Study diversity of log dependent beetles (Coleoptera) in District of Bonggo, Regency of Sarmi, Province of Papua, Indonesia

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Abstract: A research was conducted to inventory the diversity of beetles in logged areas in the District of Bonggo, Jayapura, Papua. The survey was held for 34 consecutive days in three selected study areas. The cross-wet trap was used for collecting beetles, resulting in 1,751 individuals, recognized as 219 species, representing 21 different families. Comparisons between the three different sites and four genera of trees are presented.

Rangkuman: Penelitian ini dilaksanakan dengan tujuan untuk menginventarisasi keragaman kumbang pada daerah logging di Distrik Bonggo, Jayapura, Papua. Penelitian berlangsung selama 34 hari pada tiga lokasi. Cross-wet trap digunakan untuk mengumpulkan kumbang, dengan hasil 1.751 individu, yang diidentifikasi sebagai 219 spesies yang mewakili 21 famili. Perbandingan antara tiga lokasi dan empat jenis pohon disajikan.

Key-words: Abundance, similarity, functional groups.

Introduction

Background

Beetles are taxonomically diverse and exist as the largest order of insect in the world withabout 400,000 species (Alderton *et al.*, 2001), of which more than 25,000 species probablyoccur in New Guinea and surrounding islands. The numbers may still increase consideringmany of localities in Papua are rarely or never visited for surveying Coleoptera. Severalstudies of beetles were conducted in PNG, but only a few Papua, western/indonesian part of NG. Recent studies of Riedel confirm the poor knowlegde on Papuan beetles, especiallyconcerning *Ottistira* (Curculionidae, Ottistirini) and *Trigonopterus* (Curculionidae, Cryptorhynchinae).

One of the areas which is rarely visited for research study in Papua and with no reports on beetles is District of Bonggo (between 02° 08' and 02° 38' S and between 139° 08' and 139° 48' E), where a legal logging company has been operated since 1990, with selective cutting system in their logging operation, cutting merbau (*Intsia* spp.). However, also some other species were cut as nyatoh (*Palaquium* sp.), sengon (*Albisia* sp.), and linggua (*Pterocarpus* sp.), which experiences disturbances of various factors in the former intact ecosystem, and cause an unbalanced situation. The main factors are biotic factors (pests, borers and diseases), which cause a decrease of forest's quality. A number of insect *larvae* have been reported to tunnel in dead trees or freshly cut logs. It is known that dead trees are more susceptible to infestation because they contain better starch reserves. Besides that, most of these insects cannot infest live trees because of their natural defences.

The main wood-boring insect pests of logs are: long-horned beetles, flat-headed wood borers, and powder-post beetles. In some cases a number of insect species are encountered under the bark. Logs are also vulnerable for attacks by ambrosia beetles, whose pin-hole galleries in the xylem and associated fungal staining considerably reduce the commercial value of the logs, even till in the timber stores.

In this situation it is very important to perform an assessment of the diversity of Coleoptera which is feared to be lost before they are documented.

Sampling localities

Three localities were designated as sampling sites in the logged area at Bonggo in the Regency of Sarmi (see map), between 02° 08' and 02° 38' S and between 139° 08' and 139° 48' E, at an altitude of 0-500 m above sea level. The average rainfall in this area is about 3.5 to 7 m yearly, with high rainfall in the months March and April. The average humidity is 83.6% and an average temperature of 28.4° C. The sites consist of a wet tropical rain forest with vegetation dominated by *Intsia* spp. with a diameter of 50 cm or more.

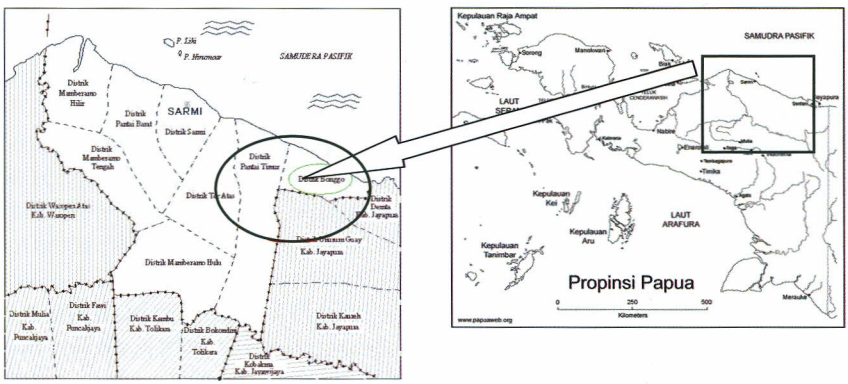

Fig. 1. Map of District of Bonggo, with its situation in Papua.

