The Effect of Human Activity on Ant Species (Hymenoptera: Formicidae) Richness at the Mont St. Hilaire Biosphere Reserve, Québec

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The ant (Hymenoptera: Formicidae) fauna of the Mont St. Hilaire Biosphere Reserve, Québec, was surveyed in 2002 and 2003. Although overall species richness was high, 10 of 40 total ant species collected were limited to anthropogenically disturbed habitats within the reserve. While only 2 of these 10 species (*Tetramorium caespitum* (L.) and *Lasius niger* (L.)) can definitively be considered introduced, areas altered by human activity (representing a small fraction of the reserve's total area) possess nearly as many unique species as the reserve's old-growth forest. Although further research will be necessary to determine the consequences of such changes in community structure, this study shows the importance of specifying the extent of biodiversity surveys within protected habitats to more accurately monitor the effectiveness of conservation efforts.

Key Words: ants, Hymenoptera: Formicidae, Mont St. Hilaire, anthropogenic disturbance, old-growth forest, species richness, inventory.

Mont St. Hilaire, protected as an International Biosphere Reserve under the Man and Biosphere program of the United Nations, is the largest remaining tract of old-growth deciduous forest in the St. Lawrence Valley (Arii and Lechowicz 2002). Although dominated by Sugar Maple (*Acer saccharum*) and American Beech (*Fagus grandifolia*), this 10 km^2 old-growth forest contains diverse habitats including exposed summits rising 200–300 m above the surrounding forest, low productivity bogs dominated by Hemlock (*Tsuga canadensis*), and stands of Red Oak (*Quercus rubr*a) and Red and White pine (*Pinus resinosa and P. strobus*). Located within a suburban setting approximately 32 km east of Montréal, Mont St. Hilaire (45°55'N; 75°13'W) also contains areas of anthropogenic disturbance. We sought to survey the ant species richness (Hymenoptera: Formicidae) at Mont St. Hilaire and determine whether human activities within and adjacent to the Biosphere Reserve have effects on the fauna.

Methods

Between 6 May and 31 July 2002, JZS [Jonathan Z. Shik] intensively hand-collected ants (243 samples, about 7500 individuals) within the boundaries of Mont St. Hilaire. Within a given habitat, individual foragers and colonies were collected in both hypogeous (e.g., under rocks, in leaf litter, and under decaying wood) and epigeous (e.g., on living vegetation, along roadsides, and on mosses and boulders) microhabitats. Additional colony sampling (56 samples) conducted by JZS and AF [André Francoeur] from 7 to 10 July 2003 verified species distributions and yielded two species not recorded in 2002 (*Brachymyrmex depilis* (Emery), and *Leptothorax ergatogyneus* (Francoeur)). Voucher specimens have been deposited in the Lyman Entomological Museum (McGill University, Macdonald Campus, Ste. Anne de Bellevue, Québec).

Because ant distributions vary along abiotic gradients of temperature and moisture that depend on exposure to sunlight (Brown 1973), ants were sampled in both "vegetated" (plant community covers the ground) and "exposed" (unshaded rocky) areas. To assess effects of human activity within these two habitat groupings, both natural and anthropogenically disturbed (henceforth, "disturbed") habitat were sampled (Table 1). Natural vegetated habitat consisted of old growth forest, while disturbed areas were mid-successional fields, isolated patches of secondary forest near boundaries, and areas dominated by introduced vegetation, especially artificially maintained grass areas near buildings. Natural exposed areas were unshaded boulders at summits, and rocky outcrops within the forest while disturbed exposed areas were roadsides and the unshaded gravel of parking lots and a sandy picnic area.

