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Ali MAA
Department of Plant Protection,
Faculty of Agriculture, Universiti
Putra Malaysia, 43400 UPM Serdang,
Selangor Darul Ehsan, Malaysia

Nur Azura A
Department of Plant Protection,
Faculty of Agriculture, Universiti
Putra Malaysia, 43400 UPM Serdang,
Selangor Darul Ehsan, Malaysia

Darya H
(1). Department of Plant Protection,
Faculty of Agriculture, Universiti
Putra Malaysia, 43400 UPM Serdang,
Selangor Darul Ehsan, Malaysia
(2). Department of Plant Protection,
College of Agriculture, Salahadin
University Arbil Iraq

Rita M
Department of Plant Protection,
Faculty of Agriculture, Universiti
Putra Malaysia, 43400 UPM Serdang,
Selangor Darul Ehsan, Malaysia

Azman S
School of Environmental and Natural
Resources Sciences, Faculty of
Science and Technology, UKM

Correspondence
Nur Azura A
Department of Plant Protection,
Faculty of Agriculture, Universiti
Putra Malaysia, 43400 UPM Serdang,
Selangor Darul Ehsan, Malaysia

Records of four species of subfamily Melolonthinae Macleay, 1819 from Malaysia (Scarabaeidae: Coleoptera)

Ali MAA, Nur Azura A, Darya H, Rita M and Azman S

Abstract

Melolonthinae is the largest subfamily of Scarabaeidae, their larvae are serious soil pests eating roots and adults have strong mouthparts eating leaves and sometimes young fruits. But it is poorly defined and often being a subject of confusion for its inclusion or exclusion at various stages. Therefore, it is always essential to conduct studies regarding their taxonomical description to differentiate the particular species. This study established the current taxonomical status of four species (*Schoenherria vervex*, *Schoenherria hispida*, *Lepidiota stigma* and *Lepidiota lei*) belonging to subfamily Melolonthinae inhabiting the region of Malaysia and scrutinized their functional sense of anatomy to show the results of evolutionary adaptation to their special habitat in the forest of Malaysia. The species primarily for morpho-species study of genera *Schoenherria* and *Lepidiota* were selected. The specimens have been identified by comparing with the specimens at Sarawak's Museum and The Natural History Museum of Sweden. It is expected from this study that in future it will be helpful for understanding to devise control measure to suppress the pest population below significant level.

Keywords: Melolonthinae, taxonomy, Malaysia

1. Introduction

Melolonthinae is the largest subfamily of Scarabaeidae with 750 genera and 11000 species recorded worldwide [9]. These are commonly called chafers (Cockchafers) with dull brown coloured beetles, rounded body with fat on surface and nocturnal in nature. The larvae are strongly curved, C-shaped and sometimes humpbacked; the pale to reddish brown head is well developed and the legs are not modified as stridulatory organs. Their larvae are serious soil pests eating roots and adults have strong mouthparts thus eat leaves and sometimes young fruits. The sub-family includes an important number of different genera such as *Melolontha*, *Serica*, *Holotrichia*, *Leucopholis* and *Dermolepida* [8]. The subfamily has been reported as divided into tribes and sub-tribes [12] however the last world catalogue of this subfamily was given by [5, 6] later the tribal classification was followed by Britton [3, 4]. According to these Melolonthinae is a world diverse subfamily but poorly known group [23]. For morphological identification of subfamilies Melolonthinae most researchers are agreed on their general characteristics [14, 15].

In Malaysia, according to the catalogue given by Junk's [5, 6] a total number 228 species had been recorded from sub-families Melolonthinae along with Rutelinae in Malaysia followed by Borneo in which 152 species including 22 species from Penang, 11 species from Perak, 30 species from Malacca, one species from Labuan and 12 species from Sarawak recorded, respectively. However, no recent study has been conducted on abundance of species from this subfamily thus created a huge gap. Therefore, this study has been carried out to know some recent species from subfamily Melolonthinae in Malaysia because this study will be helpful in future for further taxonomical studies.

2. Materials and Methods

The current study based on different insect species of subfamily Melolonthinae and most of these insect species were large in size and collected by hand directly from different parts of Malaysia. However, few species were also obtained from Universiti Putra Malaysia (UPM), Universiti Kebangsaan Malaysia (UKM) and University Malaysia Sabah (MUMS). All collected insects were brought at Department of Plant Protection, Faculty of Agriculture, UPM, Malaysia where these insects were finally pinned and preserved for further studies.

All the collected insect species were put in the close glass tubes, covered with a close plastic and kept inside the refrigerator at temperature of -5°C ; thus killing and saving of specimen were assured for several days until the stapling was performed. The morphological characteristics of insect species were examined under using a Dino Lite digital microscope (AnMo Electronic Corp, Taiwan) however, the tiny structure of the insect body was observed after preparing slides and these slides were examined through Dino-Eye digital microscope (5 MP, AnMo Electronic Corp, Taiwan). In anatomical study, insect slides were prepared by using Canada balsam and put under a light source of 100 W to dry for three to four days to make these slides ready to examine and to draw their images. The whole body image and scale characters of the insects were observed by using Canon DSLR Camera (EOS 70 D, 55-135mm lenses, Japan). The illustration has been done by using two drawing and graphic software such as Adobe illustrator CC and Wacom Cintiq 13HD. Thus, all these above mentioned procedures were applied to identify the insect species and subsequently their taxonomical keys were constructed.

In addition all the specimens were examined for specific genera and species identification based on the taxonomic key suggested by Dalla Torre [5, 6, 18, 12]. The specimens were also compared with already collected and preserved similar insect species at Centre of Insects Systematic UKM Malaysia, Sarawak's Museum, Malaysia and were further carried out to The Natural History Museum of Sweden under kind supervision of Dr. Julio Ferrier (Sweden) for proper identification.

3. Results and Discussion

Schoenherria vervex; Sharp (1876)

Description

Body is elongated oval dark brown in colour and covered with yellow setae. A yellow strap is on the elytra with the overall size of about 26 - 28 mm in length and maximum width at elytra is 12 - 14 mm (Figure 1).

Head is flattening at front, prominent with compound eyes reniform in shape and distance between two eyes is about 3.8 - 4.5 mm. The mouth parts (labrum, labium, mandible and maxilla) and antennae are illustrated in Figure 2 in which

antennae are with 10 antennomers, lamellate and about 5.1-6.1 mm in length. The first segment of antenna is elongated and it carries some long setae however the second segment is cubic in shape and the third segment is oblong. The overall segments from 4 - 10 are very flattened and plate-like in structure. Labrum carries some long setae on the anterior margin and labium is mentum oblong, flattened with three segmented palps. Maxilla with four teeth and palpi consists of four segments whereas the apical segment is oval in form.

