BANJARAN BINTANG GUNUNG INAS, KEDAH
Pengurusan Hutan, Persekitaran Fizikal
dan Kepelbagaian Biologi

Disunting oleh:
Abd. Rahman Abd. Rahim
Mohd Nasir Abu Hassan
Mohamed Zin Yusop
A. M. Richard
A. Latiff

Jabatan Perhutanan Semenanjung Malaysia
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Pengenalan
A. Latiff

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E. Quah, Nur Juliani Shafie & Rizal Mohamad Ramli
NEW RECORDS OF STAPHYLINIDS AT GUNUNG INAS FOREST RESERVE

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Abstract: Staphylinid has shortened elytra with exposed abdomen and belongs to the order Coleoptera. A total of 229 specimens from 18 species of staphylinids were sampled from Gunung Inas forest reserve. These specimens were identified to Coenonica puncticolis, Elenis kraatz, Orphebius bakerianus, Philonthus flavocinctus, Tachinomorphus fulvipes, Aclyphorus sp., Belonuchu sp., Philonthus sp., Tachinomorphus sp1, Tachinomorphus sp2, Tachinomorphus sp3, Paederus sp1, Paederus 2, Paederus 3, Paederus 4 and Paederus 5. They were new records for Gunung Inas. Two unknown species were given code name as Staphy H and Staphy Q. 88.6% of staphylinids (N=203) was assembled from pitfall traps. Overall Staphylinids at Gunung Inas is abundant, species rich (Margalef index, 3.129) and diverse (Simpson Diversity index (SDI), 0.785; Shannon-Weaver index, 2.018; Evenness index, 0.698. The most abundant and specious staphylinid was sampled from Track 4. Staphylinids hemolymph is toxic. Further study on this species will enhance our understanding of this family of beetle since its reduction in a habitat indicates its usefulness as an indicator of clear-cut harvesting and regeneration practices.

INTRODUCTION

The staphylinids belong to the largest beetle family Staphylinidae. It is commonly known as rove beetle. Staphylinids are elongated and slender with short elytra leaving half of their abdomen exposed. It is an ancient group, with its fossil dated back to Triassic, 200 million years ago (Ahn & Ashe 1996). Most staphylinids are found in terrestrial habitats such as leaf litter, plant debris, and fungi. Staphylinids includes over 58000 described species in 3,847 genera and 31 subfamilies in the world (Herman 2001). Their diets include just about everything except the living tissues of higher plants. Most staphylinids are predators of insects and other kinds of invertebrates, living in forest leaf litter and similar kinds of decaying plant matter. Some live in symbiotic relationships with mammals whereby they eat fleas and other parasites, benefiting the host. A few species, notably those of the genus Aleochara are parasitoids of other insects, particularly of certain fly pupae. The rove beetle uses two different behavior tactics to prey on flies, it can track the
chemical cues that some of its prey use to locate their food including dung, carrion or rotting fruit (Forsyth & Alcock, 1990). Several groups of staphylinids live as parasites of colonies of social insects such as termites, ants and leafhopper (Manley, 2006). They exhibit specialized behaviors and use allo-chemical cues to get food from the hosts or avoid attack by the ants (Betz, 2003). Staphylinids also exhibit complicated behaviors such as resource defense, mate guarding, female mimicry and egg guarding (Forsyth & Alcock, 1990).

Staphylinids is useful as indicators of clear-cut harvesting and regeneration practices and can be used as an example as to how species react to harvesting. It has been observed that after an area of forest was harvested rove beetles, decreased dramatically.

The haemolymph in the entire body except wings contains the most poisonous animal contact toxin and DNA inhibitor called pederin, C_{24}H_{23}N_{4}N named in 1953. It is 12 times more poisonous than cobra venom. Dried and stored staphylinids for 8 years still retain its toxicity. There have been report (Rahmah & Norjaiza, 2008) of school children in Penang who had skin inflammation after coming into contact with Paederus dermatitis in rice field. beetle dermatitis. Some recent studies on diversity of staphylinids include that of Abdullah and Ibu (2008) Abdullah (2010) on the rove beetle of Lanjak entimau Sarawak and Bachok, respectively. This study was conducted to record and determine staphylinid’s diversity at Gunung Inas forest reserve.

MATERIALS AND METHOD

How to recognize a staphylinid beetle.
The specimen is categorized as a staphylinid with the following characteristics. The abdominal sternite is not divided by hind coxae, the adult is elongate-slender with length of 0.7-25mm and the legs are usually 5-5-5, 4-5-5, 5-4-4.

