in Sabah.** Pulau Udar Besar.
**Barcode Index Number (BIN).** BOLD:ADH4032
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 17.70 Max: 22.35

**Remarks.** Head and thorax maroon red colour, and elytra with metallic bluish-green colour.

**Section MONOLEPTITES Chapius 1875**

**Genus *Metrioidea* Fairmaire, 1881.**

Refer to **Appendix A**, page 4 for the generic diagnosis of this genus.

***Metrioidea grandis* (Allard, 1889)**

(Fig. 5D)

**Examined materials (55).** *Pulau Gaya*: BOR/COL 8094, BOR/COL 8106 – 8108, BOR/COL 8121 – 8122, BOR/COL 8131 – 8132, BOR/COL 8171 – 8172, BOR/COL 8238, BOR/COL 8241 – 8245, BOR/COL 8270 – 8273, BOR/COL 8283 – 8304, BOR/COL 8310, BOR/COL 9428, BOR/COL 9465 – 9467, BOR/COL 9480, BOR/COL 9494. *Pulau Sapangar*: BOR/COL 8417, BOR/COL 8429 – 8433.

**Distribution in Sabah.** Pulau Gaya, Pulau Sapangar.

**Barcode Index Number (BIN).** BOLD:ADH7177

**Intraspecific distance (%).** Mean: 1.99 Max: 1.99

**Remarks.** Body orange in colour. Elytra become semi-transparent after soaking in ethanol.

**Genus *Monolepta* Erichson, 1843**

Refer to **Appendix A**, page 4 for the generic diagnosis of this genus.

***Monolepta* sp. 1**

(Fig. 5E)

**Examined materials (53).** *Pulau Gaya*: BOR/COL 8209 – 8211, BOR/COL 8235, BOR/COL 8250, BOR/COL 8323, BOR/COL 8332, BOR/COL 9396, BOR/COL 9460, BOR/COL 9805, BOR/COL 9836 – 9840, BOR/COL 9932. *Pulau Sapangar*: BOR/COL 8427, BOR/COL 8435 – 8436, BOR/COL 9672, BOR/COL 9674, BOR/COL 9690, BOR/COL 9699, BOR/COL 9709 – 9711. *Pulau Udar Besar*: BOR/COL 8441. *Pulau Sapi*: BOR/COL 9215 – 9220, BOR/COL 9243. *Pulau Sulug*: BOR/COL 9619 – 9622, BOR/COL 9624 – 9633, BOR/COL 9635 – 9636. *Pulau Mantukod*: BOR/COL 9736. *Pulau Udar Kecil*: BOR/COL 9899 – 9900.

**Distribution in Sabah.** Pulau Gaya, Pulau Sapangar, Pulau Udar Besar, Pulau Sapi, Pulau Sulug, Pulau Mantukod, Pulau Udar Kecil.

**Barcode Index Number (BIN).** BOLD:ADH4138

**Intraspecific distance (%).** Mean: 0.92 Max: 0.92

**Interspecific distance (%).** Mean: 15.88 Max: 24.60

**Remarks.** Whole body yellow in colour with the brown or orange tibia.

***Monolepta* sp. 2**

(Fig. 5F)

**Examined materials (4).** *Pulau Gaya*: BOR/COL 6931, BOR/COL 9442. *Pulau Tiga*: BOR/COL 8526, BOR/COL 9774.

**Distribution in Sabah.** Pulau Gaya, Pulau Tiga.

**Barcode Index Number (BIN).** BOLD:ADH7139

**Intraspecific distance (%).** N/A

**Interspecific distance (%).** Mean: 15.88 Max: 24.60

**Remarks.** Body length around 2 – 3 mm. Black colour elytra with two distinct white bands. Last ventrite segment black.

***Monolepta* sp. 3**

(Fig. 5G)

**Examined materials (8).** *Pulau Gaya*: BOR/COL 6924 – 6926, BOR/COL 9423, BOR/COL 9468 – 9470. *Pulau Tiga*: BOR/COL 9778.

**Distribution in Sabah.** Pulau Gaya, Pulau Tiga.

**Barcode Index Number (BIN).** BOLD:ADH4196

**Intraspecific distance (%).** N/A

**Interspecific distance (%).** Mean: 15.88 Max: 24.60

**Remarks.** This species especially abundant during the flowering season, with deep red colour head, thorax and abdomen, and black colour elytra, last antennae segment black in colour.

***Monolepta* sp. 4**

(Fig. 5H)

**Examined materials (174).** *Pulau Gaya*: BOR/COL 6921 – 6923, BOR/COL 9335 – 9392, BOR/COL 9471 – 9478, BOR/COL 9821. *Pulau Dinawan*: BOR/COL 8455, BOR/COL 8492 – 8505, BOR/COL 9755. *Pulau Mengalum*: BOR/COL 9249, BOR/COL 9967 – 9976. *Pulau Manukan*: BOR/COL 9558 – 9579. *Pulau Udar Besar*: BOR/COL 9640 – 9667. *Pulau Peduk*: BOR/COL 9860 – 9872. *Pulau Udar Kecil*: BOR/COL 9901 – 9914.

**Distribution in Sabah.** Pulau Gaya, Pulau Dinawan, Pulau Mengalum, Pulau Manukan, Pulau Udar Besar, Pulau Peduk, Pulau Udar Kecil.

**Barcode Index Number (BIN).** BOLD:ADH6840

**Intraspecific distance (%).** N/A

**Interspecific distance (%).** Mean: 15.88 Max: 24.60

**Remarks.** Heavily defoliate *Citrus* sp., *Mangifera* sp. and *Sauropus androgynous* plants young shoots.

***Monolepta* sp. 5**

(Figs. 6A-6D)

**Examined materials (20).** *Pulau Gaya*: BOR/COL 8178, BOR/COL 8180, BOR/COL 8251. *Pulau Sapi*: BOR/COL 8348. *Pulau Manukan*: BOR/COL 8403, BOR/COL 9583 – 9585, BOR/COL 9592. *Pulau Mamutik*: BOR/COL 9603. *Pulau Mantukod*: BOR/COL 9718 – 9719, BOR/COL 9722 – 9723, BOR/COL 9733 – 9735. *Pulau Dinawan*: BOR/COL 9740 – 9741. *Pulau Udar Kecil*: BOR/COL 9897.

**Distribution in Sabah.** Pulau Gaya, Pulau Sapi, Pulau Manukan, Pulau Mamutik, Pulau Mantukod, Pulau Dinawan, Pulau Udar Kecil.

**Barcode Index Number (BIN).** BOLD:ADH4050

**Intraspecific distance (%).** Mean: 0.96 Max: 1.69

**Interspecific distance (%).** Mean: 15.88 Max: 24.60

**Remarks.** This species exhibit phenotypic polymorphism, with four different phenotypic characters, one fully milky white in colour, one with suture and elytra edge black in colour, one elytra with two dark brown bands separated by light brown bands, and one elytra with two dark brown bands interconnected by dark brown suture but separated by two light brown bands.

***Monolepta* sp. 6**
(Fig. 6E)
**Examined materials (1).** *Pulau Tiga*: BOR/COL 8531.
**Distribution in Sabah.** Pulau Tiga.
**Barcode Index Number (BIN).** BOLD:ADH6249
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Found resting on the beach *Ipomoea* species. Head and elytra deep red in colour with thorax creamy white in colour.

***Monolepta* sp. 7**
(Fig. 6F)
**Examined materials (6).** *Pulau Sapangar*: BOR/COL 8426, BOR/COL 8437 – 8439, BOR/COL 9677, BOR/COL 9717.
**Distribution in Sabah.** Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH4051
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Usually found on the highest point in Pulau Sapangar.

***Monolepta* sp. 8**
(Fig. 6G)
**Examined materials (22).** *Pulau Gaya*: BOR/COL 8314, BOR/COL 9299 – 9301, BOR/COL 9824, BOR/COL 9826 – 9835, BOR/COL 9841, BOR/COL 9939 – 9944.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH7150
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Only collected from Pulau Gaya, light yellow in colour.

***Monolepta* sp. 9**
(Fig. 6H)
**Examined materials (15).** *Pulau Gaya*: BOR/COL 8276, BOR/COL 9330, BOR/COL 9435 – 9437, BOR/COL 9440 – 9441, BOR/COL 9443, BOR/COL 9825. *Pulau Tiga*: BOR/COL 8525, BOR/COL 9153, BOR/COL 9165 – 9166, BOR/COL 9779. *Pulau Sapangar*: BOR/COL 9684.
**Distribution in Sabah.** Pulau Gaya, Pulau Tiga, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH7149
**Intraspecific distance (%).** Mean: 1.32 Max: 1.83
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Black colour head with milky white colour thorax and black colour elytra with a white band in the middle of the elytra.

***Monolepta* sp. 10**
(Fig. 7A)
**Examined materials (3).** *Pulau Gaya*: BOR/COL 8104, BOR/COL 8181. *Pulau Mantukod*: BOR/COL 9732.

**Distribution in Sabah.** Pulau Gaya, Pulau Mantukod.
**Barcode Index Number (BIN).** BOLD:ADH7148
**Intraspecific distance (%).** Mean: 0 Max: 0
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Orange colour head and thorax, semi-transparent elytra with light green abdomen.

***Monolepta* sp. 11**
(Fig. 7B)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 8119.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH7140
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Similar to *Monolepta* sp. 18, with the difference on the elytra patterns.

***Monolepta* sp. 12**
(Fig. 7C)
**Examined materials (1).** *Pulau Tiga*: BOR/COL 9201.
**Distribution in Sabah.** Pulau Tiga.
**Barcode Index Number (BIN).** BOLD:ADH4195
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Collected from random sweeping along the Pagong-Pagong trail in Pulau Tiga.

***Monolepta* sp. 13**
(Fig. 7D)
**Examined materials (1).** *Pulau Sapangar*: BOR/COL 9678.
**Distribution in Sabah.** Pulau Sapangar.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Body length 2-3mm. Only collected from Pulau Sapangar.

***Monolepta* sp. 14**
(Figs. 7E-7F)
**Examined materials (9).** *Pulau Sapi*: BOR/COL 9223, BOR/COL 9240. *Pulau Gaya*: BOR/COL 9418 – 9419, BOR/COL 9450, BOR/COL 9842. *Pulau Manukan*: BOR/COL 9556 – 9557. *Pulau Tiga*: BOR/COL 9766.
**Distribution in Sabah.** Pulau Sapi, Pulau Gaya, Pulau Manukan, Pulau Tiga.
**Barcode Index Number (BIN).** BOLD:ADH4966
**Intraspecific distance (%).** Mean: 0.41 Max: 0.62
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Possible exhibit sexual dimorphism.

***Monolepta* sp. 15**
(Fig. 7G)

**Examined materials (7).** *Pulau Dinawan*: BOR/COL 8456. *Pulau Gaya*: BOR/COL 9438 – 9439. *Pulau Mamutik*: BOR/COL 9600. *Pulau Udar Besar*: BOR/COL 9639, BOR/COL 9670. *Pulau Peduk*: BOR/COL 9883.
**Distribution in Sabah.** Pulau Dinawan, Pulau Gaya, Pulau Mamutik, Pulau Udar Besar, Pulau Peduk.
**Barcode Index Number (BIN).** BOLD:ADH4198
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Black colour head with the yellow thorax, black elytra with one yellow band in the middle.

***Monolepta* sp. 16**
(Fig. 7H)
**Examined materials (3).** *Pulau Gaya*: BOR/COL 9424, BOR/COL 9445, BOR/COL 9958.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Whole body brown in colour, only found in Pulau Gaya.

***Monolepta* sp. 17**
(Fig. 8A)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 9449.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH7141
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Whole body white in colour, meso- and metasternum light brown in colour.

***Monolepta* sp. 18**
(Fig. 8B)
**Examined materials (1).** *Pulau Sapangar*: BOR/COL 9679.
**Distribution in Sabah.** Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH4197
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 15.88 Max: 24.60
**Remarks.** Differentiate from *Monolepta* sp. 11 by the dark colour patterns on the elytra.

**Genus *Ochralea* Clark, 1865**
Refer to **Appendix A**, page 4 for the generic diagnosis of this genus.
***Ochralea nigripes* (Olivier, 1808)**
(Fig. 8C)
**Examined materials (130).** *Pulau Tiga*: BOR/COL 8002 – 8005, BOR/COL 8015, BOR/COL 8017 – 8039, BOR/COL 8048 – 8050, BOR/COL 8515 – 8518, BOR/COL 8520 –8524, BOR/COL 8528 – 8530, BOR/COL 8542 – 8544, BOR/COL 8555 – 8558, BOR/COL 9121 – 9147, BOR/COL 9160 – 9164, BOR/COL 9198 – 9199, BOR/COL 9202 – 9206, BOR/COL 9780 – 9789, BOR/COL 9798 – 9799. *Pulau Gaya*: BOR/COL 8201, BOR/COL 8212,

BOR/COL 8234, BOR/COL 8319 – 8320, BOR/COL 8322, BOR/COL 8327, BOR/COL 9461, BOR/COL 9956. *Pulau Sapi*: BOR/COL 8356, BOR/COL 8362. *Pulau Mamutik*: BOR/COL 8408, BOR/COL 8411 – 8416, BOR/COL 9604 – 9607. *Pulau Udar Besar*: BOR/COL 9668 – 9669. *Pulau Sapangar*: BOR/COL 9692 – 9696, BOR/COL 9707.
**Distribution in Sabah.** Pulau Tiga, Pulau Gaya, Pulau Sapi, Pulau Mamutik, Pulau Udar Besar, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH4213
**Intraspecific distance (%).** Mean: 0.7 Max: 1.06
**Remarks.** 8 -10 mm body length, with colour variations of yellow and yellow-orange body colour. Very abundant especially in Pulau Gaya and Pulau Tiga. Few individuals collected in between leaf litters and twigs from the ground.

**Tribe GALERUCINI Laboissiere 1921**
**Section Coelomerites Chapius 1875**

**Genus *Clitena* Baly, 1864.**
Refer to **Appendix A**, page 4 & 5 for the generic diagnosis of this genus.
***Clitena* sp.**
(Fig. 8D)
**Examined materials (2).** *Pulau Manukan*: BOR/COL 8399, BOR/COL 9580.
**Distribution in Sabah.** Pulau Manukan.
**Barcode Index Number (BIN).** BOLD:ADH3702
**Intraspecific distance (%).** N/A
**Remarks.** Found near the sunset point shelter in Pulau Manukan.