Thorax and legs are illustrated in Figure 3 in which pronotum are displayed subtrapezoidal. The anterior border is strongly margined, anterior and posterior angles acute, sharp, surface with fine setae and scutellum almost is triangular in shape. In thorax, fore-leg protibia is apical tooth long and curved. The fifth segment tarsus is almost the same size and it carries one spur and two strong claws. In mid-leg, mesotibiae is cylindrical in shape with two simple spur on the middle dorsal border and with many other spur on the apex. In hind-leg, metatibiae is cylindrical in shape with a simple spur on the dorsal border. The length of elytra is 14.2 - 15 mm with costae defined by regular rows of punctures on the surface covered with secondary punctures however the length of aedeagus is 7.3 - 7.9 mm in abdomen (Figure 4).

Material examined

Malaysia: Johor, Gunung ledang, 27-29.iii.2014, Ali M.A. A., 2♂. [IMUPM]. Malaysia: Pahang, Cameron Highland, 21-23.iii.2014, Ali M.A. A., 2♂, 1♀. [IMUPM]. Malaysia: Kedah, Langkawi, 5-10.iv.2014, Ali M.A. A., 2♂. [IMUPM]. Malaysia: Pahang, Fraser Hill, 5-8. vi. 2014, Ali M.A. A., 2♂, 1♀. [IMUPM]. Malaysia: Selangor, UPM farm 10, 7-10.iv.2014, Ali M.A. A., 1♂. [IMUPM]. Malaysia: Selangor, Cheras Batu 9, 8. v.2014, Ali M.A. A., 2♂. [IMUPM].

Distribution

Johor, Gunung ledang, Pahang, Cameron Highland, Kedah, Langkawi. Pahang, Fraser Hill, Selangor, UPM farm. Selangor, Cheras Batu 9.

Remarks: New record in Malaysia

Schoenherria hispida Burmeister (1855)

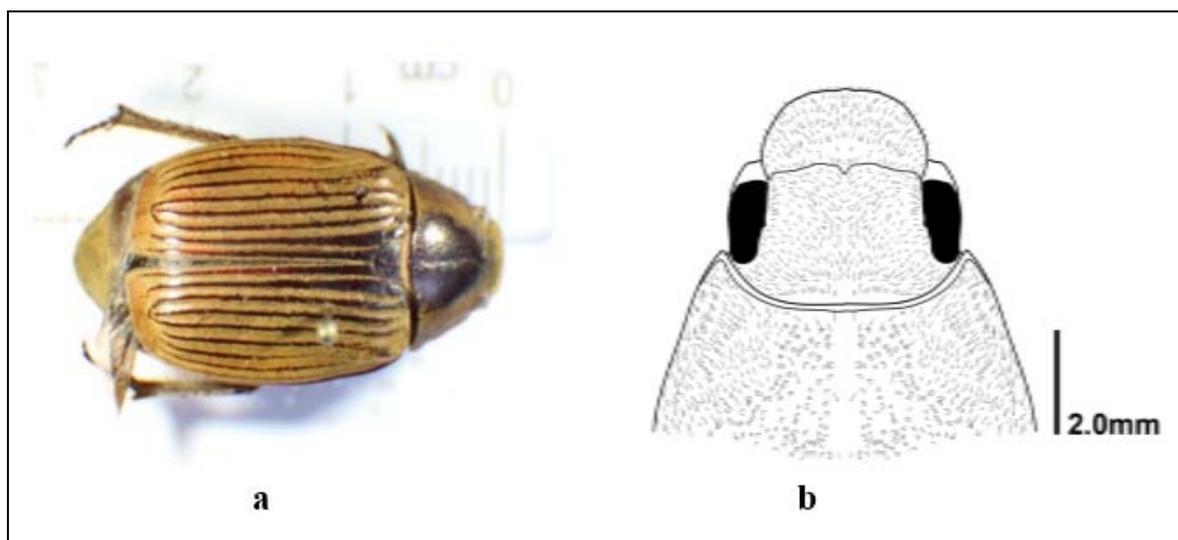


Fig 1: A dorsal view of *S. vervex* a. showing body surface (dorsal) b. dorsal view of the head

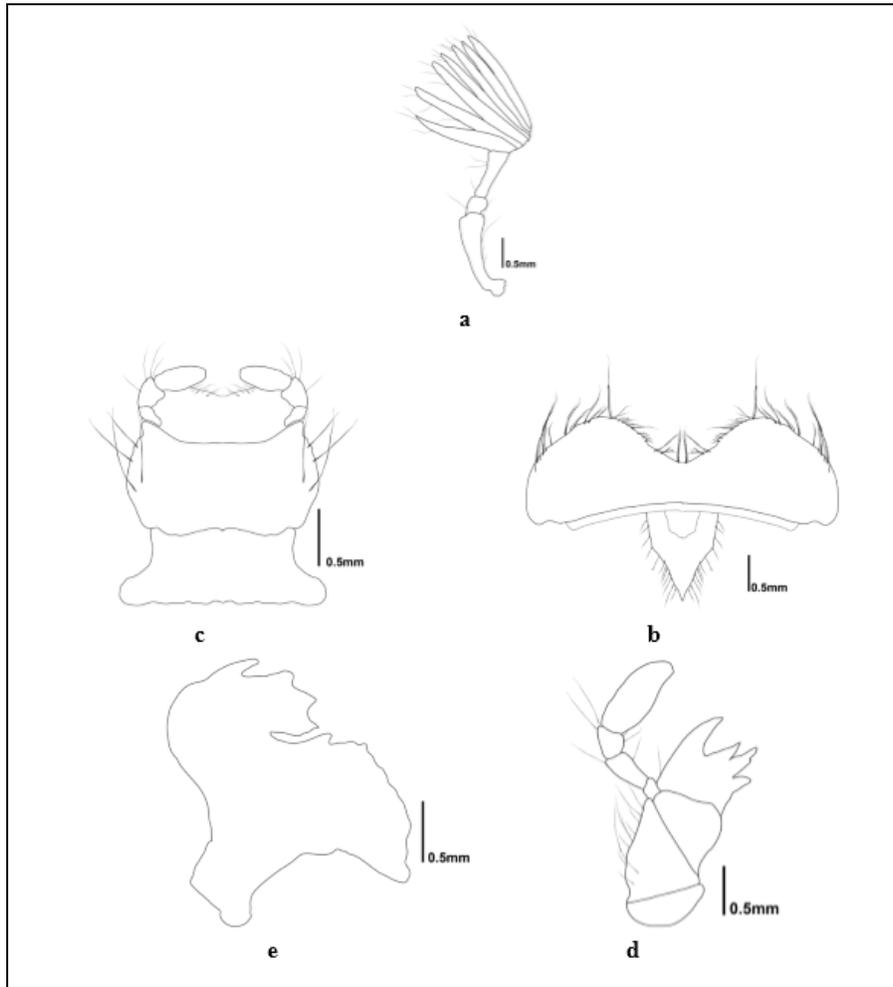


Fig 2: Antennae and mouth parts of *S. vervex* (a) antennae (b) labrum (c) labium (d) mandible (e) maxilla

