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A REPORT ON THE FAUNAL SURVEY OF INSECTS AND ARACHNIDS LIVING ON THE RAINFOREST CANOPY OF THE MALAY PENINSULA

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ABSTRACT

Insects and Arachnids living on a tree of rainforest in the Endau-Rompin State Park, southern part of the Malay Peninsula were collected by fogging and sorted into species. One thousand, seven hundred and fourteen species were recognized from 12,401 specimens. Numbers of species and specimens of respective orders and families (superfamilies) of Araneae and Coleoptera were record.

ABSTRAK

Serangga dan Arachnid yang tinggal di atas pokok di hutan hujan di Taman Negera Endau-Rompin, selatan Peninsular Malaysia telah dikumpul secara fogging dan diasingkan kepada spesies. Sejumlah 1714 spesies telah dikenalpasti daripada sejumlah 12,401 spesimen. Bilangan species dan specimen dari order dan famili (superfamili) Araneae dan Coleoptera telah direkod.

INTRODUCTION

Many biologists become aware of the fact that tremendous biodiversity of tropical rainforest depends on richness of the invertebrate community of canopy. Insect and arachnid fauna are the most important factor of the richness of species. Some results from surveys of insect fauna on rainforest canopy have inspired scientific study on the biodiversity, and have provided fundamental data for estimating the whole biodiversity of the globe.

Some pioneer works were conducted in Neotropical rainforests (Erwin and Scott, 1980, etc.). Tropical Asian rainforest is also an outstandingly attractive field for the study of biodiversity, though faunistic data on insect and arachnid community of canopy of the Asian tropical rainforest are very much lacking.

As a part of the inventory project entitled "Network construction for the establishment of insect inventory in Tropic Asia (TAIIV)", we conducted a field survey of insect and arachnid inventory on the canopy of Malaysian rainforest utilizing insecticide fogging. The present report is the first result of the inventory survey dealing with a sample of composition of the insect and arachnid community in numbers of species and specimens collected by fogging from a leguminous tree at Endau-Rompin, Pahang.

MATERIALS AND METHODS

The field survey for inventory research was located in the Endau-Rompin State Park, Pahang, and the Cameron Highlands, Pahang. Insects and arachnids living in the canopy were collected by fogging, that is, spraying insecticide on tree canopy by a fog machine. The procedure of the fogging is as follows (see Figs. 1-2): 1) before the day of fogging, a target tree is fixed and a rope and a pulley are hung up on another tree more than 20m above the ground, 2) ropes are stretched at about 120cm in height around the target tree in the area covered by the canopy, 3) collecting trays (ca. 100) are hung on the ropes in the canopy area, 4) early next morning, a fog machine is started and hung up to about 20 m above the ground, 5) insecticide is sprayed onto the underside of the canopy of the target tree, 6) more than two hours after the spray, insect specimens on trays are gathered and washed into bottles at the bottom by ethanol hydrate, 7) when all bottles are recovered, specimens are preserved in 80% ethanol hydrate. Five trees in Endau-Rompin and four on the Cameron Highlands were surveyed by fogging.

After roughly removing litter, some bottles of the materials were transferred to laboratory for identification and sorting. Each specimen was picked up from the bottle, dried, pinned or mounted on a card, and preserved in dry condition. The mounted or pinned specimens were identified to order level at first, and sorted to species under the microscope Leica MZ Apo.

In the present study, insect and arachnid faunas of a large tree surveyed in Endau-Rompin on 6th Jul. 2003 is documented. The target tree was a leguminous tree, *Koopassia excelsa* ca. 50m in height, 80-100 cm in diameter excluding the buttress roots at 1 m above the ground. The holometabolous insect larvae were excluded in account of the number of specimens, because such larvae are so soft and easily destroyed, that they were almost undeterminable even at the order level. In Table 2, the classification system by Lawrence and Newton (1995) was adopted.

RESULTS AND DISCUSSIONS

1. Total numbers of species and specimens

As the result of the survey by fogging, a total number 12,401 of insect and arachnid specimens were collected. After sorting the material, 1,714 species were recognized. It is far larger than the mean number of specimens by a tree in the survey by Holloway and Stork (1991) (the data shown in Yano and Yata eds., 1999) on ten trees in Burnei. (23,482 for ten trees).

2. Numbers of species and specimens of each orders

Table 1 shows the numbers and percentages of species and specimens of each order of the collected insects and arachnids. Five orders of Arachnida and nineteen of Insecta were recognized. As to the order Hymenoptera, ants (family Formicidae) and the other groups are separately shown.

In number of specimens, the largest three orders are Collembola (3,759), Hymenoptera (3,441) and Araneae (1,126). The three dominant orders account for two thirds of the total. On the other hand, the largest three orders in number of species were Coleoptera (425 spp.), Diptera (410 spp.) and Hymenoptera (291 spp.). They occupy about 65% of the total number of species.

