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A Study on Four Methods of Sampling Ichneumonidae and Braconidae at Two Different Habitats of Fraser's Hill, Malaysia

Idris, A.B., N. Nor Zaneedarwaty, A.D. Gonzaga, M.I. Zaidi, S. Azman and Y. Salmah
School of Environmental & Natural Resource Sciences, University Kebangsaan Malaysia,
43600 Bangi, Selangor, Malaysia

Abstract: A study on four methods of sampling Ichneumonidae and Braconidae at two different habitats of Fraser's Hill was conducted from 12 – 15 November 2000. The sampling methods tested were malaise trap (MT), yellow pan trap (YPT), flight intercept trap (FIT) and sweeping net (SWN). YPT collected the most ichneumonids while FIT collected similar numbers of ichneumonids and braconids. MT seemed to collect less ichneumonids individuals as compared with other two methods, but had high H' for ichneumonid morphospecies, indicating that MT is relatively a better method for estimating diversity over the other methods. None of the tested sampling methods has better edge over the others in collecting ichneumonids and braconids irrespective of habitat types. As such, the use of all suitable sampling methods for certain habitats per unit time are still the best suggestion in order to get enough collection and better diversity of estimation especially for ichneumonids.

Key words: Sampling method, Ichneumonidae, Braconidae, diversity, abundance

Introduction

For insect community studies to be of value, the sampling methods employed must produce samples representative of the community or taxon selected for investigation. Holloway (1987) studied the diversity of particular groups of insects using light traps but little is known about the variability of response within many insect groups. Similarly, many hypotheses concerning the ecology or diversity of insects especially in the tropics are based on the sweep sampling study (Jazen *et al*., 1976; Janzen & Pond, 1975; Janzen 1973a and 1973b; Julliet, 1963), and the efficiency of this method in sampling from vegetation has been subjected to some criticism (Erwin, 1982). Investigations of the fauna of tropical forest canopies using insecticide knockdown techniques has resulted in a greatly increased estimate of number of species of insects occurring in the world (Erwin, 1983).

A comparative study on the effectiveness of various methods of sampling Parasitic Hymenoptera conducted in Sulawesi, Indonesia, indicated that the need of various methods to get better estimates of diversity within a particular habitat (Noyes, 1989). There was only one similar study conducted in the lowland tropical rainforests of Malaysia (Idris & Nur Azura, 1998). In contrast to Noyes (1989), they reported that for collecting Ichneumonidae the Malaise trap was a better trap as compared to the yellow pan, pitfall, and light traps and sweeping net. The objective of our study was to investigate the effectiveness of four sampling methods of collecting Ichneumonidae and Braconidae in the highland tropical rainforest of the Fraser's Hill. Results of this study are expected to add the currently available information on the sampling methods of parasitic Hymenoptera.

Materials and Methods

The study was conducted at Fraser's Hill in state of Pahang, Malaysia. It lies 65 km north of Kuala Lumpur at an elevation of 1,305 m above sea level with daily temperature ranges between 18 – 20°C. Two sites (habitats) namely the University Kebangsaan Malaysia (UKM) experiment station (located on the way to Jeriau) and Bishop's Trail in Forest Reserved Area of Silver Park, 2 km away from UKM plot, were selected for the study. The UKM experimental station is located at 980 m above sea level and it is characterized as a disturbed area. Secondary growth is prominent in this area. However, the Bishop's Trail is 1,190 m above sea level, undisturbed and classified as primary forest. The traps used were Malaise traps (MT), yellow pan traps (YPT) flight intercept Trap (FIT) and sweeping net (SWN) (Figs. 1-4).

Fig. 1: One of the Malaise trap used showing the collecting insect bottle at one end of its raised roof.

Four MT (Fig. 1), six YPT (Fig. 2; 5 x 10 x 15 cm^3) and one FIT (Fig. 3; 0. 5 x 2 m^2) were placed per habitat following Idris and Nur Azura (1998) and Noyes (1989). However, the distance between each trap was 100 ±20 m and 80 ± 5 m for MT and YPT, respectively. The distance between trap types ranged from 70 to 100 m. The yellow pans (for YPT) and colourless transparent plastic container (placed below FIT) were filled up with 20 ml soap solution (10:90, v/v) to kill the insects that fell in pan or plastic container. The FIT (1.0 and 4 m in height and length) was put upright using stick found in the habitats. All traps were left in each habitat from 12 to 15 November 2000. In addition, 2-man day sweep netting (Fig. 4) was also used to collect insects for 6 hours (0900 – 1200 and 1500 – 1700) per day for three days.

The insects collected were brought to the laboratory for sorting and identification to superfamily, subfamily and

morphospecies level (Wahl & Sharkey, 1993). The total number of individuals, number of subfamily and morphospecies per habitat were recorded. Data were pooled before analysis using chi-square. The species diversity was analyzed using the Shannon-Weiner Diversity Index (Robinson, 1991). Data obtained for braconids were too small for analysis; hence, only data for ichneumonids were analyzed

Fig .2: A yellow pan trap with insects collected in it.