Sampling and ecological index
Staphylinid beetles was sampled using three types of traps namely pitfall and malaise for 24 hours at each track and for 4 hours using light trap from 1900 hours to 2300 hours. Staphylinids collected in the 70% alcohol in the collection bottle from Malaise trap were sorted out and identified to species by referring to staphylinid collections at University Malaya and the staphylinids in the collection of the agricultural department. In the field staphylinids were kept in 70% alcohol before pinning and drying in the oven and kept in insect box. Staphylinids sampled in the pitfall traps had to be sorted from the soil and debris fallen into the pitfall trap under microscope. Staphylinid that flew
to the light source of the light trap was collected manually using pill bottle or aspirator for small size specimens. The staphylinid was documented using digital camera attached to the microscope at B513, Agricultural entomology Laboratory, 5th floor Block B, Institute of Postgraduate study, University of Malaya. The abundance was calculated using Margalef index and diversity was calculated using Shannon-Weaver Index by Magurran (1988) and Evenness index according to the formula by Lloyd and Ghelardi (1964).

RESULTS

A total of 229 staphylinids and 18 species were sampled from Gunung Inas forest reserve, Kedah with maximum assemblage of 82 individuals from Track 6 (N=82) followed by track 2 of 67 individuals however the most number species was 9 species sampled from track 4 (Figure 1 and Figure 2). Figure 1 shows 36% specimens were sampled from track 6 with most species (21%) was sampled from Track 5 (Figure 2). The list of identified and unidentified staphylinids are given in Table 2. Staphylinids is abundant, species rich at Gunung Inas (Margalef index, 3.129) and diverse (Simpson Diversity index (SDI), 0.785; Shannon-Weaver index 2.018; index Evenness index, 0.698).

Figure 1: Percentage of individual (N) caught at different tracks at Gunung Inas.

Figure 2: Percentage and number of species (S) caught at at Gunung Inas
The four most sampled staphylinid species were 93 specimens of Paederus sp2. (Figure 4) followed by 40 specimens of Eleusis kraatzi (Figure 5) and 24 specimens of Paederus sp3. (Figure 6) and 17 specimens of Coenonica puncticolis respectively (Figure 7). Staphylinids at Track 4 was most abundant, diverse and heterogeneous (Simpson Diversity index (SDI) 0.927; Shannon-Weaver index 1.972; Evenness index, 0.948).

Figure 5: Eleusis kraatzi (n=40)

Figure 6: Paederus sp3. (n=24)  Figure 7: Coenonica puncticolis (n=17)
Table 2: Checklist of Rove Beetle at Gunung Inas and the overall diversity index

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of Individual</th>
<th>Margalef index</th>
<th>Simpson Diversity</th>
<th>Shannon-Weaver index</th>
<th>Evenness index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acylophorus sp.</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belonuchus sp.</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coenonica puncticolis</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eleusis kraatzi</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orphnebius bakerianus</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paederus sp1.</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paederus sp2.</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paederus sp3.</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paederus sp4.</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paederus sp5.</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philonthus flavocinctus</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philonthus sp</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachinomorphus fulvipes</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachinomorphus sp1.</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachinomorphus sp2.</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachinomorphus sp3.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown 1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown 2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S=18, N=229, 3.129, 0.785, 2.018, 0.698

Table 3: Summary of ecological index from six study sites in Gunung Inas.

<table>
<thead>
<tr>
<th>Track</th>
<th>Margalef index</th>
<th>Simpson (SDI) Diversity index</th>
<th>Shannon-Weaver index</th>
<th>Evenness index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.118</td>
<td>0.794</td>
<td>1.624</td>
<td>0.835</td>
</tr>
<tr>
<td>2</td>
<td>1.665</td>
<td>0.807</td>
<td>1.751</td>
<td>0.842</td>
</tr>
<tr>
<td>3</td>
<td>1.154</td>
<td>0.649</td>
<td>1.189</td>
<td>0.739</td>
</tr>
<tr>
<td>4</td>
<td>2.919</td>
<td>0.927</td>
<td>1.972</td>
<td>0.948</td>
</tr>
<tr>
<td>5</td>
<td>2.670</td>
<td>0.795</td>
<td>1.799</td>
<td>0.819</td>
</tr>
<tr>
<td>6</td>
<td>1.362</td>
<td>0.511</td>
<td>1.094</td>
<td>0.562</td>
</tr>
</tbody>
</table>
Table 4: Staphylinids assembled according to trap types and sampling site (track).

