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## Distribution of darkling beetles (Tenebrionidae) in Malaysia

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**Abstract**

The Indo-Malayan region has Stenochiinae, Alleculinae, Amarygmini and Ulomini as the largest number of higher groups belonging to Tenebrionidae family. Since last few years, the forests of Southeast Asia especially Malaysia have changed dramatically as a result of logging and development that caused some changes in the wildlife more particularly insects. The distribution of insect species is widely existed in Malaysia and causing economic damage to the number of plants and agricultural crops. Therefore, this study was conducted on the distribution status of three subfamilies (Stinochiinae, Tenebrioninae and Diaperinae) of family Tenebrionidae especially considering darkling beetles in Malaysia as it has significant impact worldwide. All the insects were collected through different methods to observe their distribution and seasonal abundance. These traps were monitored monthly and a total number of Tenebrionids were calculated from all study sites. A total number of 120 beetles were collected represented 30 species and 17 genera. However, the most abundant genera were *Tribolium* and *Promethis* and some species rarely found in the area. The collected information regarding distribution of Tenebrionid will be helpful in future to manage their population below economic damage.

**Keywords:** Tenebrionidae, distribution, Malaysia

**1. Introduction**

Tenebrionidae contains about 20,000 species and 2,300 genera belonging to tropical habitats [1]. It is of a great economic importance as it contains insect pests that are cosmopolitan in nature and most imperatively are associated with stored products [2]. Generally, these insect pests feed on plant materials including decaying matter, wood, leaf litters, pollen, fungal and algal matters. Some are scavengers whereas few of them are predatory especially the wood boring beetles. In Tenebrionidae, insect species are mostly large in size and flightless beetles however other insect species within similar family living in rotten wood and stored products are also small in size [3]. The world catalogues summarized the distributions of all families after that it was known that the species of this family also belongs to Malaysia [4-7]. The Indo-Malayan are the largest numbers of higher groups belongs to Tenebrionidae family but since few years back the forests of Southeast Asia have changed dramatically as a result of logging and development [8-10] and much affected typically Malaysian forests that caused some changes in the life and fauna and flora. However, the distribution of insect species is widely existed in Malaysia and causing economic damage to the number of plants and agricultural crops and barking beetles are one these insects those are pernicious insect pests. No such studies have been conducted prior to know the proper distribution of darkling beetles in Malaysian environment therefore the present study exhibited the first attempt to observe their dispersal throughout Malaysia.

**2. Geography of Malaysia**

Malaysia is a federal constitutional monarchy having 13 states and three federal territories located in Southeast Asia and having a total landmass of 330,800 square kilometres separated by the South China Sea into two similar sized regions, Peninsular Malaysia and East Malaysia [11]. Peninsular Malaysia is located between Thailand and Singapore and east Malaysia is located on the island of Borneo and shares borders with Brunei Darussalam and Kalimantan, Indonesia.

**3. Materials and Methods**

The current study was based on different insect species of Tenebrionidae family including subfamilies (Stinochiinae, Tenebrioninae and Diaperinae). Most of the insect species in these

Subfamilies were large in size and collected by hand directly from different parts of Malaysia from variable sources such as soil surface of farms and forest, under the rock surface of mountain area and from different ware houses, respectively. In addition, some insect species were also collected by using aspirator as stored grains however light traps and pitfall traps (Figure 1) were also used. The light traps were used during 7:00 pm to 10: 30 pm having 250 W mercury vapours light and placed next to a white sheet of cloth (3 x 2 sq m). However, pitfall traps involved plastic containers (8 cm top width, 10 cm bottom width) filled with animal dung (1/3 portion) and sunken in the ground.



a. Light traps

b. Pitfall traps

**Fig 1:** Collection of insets through a. light traps and b. pitfall traps

These traps were monitored monthly for insect collection and all insect species were calculated total per each site and finally brought at the nearest depository centres (Universiti

Kebangsaan Malaysia, Centre of Insect Systematic (CIS), Forest Research Centre Kinabalu National Park (KNP), Universiti Sabah Malaysia Insect Museum (IMUSM), Forest research Centre in Sabah Sandakan (FRC) and finally to Universiti Putra Malaysia Insect Museum (IMUPM) at Department of Plant Protection, Faculty of Agriculture, UPM, Malaysia where these insects were finally pinned and preserved for further studies.