In site 1, seven replications of traps for *Intsia* trees were set up in this site during 16 days, at an elevation of 145 m a.s.l. with the actual coordinates 02° 24.003' S and 139° 19.703' E. The closure of the trees ranged from 45 to 60%.

In site 2, the traps were installed in logged area of *Albisia* trees during 16 days and for *Palaquium* trees during 15 days. Seven trap replications were made for *Albisia*; for *Palaquium* six. The traps on *Albisia* were placed at a height of 187 m a.s.l. (02° 28,923' S; 139° 27,993' E) while for *Palaquium*, the traps placed at 02° 29,79' S; 139° 28,398' E, 213 m a.s.l. The closure of trees around the traps is 10-40% for *Palaquium* and 5-30% for *Albisia*.

In site 3, fourteen traps were established in Camp Karang, the base camp during field work, during 15 days, at 02° 15,443' S and 139° 25,066' E, 85 m a.s.l. (at km 19); three traps were build up in logged areas of *Intsia* trees and six traps were placed for *Pterocarpus* trees, in a radius of 4 km from base camp, at 02° 14,192' S; 139° 25,495' E, 40 m a.s.l., the last five traps were made. Four traps were placed in logged areas of *Intsia* trees and one at an area of logged *Pterocarpus*, all during a period of 15 days. Around the trap in logged areas of *Intsia* the crown-cover of trees is about 30-60%; in areas of *Pterocarpus* between 10 and 60%. The trees in the surroundings of the traps are partly the same at the three sites, as *Intsia* sp., *Myristica fragrans*, *Vatica* sp., *Pometia pinnata*, *Albisia* sp., *Pterygota* sp., *Calophyllum* sp., *Alstonia* sp. and *Palaquium* sp. Futhermore were found among others *Pterocarpus* sp., *Campnosperma* sp., *Canarium* sp., *Cananga odorata*, *Artocarpus integra*, *Draconton elum edule*, *Psidium guajava*, *Pterocarpus indicus*, *Artocarpus integra*, and *Campnosperma* sp.

Sampling Method

The cross-wet trap was used as a method to collect beetles at three sampling sites (see Fig. 2). Plastic clips and metal wire are available to secure all parts of the trap. There is a hole in the middle of the main pillar of the trap to put a liquid (i.c. alcohol) to attract insects. The advantages of these traps are that they are easy to assemble and install and do not need to be checked every day (except in the rainy season).

The traps were installed approximately 50 cm above the ground to prevent damage caused by wild animals as pigs. The insects will fall down into the plastic container which is already filled with mixture of one litre of water, 350 gr. of normal salt (maximum soluble of salt) and some detergen without perfume (RBS Neutral Roth).

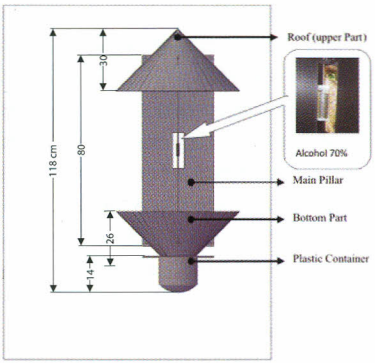

Fig. 2. The cross-wet trap.

Results

From the total 1,751 individuals of beetles collected with *cross-wet traps*, 219 different species were recognized, representing 21 different families: Carabidae (6 species), Cicindelidae (1 species), Dytiscidae (1 species), Histeridae (4 species), Elateridae (33 species), Cleridae (10 species), Cucujidae (3 species), Tenebrionidae (7 species), Mordelidae (1 species), Melandryidae (6 species), Ptylodactylidae (1 species), Phalacridae (1 species), Cerambycidae (9 species), Chrysomelidae (7 species), Anthribidae (7 species), Brenthidae (7 species), Curculionidae (43 species), Rhyncophoridae (10 species), Dryophthoridae (10 species), Scolytidae (41 species), and Platypodidae (11 species) as shown on Fig. 3.