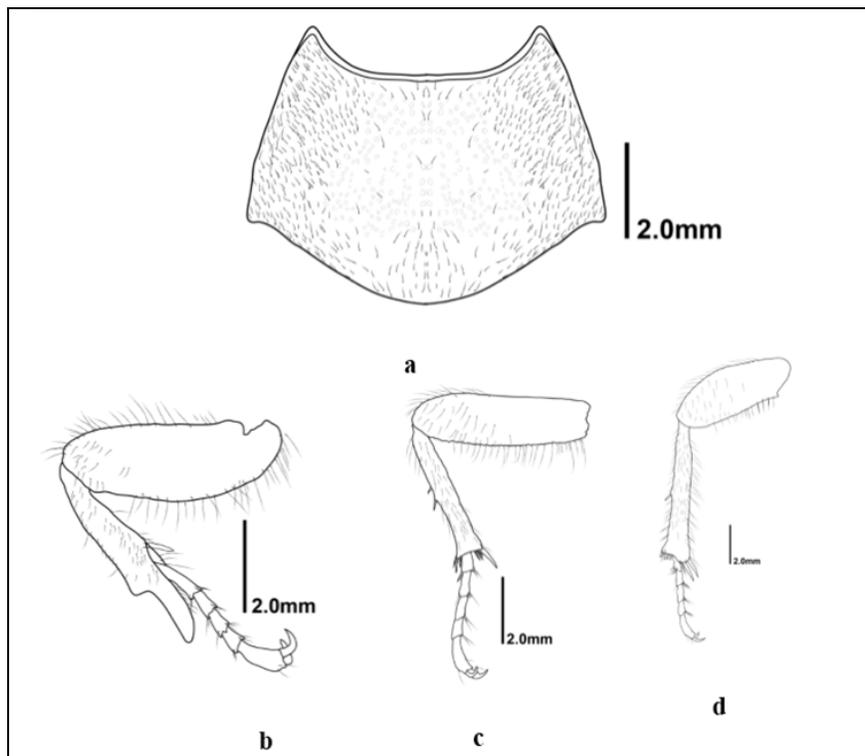


Fig 3: Thorax and legs of *S. vervex* (a) pronotum (b) fore-leg (c) mid-leg (d) hind-leg

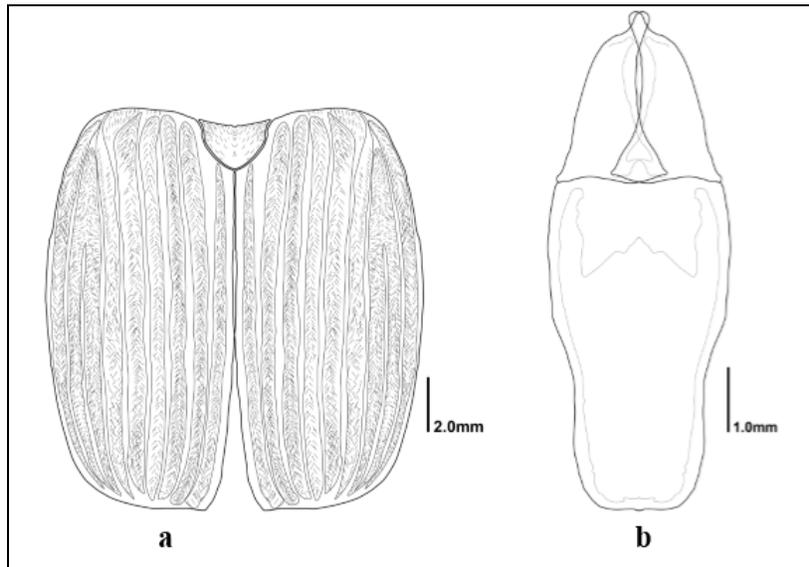


Fig 4: Abdomen of *S. vervex* (a) Elytra (b) Aedeagus

Description

Body is elongated oval, reddish brown in colour and covered with yellow setae. A yellow strap is on the elytra with the overall size of about 26 - 28 mm in length and maximum of width at elytra with 12 - 14 mm (Figure 5).

Head is flattening convex at middle, compound eyes reniform and prominent and distance between two the eyes is about 2.1 - 2.9 mm in length. The mouth parts (labrum, labium, mandible and maxilla) and antennae are illustrated in Figure 6 in which antennae are with ten antennomeres, lamellate and about 4.7 - 5.1 mm in length. The first segment is elongated and it carries some long setae however the second segment is short and the third segment is oblong. The segments are very small and the last segments are flattened and plate-like structure. Labrum oblong and it carries some long setae on the surface. Labium is mentum oblong, flattened with three

segmented palps. Maxilla with four teeth and palpi consists of four segments meanwhile the apical segment is fusiform form.

Thorax and legs are illustrated in Figure 7 in which pronotum are displayed subtrapezoidal. The anterior border is strongly margined, anterior and posterior angles acute, sharp, surface with fine setae and scutellum almost triangle in shape. In thorax, fore-leg protibia is apical tooth long and curved. The fifth segment tarsus is almost the same size and it carries one spur and two strong claws. In mid-leg, mesotibiae is cylindrical in shape with one spur on the apex. In hind-leg, metatibiae is cylindrical in shape with two simple spur on the apex. The length of elytra is 12.2 - 13 mm with costae defined by regular rows of punctures on the surface covered with secondary punctures however the length of aedeagus is 6 - 6.3 mm in abdomen (Figure 8).