The longitude and latitude of all the locations also presented for collected specimens from different parts of Malaysia during the survey period 1/9/2013 to 1/9/2014 as it helped to produce a map of the distribution of insect species from these subfamilies in Malaysia.

**4. Results and Discussion**

**I. Collected insect species of subfamilies Stinochiinae, Tenebrioninae and Diaperinae (Tenebrionidae)**

The overall 392 individual specimens were collected belong to 30 different species from different regions of Malaysia. The nine genera from Stinochiinae containing 17 different species, eight genera from Tenebrioninae containing 11 different species and only one genus with a new species from Diaperinae were collected, respectively (Table 1). However, a maximum number of species were observed from genera *Promethis* (four species) and *Strongylium* (five including one new species) from subfamily Stinochiinae.

**Table 1:** The collected genera and the species of Subfamilies Stinochiinae, Tenebrioninae and Diaperinae (Tenebrionidae)

| Family Tenebrionidae   |                     |                        |                         |                     |                        |                      |                 |         |
|------------------------|---------------------|------------------------|-------------------------|---------------------|------------------------|----------------------|-----------------|---------|
| Subfamily Stinochiinae |                     |                        | Subfamily Tenebrioninae |                     |                        | Subfamily Diaperinae |                 |         |
| S. No.                 | Genera              | Species                | S. No.                  | Genera              | Species                | S. No.               | Genera          | Species |
| 1                      | <i>Promethis</i>    | <i>Semisulcata</i>     | 1                       | <i>Leprocaulus</i>  | <i>rotundicollis</i>   | 1                    | <i>Hemicera</i> | sp. n.  |
|                        |                     | <i>Coracina</i>        | 2                       | <i>Derosphaerus</i> | <i>aeruginosus</i>     |                      |                 |         |
|                        |                     | <i>Punctulator</i>     | 3                       | <i>Pseudoblaps</i>  | <i>javana</i>          |                      |                 |         |
|                        |                     | <i>Opaca</i>           | 4                       | <i>Amarygmus</i>    | <i>metallicus</i>      |                      |                 |         |
| 2                      | <i>zophobas</i>     | <i>Asperatus</i>       |                         |                     | <i>aeneolus</i>        |                      |                 |         |
| 3                      | <i>Eucyrtus</i>     | <i>Pretiosus</i>       | 5                       | <i>Gonocephalum</i> | <i>hispidocostatum</i> |                      |                 |         |
|                        |                     | <i>Anthracinus</i>     |                         | <i>Uloma</i>        | <i>sextuberosa</i>     |                      |                 |         |
| 4                      | <i>Asbolodes</i>    | <i>Humerosus</i>       | 6                       |                     | <i>excise</i>          |                      |                 |         |
| 5                      | <i>Pseudonautes</i> | <i>Vagevittatus</i>    | 7                       | <i>Alphitobius</i>  | <i>diaperinus</i>      |                      |                 |         |
| 6                      | <i>Gauromaia</i>    | <i>Annulipes</i>       | 8                       | <i>Tribolium</i>    | <i>confusum</i>        |                      |                 |         |
|                        |                     | <i>Haagi</i>           |                         |                     | <i>castanum</i>        |                      |                 |         |
| 7                      | <i>Camptobrachy</i> | sp. n.                 |                         |                     |                        |                      |                 |         |
| 8                      | n. gen.             |                        |                         |                     |                        |                      |                 |         |
| 9                      | <i>Strongylium</i>  | <i>Varians</i>         |                         |                     |                        |                      |                 |         |
|                        |                     | <i>Erythrocephalum</i> |                         |                     |                        |                      |                 |         |
|                        |                     | <i>Orientele</i>       |                         |                     |                        |                      |                 |         |
|                        |                     | sp. n.                 |                         |                     |                        |                      |                 |         |
|                        |                     | <i>Forcipicolle</i>    |                         |                     |                        |                      |                 |         |

**ii. Distribution of the family**

The distribution of these subfamilies was widely existed in Malaysia and causing economic damage to the number of

plants and agricultural crops thus necessity to conduct a study on these species. These species were almost distributed in every state (Table 2).