**Tribe METACYCLINI Leng 1920**

**Genus *Sumatrasia* Jacoby, 1884**
Refer to **Appendix A**, page 5 for the generic diagnosis of this genus.
***Sumatrasia* sp.**
(Fig. 8E)
**Examined materials (1).** *Pulau Sapi*: BOR/COL 6938.
**Distribution in Sabah.** Pulau Sapi.
**Barcode Index Number (BIN).** BOLD:ADH4430
**Intraspecific distance (%).** N/A
**Remarks.** Whole body yellow in colour. Collected along the trail in Pulau Sapi.

**Tribe SERMYLINI Wilcox 1965**
**Section Antiphites Chapius 1875**

**Genus *Dercetina* Gressitt & Kimoto, 1963.**
Refer to **Appendix A**, page 5 for the generic diagnosis of this genus.
***Dercetina* sp.**
(Fig. 8F)

**Examined materials (5).** *Pulau Gaya*: BOR/COL 8150. *Pulau Sapangar*: BOR/COL 8428, BOR/COL 8434, BOR/COL 9671, BOR/COL 9713.
**Distribution in Sabah.** Pulau Gaya, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH3896
**Intraspecific distance (%).** Mean: 0.3 Max: 0.3
**Remarks.** Body divided into two colour: head, thorax and the basal half of elytra red colour, and apical half black. Last ventrite visible from dorsal.

**Genus indet. nr. *Monolepta***
(Figs. 8G–8H, 9A)
**Examined materials (14).** *Pulau Gaya*: BOR/COL 8277. *Pulau Peduk*: BOR/COL 9873 – 9877, BOR/COL 9884 – 9885, BOR/COL 9888 – 9893.
**Distribution in Sabah.** Pulau Gaya, Pulau Peduk.
**Barcode Index Number (BIN).** BOLD:ADH3996
**Intraspecific distance (%).** Mean: 0.2 Max: 0.3
**Remarks.** Possibly exhibit phenotypic polymorphism with three different patterns and colourations on the elytra. These three patterns also observed at UMS hill based on second author collection.

## SUBFAMILY EUMOLPINAE

### Tribe ADOXINI Jacoby 1908
### Section Scelodontites Chapius 1874

**Genus *Scelodonta* Westwood, 1837.**
Refer to **Appendix A**, page 5 for the generic diagnosis of this genus.
***Scelodonta granulosa* Baly, 1867**
(Fig. 9B)
**Examined materials (2).** *Pulau Mengalum*: BOR/COL 9531. *Pulau Sapangar*: BOR/COL 9682.
**Distribution in Sabah.** Pulau Mengalum, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADE7488
**Intraspecific distance (%).** N/A
**Remarks.** Iridescent body colour with the red colour tibia.

### Tribe COLASPOSOMINI Springlova 1960
### Section Colasposomites Wilcox 1982

**Genus *Colasposoma* Laporte, 1833.**
Refer to **Appendix A**, page 6 for the generic diagnosis of this genus.
***Colasposoma auripenne* Motschulsky, 1860**
(Fig. 9C)
**Examined materials (2).** *Pulau Dinawan*: BOR/COL 9753 – 9754.
**Distribution in Sabah.** Pulau Dinawan.
**Barcode Index Number (BIN).** BOLD:ADH6210

**Intraspecific distance (%).** N/A
**Remarks.** This species was found on the cultivated sweet potatoes plant, *Ipomoea batatas*.

**Tribe EUMOLPINI Jacoby 1908**
**Section Endocephalites Chapius 1874**

**Genus *Aulacia* Baly, 1867.**
Refer to **Appendix A**, page 6 for the generic diagnosis of this genus.
***Aulacia* sp.**
(Fig. 9D)
**Examined materials (2).** *Pulau Tiga*: BOR/COL 9154, BOR/COL 9200.
**Distribution in Sabah.** Pulau Tiga.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Dark brown in colour. Found from Pagong-Pagong trail, Pulau Tiga.

**Genus *Colaspoides* Laporte, 1833.**
Refer to **Appendix A**, page 6 for the generic diagnosis of this genus.
***Colaspoides* sp. 1**
(Fig. 9E)
**Examined materials (9).** *Pulau Tiga*: BOR/COL 8545 – 8546. *Pulau Gaya*: BOR/COL 9398, BOR/COL 9454 – 9458. *Pulau Sapangar*: BOR/COL 9691.
**Distribution in Sabah.** Pulau Tiga, Pulau Gaya, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH4442
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 23.03 Max: 23.03
**Remarks.** 1st to 8th antennae segments yellow-brown, 9th to 11th antennae segments black, dorsum and leg yellow-brown.

***Colaspoides tuberculata* Baly, 1867**
(Fig. 9F)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 9858.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH4443
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 23.03 Max: 23.03
**Remarks.** Antennae black, body colour iridescent colour.

**Tribe NODINI Chen 1940**
**Section Nodostomini Jacoby 1908**

**Genus *Basilepta* Baly, 1860**
Refer to **Appendix A**, page 6 for the generic diagnosis of this genus.
***Basilepta* sp. 1**

(Fig. 9G)
**Examined materials (21).** *Pulau Gaya*: BOR/COL 8202, BOR/COL 8237, BOR/COL 9296, BOR/COL 9302 – 9310, BOR/COL 9843 – 9848, BOR/COL 9918 – 9919. *Pulau Mantukod*: BOR/COL 9737.
**Distribution in Sabah.** Pulau Gaya, Pulau Mantukod.
**Barcode Index Number (BIN).** BOLD:ADH5567
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 18.02 Max: 21.63
**Remarks.** Pronotum strongly punctate, body dark brown in colour.

***Basilepta* sp. 2**
(Fig. 9H)
**Examined materials (9).** *Pulau Gaya*: BOR/COL 6930, BOR/COL 9311 – 9316, BOR/COL 9819. *Pulau Sapangar*: BOR/COL 9683.
**Distribution in Sabah.** Pulau Gaya, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADH5568
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 18.02 Max: 21.63
**Remarks.** Thorax strongly punctate, elytra weakly punctate than pronotum.

***Basilepta* sp. 3**
(Fig. 10A)
**Examined materials (6).** *Pulau Tiga*: BOR/COL 9158, BOR/COL 9170, BOR/COL 9187, BOR/COL 9757, BOR/COL 9769. *Pulau Sapangar*: BOR/COL 9714.
**Distribution in Sabah.** Pulau Tiga, Pulau Sapangar.
**Barcode Index Number (BIN).** BOLD:ADI3390
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 18.02 Max: 21.63
**Remarks.** Pronotum impunctate, elytra not strongly punctate.

***Basilepta* sp. 4**
(Fig. 10B)
**Examined materials (10).** *Pulau Tiga*: BOR/COL 8064 – 8065, BOR/COL 9758 – 9765.
**Distribution in Sabah.** Pulau Tiga.
**Barcode Index Number (BIN).** BOLD:ADH4287
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 18.02 Max: 21.63
**Remarks.** Body red-brown in colour. Pronotum weakly punctate than on elytra.

***Basilepta* sp. 5**
(Fig. 10C)
**Examined materials (13).** *Pulau Gaya*: BOR/COL 8102, BOR/COL 8198, BOR/COL 8324, BOR/COL 9331, BOR/COL 9420, BOR/COL 9822 – 9823, BOR/COL 9927 – 9931. *Pulau Sapangar*: BOR/COL 9686.
**Distribution in Sabah.** Pulau Gaya, Pulau Sapangar.
**Barcode Index Number (BIN).** N/A

**Intraspecific distance (%).** N/A
**Remarks.** Pronotum impunctate on median area, strongly punctate laterally.

***Basilepta* sp. 6**
(Fig. 10D)
**Examined materials (1).** *Pulau Mengalum*: BOR/COL 9977.
**Distribution in Sabah.** Pulau Mengalum.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Only collected from Pulau Mengalum.

**Genus *Nodina* Motschulsky, 1858.**
Refer to **Appendix A**, page 7 for the generic diagnosis of this genus.
***Nodina* sp.**
(Figs. 10E – 10H, 11A)
**Examined materials (159).** *Pulau Tiga*: BOR/COL 6994, BOR/COL 8047, BOR/COL 8527, BOR/COL 8547 – 8548, BOR/COL 8559, BOR/COL 9148 – 9152, BOR/COL 9167, BOR/COL 9171 – 9186, BOR/COL 9188 – 9197, BOR/COL 9210 – 9211, BOR/COL 9768, BOR/COL 9782, BOR/COL 9790 – 9797, BOR/COL 9800 – 9802. *Pulau Gaya*: BOR/COL 8179, BOR/COL 8197, BOR/COL 8240, BOR/COL 8258, BOR/COL 8328, BOR/COL 9297, BOR/COL 9298, BOR/COL 9319 – 9422, BOR/COL 9806 – 9811, BOR/COL 9920 – 9923, BOR/COL 9933 – 9935, BOR/COL 9945, BOR/COL 9955, BOR/COL 9959. *Pulau Sapi*: BOR/COL 8350 – 8352, BOR/COL 8365 – 8366, BOR/COL 8369 – 8373, BOR/COL 9221 – 9222, BOR/COL 9224 – 9237, BOR/COL 9241. *Pulau Manukan*: BOR/COL 8398, BOR/COL 8400 – 8402, BOR/COL 9552, BOR/COL 9555, BOR/COL 9590. *Pulau Sapangar*: BOR/COL 8418 – 8421, BOR/COL 9676, BOR/COL 9689, BOR/COL 9701 – 9706, BOR/COL 9712. *Pulau Dinawan*: BOR/COL 8447 – 8448, BOR/COL 8460 – 8469, BOR/COL 8473 – 8485, BOR/COL 9738 – 9739, BOR/COL 9748 – 9749. *Pulau Mantukod*: BOR/COL 8506, BOR/COL 8510, BOR/COL 9731.
**Distribution in Sabah.** Pulau Tiga, Pulau Gaya, Pulau Sapi, Pulau Manukan, Pulau Sapangar, Pulau Dinawan, Pulau Mantukod.
**Barcode Index Number (BIN).** BOLD:ADI2797, BOLD:ADI2798, BOLD:ADI3779, BOLD:ADI3780, BOLD:ADI3781
**Intraspecific distance (%).** Excluded
**Remarks.** These species are so closely similar on outer morphological traits that we refrain from sorting them into morphological species at present. Six random individuals selected for sequencing results in five different species.

**Section Pagriites Lefevre 1885**

**Genus *Pagria* Lefevre, 1884.**
Refer to **Appendix A**, page 7 for the generic diagnosis of this genus.
***Pagria* sp.**
(Fig. 11B)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 9479.

**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ACW8270
**Intraspecific distance (%).** N/A
**Remarks.** Head and thorax black in colour and elytra brown in colour.

**Section Metachromites Chapius 1874**

**Genus *Rhyparida* Baly, 1861.**
Refer to **Appendix A**, page 7 for the generic diagnosis of this genus.
***Rhyparida* sp. 1**
(Fig. 11C)
**Examined materials (74).** *Pulau Sapi*: BOR/COL 6939 – 6940, BOR/COL 8355, BOR/COL 9238 – 9239, BOR/COL 9242. *Pulau Tiga*: BOR/COL 8063, BOR/COL 9159, BOR/COL 9168, BOR/COL 9767. *Pulau Sapangar*: BOR/COL 8422, BOR/COL 9675, BOR/COL 9697 – 9698, BOR/COL 9700. *Pulau Dinawan*: BOR/COL 8450 – 8451, BOR/COL 8470, BOR/COL 9742 – 9746. *Pulau Mantukod*: BOR/COL 8508, BOR/COL 9724 – 9729. *Pulau Mengalum*: BOR/COL 9252 – 9254, BOR/COL 9258 – 9265, BOR/COL 9268 – 9270, BOR/COL 9459, BOR/COL 9496 – 9501, BOR/COL 9518 – 9530, BOR/COL 9532 – 9537, BOR/COL 9540, BOR/COL 9549. *Pulau Gaya*: BOR/COL 9329, BOR/COL 9425.
**Distribution in Sabah.** Pulau Sapi, Pulau Tiga, Pulau Sapangar, Pulau Dinawan, Pulau Mantukod, Pulau Mengalum, Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH5562
**Intraspecific distance (%).** Mean: 0.91 Max: 1.53
**Interspecific distance (%).** Mean: 16.91 Max: 17.79
**Remarks.** Anterior femora with or without weak spine.

***Rhyparida* sp. 2**
(Fig. 11D)
**Examined materials (64).** *Pulau Gaya*: BOR/COL 8196, BOR/COL 8262, BOR/COL 8269, BOR/COL 8311, BOR/COL 9322 – 9328, BOR/COL 9414, BOR/COL 9426 – 9427. *Pulau Dinawan*: BOR/COL 8471 – 8472. *Pulau Sapi*: BOR/COL 9212 – 9214. *Pulau Mengalum*: BOR/COL 9250 – 9251, BOR/COL 9255 – 9257, BOR/COL 9266 – 9267, BOR/COL 9502 – 9506, BOR/COL 9509 – 9517, BOR/COL 9538 – 9539, BOR/COL 9541 – 9548, BOR/COL 9963 – 9966, BOR/COL 9978 – 9980. *Pulau Manukan*: BOR/COL 9581. *Pulau Sapangar*: BOR/COL 9708, BOR/COL 9715 – 9716. *Pulau Mantukod*: BOR/COL 9730. *Pulau Udar Kecil*: BOR/COL 9896, BOR/COL 9898.
**Distribution in Sabah.** Pulau Gaya, Pulau Dinawan, Pulau Sapi, Pulau Mengalum, Pulau Manukan, Pulau Sapangar, Pulau Mantukod, Pulau Udar Kecil.
**Barcode Index Number (BIN).** BOLD:ADH5563
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 16.91 Max: 17.79
**Remarks.** Anterior femore with well-developed spine on inner margin.

**Section Typophorites Chapius 1874**

**Genus *Cleorina* Lefevre, 1885.**

Refer to **Appendix A**, page 7 for the generic diagnosis of this genus.

***Cleorina malayana* (Jacoby, 1896)**

(Fig. 11E)

**Examined materials (8).** *Pulau Manukan*: BOR/COL 9593 – 9599. *Pulau Sulug*: BOR/COL 9637.

**Distribution in Sabah.** Pulau Manukan, Pulau Sulug.

**Barcode Index Number (BIN).** BOLD:ADH5352

**Intraspecific distance (%).** N/A

**Remarks.** Found feeding on the family *Zingiberaceae* plants.

## SUBFAMILY CASSIDINAE

### Tribe CRYPTONYCHINI Weise 1911

**Genus *Brontispa* Sharp, 1904.**

Refer to **Appendix A**, page 7 for the generic diagnosis of this genus.