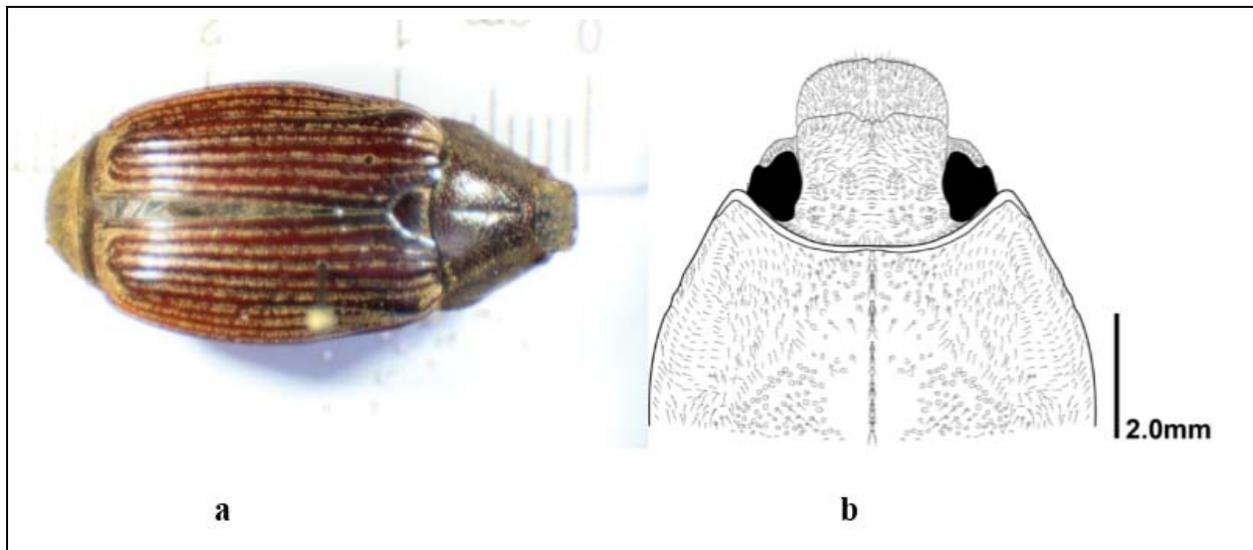


Fig 5: A dorsal view of *S. hispida* a. showing body surface (dorsal) b. dorsal view of the head

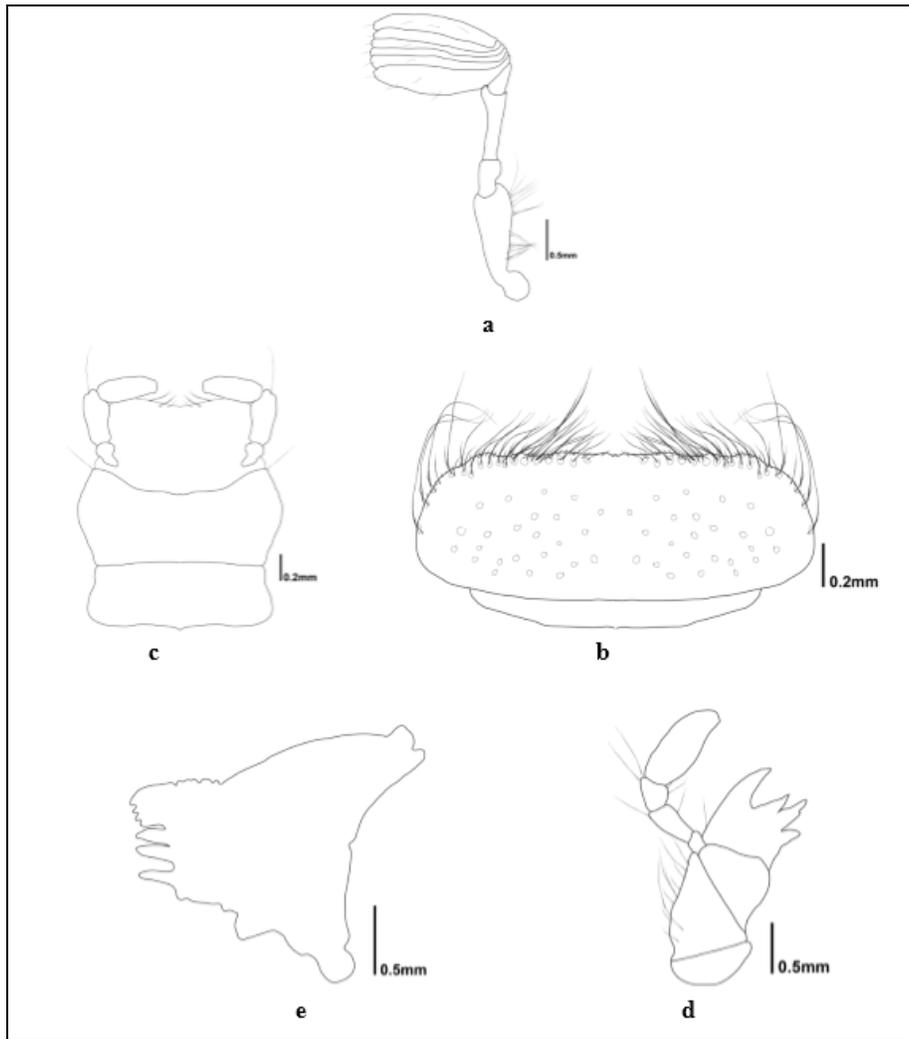


Fig 6: Mouth parts and antenna of *S. hispida* (a) antennae (b) labrum (c) labium (d) mandible (e) maxilla

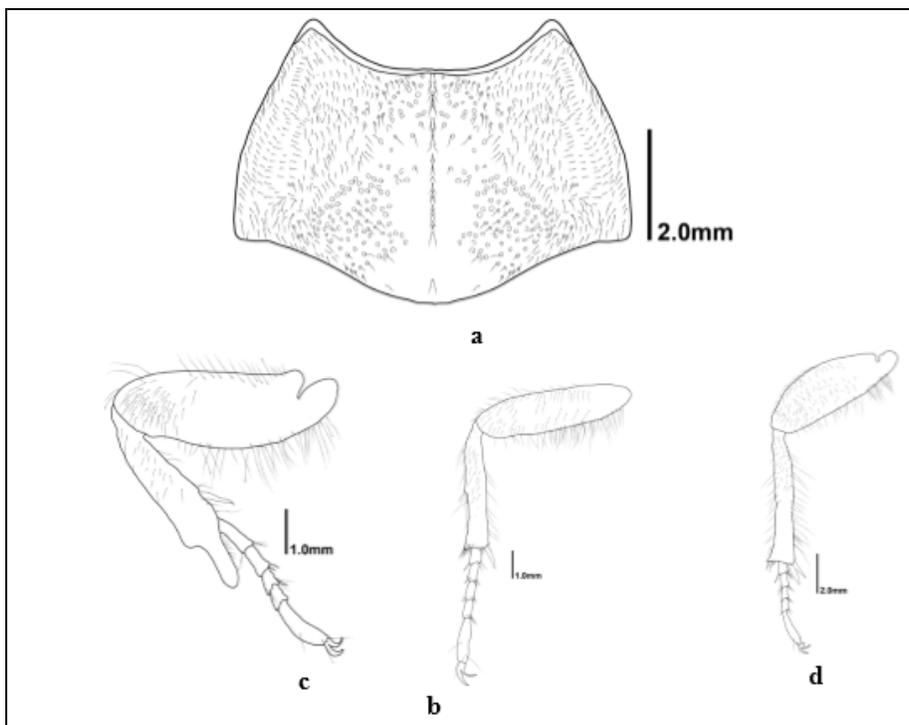


Fig 7: Thorax and legs of *S. hispida* (a) pronotum (b) fore-leg (c) mid-leg (d) hind-leg