**Table 2:** The overall collected the species of three Subfamilies from different locations of the study states indicating less common, rare and most common species

|   | Insect species        | Selangor | N. sambilan | Melaka | Johor | Pahang | Perak | Kadah | Pinang | Sabah | Sarawak |
|---|-----------------------|----------|-------------|--------|-------|--------|-------|-------|--------|-------|---------|
| 1 | <i>P. semisulcata</i> | ***      |             | *      | *     |        |       | **    | *      | ***   | ***     |
| 2 | <i>P. coracina</i>    | **       |             | *      |       | *      |       | *     |        | **    | *       |
| 3 | <i>P. punctulator</i> | *        | *           |        | *     |        |       |       |        | ***   | **      |
| 4 | <i>P. opaca</i>       | ***      |             | **     | **    | *      |       |       |        | *     | **      |
| 5 | <i>R. asperatus</i>   | *        |             |        |       |        |       |       |        | **    | *       |
| 6 | <i>E. pretiosus</i>   | **       |             |        |       |        |       |       |        | *     | **      |
| 7 | <i>E. anthracinus</i> | **       |             |        |       |        |       |       |        | *     | *       |
| 8 | <i>A. humerosus</i>   | *        |             | *      |       | *      |       |       |        | *     |         |

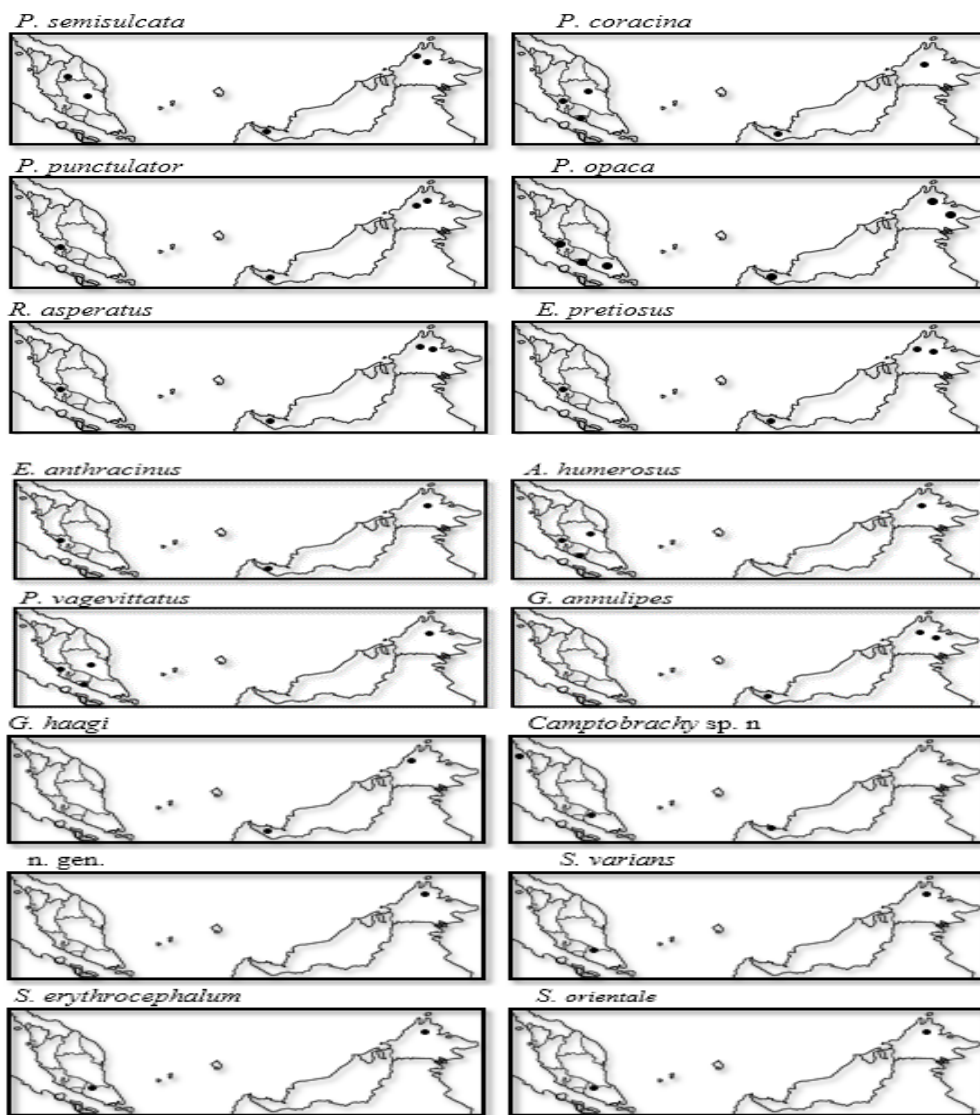
|    |                           |     |    |    |     |     |     |     |    |     |     |
|----|---------------------------|-----|----|----|-----|-----|-----|-----|----|-----|-----|
| 9  | <i>P. vagevittatus</i>    | *   | ** | *  |     | *   |     |     |    | **  | *   |
| 10 | <i>G. annulipes</i>       |     |    |    |     |     |     |     |    | *** | **  |
| 11 | <i>G. haagi</i>           |     |    |    |     |     |     |     |    | *   | **  |
| 12 | <i>C. sp.n</i>            |     |    |    | **  |     |     | *   |    |     | *   |