Fig. 3: A Flight intercept trap (FIT) with several transparent plastic containers below it to collect insects that fell after hitting the net place in upright position.

Fig. 4: One insect collector with his sweeping net (SWN).

Results and Discussion

The number of Ichneumonidae and Braconidae individuals collected per traps was significantly different among traps (χ^2 = 73.23, df = 3, P < 0.05) (Table 1). The number of ichneumonids collected using YPT (159 individuals from both habitats) was relatively higher than that collected using other methods (0, 18 and 11 individuals) for MT, FIT and SWN respectively). In contrast, there was only five braconid individuals collected by YPT as compared to 18 collected by FIT from UKM plot and Bishop's trails. The MT and SWN collected 12 and 11 individuals ichneumonid respectively, but no braconid was collected. However, FIT collected both ichneumonids and braconids. The results agree with Noyes (1989) with respect to his data collected at about similar elevation of hilly forest at Sulawesi Island, Indonesia. He reported that at 1000 m elevation YPT collected 63 and 19 ichneumonid and braconid individuals, respectively, while MT collected 108 ichneumonid and 44 braconid individuals. He did not use the FIT and SWN in his study at this elevation. In contrast, Idris and Nur Azura (1998) reported that more ichneumonids were collected using MT than YPT even though the collection was made at 50 m elevation of the lowland tropical rainforest of Malaysia. Interestingly, the number of ichneumonid and braconid individuals collected using FIT were similar. This indicates that majority of ichneumonids or braconids are attracted to the yellow colour of the YPT (Fig. 2), while the FIT (Fig. 3) which had transparent tray placed on the forest floor (10 cm below the net) did not attract many ichneumonids and braconids. The influence of yellow colour in attracting the hymenopteran parasitoids was reported by the Jervis *et al.* (1993) and Wilkinson *et al.* (1980).

The Shannon diversity index (H') for ichneumonid morphospecies was significantly higher (unpaired-t test, P < 0.05), using YPT and MT than other methods, only at Bishop's trails (Table 2). At UKM plot, however, comparison can not be made as only data of YPT was able to be analyzed. By using FIT, H' of ichneumonids morphospecies at the Bishop's trail was relatively higher (1.95) than H' of braconid morphospecies.

The YPT may be a better method for sampling ichneumonids than the other methods (Table 1). However, at similar elevations in Sulawesi, Indonesia, Noyes (1989) found that there was no clear difference between YPT and MT in their efficiency of collecting ichneumonids. Results of this study tend to disagree with those of Noyes (1989), who reported that FIT collected more braconids than ichneumonids.

We were intrigued about the inability of MT to collect more ichneumonids and braconids. In this study, we successfully collected a total of 12, 164, 36 and 11 ichneumonid plus braconid individuals by using MT, YPT, FIT and SWN, respectively, from both sampling locations (Table 1). Previous studies showed that MT was the better sampling method for collecting ichneumonids and braconids (Idris & Nur Azura, 1998; Idris, 1996; Idris, 1996; Noyes, 1989). They also found that less sampling efforts and time are needed for using MT because insects could be collected once a week. If we use YPT and FIT, however, insects have to be collected every day to avoid the impact of rain and probably tramped or disturbed

Table 1: Number of Ichneumonidae and Braconidae individuals collected by different sampling methods.

Family	Habitat	Sampling methods			
		MT	YPT	FIT	SWN
Ichneumonidae	UKM plot	-	46	1	2
	Bishop's trails	12	113	17	9
	Sub-total	12	159	18	11
Braconidae	UKM plot	-	1	12	-
	Bishop's trail	-	4	6	-
	Sub-total	0	5	18	0
Total		12	164	36	11

MT, Malaise trap; YPT, yellow pan trap; FIT, flight intercept traps; SWN, sweeping net

Table 2: Shannon diversity index (H') for ichneumonid and braconid morphospecies based on collection made using various sampling methods

Family	Habitat	Sampling methods			
		MT	YPT	FIT	SWN
Ichneumonidae	UKM plot	*	2.62	*	*
	Bishop's trail	1.92	1.09	1.95	1.21
Braconidae	UKM plot	*	*	1.70	*
	Bishop's trail	*	*	0.87	*

*, Analysis was not done because of small data available

by other animals. According to Noyes (1989) the sweeping (SWN) was also effective method for collecting ichneumonids and braconids but results of this study showed otherwise. These contradicting reports indicate that more than one sampling methods are necessary to get better representative ichneumonids and braconids collection and their diversity estimation in a particular habitat. This is true as none of the sampling methods showed consistent higher significant H' over the other sampling methods in different habitats (Table 2).

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