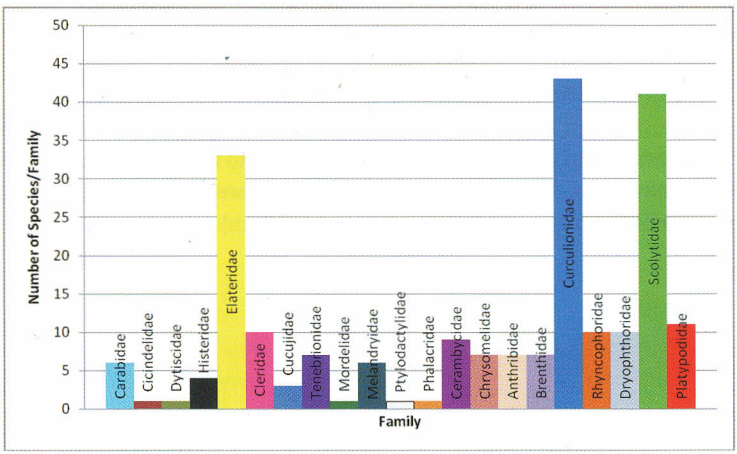

Fig. 3. Number of species per family.

Despite having a higher number of species, the abondance of Curculionidae (95 individuals) is not as much as the abundance of Scolytidae (1,001 individuals) and Platypodidae (289 individuals). The total abundance and diversity of beetles at the three sampling sites is presented in Table 1.

From 21 families mentioned above, members of 16 families were collected in the first site; members of 19 families in the second site and members of 16 families in the third site.

The 305 individuals of beetles collected site 1 represent 71 different species. In site 2, 138 species were recognized within 1,194 individuals recorded at the logged area of *Palaquium* and *Albisia* trees. In site 3, 252 individuals were collected with the traps in logged areas of *Intsia* and *Pterocarpus*, representing 86 different species.

Four families of beetles were only recorded at a single site, with for three families a low number of individuals (1, 2, 2); the fourth family was represented by 36 individuals.

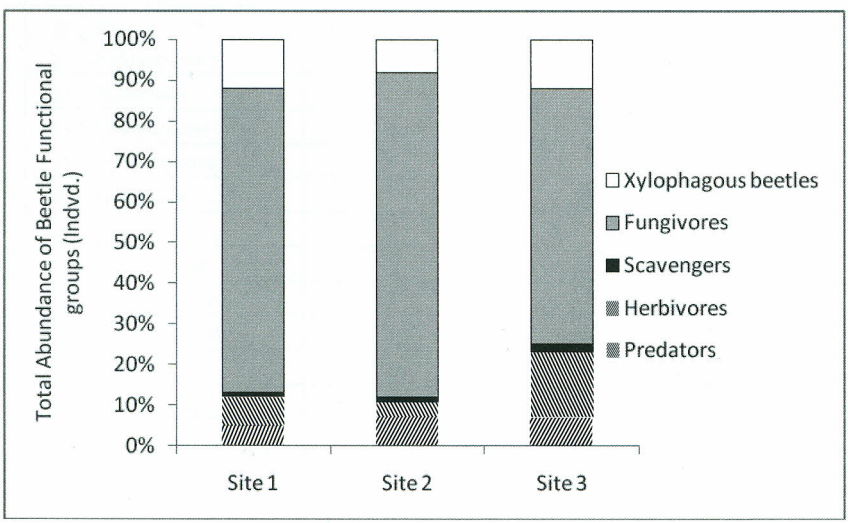

Fig. 4. Total proportional abundance of five major functional groups at each site.

The proportional diversity of predators, fungivores, and xylophagous beetles are not apparently diverse; however, its abundance showed a different pattern, where the abundance of fungivores were of proportionally higher compared with the other functional groups recorded at Bonggo. In contrary, the proportional diversity and abundance of the functional groups at the three sites showed more or less a similar pattern. Despite the fact, the diversity proportion of fungivores and herbivores are higher in site 3, the proportional abundance shown a quite similar distribution in three sites.