| 13 | <i>n. gen.</i>            |     |    |    |     |     |     |     |    | **  |     |
| 14 | <i>S. varians</i>         |     |    |    | **  |     |     |     |    | *** |     |
| 15 | <i>S. erythrocephalum</i> |     |    |    |     |     |     |     |    | **  |     |
| 16 | <i>S. orientale</i>       |     |    |    | *   |     |     |     |    | *   |     |
| 17 | <i>S. n.sp.</i>           |     |    |    |     |     |     |     |    | **  |     |
| 18 | <i>S. forcipicolle</i>    |     |    |    |     |     |     |     |    | **  | *   |
| 19 | <i>L. rotundicollis</i>   |     |    |    |     |     |     |     |    | *   | *   |
| 20 | <i>D.aeruginosus</i>      | *   |    |    |     |     |     |     |    | **  | *   |
| 21 | <i>P. javana</i>          |     |    |    |     |     |     | *   |    | *   |     |
| 22 | <i>A. metallicus</i>      |     |    |    |     | *   |     |     |    | **  |     |
| 23 | <i>A. aeneolus</i>        |     |    |    |     |     |     |     |    | *   | *   |
| 24 | <i>G. hispidocostatum</i> | **  |    |    |     |     |     | *   |    |     |     |
| 25 | <i>U. sextuberosa</i>     | **  |    |    |     |     |     |     |    | *** |     |
| 26 | <i>U. excise</i>          |     |    |    |     |     |     |     |    | *   |     |
| 27 | <i>A. diaperinus</i>      | **  |    |    |     |     |     | *   |    | *   |     |
| 28 | <i>T. confusum</i>        | *** | ** | ** | *** | **  | *   | **  | ** | *** | *** |
| 29 | <i>T. castanum</i>        | *** | ** |    | **  | *** | *** | *** | *  | **  | *** |
| 30 | <i>H.n.sp.</i>            | *   |    |    |     |     |     |     |    | *   |     |

\* Rare species, \*\* Less common species and \*\*\*Most common species

The study has also shown that the mountain area was the most abundant for these beetles however some species rarely found in the lower elevations such as *G. hispidocostatum*.

**iii. Mapping for the distribution of species**

A map has been developed for each species to show the exact distribution of collected species of Tenebrionidae.