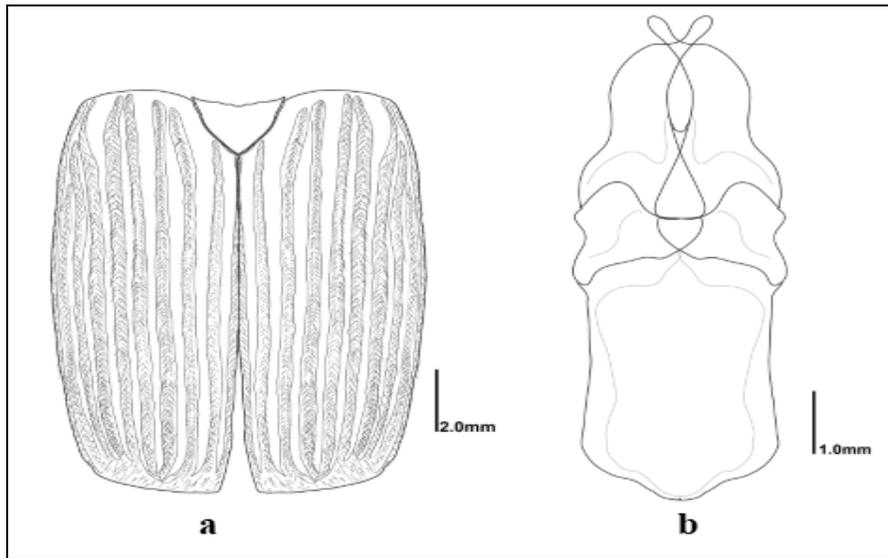


Fig 8: Abdomen of *S. hispida* (a) Elytra (b) Aedeagus

Material examined

Malaysia: Johor, Gunung ledang, 27-29.iii.2014, Ali M.A. A., 2♂. [IMUPM]. Malaysia: Pahang, Cameron Highland, 21-23.iii.2014, Ali M.A. A., 4♂. [IMUPM]. Malaysia: Kedah, Langkawi, 5-10.iv.2014, Ali M.A. A., 3♂, 2♀. [IMUPM]. Malaysia: Pahang, Fraser Hill, 5-8. vi.2014, Ali M.A. A., 3♂. [IMUPM]. Malaysia: Malaysia: Selangor, Cheras Batu 9, 8. v.2014, Ali M.A. A., 1 ♂. [IMUPM].

Distribution

Johor, Gunung ledang, Pahang, Cameron Highland, Kedah, Langkawi. Pahang, Fraser Hill, Selangor, UPM farm. Selangor, Cheras batu 9. Borneo.

Lepidiota stigma; Fabricius (1798)

Description

Body is elongated oval, light brown in colour covered with tiny yellow setae about 28-30 mm length. A maximum width of elytra is 17 - 18 mm (Figure 9).

Head is front flattened, compound eyes oval, prominent and the distance between two eyes about 5.2 mm in length. The mouth parts (labrum, labium, mandible and maxilla) and the antennae are illustrated in Figure 10 in which antennae are with ten antennomers, lamellate and about 4.7 - 4.9 mm in length. The first segment is elongated and it carries some long

setae however the second segment is short and the segments three to six are short oblong shape. The seventh segment is a small triangle like and the last three segments are flattened and plate-like structure. Labrum carries some long setae on the anterior and lateral margins and surface covers with the punctures. Labium mentum is oblong with three segmented palps. Maxilla with five teeth and palpi consists of four segments meanwhile the apical segment is fusiform form and mandible molar lobe is striated with grinding surface.

Thorax and legs are illustrated in Figure 11 in which pronotum are displayed subtrapezoidal. The lateral border is strongly curved; the anterior half of the lateral border is zigzag. Anterior and posterior angles are acute, sharp surface with fine dense setae and scutellum triangle. In thorax, fore-leg protibia is bidentate, teeth long and a bumped in the middle of the dorsal side with one strong spur on the inner. The fifth segment tarsus is almost the same size and it carries two strong claws. In mid-leg, metatibiae is cylindrical in shape, it carries strong spur on the inner side, the fifth segment tarsus is almost the same in size, and it carries two strong claws. In hind-leg, metatibiae is cylindrical in shape with two strong spur on the inner side. The length of elytra is 19.5 - 20 mm, the stria hardly can be seen because of yellow densely setae however the length of aedeagus is 11.9 - 12.3 mm in abdomen (Figure 12).

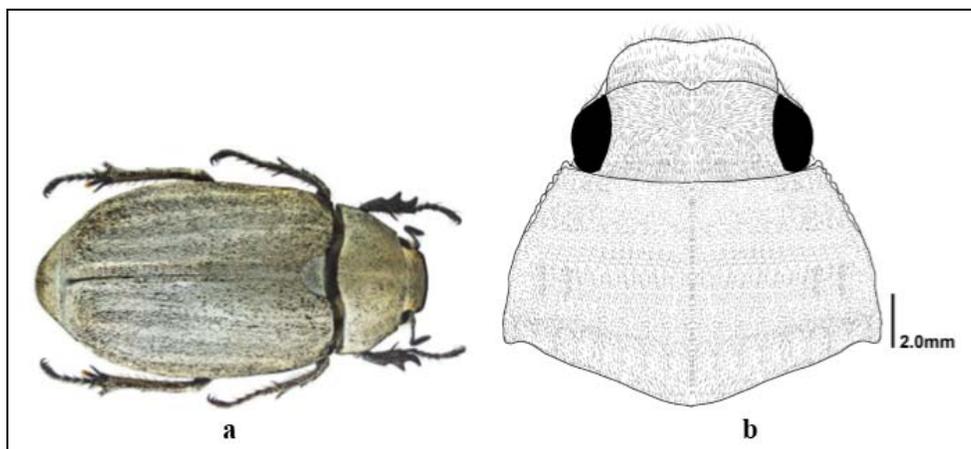


Fig 9: A dorsal view of *L. stigma* (a) showing body surface (dorsal) (b) dorsal view of the head

