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Research article

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## A Study of the Ichneumonid Wasp of Fauna Gunung Jerai, Kedah, Malaysia

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**ABSTRACT.** A preliminary study on the fauna of ichneumonid wasps at three different altitudes (150–200 m, 700–800 m and 1000–1100 m above sea level [asl]) of Gunung Jerai, Kedah, Malaysia was conducted. A total of 32 ichneumonid individuals from 21 species, 16 genera and six subfamilies (Cryptinae, Metopiinae, Campopleginae, Banchinae, Pimplinae and Ophiinae) were collected. The Cryptinae had the highest number of individuals (15), genera (8) and species (9). However, the most dominant genus was *Leptobatopsis* (Banchinae) with six individuals. The genera *Leptobatopsis* and *Friena* seemed to be specialized and adapted to higher altitudes of Gunung Jerai (1000–1100 m asl). Of 16 genera recorded, seven (*Sulcarius*, *Palpostilpus*, *Caenopimpla*, *Acerataspis*, *Eriborus*, *Sinophorus*, and *Rhachoaplex*) were new records for Malaysia. Interestingly, the genus *Sulcarius* was recorded for the first time in the Oriental and Australian Regions. The number of ichneumonid individuals was somewhat higher at 1000–1100 m than at the lower altitudes.

### INTRODUCTION

Gunung Jerai, popularly known as Kedah Perak, is one of the classical localities in

Malaysia. Its accessibility from nearby Penang Island, its isolation, and its not so excessive height (c. 1200 m asl) permitted naturalists to visit the area and collect specimens, beginning fairly early in the 19<sup>th</sup> century (Stones, 1983). Although parts of the mountain were selectively logged, other parts, particularly at the lower boundaries, have been cleared for small-scale tapioca and rubber cultivation, orchards, and some other parts were simply disturbed. It is a biologically interesting area with an island-like, self-contained peak. In a combination of 740 m<sup>2</sup> plots at different elevations (150–1140 m), Kochummen (1982) recorded 1148 stems, of 192 species, 120 genera, and 52 plant families. Based on this, Stones (1983) concluded that by Malaysian standards, Gunung Jerai seems to have low floristic richness. This is probably due to its location and substrate, the latter being schist and quartzite, which tend to break down to white-sand and support a fascinating, but somewhat impoverished flora. Additionally, the rainfall, which averages 357 cm per annum is a trifle low (Kochummen, 1982).

The ichneumonid wasps (Ichneumonidae) are one of the largest families in the insect order Hymenoptera (bees, true ants, and wasps all fall within this order). There are nearly 60,000 species worldwide, of which about 16,000 species occur in the Oriental region (Gupta & Tikar, 1976). The ichneumonid wasps are

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*Key words:* Ichneumonid wasp, Gunung Jerai, Kedah, Malaysia



mainly parasitoids; their larvae develop as internal or external parasites of other holometabolous insect larvae and pupae, particularly Lepidoptera (LaSalle & Gauld 1993; Townes 1969a; Townes & Chiu 1970). The family is particularly well-represented in cooler environments (higher latitude or altitude), thus mostly in temperate and semi-temperate regions (LaSalle & Gauld 1993). Among the ichneumonids' hosts are many pest species (Wahl & Sharkey 1993). This explains why the group is vitally important as biological control agents of insect pests of economic importance (Wäckers 2004; Quicke 1997).

The improper developments of the agricultural sector, infrastructure, and residential areas have caused destruction of natural ecosystems and habitats that directly affect the biodiversity (Idris *et al.*, 2002; Idris, 2000, Ng *et al.*, 2003, Niiyama *et al.*, 2003). According to Young-Dal (1997), natural yearly extinction and speciation rates are in equilibrium, in which 20 new species are added annually and 20 others go out of existence, maintaining an equilibrium of 10 million species of insects. Presently, the number of species going extinct (30 to 300 per year) vastly exceeds the number of new species created by natural selection. Of all insect species, the parasitoids are highly responsive to environment and habitat changes and they could be the first affected (Gauld, 1984). Therefore, they have the potential to be used as bio-indicators of habitat change (Kremen *et al.*, 1993).

A study conducted at Gunung Janing Barat, Johor, Malaysia revealed that the Ichneumonidae, Braconidae, and Formicidae were comparatively more diverse and abundant than other hymenopterans, and that their diversity decreased as altitude increased (Tan *et al.*, 1985). Up to date, there has been no such study conducted in Gunung Jerai. This paper therefore presents a first list of the ichneumonid wasps of this area.