In Holloway and Stork (1991), the three dominant orders in number of specimens were Hymenoptera, Diptera and Coleoptera. Only in Hymenoptera, the rank of them is close to that of the present report. In contrast, the dominant orders in number of species in their result are same as those in the present, however the ranks of Coleoptera and Hymenoptera are different. Additionally, the dominant five are also the same as those of the present.

3. Numbers of species and specimens of each family in the order Coleoptera

In the order Coleoptera, the numbers and percentages of species and specimens of each family are listed in Table 2. The three dominant families were Staphylinidae (188), Curculionidae (107) and Chrysomelidae (93). However, the three families occupy less than half of the total number (47.7%). In number of species, the

dominant three families were Staphylinidae (84 spp.), Curculionidae (78 spp.) and Chrysomelidae (33 spp.). The percentage of the three families also amounts for less than the half (45.9%).

According to Erwin and Scott (1980) also investigated nineteen trees in Canal Zone of Panama, the three dominant families in number of specimens were Chrysomelidae, Staphylinidae and Ptilodactylidae (Curculionidae was excluded). The major three in number of species were Chrysomelidae, Staphylinidae and Cerambycidae. The major two families, Chrysomelidae and Staphylinidae in both numbers of species and specimens are common between Erwin and Scott (1980) and the present survey.

4. Numbers of species and specimens of each family in the order Araneae

In the arachnid order Araneae (spiders), the numbers and percentages of species and specimens of each family (superfamily) are shown in Table 3. Within the superfamily Araneoidea, the families are not distinguished. The three dominant families (superfamily) in number of specimens are Salticidae, Araneoidea and Clubionidae. They occupy 57.7% of the whole. The dominant three in number of species are Araneoidea (57 spp.), Salticidae (50 spp.), Clubionidae and Thomisidae (same, 24 spp.). The percentage of the major three amounts for more than 60%. The dominant members are similar between numbers of species and specimens in contrast with those in insect and arachnid orders shown in Table 1.

Table 1. Number and percentage of species and individuals (=specimens) of each order of the classes Arachnida and Insecta.

Order	species		individuals	
	N	%	N	%
Class ARACHNIDA				
Araneae	217	12.7	1,126	9.08
Scorpiones	1	0.06	5	0.04
Opiliones	7	0.41	31	0.25
Pseudoscorpiones	5	0.29	81	0.65
Acari	9	0.53	24	0.19
Class INSECTA				
Collembola	26	1.52	3,759	30.3
Zygentoma	12	0.70	38	0.31
Ephemeroptera	4	0.23	8	0.06
Odonata	2	0.12	2	0.02
Isoptera	4	0.23	21	0.17
Blattodea	11	0.65	140	1.13
Mantodea	1	0.06	16	0.13
Orthoptera	29	1.70	284	2.29
Dermaptera	2	0.12	2	0.02
Phasmida	2	0.12	20	0.16
Embioptera	8	0.46	24	0.19
Psocoptera	49	2.87	377	3.04
Thysanoptera	56	3.28	251	2.03
Homoptera	64	3.75	637	5.14
Heteroptera	62	3.64	186	1.50
Lepidoptera	17	1.00	19	0.15
Diptera	410	23.9	1,096	8.84
Coleoptera	425	24.8	813	6.56
Hymenoptera excl. ants	196	11.4	406	3.27
Hymenoptera (ants)	95	5.54	3,035	24.5
Total	1,714	100	12,401	100

Table 2. Number and percentage of species and individuals (=specimens) of each family of the order Coleoptera.

Family	species		individuals	
	N	%	N	%
Order COLEOPTERA				
Carabidae	6	1.41	15	1.85
Hydrophilidae	3	0.71	3	0.37
Leiodidae	2	0.47	2	0.25
Scydmaenidae	4	0.94	25	3.08
Ptilidae	8	1.88	11	1.35
Staphylinidae	84	19.8	188	23.1
Scarabaeidae	3	0.71	3	0.37
Helodidae	4	0.94	7	0.86
Buprestidae	5	1.18	8	0.98
Chelonariidae	1	0.24	1	0.13
Eucnemidae	3	0.71	3	0.37
Throscidae	1	0.24	1	0.13
Elateridae	20	4.70	80	9.84
Lycidae	1	0.24	1	0.13
Cantharidae	1	0.24	1	0.13
Anobiidae	12	2.82	19	2.34
Cleridae	3	0.71	6	0.74
Trogossitidae	2	0.47	2	0.25
Melyridae	8	1.88	14	1.72
Nitidulidae	7	1.65	11	1.35
Silvanidae	5	1.18	5	0.62
Passandridae	2	0.47	2	0.25
Cucujidae	2	0.47	2	0.25
Phalacridae	5	1.18	10	1.23
Languriidae	2	0.47	2	0.25
Erotylidae	2	0.47	8	0.98
Coccinellidae	8	1.88	8	0.98
Discolomatidae	6	1.41	7	0.86
Corylophidae	11	2.59	13	1.60
Lathridiidae	2	0.47	5	0.62
Ciidae	10	2.35	18	2.21
Mordellidae	13	3.06	32	3.94

Colydiidae	3	0.71	3	0.37
Tenebrionidae	20	4.71	33	4.06
Oedemeridae	1	0.24	1	0.13
Salpingidae	1	0.24	1	0.13
Anthicidae	3	0.71	9	1.11
Aderidae	6	1.41	9	1.11
Cerambycidae	10	2.35	12	1.48
Chrysomelidae	33	7.76	93	11.4
Anthribidae	15	3.53	16	1.97
Attelabidae	4	0.94	5	0.62
Brentidae	5	1.18	11	1.35
Curculionidae	78	18.4	107	13.2
Total	425	100	813	100

Table 3. Number and percentage of species and individuals (=specimens) of each family (superfamily) of the order Araneae.