<table>
<thead>
<tr>
<th>Species</th>
<th>Track</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>LT</td>
</tr>
<tr>
<td><strong>Acylphorus sp.</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Belonuchus sp.</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Coenonica puncticolis</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Euleis kraatzii</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Orphnebius bakertianus</strong></td>
<td>-</td>
</tr>
<tr>
<td>Paederus sp1.</td>
<td>-</td>
</tr>
<tr>
<td>Paederus sp2.</td>
<td>-</td>
</tr>
<tr>
<td>Paederus sp3.</td>
<td>-</td>
</tr>
<tr>
<td>Paederus sp4.</td>
<td>-</td>
</tr>
<tr>
<td>Paederus sp5.</td>
<td>-</td>
</tr>
<tr>
<td>Philonthus flavocinctus</td>
<td>-</td>
</tr>
<tr>
<td>Philonthus sp.</td>
<td>1</td>
</tr>
<tr>
<td>Tachinomorphus fulvipes</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Tachinomorphus sp1.</td>
<td>-</td>
</tr>
<tr>
<td>Tachinomorphus sp2.</td>
<td>-</td>
</tr>
<tr>
<td>Tachinomorphus sp3.</td>
<td>-</td>
</tr>
<tr>
<td>Unknown 1 staphy H</td>
<td>-</td>
</tr>
<tr>
<td>Unknown 2 staphy 1</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:** LT: Light Trap; MT: Malaise Trap; PF: Pitfall Trap

Most staphylinids 88.6% (N=203) was assembled from pitfall trap with 9.8% (N=22) from Malaise trap and the least only (N=4) from light trap. Table 4 gives the list of staphylinids sampled from different traps. Only *Philonthus* spp. (Figure 8) and *Paederus* sp1. (Figure 9) were caught by light trap. Whereas Malaise caught *Acylphorus* sp. (Figure 10), *Belonuchus* sp. (Figure 11) *Paederus* sp1, *Paederus* sp3, *Paederus* sp4. (Figure 12), *Paederus* sp5. (Figure 13) *Tachinomorphus* sp2. (Figure 14), *Tachinomorphus* sp3. (Figure 15) and two individuals of unknown 2 coded as Staphy H (Figure 16). Most of the staphylinid species assembled by Malaise was also sampled using pitfall with additional species caught *Coenonica puncticolis*, *Euleis kraatzii*, *Orphnebius bakertianus* (Figure 17) *Paederus* sp2., *Philonthus flavocinctus* (Figure 18). *Philonthus flavocinctus* (Figure 19) and unknown 1 coded as Staphy H were caught both by Malaise and pitfall trap. While unknown 2, staphy 1 was only caught by Malaise trap. Figure 3 shows that the most.
species was caught by pitfall and Malaise trap. Light trap caught the least staphylinids (2 species). Table 5 shows that Malaise trap sampled the most abundant (Margalef index, 3.559) diverse (Simpson Diversity index (SDI) 0.931; Shannon-Weaver index 2.347) and heterogeneous staphylinids; Evenness index, 0.945).

Figure 8: Philonthus sp.

Figure 9: Paederus sp1

Figure 10: Acylophorus sp.

Figure 11: Belonuchus sp.

Figure 12: Paederus sp4

Figure 13: Paederus sp 5

Figure 14: Tachinomorphus sp2.

Figure 15: Tachinomorphus sp3.

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Figure 16: Unknown species 2

Figure 17: *Orpnebius bakerianus*

Figure 18: *Philonthus flavocinctus*

Figure 19: Unknown 1 Staphy H

Figure 20: Staphylinid species and individuals caught by different traps at Gunung Inus.
Table 5: Ecological index of Rove Beetle according to the type of traps at Gunung Inas.

<table>
<thead>
<tr>
<th>Trap</th>
<th>Margalef index</th>
<th>Simpson Diversity index</th>
<th>Shannon-Weaver index</th>
<th>Evenness index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Trap</td>
<td>0.721</td>
<td>0.667</td>
<td>0.693</td>
<td>1.000</td>
</tr>
<tr>
<td>Malaise Trap</td>
<td>3.559</td>
<td>0.931</td>
<td>2.347</td>
<td>0.945</td>
</tr>
<tr>
<td>Pitfall Trap</td>
<td>1.882</td>
<td>0.732</td>
<td>1.686</td>
<td>0.703</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Due to its unusual characteristic, staphylinids is often misinterpreted as not being a beetle. Staphylinids attracted attention to themselves from the general public after its toxic caused skin dermatitis upon contact with its haemolymph after it was squashed by school children. In a recent newspaper, the staphylinids received publicity when it is found in University Technology Mara hostels causing local newspaper to announce a new unidentified insect species found. Khan et al. (2009) described new clinical features of swelling, redness, fatigue, localized stretching of the skin and difficulty to breath due to rove beetle dermatitis. The staphylinid ranges from 1 mm to 40 mm. Non entomologist may confuse it with *Dermoptera commonly* known as earwigs. Gack and Peschke (1994) reported spermathecal morphology, sperm transfer and a novel mechanism of sperm displacement in the rove beetle, *Aleochara curtula*. The staphylinids are interesting beetle family to study, in view of its various role including as a predator of insects. In conclusion the staphylinids is diversed at Gunung Inas and heregenous. More study should be done in Malaysia on staphylinids to understand this family of beetle and to use them as biological control agents.

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