## MATERIALS AND METHODS

### Site of Study

Gunung Jerai, an isolated mountain, is located 11 km Northwest of the town of Gurun and 43 km South of Alor Star, the capital city of Kedah State. The attractions to the local and foreign tourists of Gunung Jerai are among other things, the waterfall, the recreation areas, the Forest Museum Gallery and the diversity of its flora and fauna. Because of its isolation, Gunung Jerai has the "telescoped" zonation by altitude common to islands and isolated peaks; the mountain oak forest vegetation type, common on hills of the main range between 1000 and 1500 m, is absent. Instead, a myrtaceous forest, dominated by *Eugenia*, *Leptospermum*, *Tristania*, and *Rhodamnia*, is obvious in this zone (Kochummen, 1982). The lower and upper Dipterocarp forest types seem to be merged and dipterocarps are effectively at their limit at 780 m. Fagaceae and Lauraceae here are mostly confined to the zone below 750 m, with few record above (at 930 m). From 780 m upward, Myrtaceae achieve a proportion of 40%, associated with Guttiferae, the Gymnosperms (i.e. *Dacrydium* and *Agathis* and some *Podocarpus*), Myrsinaceae, Rutaceae, and Theaceae. At 1200 m (the summit of G. Jerai) about one-third of all stems are members of the Ericaceae, all are less than 5 cm diameter, and nearly 80% of the total stems were less than 10 m tall.

### Experimental Layout

Three trails (treatments) were selected, namely the Denai Puteri Mandi (trail 3, 150 - 200 m asl), a self-made trail near the Forestry Museum (700 - 800 m asl) and Denai Jejak Warisan (trail 6, 1000 - 1100 m asl), representing low, middle and higher altitudes of Gunung Jerai, respectively. On the 2<sup>nd</sup> of June 2005, four Malaise traps (MT) per trail, with 100 - 150 m distance between traps, were installed



along the trails started at 50 m from the forest edge into the forest (Idris & Kee, 2002). Traps were left in the field and insects were collected on the 7<sup>th</sup> of June 2005. In addition to MT, four yellow pan traps (YPT) were also placed between 50 and 100 m from the MTs. Insects from the YTPs were collected every two days until the 7<sup>th</sup> of June 2005. Insects collected from MT and YPT were pooled and then transferred to glass vials filled with 70% alcohol, brought back to the laboratory and temporarily kept in the freezer. In the laboratory, insects were sorted, pinned and identified up to species or morphospecies level (Gauld, 1984; Townes & Chiu, 1970; Townes *et al.*, 1971; Townes 1969a-d; Jonathan & Gupta, 1973). Numbers of ichneumonid individuals, subfamilies, genera, and species were recorded.

## RESULTS AND DISCUSSION

A total of 32 ichneumonid individuals comprising 21 species, 16 genera and six subfamilies (Cryptinae, Metopiinae, Campopleginae, Banchinae, Pimplinae, and Ophiinae) were successfully collected at three different altitudes of Gunung Jerai (Table 1). Overall, cryptines had the highest number of genera (8), species (9), and individuals (15) while ophiines had the lowest with only one species with one individual. Although the banchines had only one genus, it had three species and six individuals. Higher individual abundance of cryptines at Gunung Jerai was not a surprise, as members of this subfamily are ubiquitous in nature compared to members of the other subfamilies (Wahl & Sharkey 1993, Idris & Kee 2002). Two genera, *Goryphus* and *Leptobatopsis*, seemed to be dominant in Gunung Jerai over the other genera by having more than five individuals (Table 1). The number of individuals per genus per altitude was low in most genera, except for *Leptobatopsis* (six individuals). Results also indicate that members of the genus

*Leptobatopsis* inhabit high altitude (1000 – 1100 m). More sampling efforts are needed to ascertain specific altitudes inhabited by other genera. For example, members of Ophiinae are more abundant in highland than in lowland (Gauld & Mitchell, 1984), but in our study there was only one individual recorded from high altitude of Gunung Jerai (Table 1).

There are at least seven genera, namely *Sulcarius*, *Palpostilpus*, *Caenopimpla*, *Acerataspis*, *Eriborus*, *Sinophorus*, and *Rhachoplex*, that are new records for Malaysia (Yu & Horstmann, 1997) (Table 1). Interestingly, *Sulcarius*, a parasitoid of *Delia radicum* and *Limnophilus* spp. (Diptera), previously recorded from the Nearctic and Palearctic regions (Yu & Horstmann, 1997), was a new record for the Oriental Region. Both *Palpostilpus* and *Caenopimpla* were reported to be present in Australian and Oriental Regions (Townes, 1969). Besides in Australian and Oriental Regions, the *Acerataspis* was also found in the Palearctic region (Yu & Horstmann, 1997). The genera *Eriborus* and *Sinophorus* were recorded from all zoological regions while the *Rhachoplex* was recorded from countries in the Oriental Region except Malaysia (Yu & Horstmann, 1997; Townes, 1970). The ophiine species, *Enicospilus melanacarpus*, a parasitoid of lepidopterans feeding on *Artocarpus* plants, was recorded for the first time from Malaysia (Table 1). *E. melanacarpus* was reported to be present in other parts of the tropics regions including Africa and the Neotrops (Gauld & Mitchell, 1978).