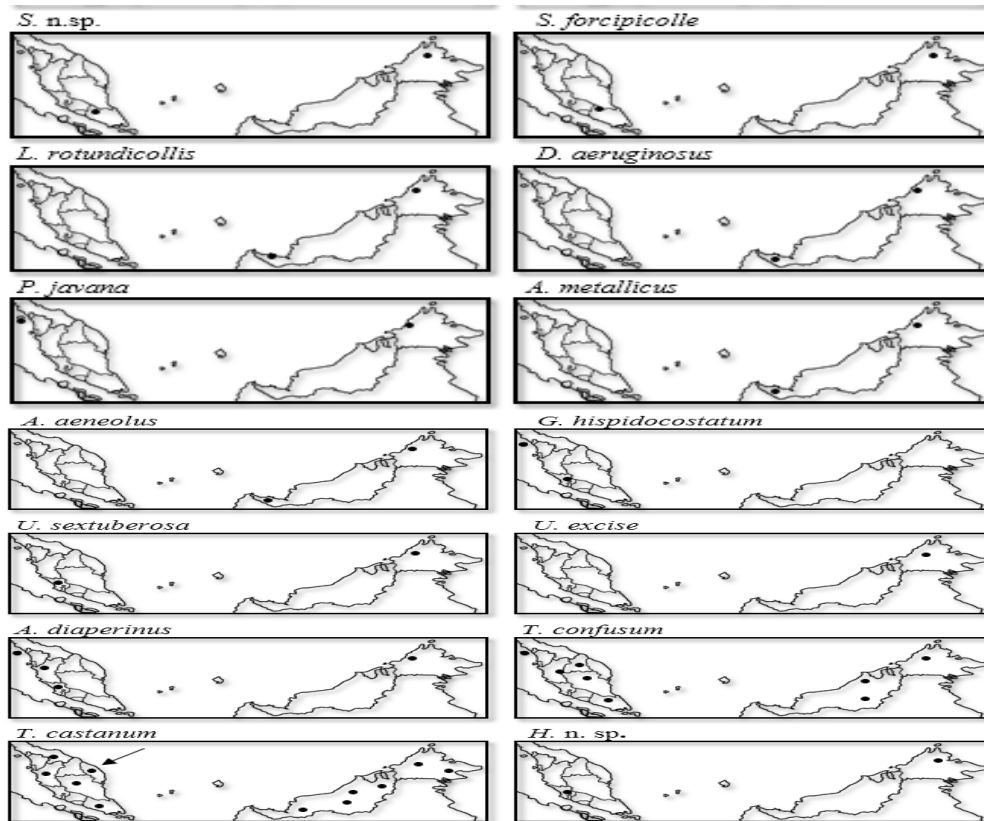


Fig 2: Distribution of each species of family Tenebrionidae in the different states of Malaysia indicated by points (●)

Tenebrionidae mainly existed in tropical and subtropical regions of both hot and cold deserts [12]. The Paleotropics are present in the Indian subcontinent, Equatorial Africa, Madagascar, south-east Asia, southern China, New Guinea, northern Australia and the Pacific. There have been for last few years, a series of a bigger Tenebrionid known from the Cameron Highlands (Malaysia) and after a detailed study it was observed to be a new genus and new species of the Pycnocerini. The Pycnocerini are a group of Tenebrionidae occurring specially in tropical Africa [13]. Three species had been described by [14] and four species of *Aediotorix* by [15] in the oriental regions (Philippines, Indonesia and Malaysia). The Pycnocerini are placed within the subfamily of Lagriinae and are divided into two subtribes which are Chiroscelina with bifid and Pycnocerina with truncate mandibles [12]. Similarly, in this study few very important species of Tenebrionid including some new species have been collected and in future it is quite essential to properly identify these for implementing their control managements. Because, Dark beetles are probably fundamental in important processes of ecosystem function such as the indicators of environmental quality, as their presence signifies that the localities in question are relatively undisturbed however a significant majority of these insects are scavengers. Examples of the former which affect primarily the dryland agriculture are the species of *Eleodes* and *Embaphion* (Amphidorini) in North America [16-21], *Blapstinus* (Opatrini) in Paraguay [22], *Gonocephalum* Solier (Opatrini) in Europe [23,24], India [25,26], south-east Asia, Hawaii [27], South Africa [28,29], *Opatroides* and *Sclerum* (Opatrini) in India [27], *Somaticus* Hope (Sepidiini) in South Africa, *Adesmia* (Adesmiini) in Jordan [30], *Mantichorula* Reitter (Pimeliini) in China [31], *Epitragus* (Epitragini) in the West Indies [32] and *Gonocephalum* as well as *Adelium*, *Isopteron* Hope (Adeliini), *Pterohelaeus*, and *Celibe* Boisduval (Heleini), in Australia [33-40]

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