The level of species diversity of beetles in three sampling sites based on the calculation of Shannon-Weiner Diversity Index (H') and Shannon-Weiner Equitability Index (J) are presented on the bottom of Table 1.

The similarity of beetles in three sampling site and within different kind of tree species are figured out in Table 2. The value of *CCs* indicated a lower similarity of beetles both in different sampling sites (CCs= 0.122 or 12.2%) and among different trees species (CCs= 0.054 or 5.4%).

Table 2. Similarity Index of beetles in three sites and on different tree species

No.	Family	Number of Species			c	c
		Site 1	Site 2	Site 3	All Sites	All Tree
1	Carabidae	3	2	3	0	0
2	Cicindelidae	0	1	0	0	0
3	Dytiscidae	0	1	0	0	0
4	Histeridae	2	3	3	1	1
5	Elateridae	9	11	15	0	0
6	Cleridae	4	8	0	0	0
7	Cucujidae	0	3	1	0	0
8	Tenebrionidae	2	1	3	0	0
9	Mordelidae	1	0	0	0	0
10	Melandryidae	0	5	2	0	0
11	Ptylodactylidae	0	0	1	0	0
12	Phalacridae	1	1	0	0	0
13	Cerambycidae	3	6	1	0	0
14	Chrysomelidae	1	3	5	0	0
15	Anthribidae	3	6	1	1	0
16	Brenthidae	1	5	2	0	0
17	Curculionidae	17	29	10	2	1
18	Rhyncophoridae	3	5	5	1	0
19	Dryophthoridae	3	7	4	1	0
20	Scolytidae	11	31	23	7	4
21	Platypodidae	7	10	7	5	2
TOTALS		**71**	**138**	**86**	*18*	*8*
CCs					**0.122**	**0.054**
					12.2%	**5.4%**

The composition of beetles observed at the four different tree species is diverse. It appears that *Albisia* ranks first with total of 91 species followed by *Palaquium* with 85 species, *Intsia* with respectively 71 species at site 1 and 55 species at site 3 and *Pterocarpus* with 49 species.

Discussion

This study showed that from 219 species of beetles found at Bonggo during surveys, only members of the superfamily of Curculionoidea (Dryophthoridae, Curculionidae and Rhyncophoridae), of the family of Cerambycidae and some members of Tenebrionidae are identified into species level. In many cased the species name is doubtful; some species are surely undescribed and new to science. Concerning the large number of other remaining families of beetles encountered from the three sites, identification is even more complicated. This is due to the several reason like the identification of most species required a several-year-long effort, identification process are extremely difficult since the type material is scattered in various museums all over the world and besides that limited information about related publications of the species is provided.

The results pointed out that site 2 has the highest species diversity (138 species), in comparison to site 3 (86 species) and site 1 (71 species). The differences in diversity levels at these three sites are probably due to a number of factors, as differences in number of traps, selected tree species, stadia of rotten wood, quality of the forest and distance from population centra.

The uneven distribution of individuals of the observed beetles in three sampling sites is mostly defined by the presence of a dominant family of beetle with greater number of individuals per species. The pooled data in site 2 show that the numbers of the families of Scolytidae and Platypodidae (mostly the dominant families), presented more than of 75 % of the cumulative number of individuals caught in all traps during period of study, while the remaining species belong to the other 19 families representing less than 25%. It is most likely the same for site 1 and site 3, but with only one dominant family, the Scolytidae. The species belonging to Scolytidae represent more than 50% of the cumulative number of individuals at site 1 and site 3, while the remaining species belonging to the other 20 families represent less than 45%.

Considering that many of collected beetles are not identified specifically, caused by less and poor morphological differences which make it difficult to separate them on species level, it is important to carry out studies about their DNA sequencing or DNA barcoding.

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and identified all Curculionidae, as far as possible. Many thanks I express also to all scientists who assisted me in identifying the results of the survey; especially Drs. Rob de Vos and Mr. Gerrit Withaar of the Papua Insects Foundation (Cerambycidae), Mr. Thomas Lackner, contributor of Papua-Insects website (Histeridae), Dr. Andreas Weigel (Cerambycidae), Enrico Ruzzier (Mordellidae and Elateridae) and Dr. Jiri Hulcr (Scolytidae and Platypodidae). I greatfully acknowledge Br. Henk van Mastrigt and Dra. Daawia for their advices, corrections and support.