***Brontispa longissima* (Gestro, 1885)**

(Fig. 11F)

**Examined materials (39).** *Pulau Tiga*: BOR/COL 8054 – 8062. *Pulau Manukan*: BOR/COL 8397, BOR/COL 9586 – 9589. *Pulau Dinawan*: BOR/COL 8453 – 8454, BOR/COL 8457, BOR/COL 8486 – 8491, BOR/COL 9751 – 9752. *Pulau Mengalum*: BOR/COL 9244 – 9248. *Pulau Mamutik*: BOR/COL 9610 – 9618.

**Distribution in Sabah.** Pulau Tiga, Pulau Manukan, Pulau Dinawan, Pulau Mengalum, Pulau Mamutik.

**Barcode Index Number (BIN).** BOLD:AAL7691

**Intraspecific distance (%).** Mean: 0.10 Max: 0.15

**Remarks.** Only found on the islands with tourisms activities and/or resorts.

### Tribe GONOPHORINI Weise 1911

**Genus *Gonophora* Baly, 1858.**

Refer to **Appendix A**, page 8 for the generic diagnosis of this genus.

***Gonophora* sp.**

(Fig. 11G)

**Examined materials (21).** *Pulau Tiga*: BOR/COL 8016, BOR/COL 8519, BOR/COL 8532 – 8533, BOR/COL 9169, BOR/COL 9207 – 9209, BOR/COL 9770, BOR/COL 9803 – 9804. *Pulau Gaya*: BOR/COL 8260, BOR/COL 8266 – 8267, BOR/COL 9957, BOR/COL 9960. *Pulau Sapi*: BOR/COL 8344 – 8346. *Pulau Sapangar*: BOR/COL 8423 – 8424.

**Distribution in Sabah.** Pulau Tiga, Pulau Gaya, Pulau Sapi, Pulau Sapangar.

**Barcode Index Number (BIN).** BOLD:ADH6672

**Intraspecific distance (%).** Mean: 0.69 Max: 1.38

**Remarks.** Usually found on the leaf surface of *Oncosperma tigillarium*.

**Tribe HISPINI Weise 1911**

**Genus *Dactylispa* Weise, 1897.**
Refer to **Appendix A**, page 8 for the generic diagnosis of this genus.
***Dactylispa* sp. 1**
(Fig. 11H)
**Examined materials (1).** *Pulau Tiga*: BOR/COL 9777.
**Distribution in Sabah.** Pulau Tiga.
**Barcode Index Number (BIN).** BOLD:ADH5880
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 21.32 Max: 21.32
**Remarks.** Different from *Dactylispa* sp. 2 by the spine branching on the prothorax and smaller in size.

***Dactylispa* sp. 2**
(Fig. 12A)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 8305.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH6349
**Intraspecific distance (%).** N/A
**Interspecific distance (%).** Mean: 21.32 Max: 21.32
**Remarks.** Generally bigger in size than *Dactylispa* sp. 1.

**Tribe NOTOSACANTHINI Hincks 1952**

**Genus *Notosacantha* Chevolat, 1836.**
Refer to **Appendix A**, page 8 for the generic diagnosis of this genus.
***Notosacantha* sp. 1**
(Fig. 12B)
**Examined materials (4).** *Pulau Gaya*: BOR/COL 8312, BOR/COL 9446 – 9448.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH5640
**Intraspecific distance (%).** N/A
**Remarks.** Found on *Ardisia* sp. plant.

***Notosacantha* sp. 2**
(Fig. 12C)
**Examined materials (7).** *Pulau Tiga*: BOR/COL 8540, BOR/COL 9771 – 9773, BOR/COL 9776. *Pulau Mengalum*: BOR/COL 9550 – 9551.
**Distribution in Sabah.** Pulau Tiga, Pulau Mengalum.
**Barcode Index Number (BIN).** BOLD:ADH5641
**Intraspecific distance (%).** N/A
**Remarks.** Found on *Ardisia* sp. plant.

***Hispinae* sp**.

(Fig. 12D)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 9417.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** N/A
**Intraspecific distance (%).** N/A
**Remarks.** Elytra dilated at side, regularly with four interstices of two regular rows of punctures.

**SUBFAMILY CHRYSOMELINAE**

**Tribe CHRYSOMELINI Reitter 1912**
**Subtribe CHRYSOMELINA Chen 1936**

**Genus *Plagiodera* Chevrolat, 1837.**
Refer to **Appendix A**, page 8 & 9 for the generic diagnosis of this genus.
***Plagiodera* sp.**
(Fig. 12E)
**Examined materials (1).** *Pulau Tiga*: BOR/COL 8514.
**Distribution in Sabah.** Pulau Tiga.
**Barcode Index Number (BIN).** BOLD:ADH0536
**Intraspecific distance (%).** N/A
**Remarks.** Found on plants near southeast mud volcano of Pulau Tiga.

**Subtribe PHYLLOCHARINA Weise 1915**

**Genus *Phola* Weise, 1890.**
Refer to **Appendix A**, page 9 for the generic diagnosis of this genus.
***Phola sedecimpustulata* (Stal, 1857)**
(Fig. 12F)
**Examined materials (1).** *Pulau Peduk*: BOR/COL 9882.
**Distribution in Sabah.** Pulau Peduk.
**Barcode Index Number (BIN).** BOLD:ADH6695
**Intraspecific distance (%).** N/A
**Remarks.** Pronotum with three spots forming a triangular shape, elytra with nine yellow spots and one of the spots at the tip of the elytra.
**SUBFAMILY CRIOCERINAE**

**Tribe LEMIINI Heinze 1962**

**Genus *Lema* Fabricius, 1798.**
Refer to **Appendix A**, page 9 for the generic diagnosis of this genus.
***Lema* sp.**
(Fig. 12G)
**Examined materials (1).** *Pulau Gaya*: BOR/COL 9393.
**Distribution in Sabah.** Pulau Gaya.
**Barcode Index Number (BIN).** BOLD:ADH6230

**Intraspecific distance (%).** N/A
**Remarks.** Found after a shower rain near the Padang Point Restaurant at Pulau Gaya.

## Conclusions

A total of 68 leaf beetle species was collected from 13 islands off Sabah west coast, representing leaf beetle species richness on a small portion (~ 3 %) of island habitat in Sabah and indicates that many species yet to be discovered from the island habitats. This study also provides baseline knowledge and information about the DNA barcodes of leaf beetle species on Sabah's island habitats for use in future studies.

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## References

Altschul SF., Gish W., Miller W., Myers EW., Lipman DJ. 1990. Basic local alignment search tool. *Journal of Molecular Biology* 215:403–410. DOI: 10.1016/S0022-2836(05)80360-2.

Baly JS. 1860. Descriptions of the new Genera and Species of Phytophaga. *The Journal of entomology : descriptive and geographical.* 1:550.

Baly JS. 1865. Phytophaga Malayana. A revision of the phytophagous beetles of the Malay Archipelago, with description of the new species collected by Alfred R. Wallace. *The Transactions of the Entomological Society of London* Vol. IV:300.

Beenen R. 2007. Pseudoshaira , a new leaf beetle genus occurring in Borneo (Coleoptera : Chrysomelidae : Galerucinae). *Genus* 18:597–602.

Bezděk J., Romantsov P V., Medvedev LN. 2014. A review of Luperogala Medvedev & Samoderzhenkov , 1989 , with description of a new species from Borneo (Coleoptera : Chrysomelidae : Galerucinae). *Genus* 25:459–479.

Blanco J., Konstantinov A. 2013. Review of the New World species of the genus Argopistes

1102 Motschulsky (Coleoptera: Chrysomelidae: Galerucinae: Alticini). *Zootaxa* 3626:249–267.
1103 DOI: 10.11646/zootaxa.3626.2.3.

1104 Borowiec L. 2009. New records of Asian and Australopapuan tortoise beetles (Coleoptera:
1105 Chrysomelidae: Cassidinae). *Genus* 20:435–484.

1106 Borowiec L., Takizawa H., Swietojańska J. 2013. Five new species of Notosacantha Chevrolat
1107 (Coleoptera: Chrysomelidae: Cassidinae) from Borneo, with a key to the Bornean species
1108 and new faunistic data. *Zootaxa* 3608:161–177. DOI: 10.11646/zootaxa.3608.3.1.

1109 Bouchard P., Bousquet Y., Davies AE., Alonso-Zarazaga MA., Lawrence JF., Lyal CHC.,
1110 Newton AF., Reid CAM., Schmitt M., Ślipiński SA., Smith ABT. 2011. Family-group
1111 names in Coleoptera (Insecta). *ZooKeys* 88:1–972. DOI: 10.3897/zookeys.88.807.

1112 Bridge PD., Roberts PJ., Spooner BM., Panchal G. 2003. On the unreliability of published DNA
1113 sequences. *New Phytologist* 160:43–48. DOI: 10.1046/j.1469-8137.2003.00861.x.

1114 Chaboo CS. 2007. Biology and Phylogeny of the Cassidinae Gyllenhal Sensu Lato (Tortoise and
1115 Leaf-Mining Beetles) (Coleoptera: Chrysomelidae). *Bulletin of the American Museum of*
1116 *Natural History* 305:1–250. DOI: 10.1206/0003-0090(2007)305[1:BAPOTC]2.0.CO;2.

1117 Clark H. 1865. Description of species of Phytophaga received from Pulo Penang or its
1118 Neighbourhood. In: Selby PJ, Babington CC, Gray JE, Francis W eds. *The Annals and*
1119 *Magazine of Natural History, including Zoology, Botany, and Geology*. London: Taylor and
1120 Francis, 568.

1121 Crownson RA. 1981. Cytology and Genetics. In: *The Biology of the Coleoptera*. Elsevier, 397–
1122 428. DOI: 10.1016/B978-0-12-196050-6.50017-8.

1123 Doberl M. 2007. Warchaltica nov . gen . from Borneo (Coleoptera: Chrysomelidae: Alticinae).
1124 *Genus* 18:617–621.

1125 Fairmaire L. 1881. Coléoptères des îles Viti. *Annales de la Société entomologique de France.*
1126 ser.6:t.1:866.

1127 Folmer O., Black M., Hoeh W., Lutz R., Vrijenhoek R. 1994. DNA primers for amplification of
1128 mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates.
1129 *Molecular Marine Biology and Biotechnology* 3:294–299. DOI:
1130 10.1371/journal.pone.0013102.

1131 GBIF S. 2017.Altica engstroemi (Sahlberg, 1894) Sahlberg, 1894. *Available at*
1132 *https://www.gbif.org/species/4462330* (accessed November 27, 2017). DOI:
1133 https://doi.org/10.5072/hufs9m.

1134 Gomez-Zurita J., Cardoso A., Coronado I., De la Cadena G., Jurado-Rivera JA., Maes J-M.,
1135 Montelongo T., Nguyen D., Papadopoulou A. 2016. High-throughput biodiversity analysis:
1136 Rapid assessment of species richness and ecological interactions of Chrysomelidae
1137 (Coleoptera) in the tropics. *ZooKeys* 597:3–26. DOI: 10.3897/zookeys.597.7065.

1138 Gressitt JL. 1969. Chrysomelid beetles from the Papuan subregion, 6 (Eumolpinae, 4). *Pacific*
1139 *Insects* 11:1–31.

1140 Gressitt JL., Kimoto S. 1963. The Chrysomelidae ( Coleopt .) of China and Korea, Part 2. *Pacific*
1141 *Insects Monographs* 1:301–1026.

1142 Hall TA. 1999. BioEdit: a user-friendly biological sequence alignment editor and analysis
1143 program for Windows 95/98/NT. *Nucleic Acids Symposium Series* 41:95–98. DOI:
1144 citeulike-article-id:691774.

1145 Hazmi IR., Wagner T. 2010. Revalidation and revision of Ochralea Clark, 1865 (Coleoptera:
1146 Chrysomelidae: Galerucinae) from the oriental region. *Zootaxa* 1865:47–59. DOI:
1147 10.5281/zenodo.196518.

1148 Hebert PDN., Cywinska A., Ball SL., deWaard JR. 2003. Biological identifications through
1149 DNA barcodes. *Proceedings. Biological sciences / The Royal Society* 270:313–21. DOI:
1150 10.1098/rspb.2002.2218.

1151 Helen FN., Geoff RA. 2005. Maintenance of colour polymorphism in the leaf beetle
1152 Chrysophtharta agricola Chapuis Coleoptera: Chrysomelidae: Paropsini. *Journal of Natural*
1153 *History* 39:79–90. DOI: Doi 10.1080/00222930310001552 69.

1154 Jacoby M. 1884. Descriptions of new genera and species of Phytophagous Coleoptera from
1155 Sumatra. *Notes from the Leyden Museum* VI:9–70.

1156 Jacoby M. 1908. *The Fauna of British India, including Ceylon and Burma. Coleoptera:*
1157 *Chrysomelidae*. London: Taylor and Francis.

1158 James Harris D. 2003. Can you bank on GenBank? *Trends in Ecology & Evolution* 18:317–319.
1159 DOI: 10.1016/S0169-5347(03)00150-2.

1160 Jolivet P. 2015. Together with 30 years of symposia on chrysomelidae! memories and personal
1161 reflections on what we know more about leaf beetles. *ZooKeys* 2015:35–61. DOI:
1162 10.3897/zookeys.547.7181.

1163 Jolivet P., Petitpierre E., Hsiao TH. 1988. Food Habits and Food Selection of Chrysomelidea.
1164 Bionomic and Evolutionary Perspectives. In: Jolivet P, Petitpierre E, Hsiao TH eds. *Biology*
1165 *of Chrysomelidae*. Dordrecht/ Boston/ London: Kluwer Academic Publishers, 615. DOI:
1166 10.1007/978-94-009-3105-3.

1167 Kearse M., Moir R., Wilson A., Stones-Havas S., Cheung M., Sturrock S., Buxton S., Cooper A.,
1168 Markowitz S., Duran C., Thierer T., Ashton B., Meintjes P., Drummond A. 2012. Geneious
1169 Basic: An integrated and extendable desktop software platform for the organization and
1170 analysis of sequence data. *Bioinformatics* 28:1647–1649. DOI:
1171 10.1093/bioinformatics/bts199.

1172 Kier G., Kreft H., Lee TM., Jetz W., Ibisch PL., Nowicki C., Mutke J., Barthlott W. 2009. A
1173 global assessment of endemism and species richness across island and mainland regions.
1174 *Proceedings of the National Academy of Sciences* 106:9322–9327. DOI:
1175 10.1073/pnas.0810306106.

1176 Kimoto S. 1988. Zoogeography of the Chrysomelidae. In: Jolivet P, Petitpierre E, Hsiao TH eds.
1177 *Biology of Chrysomelidae*. Dordrecht/ Boston/ London: Kluwer Academic Publishers, 107–
1178 114.

1179 Kimoto S. 1989. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos and Vietnam. IV.
1180 Galerucinae*. *Esakia*:1–241.