Family (superfamily)	species		individuals	
	N	%	N	%
Order ARANEAE				
Araneoidea	57	26.3	189	16.8
Corinnidae	12	5.53	41	3.64
Clubionidae	24	11.1	176	15.6
Salticidae	50	23.0	285	25.3
Uloboridae	2	0.92	2	0.18
Zodariidae	5	2.30	6	0.53
Pholcidae	6	2.76	30	2.66
Oonopidae	4	1.84	11	0.98
Scytodydae	1	0.46	2	0.18
Gnaphosidae	2	0.92	2	0.18
Segestriidae	1	0.46	1	0.09
Mimetidae	2	0.92	2	0.18
Sparassidae	10	4.61	18	1.60
Pisauridae	2	0.92	2	0.18
Hersiliidae	1	0.46	2	0.18
Oxyopidae	13	5.99	14	1.24
Theraphosidae	1	0.46	1	0.09
Thomisidae	24	11.1	37	3.29
family undetermined	-	-	305	27.1
Total	217	100	1,126	100

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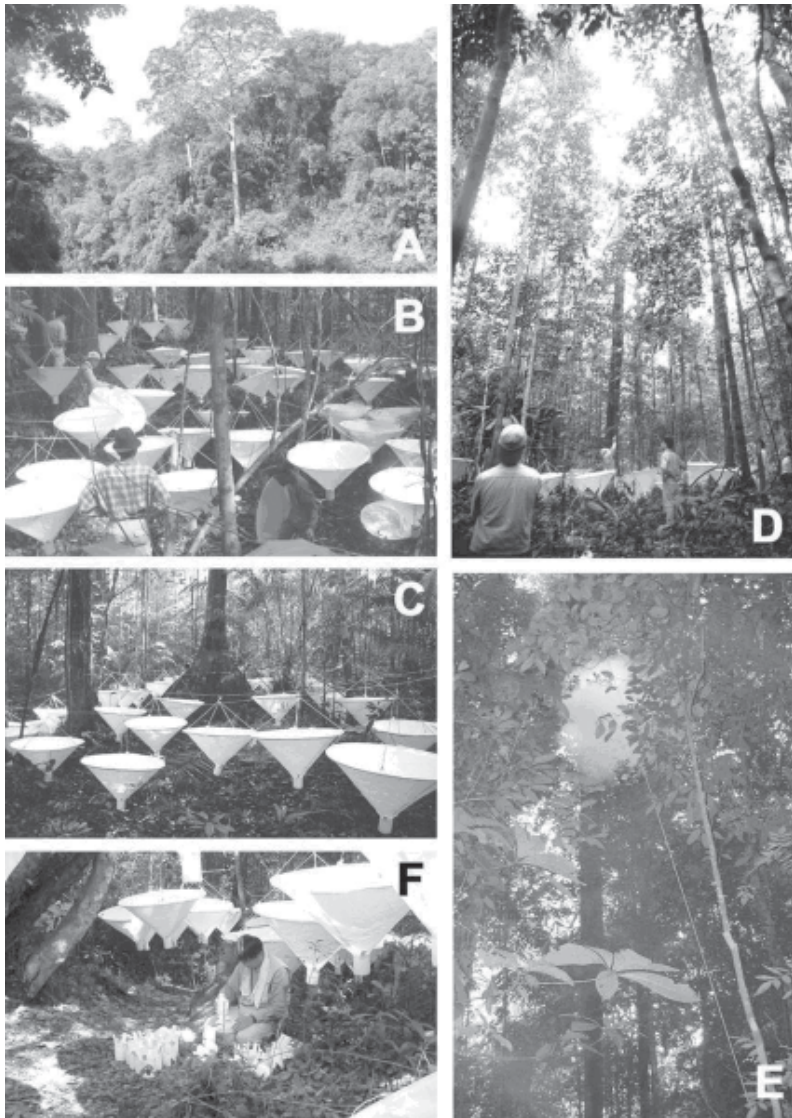


Fig. 1 Views of insecticide fogging in Endau-Rompin. A. A rainforest canopy in Endau-Rompin; B. Setting of collecting trays; C. A target tree and collecting trays; D. Start of fogging; E. A smoky fog below the canopy; F. Collecting bottles.



Fig. 2 Views of fogging in the Cameron Highlands. A. A target tree in a moss forest; B. Stretching ropes for trays; C. Spraying by hand; D. Gathering insect specimens on trays; E. Rough sorting in the hotel.