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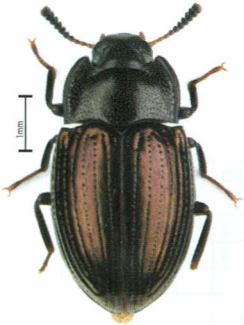

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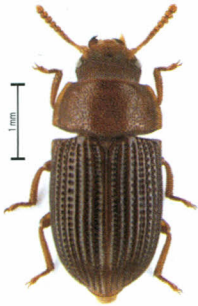

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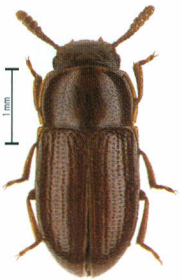

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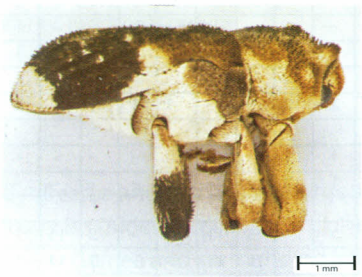

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Figs 1-4. Some species of Tenebrionidae: 1. *Androsus* sp.; 2. *Bolitonaeus* sp.; 3. Genus unknown; 4. *Menimus* sp. **Figs 5-7.** Some species of Curculionidae: 5. *Asytesta* sp. 1; 6. *Asytesta* sp. 2; 7. *Platyrus varius.*

Table 1. Abundance and diversity per family/species per site/genus tree

	(sub)family/tribe/name	Site 1		Site 2						Site 3						TT		Ab in
		In		Pa		Al		TT		In		Pt		TT				
		Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	% Di
	01. Carabidae																	
1-6	unidentified species	3	4	1	1	2	3	2	4	2	2	3	4	3	6	6	14	233
		3	**4**	**1**	**1**	**2**	**3**	**2**	**4**	**2**	**2**	**3**	**4**	**3**	**6**	**6**	**14**	**233**
	02. Cycindelidae																	
7	unidentified species	-	-	-	-	1	2	1	2	-	-	-	-	-	-	1	2	200
		-	**-**	**-**	**-**	**1**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**200**
	03. Dytiscidae																	
8	unidentified species	-	-	1	2	1	34	1	36	-	-	-	-	-	-	1	36	3,600
		-	**-**	**1**	**2**	**1**	**34**	**1**	**36**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**36**	**3,600**
	04. Histeridae																	
9	*Procoryphaeus wallacei*	-	-	-	-	-	-	-	-	1	1	-	-	1	1	1	1	100
10	*Eblisia* sp.	1	3	1	7	1	9	1	16	1	2	1	4	1	6	1	25	2,500
11-12	*Trypeticus* sp.	1	1	1	2	1	1	2	3	1	2			1	2	2	6	300
		2	**4**	**2**	**9**	**2**	**10**	**3**	**19**	**3**	**5**	**1**	**4**	**3**	**9**	**4**	**32**	**800**
	05. Elateridae																	
13-45	unidentified species	9	12	3	3	9	10	11	13	12	13	4	4	15	17	33	42	127
		9	**12**	**3**	**3**	**9**	**10**	**11**	**13**	**12**	**13**	**4**	**4**	**15**	**17**	**33**	**42**	**127**
	06. Cleridae																	
46-55	unidentified species	4	6	6	7	3	3	8	10	-	-	-	-	-	-	10	16	160
		4	**6**	**6**	**7**	**3**	**3**	**8**	**10**	**-**	**-**	**-**	**-**	**-**	**-**	**10**	**16**	**160**
	07. Cucujidae																	
56-58	unidentified species	-	-	2	7	3	4	3	11	1	1	-	-	1	1	3	12	400
		-	**-**	**2**	**7**	**3**	**4**	**3**	**11**	**1**	**1**	**-**	**-**	**1**	**1**	**3**	**12**	400
	08. Tenebrionidae																	
59-61	*Amarygmus* sp.	-	-	-	-	1	1	1	1	2	3	-	-	2	3	3	4	133
62	*Bolitanaeus* sp.	-	-	-	-	-	-	-	-	1	1	-	-	1	1	1	1	100
63	*Menimus* sp.	-	-	-	-	-	-	-	-	1	1	-	-	1	1	1	1	100
64-65	*Andrasus* sp.	2	2	-	-				-	-	-	-	-	-	-	2	2	100
		2	**2**	**-**	**-**	**1**	**1**	**1**	**1**	**4**	**5**	**-**	**-**	**4**	**5**	**7**	**8**	**114**
	09. Mordellidae																	
66	*Paratomoxia* (cfr. *agathae*)	1	2	-	-	-	-	-	-	-	-	-	-	-	-	1	2	200
		1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**200**
	10. Melandryidae																	
67-72	unidentified species	-	-	5	11	-	-	5	11	1	1	1	1	1	2	6	13	217
		-	**-**	**5**	**11**	**-**	**-**	**5**	**11**	**1**	**1**	**1**	**1**	**2**	**2**	**6**	**13**	**217**
	11. Ptilodactylidae																	
73	unidentified species	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1	100
		-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	100
	12. Phalacridae																	
74	unidentified species	1	23	1	13	1	12	1	25	-	-	-	-	-	-	1	48	4,800
		1	**23**	**1**	**13**	**1**	**12**	**1**	**25**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**48**	**4,800**