1181 Kimoto S., Gressitt JL. 1979. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos and
1182 Vietnam: I. Sagrinae, Donaciinae, Zeugophorinae, Megalopodinae and Criocerinae. *Pacific*
1183 *Insects* 20:191–256.

1184 Kimoto S., Gressitt JL. 1981. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos and
1185 Vietnam. II. Clytrinae, Cryptocephalinae, Chlamisinae, Lamprosomatinae and
1186 Chrysomelinae. *Pacific Insects* 23:286–391.

1187 Kimoto S., Gressitt JL. 1982. Chrysomelidae (Coleoptera) of Thailand, Cambodia, Laos and
1188 Vietnam. III. Eumolpinae. *Esakia*:1–141.

1189 Kimura M. 1980. A simple method for estimating evolutionary rates of base substitutions
1190 through comparative studies of nucleotide sequences. *Journal of Molecular Evolution*
1191 16:111–120. DOI: 10.1007/BF01731581.

1192 Kishimoto-Yamada K., Takizawa H., Mahadimenakbar MD. 2016. Temporal Occurrence
1193 Patterns of Chrysomelidae (Coleoptera) on the Universiti Malaysia Sabah Campus, Borneo.
1194 *The Coleopterists Bulletin* 70:541–548. DOI: https://doi.org/10.1649/0010-065X-70.3.541.

1195 Kristiansen KA., Cilieborg M., Drábková L., Jørgensen T., Petersen G., Seberg O. 2005. DNA
1196 Taxonomy - the Riddle of Oxychloë (Juncaceae). *Systematic Botany* 30:284–289. DOI:
1197 10.1600/0363644054223710.

1198 Laboissiere V. 1933. *Annales de la Société entomologique de France.* Paris: Au Siege De La
1199 Société.

1200 Lefevre E. 1884. Bulletin des séances. *Bulletin des séances de la Société entomologique de*
1201 *France* 3:1000.

1202 Mahadimenakbar MD., Takizawa H. 2013. Revision of Mistika Mohamedsaid From the Great
1203 Sunda Area , With Description of A New Genus (Coleoptera : Chrysomelidae : Alticinae ).
1204 *Serangga* 18:1–21.

1205 Maulik S. 1919. *The Fauna of British India including Celyon and Burma. Coleoptera:*
1206 *Chrysomelidae (Hispinae and Cassidinae)*. London: Taylor and Francis.

1207 Maulik S. 1926. *The Fauna of British India including Celyon and Burma. Coleoptera:*
1208 *Chrysomelidae (Chrysomelinae and Halticinae)*. London. DOI: 10.1038/148423c0.

1209 Maulik S. 1936. *The Fauna of British India including Celyon and Burma. Coleoptera:*
1210 *Chrysomelidae (Galerucinae)*. London: Taylor and Francis.

1211 Medvedev LN. 2007. New and poorly known Oriental Chrysomelidae (Coleoptera) of the
1212 Staatliches Museum für Naturkunde, Stuttgart. *Stuttgarter Beiträge zur Naturkunde* Ser.
1213 A:1–20.

1214 Medvedev LN. 2009. A New Species of the Genus Megalocolaspoides L. Medvedev, 2005
1215 (Chrysomelidae: Eumolpinae) from Borneo. *Annales Zoologici* 59:617–620. DOI:
1216 10.3161/000345409X484973.

1217 Medvedev LN. 2010. New and poorly known Alticinae (Coleoptera: Chrysomelidae) from New
1218 Guinea and islands of Southeast Asia. *Stuttgarter Beiträge zur Naturkunde A* 3:291–304.

1219 Medvedev LN. 2013. New and poorly known Clytrinae (Coleoptera: Chrysomelidae) from
1220 Borneo. *Eurasian Entomological Journal* 12:489–492.

1221 Medvedev LN. 2016a. New and poorly known Clytrini (Coleoptera , Chrysomelidae ,
1222 Cryptocephalinae) from Borneo island , South-East Asia. *Euroasian Entomological Journal*
1223 15:44–45.

1224 Medvedev LN. 2016b. New and poorly known Oriental Alticinae (Coleoptera : Chrysomelidae).
1225 *Russian Entomological Journal* 25:259–264.

1226 Medvedev LN., Romantsov P V. 2014. New and poorly known Chrysomelidae ( Coleoptera )
1227 from Borneo. *Stuttgarter Beiträge zur Naturkunde A* 7:235–251.

1228 Medvedev LN., Romantsov P V. 2015. Leaf beetles of the tribe Clytrini (Coleoptera :
1229 Chrysomelidae : Cryptocephalinae) from Borneo. *Stuttgarter Beiträge zur Naturkunde A*
1230 8:227–245.

1231 Medvedev LN., Romantsov P V. 2017a. Leaf beetles of the tribe Cryptocephalini (Coleoptera :
1232 Chrysomelidae : Cryptocephalinae) from Borneo. *Stuttgarter Beiträge zur Naturkunde A*
1233 10:185–201. DOI: 10.18476/sbna.v10.a6.

1234 Medvedev LN., Romantsov P. 2017b. Leaf beetles of the tribe Cryptocephalini (Coleoptera:
1235 Chrysomelidae: Cryptocephalinae) from Borneo. *Stuttgarter Beiträge zur Naturkunde A*
1236 10:185–201. DOI: 10.18476/sbna.v10.a6.

1237 Mohamedsaid MS. 1994. A new species of the genus Metrioidea from Malaysia (Coleoptera,
1238 Chrysomelidea, Galerucinae). *Ent. Rev. Japan* XLIX:25–28.

1239 Mohamedsaid MS. 2004. *Catalogue of the Malaysian Chrysomelidae*. Sofia - Moscow: Pensoft
1240 Publishers.

1241 Mohamedsaid MS. 2006. Kumbornia tuberculata, a new genus and species of Galerucinae from
1242 Borneo (Coleoptera : Chrysomelidae : Galerucinae). *Entomollogische Zeitschrift* 116:1–3.

1243 Mohamedsaid MS. 2010. Three interesting new species of leaf beetles ( Coleoptera :
1244 Chrysomelidae : Galerucinae ) in BORNEENSIS collection at ITBC , Universiti Malaysia
1245 Sabah. *Journal of Tropical Biology and Conservation* 7:59–64.

1246 Mohamedsaid MS., Salleh I., Hassan MN. 1990. The Leaf Beetles of Borneo. In: *Proceedings of*
1247 *the International Conference on Forest Biology and Conservation in Borneo*. 139–146.

1248 Moseyko AG. 2012. To the knowledge of the leaf-beetle tribe Nodinini (Coleoptera,
1249 Chrysomelidae, Eumolpinae) from the Philippines and Borneo. *Entomological Review*
1250 92:315–328. DOI: 10.1134/S0013873812030086.

1251 Pentinsaari M., Hebert PDN., Mutanen M. 2014. Barcoding beetles: A regional survey of 1872
1252 species reveals high identification success and unusually deep interspecific divergences.
1253 *PLoS ONE* 9. DOI: 10.1371/journal.pone.0108651.

1254 Petitpeirre E. 2014. Chromatic polymorphism in a Pyrenean population of the leaf beetle

1255 Gonioctena linnaeana ( Schrank ) ( Coleoptera , Chrysomelidae ). *Boln. Asoc. esp. Ent.*
1256 38:225–234.

1257 Phung CC., Yu FTY., Liew TS. 2017. A checklist of land snails from the west coast islands of
1258 Sabah, Borneo (Mollusca, Gastropoda). *ZooKeys* 2017:49–104. DOI:
1259 10.3897/zookeys.673.12422.

1260 Prado L. 2013. Review on the use of sexually dimorphic characters in the taxonomy of
1261 Diabroticites (Galerucinae, Luperini, Diabroticina). *ZooKeys* 332:33–54. DOI:
1262 10.3897/zookeys.332.4931.

1263 Puillandre N., Lambert A., Brouillet S., Achaz G. 2012. ABGD, Automatic Barcode Gap
1264 Discovery for primary species delimitation. *Molecular Ecology* 21:1864–1877. DOI:
1265 10.1111/j.1365-294X.2011.05239.x.

1266 Ratnasingham S., Hebert PDN. 2007. BARCODING, BOLD : The Barcode of Life Data System
1267 (www.barcodinglife.org). *Molecular Ecology Notes* 7:355–364. DOI: 10.1111/j.1471-
1268 8286.2006.01678.x.

1269 Ratnasingham S., Hebert PDN. 2013. A DNA-Based Registry for All Animal Species: The
1270 Barcode Index Number (BIN) System. *PLoS ONE* 8. DOI: 10.1371/journal.pone.0066213.

1271 Reid CAM., Beatson M. 2015. Disentangling a taxonomic nightmare: A revision of the
1272 Australian, Indomalayan and Pacific species of Altica Geoffroy, 1762 (Coleoptera:
1273 Chrysomelidae: Galerucinae). *Zootaxa* 3918:503–551. DOI: 10.11646/zootaxa.3918.4.3.

1274 Samuelson GA. 1969. Alticinae of New Guinea, III. Schenklingia and allies (Coleoptera:
1275 Chrysomelidae). *Pacific Insects* 11:33–47.

1276 Sánchez-Reyes UJ., Niño-Maldonado S., Jones RW. 2014. Diversity and altitudinal distribution
1277 of Chrysomelidae (Coleoptera) in Peregrina Canyon, Tamaulipas, Mexico. *ZooKeys*
1278 417:103–132. DOI: 10.3897/zookeys.417.7551.

1279 Seeno TN., Wilcox JA. 1982. *Leaf Beetle Genera (Coleoptera: Chysomelidae)*. Sacramento,
1280 California: Entomography Publications.

1281 Sharp D. 1904. Description of a new genus and species of Coleoptera (family Hispidae) from
1282 New Britain. *Proceedings of the Linnean Society of New South Wales.* 28:1134.

1283 Splipnski SA., Leschen RAB., Lawrence JF. 2011. Order Coleoptera Linnaeus, 1758. In: Zhang,
1284 Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of
1285 taxonomic richness. *Zootaxa* 3148:203–208. DOI: 10.1371/journal.pone.0005502.Franz.

1286 Suffrian E. 1854. Verzeichniss der bis jetzt bekannt gewordenen Asiatischen Cryptocephalen.
1287 *Linnaea entomologica : Zeitschrift herausgegeben von dem Entomologischen Vereine in*
1288 *Stettin* 9:8–11.

1289 Takizawa H. 2005. Two new species of the genus Hesperella Medvedev from S. E. Asia
1290 (Coleoptera, Chrysomelidae). In: Konstantinov A, Tishechkin A, Penev LD eds.
1291 *Contributions to Systematics and Biology of Beetles. Papers celebrating the 80th birthday*
1292 *of Igor Konstantinovich Lopatin*. Sofia - Moscow: Pensoft Publishers, 179–184.

1293 Takizawa H. 2011. Description of a new species of Borneola Mohamedsaid from Borneo with
1294 notes on their larvae (Coleoptera, Chrysomelidae, Galerucinae). *Serangga* 16:1–18.

1295 Takizawa H. 2012. Descriptions of new species of the genus Chaloenus W estwood from Greater
1296 Sunda Islands (Coleoptera: Chrysomelidae: Alticinae). *Genus* 23:269–330.

1297 Takizawa H. 2013. Five new species of the genus Chaloenus Westwood from Sabah, Malaysia.
1298 *Jpn. J. syst. Ent.* 19:35–46.

1299 Takizawa H. 2014. Genus Tamdaoana Medvedev in Malaysia (Coleoptera : Chrysomelidae,
1300 Alticinae). *Journal of Tropical Biology and Conservation* 11:87–95.

1301 Takizawa H. 2017. Notes on the genus Chilocoristes Weise (Coleoptera : Chrysomelidae :
1302 Alticinae) in Malaysia. *Journal of Tropical Biology and Conservation* 14:55–68.

1303 Takizawa H., Mohamedsaid MS. 2015. Descriptions of Four New Species of the Hoplosaenidea
1304 takizawai Group from the Greater Sunda Islands Area (Coleoptera : Chrysomelidae :
1305 Galerucinae). *Journal of Tropical Biology and Conservation* 12:113–125.

1306 Vilgalys R. 2003. Taxonomic misidentification in public DNA databases. *New Phytologist*
1307 160:4–5. DOI: 10.1046/j.1469-8137.2003.00894.x.

1308

## Table 1(on next page)

Coordinate, area ($km^2$), distance from nearest mainland (km) and number of plot(s) on the 13 sampled west coast islands of Sabah.

**Table 1**: Coordinate, area (km$^2$), distance from nearest mainland (km) and number of plot(s) on the 13 sampled west coast islands of Sabah.

| Island name (*pulau*) | Latitude | Longitude | Area (km$^2$) | Distance from nearest mainland (km) | No. of plot(s) |
|---|---|---|---|---|---|
| 1. Pulau Dinawan | 5.8472 | 115.9907 | 0.2603 | 3.0116 | 5 |
| 2. Pulau Gaya | 6.0176 | 116.0316 | 14.3166 | 1.4657 | 16 |
| 3. Pulau Mamutik | 5.9666 | 116.0137 | 0.0563 | 3.2546 | 3 |
| 4. Pulau Mantukod | 5.8379 | 116.0129 | 0.0968 | 1.0626 | 3 |
| 5. Pulau Manukan | 5.9753 | 116.0012 | 0.4402 | 4.3244 | 9 |
| 6. Pulau Mengalum | 6.2001 | 115.5968 | 5.1640 | 53.8144 | 7 |
| 7. Pulau Peduk | 6.0873 | 116.0963 | 0.0052 | 0.4369 | 1 |
| 8. Pulau Sapangar | 6.0674 | 116.0738 | 1.3188 | 2.3408 | 8 |
| 9. Pulau Sapi | 6.0095 | 116.0061 | 0.1877 | 6.9039 | 3 |
| 10. Pulau Sulug | 5.9599 | 115.9933 | 0.1261 | 5.1081 | 3 |
| 11. Pulau Tiga | 5.7235 | 115.6521 | 6.9860 | 10.1733 | 12 |
| 12. Pulau Udar Besar | 6.0794 | 116.0881 | 0.0369 | 1.4654 | 3 |
| 13. Pulau Udar Kecil | 6.0849 | 116.0942 | 0.0748 | 0.5930 | 2 |

## Table 2 (on next page)

Nucleotide composition of the 101 sequences.

