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The Rove Beetles of Imbak Canyon Conservation Area

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Abstract

Beetle diversity was assessed at the Imbak Canyon Conservation Area (ICCA), using the pitfall and light trap during the Imbak Canyon Scientific Expedition from 26th November until December, 2010. A total of 32 species from 345 specimens were sampled from the six locations by Base camp, Reverine trail, Ridge trail, Slope trail, Kuli trail and Small Waterfall trail. The most abundant species was Listerus sp.3 (N=44), followed by Paederus sp.2 (N=34) and Aclyophorus sp.2 (N=34). The most individual caught from the Slope trail (N=140, S=16) followed by Kuli trail (N=90, S=12) and Small Waterfall trail (N=51, S=12). The pitfall trap caught more individual (N=316) with species than light trapping method (N=29, S=22). This study shown that there is high abundance and diversity (Shannon-Weaver index, 2.818) of rove beetle at ICCA indicating that the area had been protected well. A checklist of the species sampled through the study was provided for future study on conservation.

Beetles are very diverse and abundant in the tropics, and beetles are among the prominent orders in the insecta. Even at the family level, there are 166 families worldwide and more than half are found in Malaysia (Chung, 2005). The family Staphylinidae is one of the largest families of beetles, about 32,000 known species by Newton (1990) and 45,000 by Melaima and Cornelia (2005). The family is distributed worldwide and is found in practically all types of ecosystems. The greatest diversity of life forms was found in staphylinid communities living in natural or semi-natural ecosystems (forest, steppe, non-regulated riversides and brook sides, subalpine meadows, ponds). For each of these ecosystems there is a characteristic predominance of individuals of certain forms (Krivoluckij & Bohac, 1989). The spectrum of life forms of staphylinid adults is due to various ecological and anthropogenous parameters in ecosystems of open landscapes.

Staphylinid adults are usually easily distinguished from other beetles by their short truncate elytra, with a yellowish to dark color; other colours (red, blue, yellow) are rare (Jaroslav 1999). Shape, sensory adaptations, thoracic and basal abdominal structure and leg specializations can be explained in terms of locomotory specialization (Coiffait, 1972; Tikhomirova, 1973). Mouthparts reflect both the type of food and particular feeding method employed (Evans, 1964; Tikhomirova, 1973). Higher numbers of life forms are present in seminatural habitats that are less used by man (Jaroslav 1999). Knowledge of the broad habitat requirements of common
staphylinid species and the fact that the family is distributed in practically all semi-natural and man-made habitats are two features that make staphylinids attractive as potential bioindicators.

This paper presents general information about the diversity of rove beetle at Imbak Canyon Conservation Area (ICCA), the possible application of staphylinids as bioindicators and a description of the structure of beetle communities. The checklist of rove beetle collection during expedition also listed.

MATERIAL AND METHODS

Study Area

This study was conducted from 26th November until 5th December, 2010 during the Imbak Canyon Conservation Area (ICCA) Scientific Expedition organized by Academy of Sciences Malaysia (ASM) jointly with Yayasan Sabah in collaboration with Sabah Parks, Sabah Wildlife Department, Sabah Forestry Department, Sabah Biodiversity Centre, Universiti Kebangsaan Malaysia, Universiti Malaysia Sabah and WWF-Malaysia. ICCA a total area of about 30,000 hectares is located almost right in the heart of Sabah, just north of the famous Maliau Basin. Approximately 80 kilometers south of Telupid and the Canyon is a Class II Commercial Forest Reserve, part of the one million hectare Yayasan Sabah Forest Management Area. ICCA is reachable by road from Kota Kinabalu to Tongod approximately 10 hour by four-wheel drive is essential as the latter part of the journey is on logging roads. Though to Gunung Kuli Research Station need walking about 4 km (2 hours) from the starting point.

Sampling Method

Two methods were used to sample rove beetles, namely pitfall trap and light trapping method for nocturnal sampling followed method from Abdullah (2005), Abdullah et al. (2008) and Abdullah and

Figure 1. Map of study site.
Sina (2009). Sampling was carried out at six locations namely Base camp, Reverine trial, Ridge trail, Slope trail, Kuli trail and Small Waterfall trail. In this study, rove beetle specimens were collected using 150 pitfall traps for 24 h. Night sampling were conducted using 12 light trapping method set for 5 h started 1800 h to 2300 h.

**Sorting, Preservation and Identification**

All the specimens from both traps were sorted to family level by referring to Borror and Delong (1974). The rove beetle specimens preserved in 70% alcohol were pinned, dried in oven at the University Malaya and then identified at Department of Agriculture Malaysia, Kuala Lumpur.

**Ecological Indices Calculation and Photography of Specimens**

Species richness and abundances of rove beetle were determined using Margalef index (SR) and the diversity was calculated using Shannon-weaver index (H) as follows:

\[
\text{Margalef index, } R' = S - 1 / \ln N
\]

Where, \( S \) = the number of species recorded in a simple
\( N \) = the number of sample size (White 2000)

\[
\text{Shannon-weaver index, } H' = - \sum p_i \log p_i
\]

The beetle specimens were photographed with Leica microscope model EZ4D attached with a digital camera.

**RESULT**

A total of 345 rove beetle specimens from 32 species were collected during ICCA expedition *(Table 1)*. The Slope trail has the highest percentage number of individual (41%, \( N=140 \)) followed by Kuli trail (26%, \( N=90 \)) and Small Waterfall trail (15%, \( N=51 \)) *(Figure 2)*. Most prominent species (S) caught from Slope trail (25%, S=16) followed by Kuli trail (20%, S=13) and 19% (S=12) for both Small Waterfall trail and Ridge trail.