	(sub)family/tribe/name	Site 1		Site 2						Site 3						TT		Ab in
		In		Pa		Al		TT		In		Pt		TT				
		Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	% Di
	13. Cerambycidae																	
75	*Acanista alphoides*	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	100
76	*Cacia* sp.	1	1	-	-	1	1	1	1	-	-	-	-	-	-	1	2	200
77	*Chloraphorus* (cf. *muscifluvis*)	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1	100
	Pteropliini/Rhodopini								-					-				
78	unidentified species	-	-	-	-	-	-	-	-	1	1	-	-		1	1	1	100
79	*Anancytus* sp.	1	1	-	-	-	-	-	-	-	-	-	-	1	-	1	1	100
80	*Tmesistermus obliquelineatus*	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1	100
81	*Tmesistermus* sp.	-	-	-	-	1	1	1	1	-	-	-	-	-	-	1	1	100
82	*Glenea* sp.	-	-	-	-	1	1	1	1	-	-	-	-	-	-	1	1	100
83	*Pelargoderus rubropunctatus*	-	-	1	3	-	-	1	3	-	-	-	-	-	-	1	3	300
		3	**3**	**3**	**5**	**3**	**3**	**6**	**8**	**1**	**1**	**-**	**-**	-	**1**	**9**	**12**	**133**
	14. Chrysomelidae													**1**				
84-90	unidentified species	1	1	1	1	2	2	3	3	3	3	3	7		10	7	14	200
		1	**1**	**1**	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**7**	5	**10**	**7**	**14**	**200**
	15. Anthribidae													**5**				
91-97	unidentified species	3	4	3	3	3	3	6	6	1	3	-	-		3	7	13	186
		3	**4**	**3**	**3**	**3**	**3**	**6**	**6**	**1**	**3**	**-**	**-**	1	**3**	**7**	**13**	**186**
	16. Brentidae													**1**				
98-104	unidentified species	1	1	5	11	1	2	5	13	1	1	1	7		8	7	22	314
		1	**1**	**5**	**11**	**1**	**2**	**5**	**13**	**1**	**1**	**1**	**7**	2	**8**	**7**	**22**	**314**
	17. Cucullionidae													**2**				
	Ottistirini																	
105	unidentified species	-	-	-	-	-	-	-	-	1	1	-	-		1	1	1	100
	Conoderinae													1				
106	*Telephae* sp.	-	-	-	-	1	1	1	1	-	-	-	-		-	1	1	100
107	*Imathia* sp.	-	-	1	1	-	-	1	1	-	-	-	-	-	-	1	1	100
	Baridinae													-				
108	unidentified species	-	-	-	-	1	1	1	1	-	-	-	-		-	1	1	100
	Cossoninae													-				
109-115	unidentified species	5	8	2	3	3	4	4	7	1	5	2	6	2	11	7	26	371
	(including 2 Himatini)								-									
	Aedemonini								-									
116-126	unidentified species	5	14	7	13	4	5	7	18	3	3	2	2	5	5	11	37	336
	Cryptorhynchinae																	
	Gasterocercini																	
127	*Lophocheirus* sp.	-	-	-	-	1	2	1	2	-	-	-	-	-	-	1	2	200
	Cryptorhynchini																	
128-138	unidentified species	4	4	1	1	6	6	7	7	-	-	1	1	1	1	11	12	109
	Ithyporini																	
139	*Platytenes varius*	1	1	-	-	1	1	1	1	-	-	-	-	-	-	1	2	200