1 **Table 2**: Nucleotide composition of the 101 sequences.

| | MIN | MEAN | MAX | SE |
|---|---|---|---|---|
| **G %** | 14.58 | 16.38 | 18.13 | 0.0768 |
| **C %** | 13.23 | 17.19 | 24.02 | 0.2581 |
| **A %** | 27.11 | 29.86 | 33.13 | 0.1162 |
| **T %** | 30.66 | 36.57 | 40.99 | 0.2408 |
| **GC %** | 28.34 | 33.57 | 42.15 | 0.3056 |
| **GC % CODON POS 1** | 38.84 | 43.88 | 48.25 | 0.2123 |
| **GC % CODON POS 2** | 38.77 | 41.93 | 44.09 | 0.0915 |
| **GC % CODON POS 3** | 3.49 | 14.91 | 36.36 | 0.7686 |

2

## Table 3(on next page)

BLAST top-hits result from NCBI GenBank for each sequence.

1 **Table 3**: BLAST top-hits result from NCBI GenBank for each sequence.

| Query ID | BOR/ COL | Pairwise identity (%) | Species name | GenBank Accession |
|---|---|---|---|---|
| *Brontispa longissima* | 8054 | 100.00 | *Brontispa longissima* | JQ302136 |
| *Brontispa longissima* | 8397 | 100.00 | *Brontispa longissima* | JQ302136 |
| *Brontispa longissima* | 8453 | 100.00 | *Brontispa longissima* | JQ302136 |
| *Altica aenea* | 8071 | 99.20 | *Altica birmanensis* | KX778628 |
| *Altica aenea.* | 8166 | 99.00 | *Altica engstroemi* | KX778636 |
| *Monolepta* sp. 7 | 8426 | 98.00 | *Galerucinae* sp. | KF946433 |
| *Hoplosaenidea variabilis* | 9638 | 97.90 | *Theopea* sp. | AB794770 |
| *Monolepta* sp. 17 | 9449 | 97.10 | *Monolepta* sp. | AB794728 |
| *Monolepta* sp. 8 | 8314 | 96.20 | *Monolepta* sp. | AB794731 |
| *Monolepta* sp. 15 | 8456 | 93.00 | *Monolepta* sp. | AB794741 |
| *Colasposoma auripenne* | 9753 | 91.80 | *Colasposoma dauricum* | LN995410 |
| *Monolepta* sp. 3 | 6924 | 91.40 | *Monolepta longitarsoides* | KC185734 |
| *Monolepta* sp. 4 | 6921 | 90.90 | *Monolepta* sp. | AB794741 |
| *Monolepta* sp. 2 | 6931 | 90.40 | *Monolepta* sp. | AB794753 |
| *Hoplosaenidea* sp. 2 | 8538 | 90.30 | *Hoplosaenidea subcostata* | KC255439 |
| *Ochralea nigripes* | 8356 | 90.30 | *Galerucinae* sp. | KF946261 |
| *Monolepta* sp. 5 | 9734 | 90.20 | *Monolepta* sp. | AB794757 |
| *Clitena* sp. | 8399 | 90.00 | *Clitea fulva* | KC185760 |
| *Ochralea nigripes* | 8362 | 90.00 | *Galerucinae* sp. | KR425397 |
| *Monolepta* sp. 5 | 8178 | 90.00 | *Monolepta* sp. | AB794757 |
| *Monolepta* sp. 5 | 8180 | 90.00 | *Monolepta* sp. | AB794753 |
| *Monolepta* sp. 5 | 8403 | 89.90 | *Monolepta* sp. | AB794757 |
| *Ochralea nigripes* | 8411 | 89.80 | *Galerucinae* sp. | KR425397 |
| *Monolepta* sp. 18 | 9679 | 89.80 | *Monolepta longitarsoides* | KC185734 |

| | | | | |
|---|---|---|---|---|
| *Monolepta* sp. 5 | 9718 | 89.80 | *Monolepta* sp. | AB794757 |
| *Ochralea nigripes* | 8015 | 89.70 | *Galerucinae* sp. | KR425397 |
| *Monolepta* sp. 5 | 8348 | 89.70 | *Monolepta* sp. | AB794757 |
| *Monolepta* sp. 5 | 9719 | 89.70 | *Monolepta* sp. | AB794753 |
| *Aulacophora* sp. | 8103 | 89.70 | *Atrachya* sp. | KC185693 |
| *Monolepta* sp. 5 | 9897 | 89.60 | *Monolepta* sp. | AB794753 |
| *Ochralea nigripes* | 8408 | 89.50 | *Galerucinae* sp. | KR425397 |
| *Monolepta* sp. 11 | 8119 | 89.50 | *Monolepta longitarsoides* | KC185734 |
| *Dercetina* sp. | 8150 | 89.20 | *Atrachya* sp. | KC185693 |
| *Monolepta* sp. 10 | 8104 | 89.10 | *Galerucinae* sp. | KJ677806 |
| *Monolepta* sp. 10 | 8181 | 89.10 | *Galerucinae* sp. | KJ677806 |
| *Monolepta* sp. 9 | 9440 | 89.00 | *Monolepta longitarsoides* | KC185734 |
| *Monolepta* sp. 9 | 9825 | 89.00 | *Monolepta longitarsoides* | KC185734 |
| *Monolepta* sp. 9 | 8525 | 88.90 | *Galerucinae* sp. | KJ677802 |
| *Dercetina* sp. | 8428 | 88.90 | *Monolepta quadriguttata* | KC135967 |
| *Aphthona* sp. | 9602 | 88.60 | *Longitarsus candidulus* | KF654954 |
| genus indet. nr. *Monolepta* | 8277 | 88.10 | *Monolepta longitarsoides* | KC185734 |
| genus indet. nr. *Monolepta* | 9875 | 88.10 | *Monolepta longitarsoides* | KC185734 |
| genus indet. nr. *Monolepta* | 9893 | 88.10 | *Monolepta longitarsoides* | KC185734 |
| *Hoplosaenidea malayensis* | 8330 | 87.90 | *Hoplosaenidea subcostata* | KC255439 |
| *Erystus villicus* | 8134 | 87.80 | *Longitarsus tabidus* | KF654096 |
| *Hoplosaenidea malayensis* | 8425 | 87.80 | *Hoplosaenidea subcostata* | KC255439 |
| *Hoplosaenidea malayensis* | 8440 | 87.80 | *Hoplosaenidea subcostata* | KC255439 |
| *Cleorina malayana* | 9597 | 87.50 | *Eumolpinae* sp. | KF946194 |
| *Hyphasis* sp. | 8449 | 87.40 | *Monolepta* sp. | AB794736 |
| *Monolepta* sp. 6 | 8531 | 87.40 | *Monolepta quadriguttata* | KF966604 |
| *Plagiodera* sp. | 8514 | 87.20 | *Chrysomela vigintipunctata* | KU188452 |
| *Basilepta* sp. 2 | 6930 | 87.10 | *Chrysomelidae* sp. | KX781753 |

| | | | | |
|---|---|---|---|---|
| *Metrioidea grandis* | 8417 | 87.10 | *Hapalaraea* sp. | KU875173 |
| *Pagria* sp. | 9479 | 87.10 | *Eumolpinae* sp. | KF946272 |
| *Basilepta* sp. 1 | 8202 | 86.90 | *Eumolpinae* sp. | KF946257 |
| *Monolepta* sp. 12 | 9201 | 86.50 | *Lochmaea crataegi* | KM447871 |
| *Hoplosaenidea* sp. 1 | 7000 | 86.40 | *Paleosepharia posticata* | KY195975 |
| *Metrioidea grandis* | 8094 | 86.40 | *Phaedon armoraciae* | KC255426 |
| *Argopistes* sp. 1 | 8442 | 86.30 | *Monolepta* sp. | AB794741 |
| *Lema* sp. | 9393 | 86.30 | *Lema daturaphila* | KR481201 |
| *Argopistes* sp. 2 | 9608 | 86.20 | *Longitarsus atricillus* | KF134547 |
| *Phola sedecimpustulata* | 9882 | 86.20 | *Galerucinae* sp. | KR425406 |
| *Notosacantha* sp. 1 | 8312 | 86.10 | *Hispinae* sp. | KR424810 |
| *Lanka* sp. | 8097 | 86.00 | *Orestia punctipennis* | KF654864 |
| *Sumatrasia* sp. | 6938 | 85.80 | *Longitarsus parvulus* | KX943391 |
| *Basilepta* sp. 4 | 8064 | 85.50 | *Eumolpinae* sp. | KF946194 |
| *Strobiderus* sp. | 6995 | 85.50 | *Psylliodes chrysocephalus* | KF653250 |
| *Monolepta* sp. 14 | 9418 | 85.30 | *Mantura chrysanthemi* | KF653804 |
| *Monolepta* sp. 14 | 9556 | 85.30 | *Mantura chrysanthemi* | KF653804 |
| *Monolepta* sp. 14 | 9557 | 85.30 | *Mantura chrysanthemi* | KF654246 |
| *Nodina* sp. | 8418 | 85.20 | *Colasposoma dauricum* | LN995410 |
| *Monolepta* sp. 1 | 8323 | 85.10 | *Monolepta atrimarginata* | KC185733 |
| *Monolepta* sp. 1 | 8427 | 85.10 | *Monolepta atrimarginata* | KC185733 |
| *Basilepta* sp. 3 | 8379 | 84.80 | *Eumolpinae* sp. | KF946194 |
| *Schenklingia* sp. | 9429 | 84.80 | *Psylliodes cucullatus* | KR486778 |
| *Notosacantha* sp. 2 | 8540 | 84.70 | *Dicladispa armigera* | KY845676 |
| *Nodina* sp. | 8447 | 84.60 | *Eumolpinae* sp. | KF946194 |
| *Nodina* sp. | 8197 | 84.40 | *Eumolpinae* sp. | KF946194 |
| *Nodina* sp. | 8398 | 84.40 | *Eumolpinae* sp. | KF946194 |
| *Colaspoides* sp. 1 | 9398 | 84.10 | *Eumolpinae* sp. | KJ677941 |

| | | | | |
|---|---|---|---|---|
| *Gonophora* sp. | 8260 | 84.10 | *Agrius convolvuli* | LC049959 |
| *Gonophora* sp. | 8344 | 84.10 | *Agrius convolvuli* | LC049959 |
| *Gonophora* sp. | 8423 | 84.10 | *Agrius convolvuli* | LC049959 |
| *Hoplosaenidea* sp. 5 | 9721 | 84.10 | *Galerucinae* sp. | KJ677800 |
| *Hoplosaenidea* sp. 4 | 8095 | 84.00 | *Longitarsus luridus* | KF134571 |
| *Hoplosaenidea* sp. 5 | 9720 | 84.00 | *Galerucinae* sp. | KJ677800 |
| *Nodina* sp. | 8179 | 84.00 | *Colydiinae* sp. | KU873303 |
| *Scelodonta granulosa* | 9531 | 84.00 | *Chrysomelidae* sp. | KM842629 |
| *Nodina* sp. | 8510 | 83.90 | *Colaspidea globosa* | KF653259 |
| *Gonophora* sp. | 8016 | 83.80 | *Epinotia nigricana* | KP253547 |
| *Dactylispa* sp. 1 | 9777 | 83.40 | *Callisto basistrigella* | KM253781 |
| *Colaspoides tuberculata* | 9858 | 83.20 | *Eumolpinae* sp. | KR424893 |
| *Rhyparida* sp. 2 | 8262 | 83.20 | *Eumolpinae* sp. | KF946328 |
| *Rhyparida* sp. 1 | 8355 | 83.00 | *Eumolpinae* sp. | KF946450 |
| *Dactylispa* sp. 2 | 8305 | 82.90 | *Monolepta* sp. | AB794736 |
| *Rhyparida* sp. 1 | 8422 | 82.90 | *Eumolpinae* sp. | KF946450 |
| *Rhyparida* sp. 1 | 8508 | 82.90 | *Eumolpinae* sp. | KF946450 |
| *Rhyparida* sp. 1 | 8450 | 82.70 | *Eumolpinae* sp. | KF946450 |
| *Rhyparida* sp. 1 | 8470 | 82.70 | *Eumolpinae* sp. | KF946450 |
| *Rhyparida* sp. 1 | 6939 | 82.60 | *Eumolpinae* sp. | KF946450 |
| *Rhyparida* sp. 1 | 8063 | 82.60 | *Eumolpinae* sp. | KF946450 |

2

## Table 4(on next page)

Summary of BLAST top-hits result based on identical percentage.

1 **Table 4**: Summary of BLAST top-hits result based on identical percentage.

| Identical percentage | Taxonomy identification level | Number of query sequences | Number of species |
|---|---|---|---|
| 90 % and above | Subfamily | 3 | |
| | Genus | 9 | 15 (2) |
| | Species | 9 | |
| Below 90 % | Family | 2 | |
| | Subfamily | 29 | 45 (2) |
| | Genus | 11 | |
| | Species | 38 | |
| | **Total** | 101 | 60 |

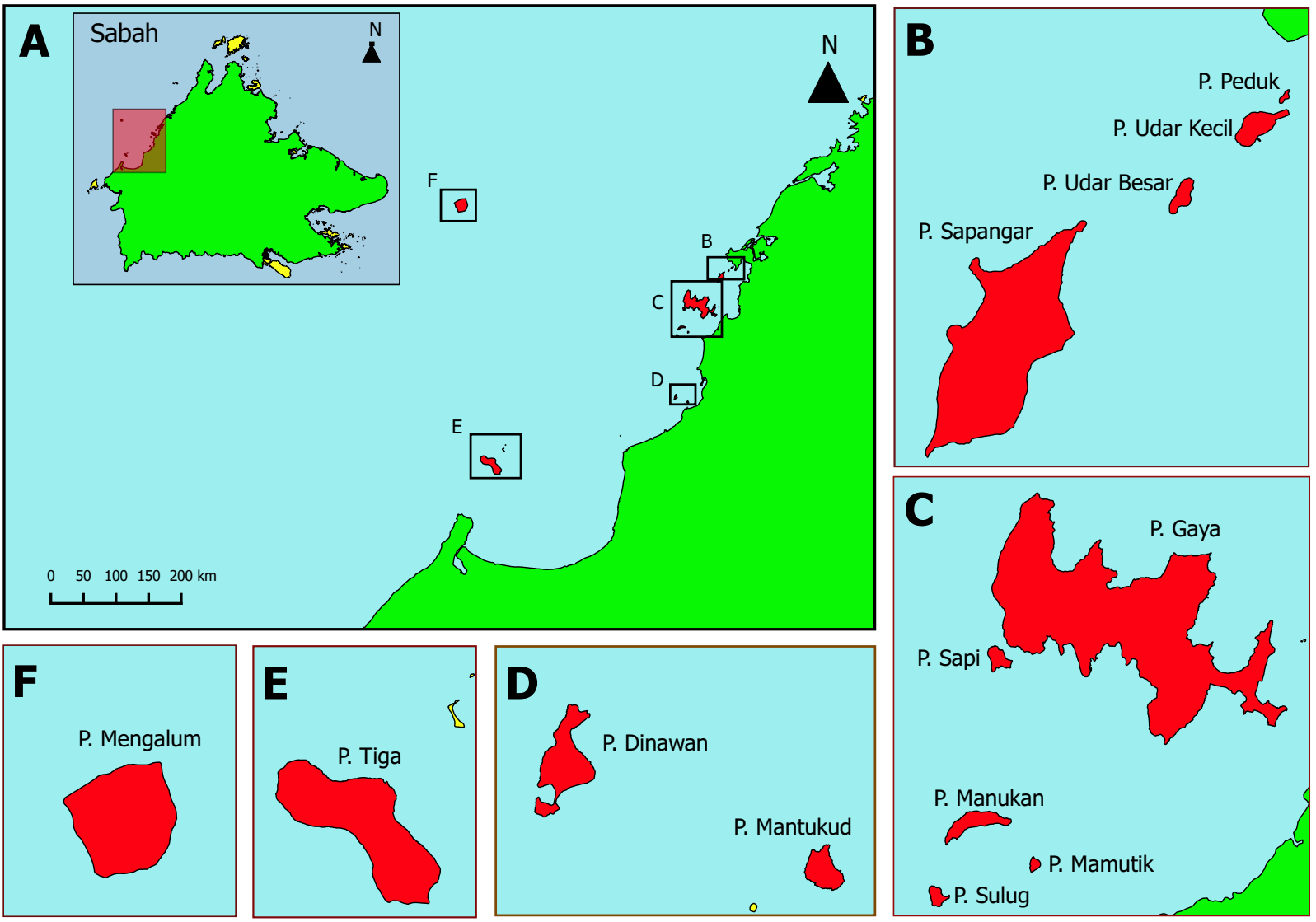
2 ***** Number in bracket shows the number of species shared in both identical percentage.