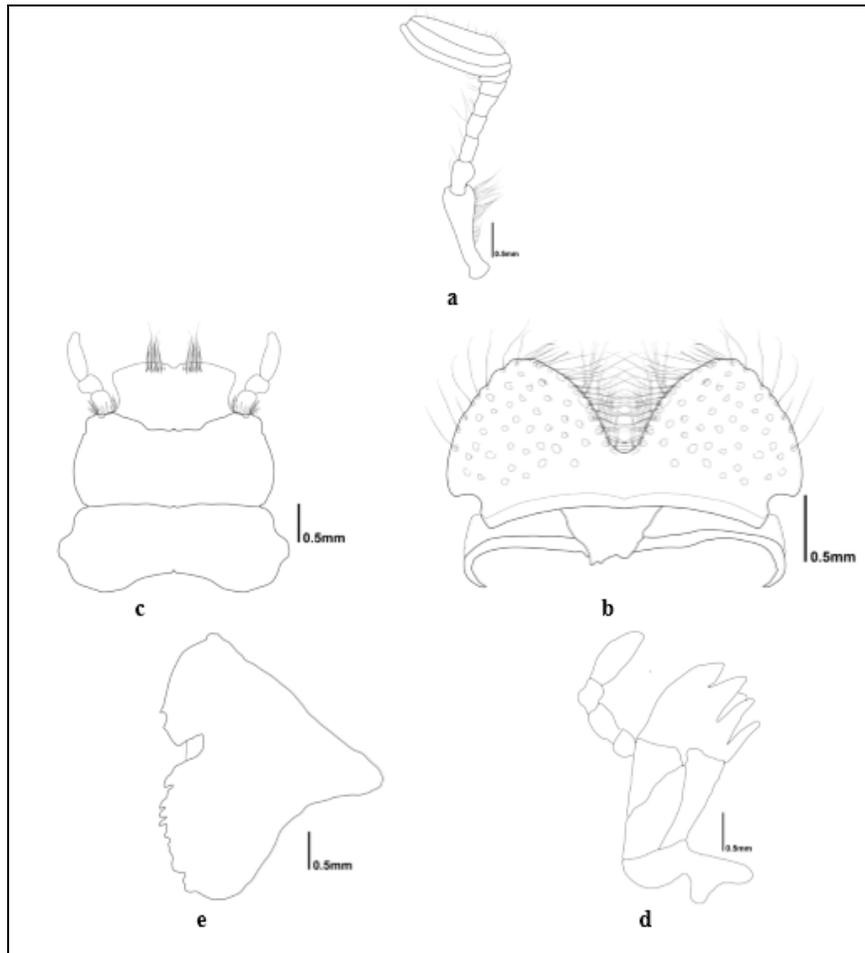


Fig 10: Mouth parts and antennae of *L. stigma* (a) antennae (b) labrum (c) labium (d) mandible (e) maxilla

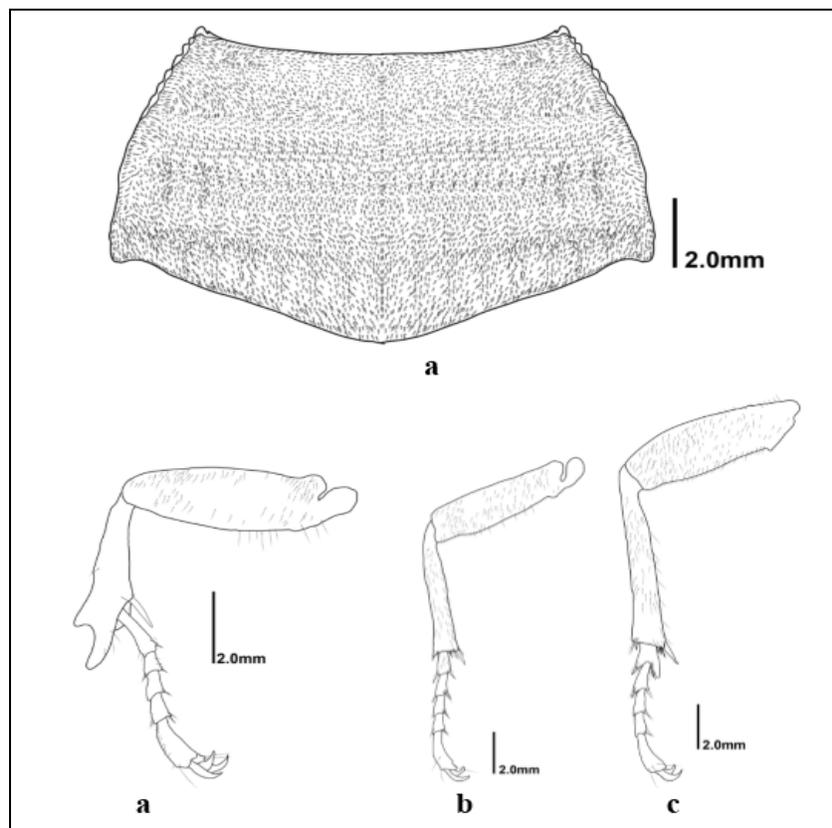


Fig 11: Thorax and legs of *L. stigma* (a) pronotum (b) fore-leg (c) mid-leg (d) Hind-leg
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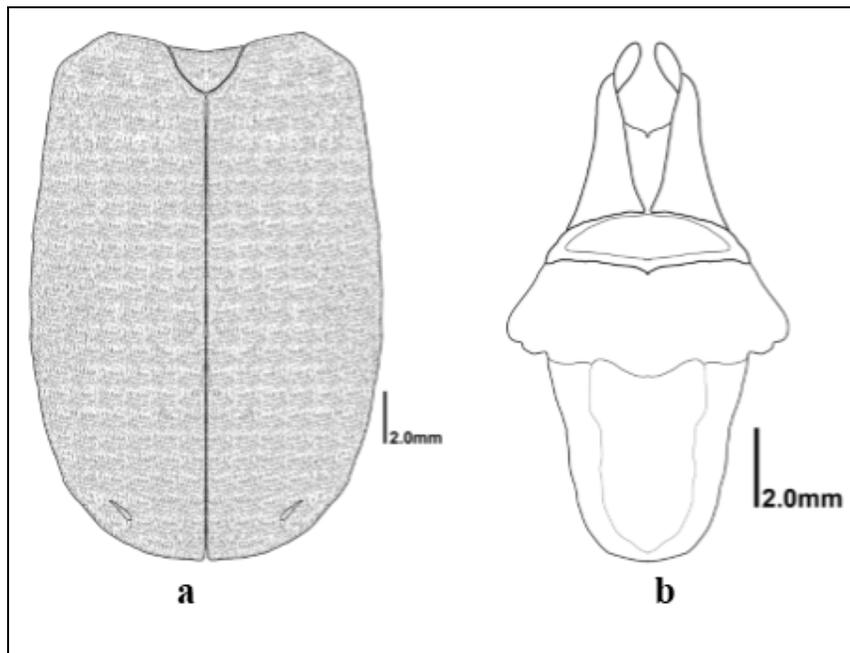


Fig 12: Abdomen of *L. stigma* (a) Elytra (b) Aedeagus

Material examined

Malaysia: Johor, Gunung ledang, 27-29.iii.2014, Ali M.A. A., 2♂, 3♀. [IMUPM]. Malaysia: Pahang, Cameron Highland, 21-23.iii.2014, Ali M.A. A., 4♂. [IMUPM]. Malaysia: Kedah, Langkawi, 5-10.iv.2014, Ali M.A. A., 2♂. [IMUPM]. Malaysia: Pahang, Fraser Hill, 5-8.vi. 2014, Ali M.A. A., 3♂. [IMUPM].