	(sub)family/tribe/name	Site 1		Site 2						Site 3						TT		
		In		Pa		Al		TT		In		Pt		TT				Ab in
		Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	Di	Ab	% Di
140-141	*Asytesta* sp.	1	1	-	-	1	2	1	2	-	-	-	-	-	-	2	3	150
142-147	unidentified species	1	1	3	5	2	2	5	7	1	1	-	-	1	1	6	9	150
		17	**29**	**14**	**23**	**20**	**24**	**29**	**47**	**6**	**10**	**5**	**9**	**10**	**19**	**43**	**95**	**221**
	18. Rhynchophoridae																	
148	*Sipalinus gigas*	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1	2	200
149	*Dysopirhinus* sp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	100
150-151	*Orthorhinus* sp.	-	-	-	-	-	-	-	-	1	2	-	-	1	2	2	2	100
	Hylobiini																	
152	*Pseudaclees* sp.	-	-	1	1	-	-	1	1	1	-	-	-	1	-	1	1	100
153	*Orochiesis* sp?	-	-	-	-	-	-	-	-	1	1	-	-	1	1	1	1	100
154	*Phaenomerus* spp.	1	1	1	8	1	2	1	10	-	-	1	1	1	1	>1	12	1,200
155-157	*Acicnemis* sp.	-	-	2	5	2	2	3	7	-	-	-	-	-	-	3	7	233
		3	**3**	**4**	**14**	**3**	**4**	**5**	**18**	**3**	**3**	**2**	**2**	**5**	**5**	**10**	**26**	260
	19. Dryophthoridae																	
158-162	*Trochorhopalus* sp.	-	-	3	4	1	2	3	6	1	1	1	1	2	2	5	8	160
163-164	unidentified species	1	2	1	14	2	14	2	28	-	-	-	-	-	-	2	30	1,500
	Sphenophorini								-						-		0	
165	unidentified species	1	2	-	-	1	5	1	5	-	-	1	4	1	4	1	11	1,100
	Stromboscerini								-						-		0	
166	*Camptorhinus doriae*	-	-	1	2	-	-	1	2	1	1	-	-	1	1	1	3	300
167	unidentified species	1	1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	100
		3	**5**	**5**	**20**	**4**	**21**	**7**	**41**	**2**	**2**	**2**	**5**	**4**	**7**	**10**	**53**	**530**
	20. Scolytidae																	
168-208	unidentified species	11	168	19	218	24	481	31	699	12	41	20	93	23	134	41	1001	2,441
		11	**168**	**19**	**218**	**24**	**481**	**31**	**699**	**12**	**41**	**20**	**93**	**23**	**134**	**41**	**1001**	**2,441**
	21. Platypodidae																	
209-219	unidentified species	7	38	10	132	8	95	10	227	3	7	6	17	7	24	11	289	2,627
		7	**38**	**10**	**132**	**8**	**95**	**10**	**227**	**3**	**7**	**6**	**17**	**7**	**24**	**11**	**289**	**2,627**
	total species beetles	**71**	**305**	**85**	**480**	**91**	**714**	**138**	**1194**	**55**	**98**	**49**	**154**	**87**	**252**	**219**	**1751**	**800**

ln S	**4.263**	**4.443**	**4.511**	**4.927**	**4.007**	**3.892**	**4.454**	**5.389**
H'	**1.277**	**1.578**	**1.384**	**1.551**	**1.609**	**1.426**	**1.626**	**1.651**
J	**0.300**	**0.355**	**0.307**	**0.315**	**0.402**	**0.367**	**0.345**	**0.306**

Explanation:	
In	on *Intsia* sp.
Pa	on *Palaquium* sp.
Al	on *Albisia* sp.
Pt	on *Pterocarpus* sp.
Di	Diversity
Ab	Abundance
TT	totals