<table>
<thead>
<tr>
<th>Location</th>
<th>Species (S)</th>
<th>Specimen (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Camp</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Reverine Trail</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Ridge Trail</td>
<td>12</td>
<td>46</td>
</tr>
<tr>
<td>Slope Trail</td>
<td>16</td>
<td>140</td>
</tr>
<tr>
<td>Kuli Trail</td>
<td>13</td>
<td>90</td>
</tr>
<tr>
<td>Small Waterfall Trail</td>
<td>12</td>
<td>51</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
<td><strong>345</strong></td>
</tr>
</tbody>
</table>

TABLE 1. A SUMMARY OF ROVE BEETLE COLLECTED AT THE SELECTED SITES OF ICCA
Checklist of the identified species and number of individual caught during expedition shown in table 2. Twenty four species (N=258) of rove beetle were identified. However, eight species (N=87) could not identified even for genus level and possibly new species for ICCA. The best trapping method for assembly of rove beetle at ICCA was pitfall trap (S=22, N=317) followed by light trap (S=16, N=26) (Figure 4). The most species caught was Lispinus sp.3 (N=44) (Figure 5) followed by Paederus sp.2 (N=34) (Figure 6) and Acylophorus sp.2 (N=30) (Figure 7). Ecological indices calculation showed the high abundance (Margalef index (R'), 5.305) and diversity (Shannon-Weaver index (H'), 2.818; Simpson Diversity index, 0.922) of rove beetle at ICCA (Table 2).

Figure 2. Percentage of individual caught at deference location at ICCA.

Figure 3. Percentage of species caught at deference location at ICCA.
Figure 4. Number of individual caught using different trap at ICCA.

Figure 5. Lispinus sp.3 (3.35 mm) (N=44).

Figure 6. Paederus sp.2 (4.23 mm) (N=34).
TABLE 2. LIST OF IDENTIFIED ROVE BEETLE OF ICCA

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of individual</th>
<th>Margalef index (R')</th>
<th>Shannon-weaver index (H')</th>
<th>Simpson DI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aecylophorus sp.1</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aecylophorus sp.2</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bledius sp.</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coproporus sp.</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eleusis kraaatzii</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hesperus laevigatus</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leptadinus sp.1</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leptadinus sp.2</td>
<td>22</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Leptadinus sp.3</td>
<td>7</td>
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<tr>
<td>Lissinus sp.1</td>
<td>17</td>
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<tr>
<td>Lissinus sp.2</td>
<td>19</td>
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</tr>
<tr>
<td>Lissinus sp.3</td>
<td>44</td>
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<td>2</td>
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<td>Orphnebius sp.1</td>
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<tr>
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<td>12</td>
<td></td>
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<td></td>
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<tr>
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<td>1</td>
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<tr>
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<td>1</td>
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<td></td>
<td></td>
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<tr>
<td>Paederus sp.1</td>
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<td>Paederus sp.2</td>
<td>34</td>
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<td></td>
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<tr>
<td>Paederus sp.3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philontus ventralis</td>
<td>3</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Stenomastax sp.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stenomastax tuberculicollis</td>
<td>21</td>
<td></td>
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<td></td>
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<tr>
<td>Tachnimorphus fulvipes</td>
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<td></td>
</tr>
<tr>
<td>S = 24</td>
<td>N = 258</td>
<td>5.305</td>
<td>2.818</td>
<td>0.922</td>
</tr>
</tbody>
</table>
DISCUSSION

Imbak Canyon Conservaton Area (ICCA) is the last remaining untouched and relatively unexplored area of Sabah. 32 species were recorded from 324 specimens shown the ICCA have the interesting forest to be preserved. Chung et al (2010) was recorded 114 specimen of family staphylinidae and this family is most prominent family in Ginseng Camp, Maliau Basin, Sabah. Meanwhile Fauziah and Sina (2009) reported 175 specimens from 17 species assembled at Lanjak Entimau, Sarawak.

Different methods have to be used to get a comprehensive survey of rove beetles because of their occurrence in various types of habitats. Assemblage of staphylinids was most successful using pitfall trap in this study. This is due to their small and narrow body with short elytra and flexible abdomen enabling staphylinids to live and move in ground litter (with abundant decaying organic matter) which is not accessible for robust and less flexible organisms. Most rove beetles are predators of other insects and live on or in the soil, in ground litter, moss, or in decomposing organic matter. Thus pitfall trap was the most suitable method of sampling them. High abundance and diversity of staphylinids at Imbak Canyon is because staphylinids prefer moist habitats along the margins of streams, Lakes and snowfields (Stan Melania & Cornelius, 2005). Habitat heterogeneity is a determinant cause of biological diversity in natural ecosystems, and therefore its preservation should be a priority when planning conservation strategies (Romero-alcaraz & Avila, 2000).

The rove beetle diversity from the ICCA is considered diverse and interesting, even from this preliminary and short survey. Such interesting diversity of beetles is due to the pristine and mostly undisturbed environment at the ICCA. Knowledge of the broad habitat requirements of common staphylinid species and the fact that the family is distributed in practically all semi-natural and man made habitats are two features that make staphylinids attractive as potential bioindicators (Jaroslav, 1999). Various bioindicators have been applied as useful tools to assess living conditions for organisms, traditionally in aquatic environments (Rosenberg et al., 1986) and recently in terrestrial environments (Van Jaarsveld et al., 1998; Baldi, 2003; Ekschmitt et al., 2003; Woodcock et al., 2003). Appropriate technique and monitoring used indicator of climate changes to conserve forest need to be practice for future plan.

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