Distribution

Johor, Gunung ledang, Johor, Segamat. Pahang, Cameron Highland,. Kedah, Langkawi. Kedah sintok. Pahang, Fraser hill, Selangor, UPM farm. Selangor, Cheras Batu 9. Selangor, UKM Bangi. Melaka, Bukit Senggeh. Pahang, Pulau Tioman. Perak, Telok Anson. Bukit Larut. Terengganu, Jerteh. Kelantan, Kota baharu. pengkalan Chepa. Tanah Mareh. Kuala Lompat. Perak, Sg. Perak. Kuala Dungun, Dungun.

Lepidiota leai; Blackburn (1912)

Description

Body is elongated oval, the integument of elytra is reddish brown in color with delimited yellow spots that is covered with very short thick yellow setae of about 22 - 24 mm in length however a maximum width at elytra of 12 - 14 mm (Figure 13).

Head is slightly convex at front, compound eyes reniform, prominent and the distance between two eyes is about 3.6 mm. The mouth parts (labrum, labium, mandible and maxilla) and the antennae are as illustrated in Figure 14 in which antennae are with ten antennomeres, lamellate and about 3.1 - 3.3 mm in length. The first segments is elongated, the second segment is short, the segments three to five are short oblong sharp, the segments six and seven are small and almost in the

same shape however the last three segments are flattened and plate-like in structure. Labrum carries some long setae on the anterior margin and the surface is smooth. Labium mentum is flattened with three segmented palps. Maxilla with three teeth and palpi consists of four segments meanwhile the apical segment is cylindrical and mandibles molar lobe is striated with grinding surface.

Thorax and legs are as illustrated in Figure 15 in which pronotum are subtrapezoidal. The lateral border is strongly curved and the anterior border is strongly margined. The anterior angles are acute, sharp and posterior angles are obtuse surface with fine dense setae however scutellum is triangle in shape. In thorax, fore-leg protibia is bidentate, one of the tooth long and the other short with a bump in the middle of the dorsal side of the tibia with one strong spur on the inner side. The fifth segment tarsus is almost in the same size and it carries two strong claws. In mid-leg, mesotibiae is cylindrical in shape and it carries strong spur on the inner side and the fifth segments tarsus are almost the same size and it carries two strong claws. In hind-leg, metatibiae is cylindrical in shape and it carries one strong spur on the inner side. The length of elytra is 13.6 – 14 mm, the stria hardly can be seen because of the densely yellow setae with two extraordinary black circle spot in the posterior part of the elytra however the length of aedeagus is 7.3 - 7.7 mm in abdomen (Figure 16).

Material examined

Malaysia: Johor, Gunung ledang, 27-29.iii.2014, Ali M.A. A., 3♂. [IMUPM]. Malaysia: Pahang, Cameron highland, 21-23.iii.2014, Ali M.A. A., 4♂. [IMUPM]. Malaysia: Kedah, Langkawi, 5-10.iv.2014, Ali M.A. A., 3♂, 2♀. [IMUPM]. Malaysia: Pahang, Fraser hill, 5-8.vi.2014, Ali M.A. A., 2♂. [IMUPM].

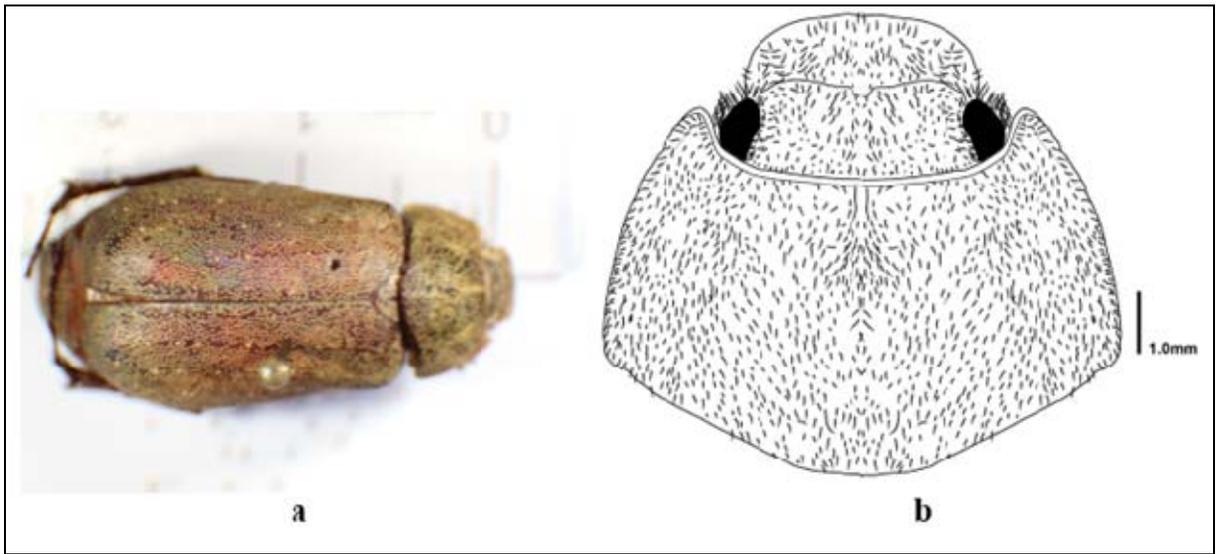


Fig 13: A dorsal view of *L. leai* (a) showing body surface (dorsal) (b) dorsal view of the head