3

## Figure 1(on next page)

The 13 Sabah west coast islands selected and sampled in this study.

**A** Sabah overview map with the location of each island group (highlighted in red and selected in box); **B** Sapangar bay island group; **C** Tunku Abdul Rahman Park; **D** Pulau Dinawan and Pulau Mantukod; **E** Pulau Tiga; **F** Pulau Mengalum. Pulau = Island.

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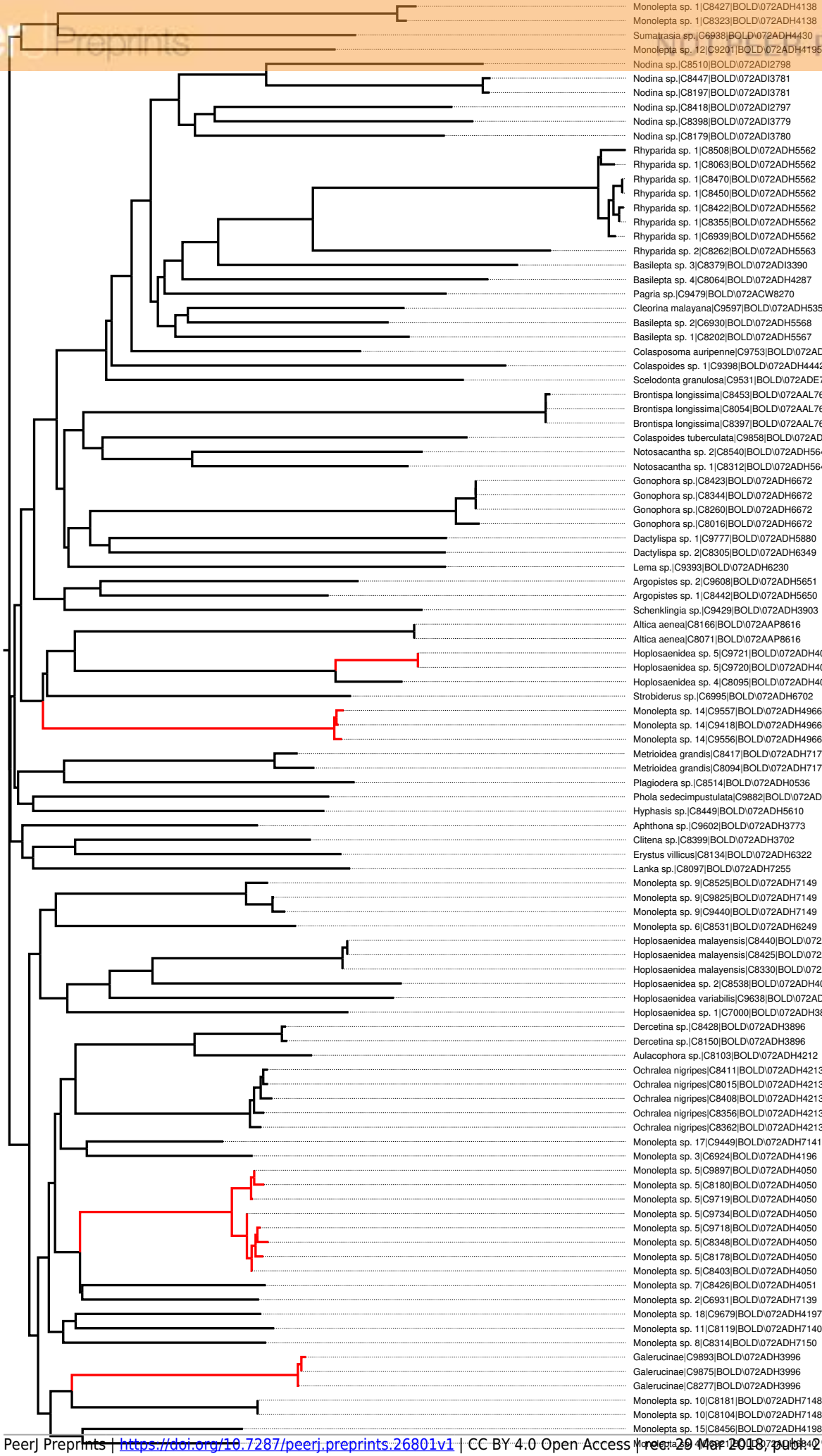
## Figure 2(on next page)

Neighbour-joining tree for all the 101 analysed COI sequences (performed on the BOLD).

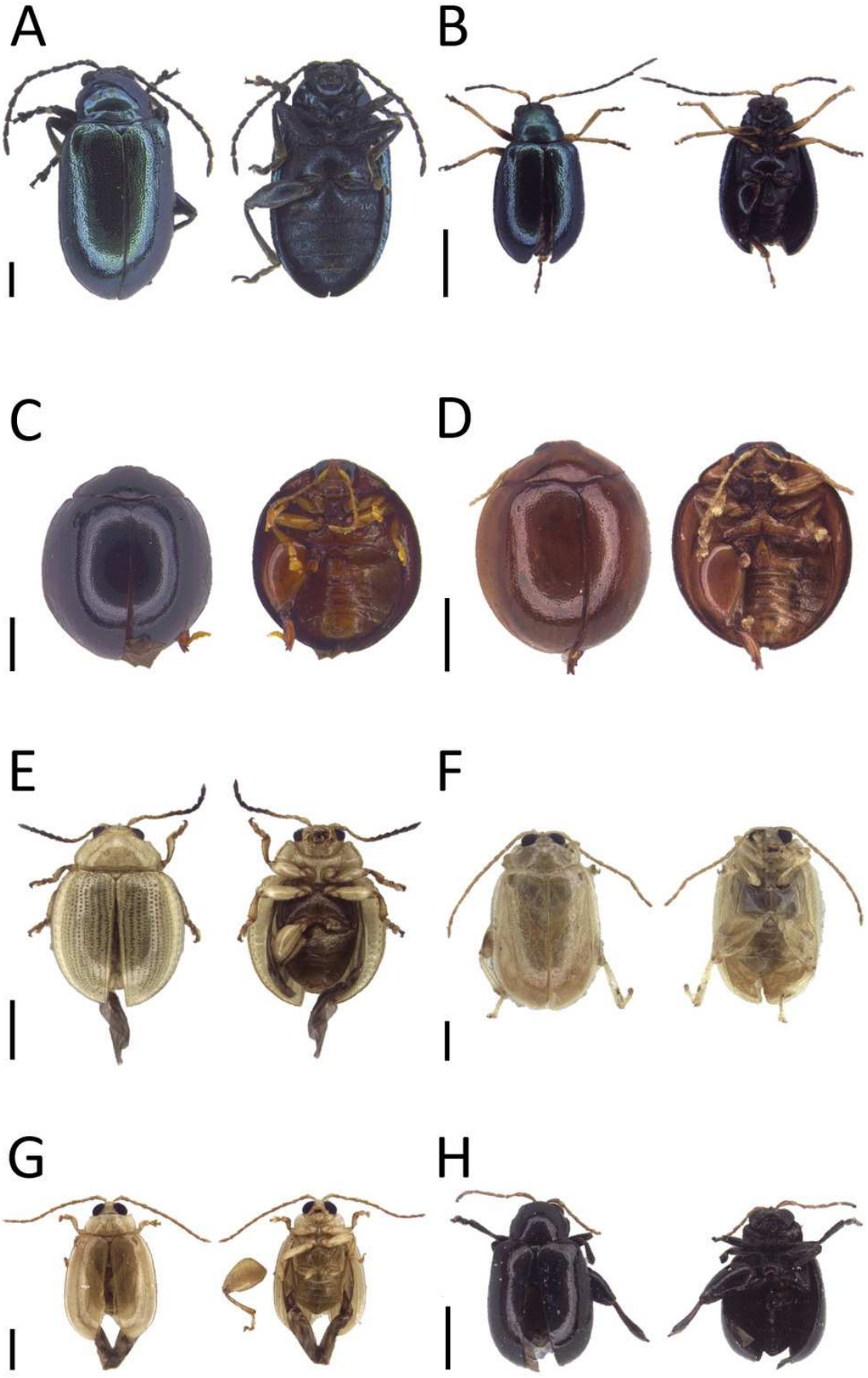
Clade highlighted in red colour represents leaf beetle species with phenotypic variation.



# Figure 3

Dorsal and ventral habitus of leaf beetle species.

**A** *Altica aenea*; **B** *Aphthona* sp. 1; **C** *Argopistes* sp. 1; **D** *Argopistes* sp. 2; **E** *Erystus villicus*; **F** *Hemipyxis* sp.; **G** *Hyphasis* sp.; **H** *Lanka* sp.



# Figure 4

Dorsal and ventral habitus of leaf beetle species.

**A** *Schenklingia* sp.; **B** *Aulacophora* sp.; **C** *Strobiderus* sp.; **D** *Hoplosaenidea malayensis*; **E** *Hoplosaenidea* sp. 1; **F** *Hoplosaenidea* sp. 2; **G** *Hoplosaenidea* sp. 3; **H** *Hoplosaenidea* sp. 4.

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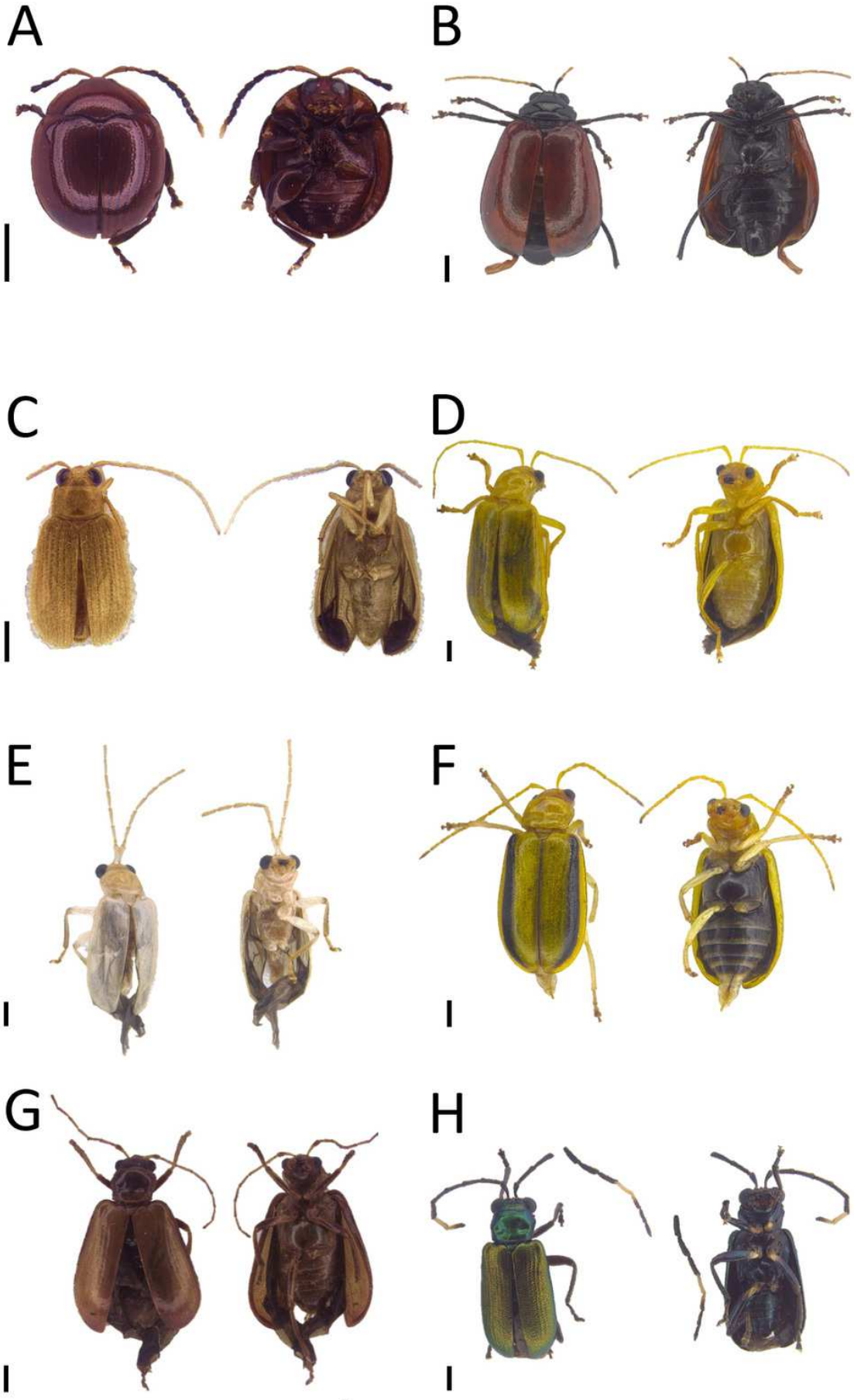

# Figure 5

Dorsal and ventral habitus of leaf beetle species.

