COLEOPTERA ABUNDANCE AND DISTRIBUTION IN FIVE COSTA RICAN FORESTS

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Abstract . The order Coleoptera(Beetles) is the most diverse and abundant group in the animal kingdom. We examined beetle community composition in five habitats in Costa Rica. We found differences in beetle family representation and relative abundance among the five sites. We collected the largest number of families at La Selva, an Atlantic lowland wet forest, while the lowest number was at Palo Verde, a lowland dry forest. We collected the fewest total beetles at Monteverde and Cerro, the two sites at the highest elevations. The data suggest that beetles are most diverse and abundant in lowland tropical sites. Differences in relative diversity and abundance among sites could also be influenced by local temporal and spatial patchiness in the beetle population. Of the five collecting techniques, we found the black light and net sweeps to be the most effective with respect to family richness and overall abundance. The Malaise trap was least effective in beetle collection. Using additional methods of sampling may have enabled us to collect more beetle families which were otherwise under-represented in our samples.

Key words: beetles, family richness, insect sampling

INTRODUCTION

The insect order Coleoptera (beetles), with almost 300,000 species worldwide, represents 30% of the world's animal species. Beetles demonstrate astounding adaptability in habitat and resource utilization. Representatives are found from the driest desert to the wettest cloud forest and consume virtually every form of living and dead organic matter (White 1983).

We examined beetle community composition in five habitats in Costa Rica that differed in forest type and elevation. We expected to find differences in beetle family representation among the five habitats. We also evaluated the effectiveness of various collection techniques for capturing different families of beetles.

METHODS

We collected beetles over the following dates at five sites in Costa Rica: Palo Verde National Wildlife Refuge, a deciduous dry forest and swamp (3-183 m), 11 January 1997; Monteverde Biological Station, a mid-elevation montane cloud forest (1600-1800 m), 18 January; Cerro de la Muerte (Cerro), a high-elevation montane forest (2500-2800 m), 31 January; Corcovado National Park, a Pacific lowland wet forest (0-400 m), 3 February; and La Selva Biological Station, an Atlantic lowland wet forest (29-100 m), 13 February. At each site, we employed five different methods for collecting adult beetles: (i) we ran a mercury vapor light with a white sheet near camp for 3-4 hours on a single night, (ii) we took approximately 40 sweep net samples in at least two well-represented habitats (usually forested and early successional), (iii) we placed 10 pitfall traps in a leaf-litter containing habitat, each baited with a banana for one night prior to collection, (iv) we collected beetles from a Malaise trap set up for approximately 24 hours prior to collection, and (v) we collected beetles from ten pitfall traps baited with dung. Beetles collected by all methods were placed in alcohol and returned to the lab for identification. Identification to family followed White (1983).

RESULTS

We found 20 different Coleopteran families and 397 individual beetles across the five sites. La Selva had the most families (14), followed by Cerro (10), Corcovado (8), Monteverde (8), and Palo Verde (7). Cerambycidae, Chrysomelidae, and Staphylinidae were found at all five sites. Bruchidae, Erotylidae, Eucnemidae, Phalacridae, and Scaphidiidae were only found at La Selva. Melyridae was only found in Corcovado, and Tenebrionidae was only found at Palo Verde (Table 1).

Table 1: Comparison of family representation of Coleoptera across five sites in Costa Rica. Cell entries represent the number of beetles collected in each family.

Family	Palo Verde	Monteverde	Cerro	Corcovado	La Selva	Totals
Bruchidae					1	1
Carabidae	24	17	14	6		61
Cerambycidae	10	1	2	1	1	15
Chrysomelidae	117	15	4	28	9	173
Coccinellidae		7	1			8
Cucujidae					1	1
Curculionideae		6	3	8	6	23
Elateridae			1	2	2	5
Erotylidae					3	3
Eucnemidae					1	1
Hydrophilidae	3					3
Lampyridae	2	4			1	7
Melyridae				1		1
Nitidulidae			1		1	2
Passalidae			1	3		4
Phalacridae					4	4
Scaphidiidae					1	1
Scarabaeidae	17	2	1	12	41	73
Staphylinidae		1	6		1	8
Tenebrionidae	3					3
Total Numbers	176	53	34	61	73	397
Number of families	7	8	10	8	14	20

Of the 397 beetles collected, we caught 42% with the black light method, 22% with the sweep method, 18% with banana-baited pitfall traps, 10% with dung-baited pitfall traps and 8% with the Malaise trap. We collected 13 families with the blacklight, 12 with the sweep method, 7 with the pitfall trap, 4 with the Malaise trap, and 1 with dung (Table 2).