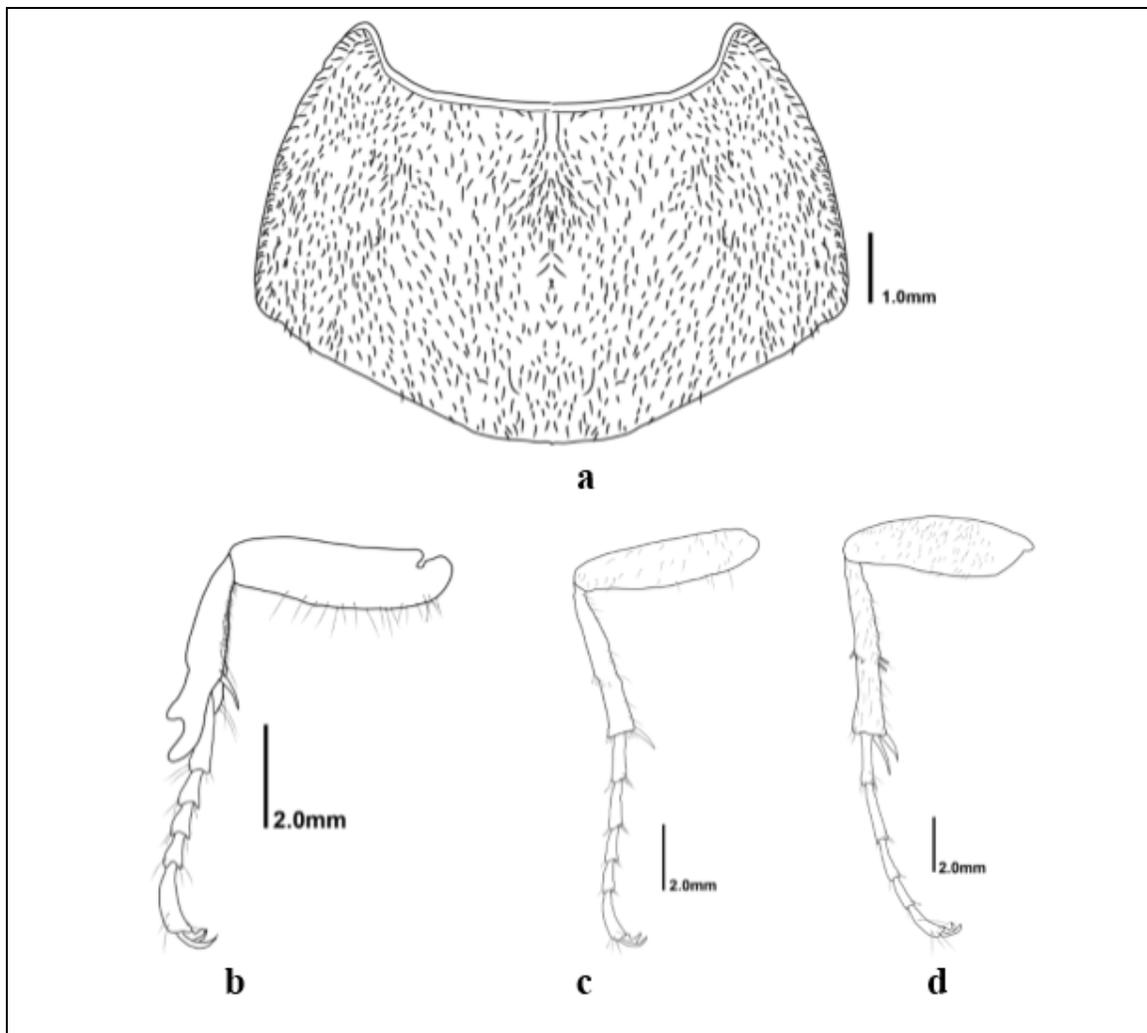


Fig 15: Thorax and legs of *L. leai* (a) pronotum (b) fore-leg (c) mid-leg (d) Hind-leg

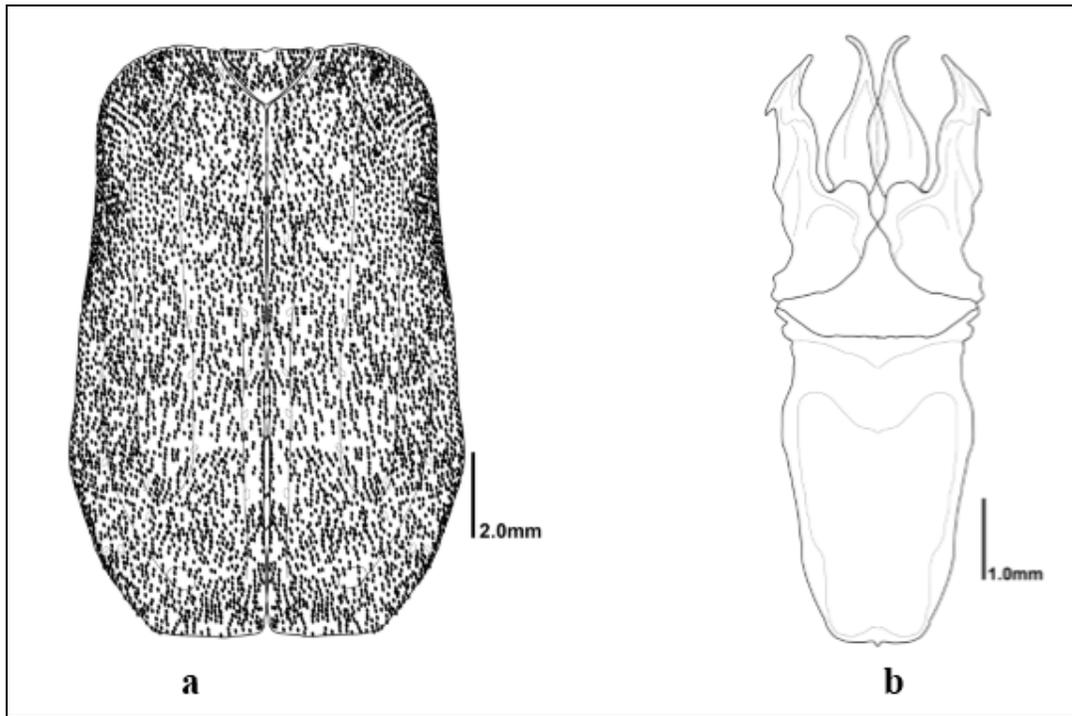


Fig 16: Abdomen of *L. leai* (a) Elytra (b) Aedeagus

Distribution

Johor, Gunung ledang. Pahang, Cameron Highland., Kedah, Langkawi. Pahang, Fraser Hill, Selangor, UPM farm. Selangor, Cheras Batu 9. Selangor, UKM Bangi. Melaka, Bukit Senggeh.

Remarks: New record in Malaysia

Melolonthinae (subfamily) is a poorly defined and often being a subject of confusion for its inclusion or exclusion at various stages by different authors. One extreme example is the Glaphyridae (as currently recognized) that has varied from being a superfamily with two families, to being treated as a tribe of the Melolonthinae. In essence, the recognition of tribes or subfamilies has not been applied consistently. Evans [7] was also in accordance with [8, 19] regarding tribal classification as it was complex and lack of defined characteristics. In addition, he summarized some of the tribal applications of new world fauna that gave a good idea of the inconsistencies of classification systems and the complexities of the group. The only regional fauna that has been studied systematically in any detail is that of Australia.

The current study presented recent taxonomical description of four different species (*S. vervex* (Sharp, 1876), *S. hispida* (Burmeister, 1855), *L. stigma* (Fabricius, 1798), *L. leai* Blackburn, 1912) of subfamily Melolonthinae first time in Malaysia. The overall body structure of all collected species of this subfamily is oval in shape however with variable size of setae but the maximum length was similarly observed in each species at elytra. The head, mouth parts, antennae, legs, elytra and legs were thoroughly examined that showed variable characteristics of each species. Previously, the first major contributor of Melolonthinae was Macleay [16, 17] who described 153 species of this subfamily later followed by Blackburn [1, 2] with massive description of 545 new species of Melolonthinae. Thus, this subfamily includes species having economic importance because both adults and larvae of some genera in this subfamily may be of considerable dangerous [20] and losses could be caused by adult or larvae feed on roots of

grasses and clover as well as organic material in the soil [21, 22, 24, 25].

Therefore, this study has provided a platform for exact identification of certain species of subfamily Melolonthinae and in future will be helpful for understanding to devise control measure to suppress the pest population below significant level.

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