**A**-**B** *Hoplosaenidea* sp. 5; **C** *Hoplosaenidea variabilis*; **D** *Metrioidea grandis*; **E** *Monolepta* sp. 1; **F** *Monolepta* sp. 2; **G** *Monolepta* sp. 3; **H** *Monolepta* sp. 4.

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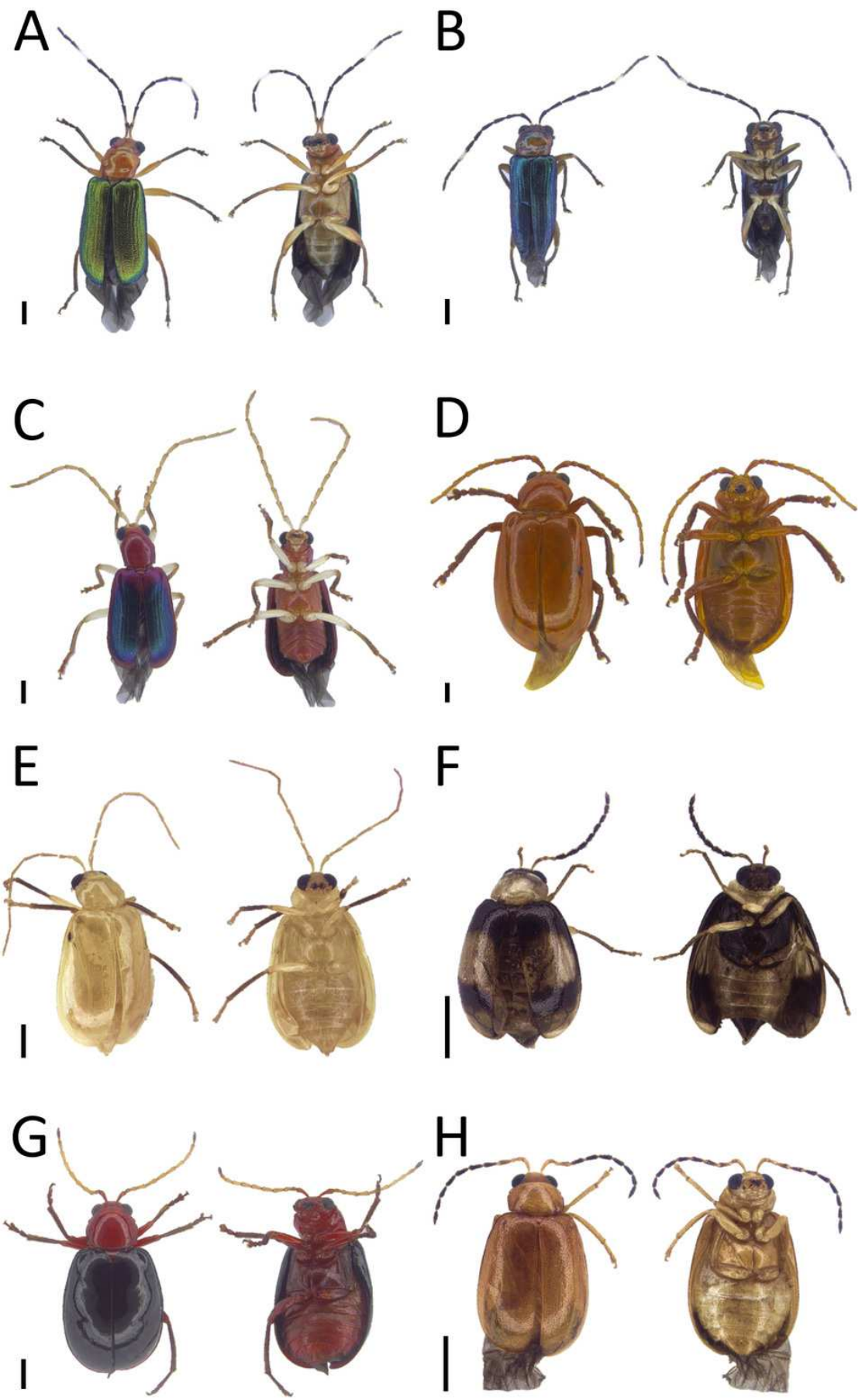
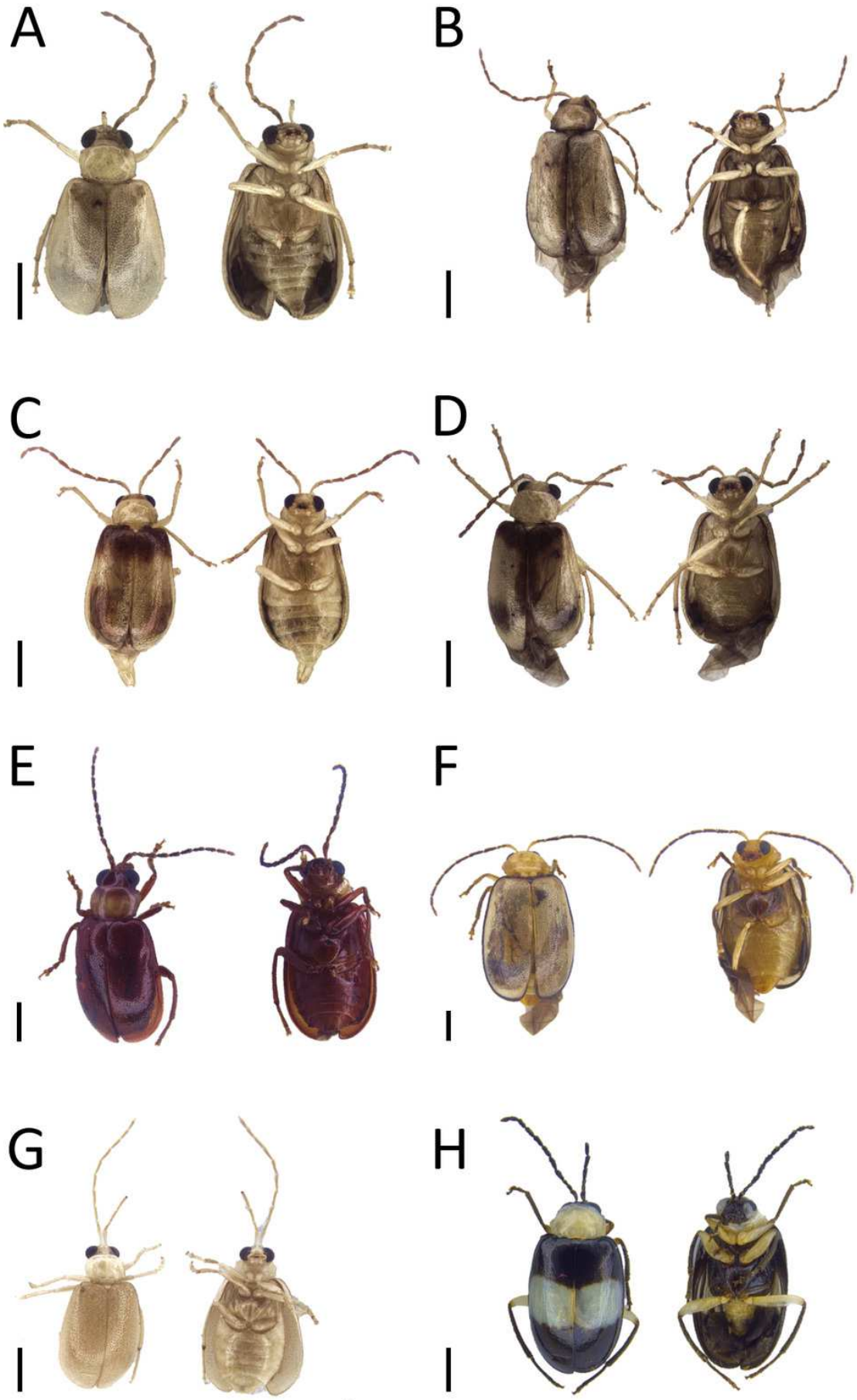


# Figure 6

Dorsal and ventral habitus of leaf beetle species.

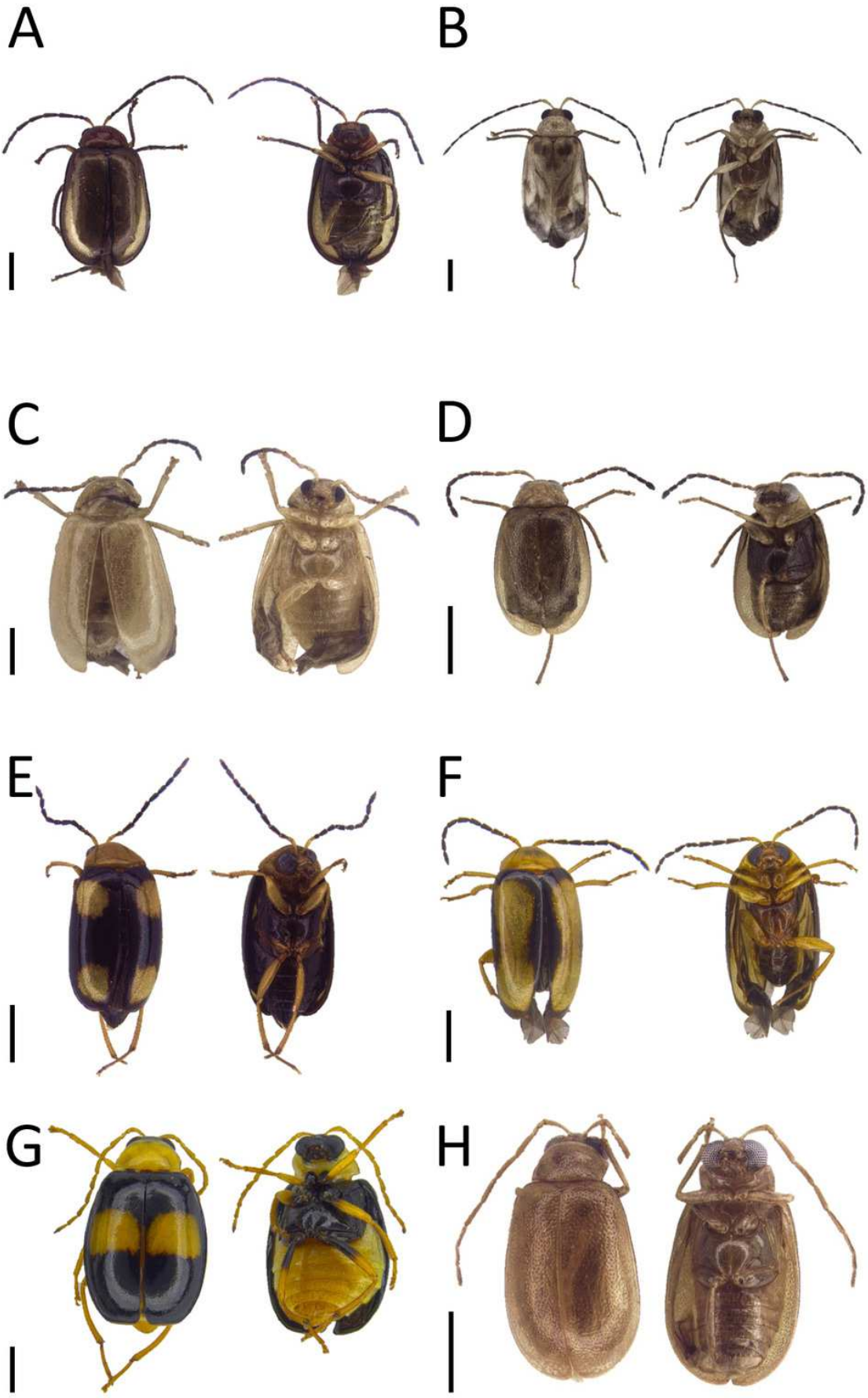
**A**–**D** *Monolepta* sp. 5; **E** *Monolepta* sp. 6; **F** *Monolepta* sp. 7; **G** *Monolepta* sp. 8; **H** *Monolepta* sp. 9.



# Figure 7

Dorsal and ventral habitus of leaf beetle species.

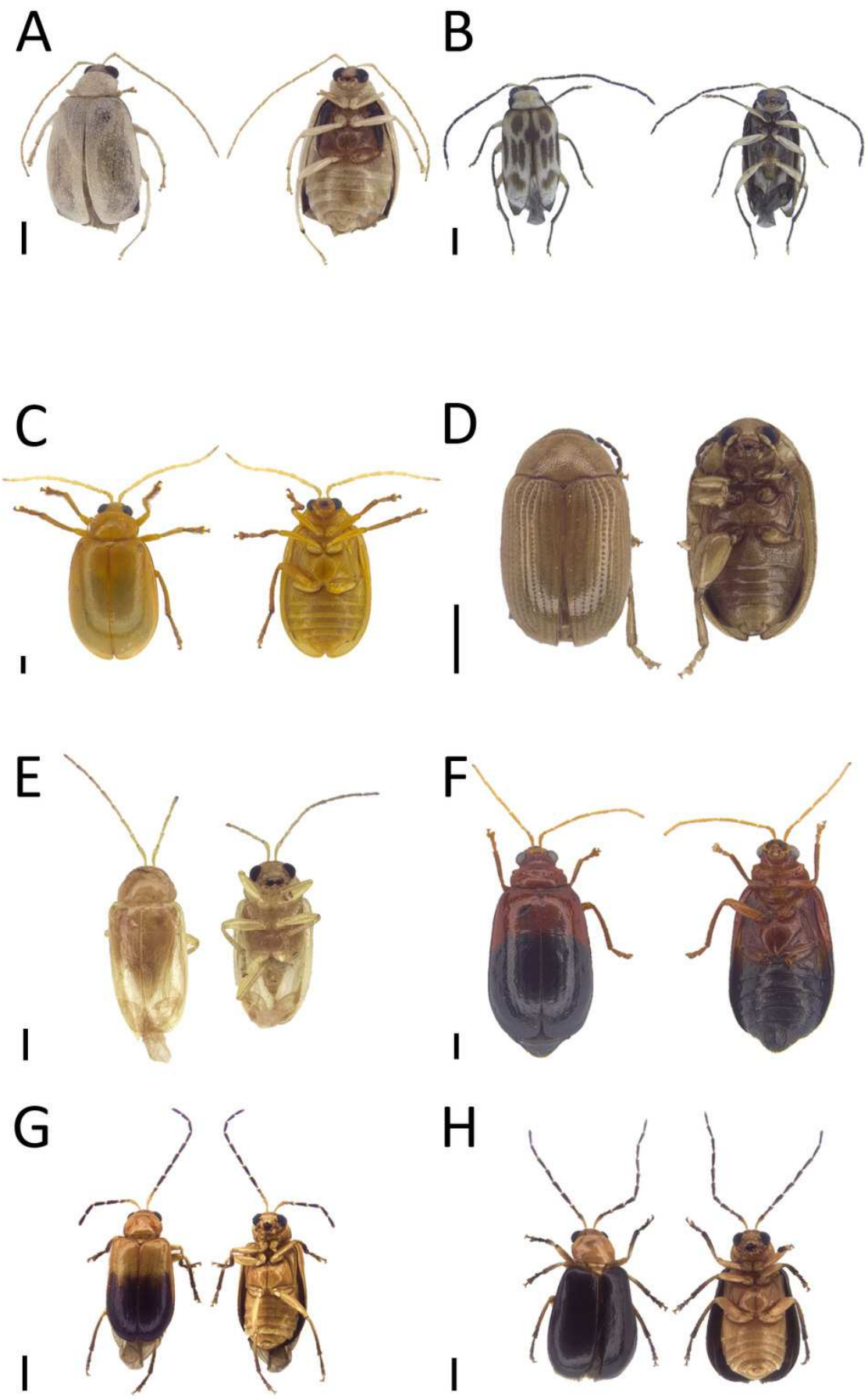
**A** *Monolepta* sp. 10; **B** *Monolepta* sp. 11; **C** *Monolepta* sp. 12; **D** *Monolepta* sp. 13; **E** – **F** *Monolepta* sp. 14; **G** *Monolepta* sp. 15; **H** *Monolepta* sp. 16.