The total number of ichneumonid individuals among altitudes of Gunung Jerai seemed to be different (Table 1). The abundance of ichneumonid wasps was lowest at the 700 – 800 m altitude and highest at 1000 -1100 m altitude. This is in disagreement with Tan *et al.*, (1985) who found that abundance of hymenopterans especially the ichneumonids,

**Table 1.** List of subfamilies, genera, species, and individuals per species of ichneumonid wasps collected at different altitudes of Gunung Jerai, Kedah from 2<sup>nd</sup> to 7<sup>th</sup> June 2005.

Subfamilies/Genera/Species	Altitude (m) above sea level			Total
	1000 - 1100	700- 800	150 - 200	
<b>Cryptinae</b>				
<i>Friona</i> spp.	2	0	0	2
<i>Chrysocryptus</i> sp.	1	0	0	1
<i>Mansa</i> sp.	1	0	0	1
<i>Goryphus</i> sp. 1	2	0	2	4
<i>Goryphus</i> sp. 2	0	1	1	2
* <i>Sulcarius</i> sp.	1	0	0	1
* <i>Palpostilpus</i> sp.	0	1	0	1
* <i>Caenopimpla</i> sp.	0	0	1	1
<i>Coesula</i> spp.	0	0	2	2
<b>Metopiinae</b>				
<i>Hypsicera</i> spp.	2	0	1	3
* <i>Acerataspis</i> sp.	0	0	1	1
<b>Campopleginae</b>				
<i>Casinaria</i> sp.	1	0	0	1
* <i>Eriborus</i> sp.	0	0	1	1
* <i>Sinophorus</i> sp.	0	0	1	1
* <i>Rhachoaplex</i> sp.	1	0	0	1
<b>Banchinae</b>				
<i>Leptobatopsis</i> sp. 1	3	0	0	3
<i>Leptobatopsis</i> sp. 2	2	0	0	2
<i>Leptobatopsis</i> sp. 3	1	0	0	1
<b>Pimplinae</b>				
<i>Theronias ultaca</i>	0	0	2	2
<i>Xanthopimpla</i> spp.	0	1	1	2
<b>Ophioninae</b>				
<i>Enicospilus melanacarpus</i> **	1	0	0	1
<b>Total no. of individual</b>	<b>18</b>	<b>3</b>	<b>13</b>	<b>32</b>
<b>Total no. of species</b>	<b>15</b>	<b>3</b>	<b>10</b>	<b>21</b>
<b>Total no. of genera</b>	<b>10</b>	<b>3</b>	<b>9</b>	<b>16</b>
<b>Total no. of subfamilies</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>6</b>

Genera with '\*' and species with '\*\*' are new records for Malaysia (Yu & Horstmann, 1997).



braconids and formicids decreases with increase in elevation at Gunung Janing Barat of Endau Rompin National Park, Johor. However, our result is in agreement with Soo (2004) who conducted a similar study at Gunung Ledang, Johor.

Although the total number of plant species, genera, families, and stems reached a maximum at approximately 750 m altitude (transition zone) (Kochummen 1982), their abundance (number of individuals per species) might have not been sufficient to support the insect herbivores that are host to the ichneumonid wasps. Differences in plant species distribution and abundance are the dominant factor to determine the distribution of insect species along altitudinal gradients (MacCoy, 1990). In addition, at Gunung Jerai, members of *Dipterocarpus* are dominant below 750 m altitude but above it Myrtaceae was the dominant family (40%). Members of Myrtaceae were at low density at approximately 750 m altitude. These plant groups appear to harbor the majority of insect herbivores compared to other plant groups (Ng *et al.*, 2004). All the above probably explains why the ichneumonid wasp abundance was low at middle altitude (700-800 m asl).

There was an overlapping presence of some species at the middle and lower altitudes, but species recorded at higher altitudes were never recorded at the other two altitudes (Table 1). Although this study is still a preliminary one, this result indicates that ichneumonid species of higher altitudes are more adapted to the conditions and plant species present there.

## CONCLUSION

Up to date there has been no study on the insect fauna of Gunung Jerai. As such this preliminary study is important to indicate the abundance and richness of ichneumonid

species at this isolated mountain. It is interesting to know that some species are new records for Malaysia and the Oriental Region. Probably, some new species would be collected and described if intensive sampling is carried out. However, the result of this study already clearly shows that the ichneumonid wasps are abundant and that altitudinal differences of Gunung Jerai have influenced ichneumonid wasp species distribution.

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