DISCUSSION

The highest number of families was collected at La Selva. Beetles seem to thrive at high temperatures and in wet conditions like those present in lowland forests. The dry conditions at Palo Verde may be a reason for the lowest family richness found there. There was also a low abundance of beetles in the high elevation sites, Cerro and Monteverde. In particular,

dung beetles were relatively scarce at the high elevations, which is reflective of the lower rates of decomposition occurring at these sites due to lower temperatures. These climates and habitats are most similar to temperate climates, which have a lower abundance and diversity of beetles than tropical climates.

Beetle populations are temporally and spatially patchy both between and within sites. Palo Verde had an unusually high number of Chrysomelidae (leaf beetles) that were attracted to the black light on the night of sampling. On other nights at Palo Verde, we observed far fewer Chrysomelidae at the black light. Therefore, increasing sampling replicates may have helped catch a different and more representative assemblage and number of beetles.

Our results showed that the pitfall and dung-baiting traps were effective for collecting specific species of beetles. The sweeping and black light methods were generally effective for collecting many beetle families. The Malaise trap, effective in collecting representatives from the orders Lepidoptera, Diptera and Hemiptera, was relatively ineffective in catching beetles. Further studies may wish to implement additional sampling techniques. For example, a Berlese to sample soil and leaf litter beetles that may have been underrepresented in our collection techniques.

Of the three most common beetle families found in North America (Carabidae, Curculionidae, and Staphylinidae), only Carabidae was commonly found in our study. The lack of Staphylinidae in particular may reflect our inability to adequately sample the soil and litter-dwelling species.

Table 1: Comparison of collection method effectiveness for different families of Coleoptera.

Family	Black light	Malaise	Pitfall	Sweep	Dung	Totals
Bruchidae				1		1
Carabidae	1	1	53	6		61
Cerambycidae	11	1	1	2		15
Chrysomelidae	99	29	4	41		173
Coccinellidae				8		8
Cucujidae	1					1
Curculionideae	4			19		23
Elateridae	5					5
Erotylidae				3		3
Eucnemidae				1		1
Hydrophilidae	3					3
Lampyridae	6	1				7
Melyridae				1		1
Nitidulidae			2			2
Passalidae	4					4
Phalacridae	2			2		4
Scaphidiidae	1					1
Scarabaeidae	28		3	2	40	73
Staphylinidae			7	1		8
Tenebrionidae	3					3
Total Numbers	167	32	70	87	40	397
Number of families	13	4	6	12	1	20

LITERATURE CITED

White, E. 1983. A field guide to the beetles of North America. Houghton Mifflin Company, NY.

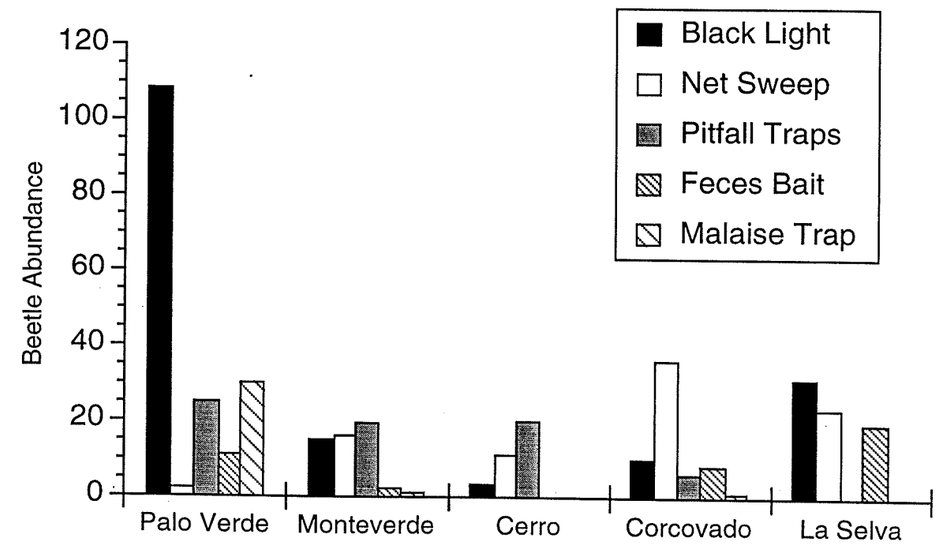

FIG. 1. Total Coleopterans collected with five different methods from five sites in Costa Rica.