# Figure 8

Dorsal and ventral habitus of leaf beetle species.

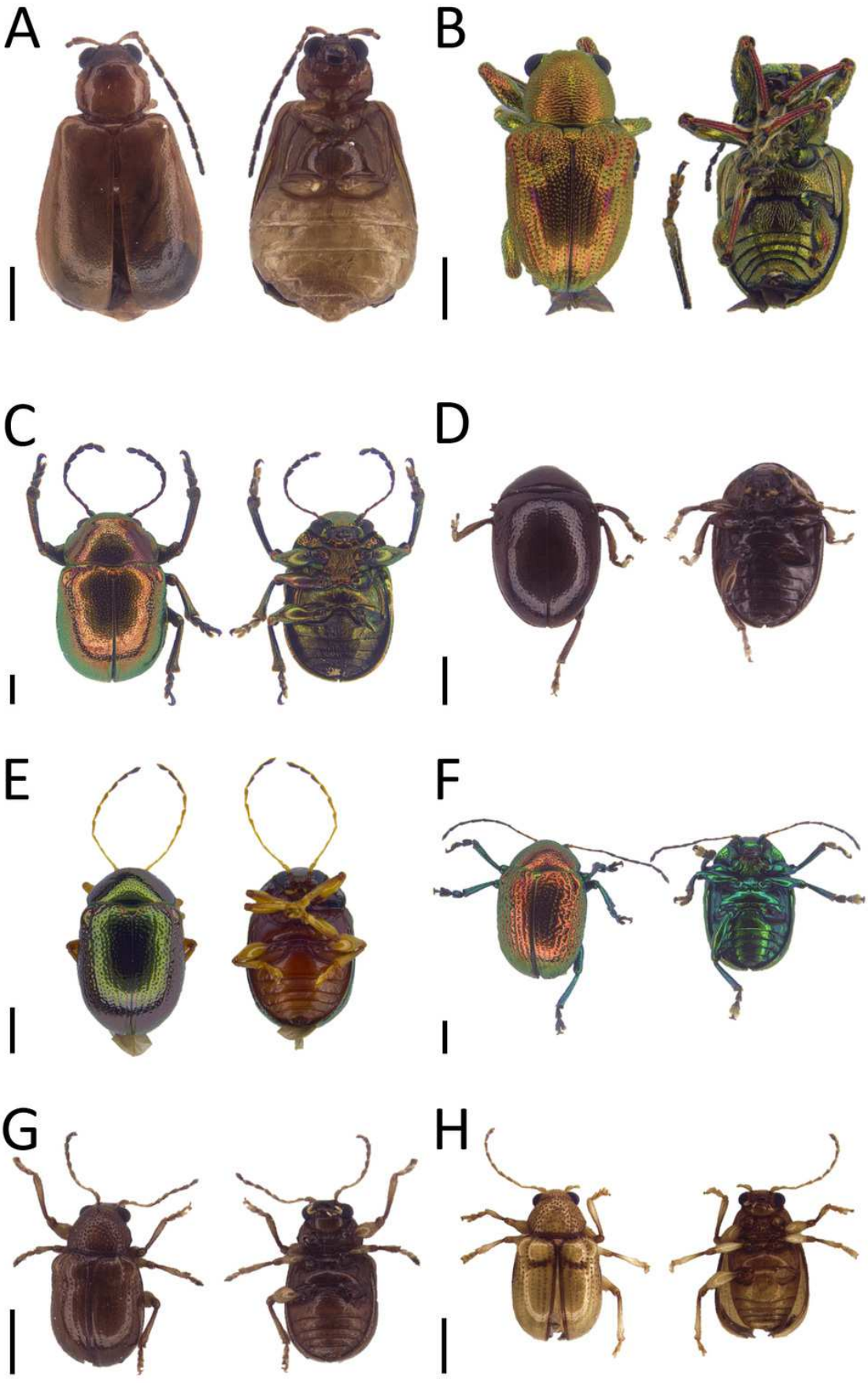
**A** *Monolepta* sp. 17; **B** *Monolepta* sp. 18; **C** *Ochralea nigripes*; **D** *Clitena* sp.; **E** *Sumatrasia* sp.; **F** *Dercetina* sp.; **G**-**H** genus indet. nr. *Monolepta.*



# Figure 9

Dorsal and ventral habitus of leaf beetle species.

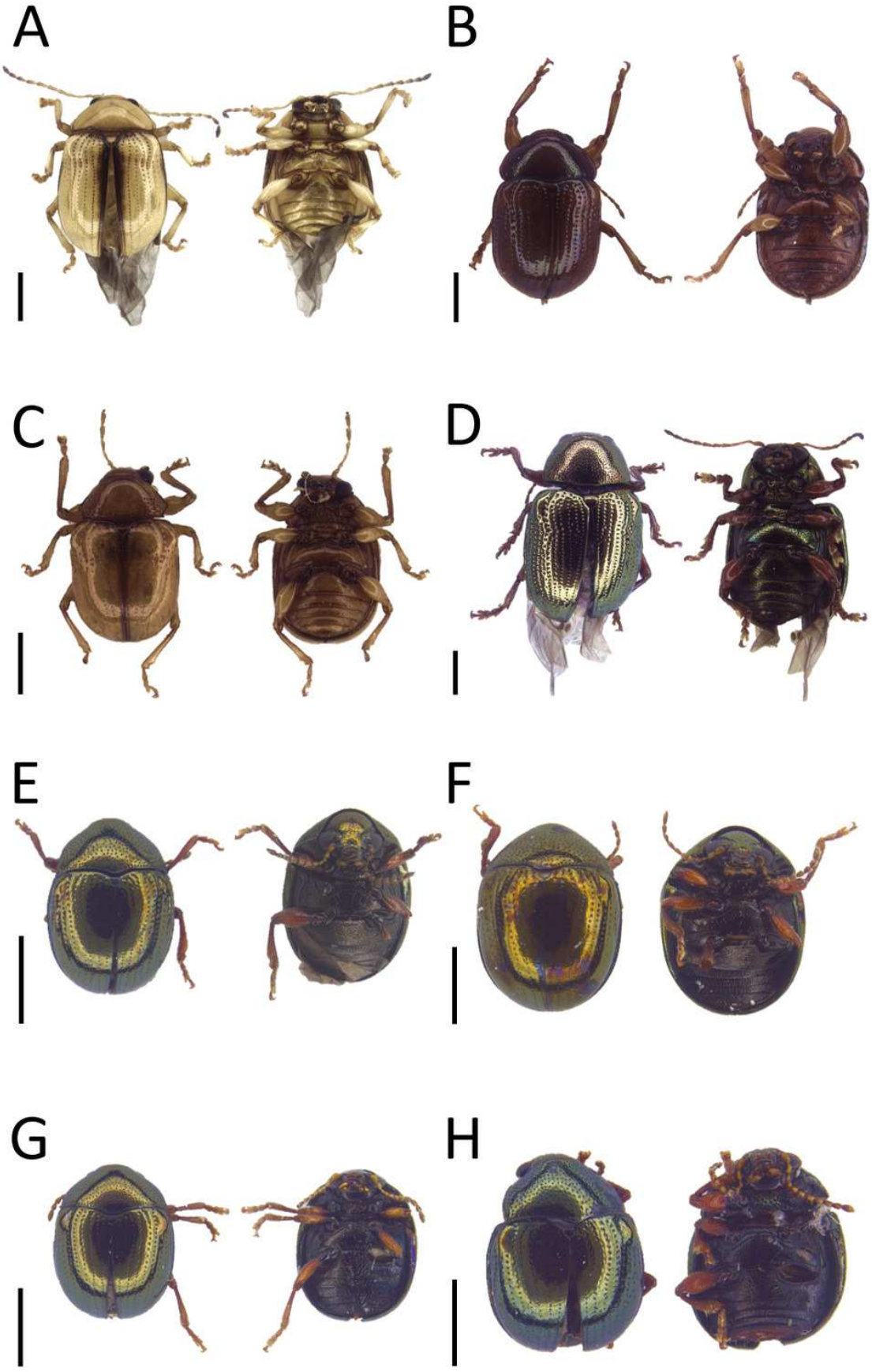
**A** genus indet. nr. *Monolepta*; **B** *Scelodonta* sp.; **C** *Colasposoma auripenne*; **D** *Aulacia* sp.; **E** *Colaspoides* sp. 1; **F** *Colaspoides tuberculata*; **G** *Basilepta* sp. 1; **H** *Basilepta* sp. 2.



# Figure 10

Dorsal and ventral habitus of leaf beetle species.

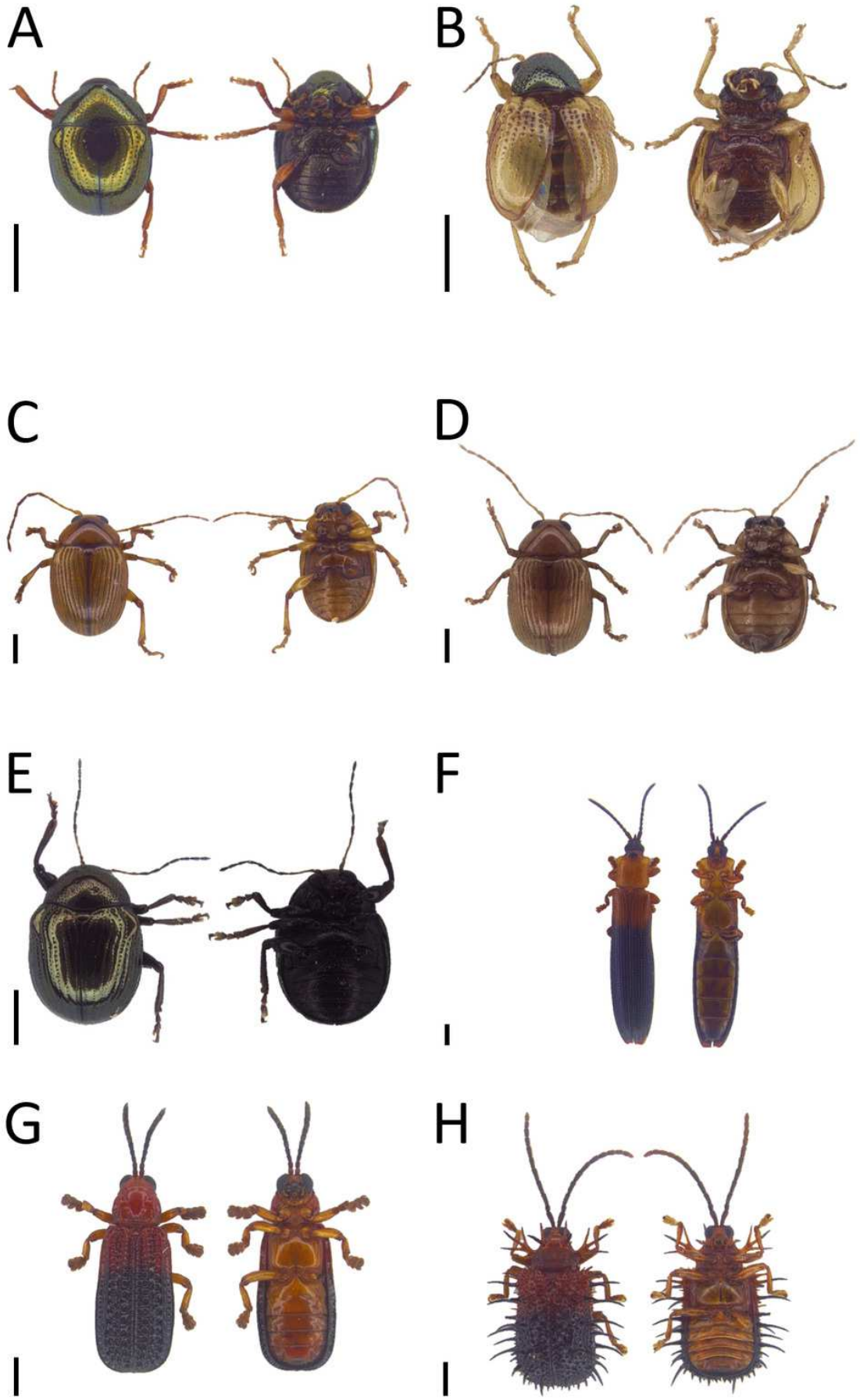
**A** *Basilepta* sp. 3; **B** *Basilepta* sp. 4; **C** *Basilepta* sp. 5; **D** *Basilepta* sp. 6; **E** – **H** *Nodina* sp.



# Figure 11

Dorsal and ventral habitus of leaf beetle species.

**A** *Nodina* sp.; **B** *Pagria* sp.; **C** *Rhyparida* sp. 1; **D** *Rhyparida* sp. 2; **E** *Cleorina malayana*; **F** *Brontispa longissima*; **G** *Gonophora* sp.; **H** *Dactylispa* sp. 1.



# Figure 12

Dorsal and ventral habitus of leaf beetle species.

**A** *Dactylispa* sp. 2; **B** *Notosacantha* sp. 1; **C** *Notosacantha* sp. 2; **D** *Hispinae* sp.; **E** *Plagiodera* sp.; **F** *Phola sedecimpustulata*; **G** *Lema* sp.

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