Results

The ant survey yielded 40 species spread across 17 genera, making it one of the most species rich localities in the eastern Canadian boreal-broadleaved tran-

TABLE 1. Summary of ants (Hymenoptera: Formicidae) collected at the Mont. St. Hilaire biosphere reserve. Numbers indicate number of direct observations by species and habitat type. Vegetative habitats are collections made on or beneath vegetation (shaded), exposed refers to lack of direct shading. Anthropogenic habitats are defined by proximity to human buildings or roads. The symbol * represent natural habitat specialists (>90% of observations in natural habitats), † refers to specialists of anthropogenic habitats, no symbol represents generalist. Species are identified according to Creighton (1950) or more recent generic revisions as stated in Bolton (1995). The *Myrmica* species follow the upcoming taxonomic revision of the nearctic species by A. Francoeur (unpublished).

	Natural				Anthropogenically Disturbed				
	Vegetated			Exposed	Vegetated			Exposed	
	Old-growth forest	Summit	Rock outcrop (forest)	Field (mid-succession)	Grass (building)	Isolated forest	Parking lot gravel, sandy picnic area	Road-side	Total Number of Observations
SUBFAMILY PONERINES									
Ambylpone pallipes (Haldeman)*	5								5
Ponera pennsylvanica (Buckley)†						3	1	1	5
SUBFAMILY MYRMICINES									
Aphaenogaster rudis (Emery)	9		1			4		1	15
Crematogaster cerasi (Fitch)	1					2			3
Leptothorax ambiguus (Emery)†				1					1
L. canadensis (Provancher)	2	3				1			6
L. ergatogyneus (Francoeur)*		1							1
L. longispinosus (Roger)	21	2	2			5			30
Myrmecina americana (Emery)	2					2			4
Myrmica detritinodis (Emery)*		4	1						5
M. emeryana (Forel)	2					1			3
M. fracticornis (Emery)			1	4					5
M. pinetorum (Wheeler)*		1							1
M. punctiventris (Roger)	4					1			5
M. sculptilis, n.sp. (Francoeur)	4	11				6			21
Solenopsis molesta (Say)†						2	1		3
Stenamma diecki (Emery)*	3								3
S. impar (Forel)*	2								2
Tetramorium caespitum (Linnaeus)†					1			8	9
SUBFAMILY DOLICHODERINES									
Dolichoderus plagiatus (Mayr)*		4							4
Tapinoma sessile (Say)		5				1	3	2	11
SUBFAMILY FORMICINES									
Acanthomyops subglaber (Emery)*	1								1
Brachymyrmex depilis (Emery)	1				1				2
Camponotus nearcticus (Emery)*	14					1			15
C. novaeboracensis (Fitch)	3		2			2			7
C. pennsylvanicus (De Geer)	10	2	1			1		1	15
Formica glacialis (Wheeler)	3	3	1					2	9
F. lasioides (Emery)†						1			1

TABLE 1. (*continued*)

	Natural				Anthropogenically Disturbed				
	Vegetated		Exposed		Vegetated		Exposed		
	Old-growth forest	Summit	Rock outcrop (forest)	Field (mid-succession)	Grass (building)	Isolated forest	Parking lot gravel, sandy picnic area	Road-side	Total Number of Observations
F. neogagates (Emery)*	8	15	2	1					26
F. nepticula (Wheeler)*		2	1						3
F. nitidiventris (Emery)†						2	6	1	9
F. subaenescens (Emery)*	7								7
F. aserva (Wheeler)†							3	2	5
F. subsericea (Say)		1			1	2	3		7
Lasius alienus (Foerster)*	9	5				1			15
L. nearcticus (Wheeler)*	12		1						13
L. neoniger (Emery)†						2	2	6	10
L. niger (Linnaeus)†								3	3
L. pallitarsis (Provancher)†						2	1		3
L. umbratus (Nylander)	2		1			2	1		6
Total observations	125	59	14	6	3	44	21	27	299
Number of species per habitat	22	14	11	3	3	21	9	10	

sition forests (Table 1). Of this total, 10 species were most commonly collected (i.e., occurred >90% of the sampling observations) in disturbed habitat (disturbance specialists), 14 species could be considered specialists in natural habitat (>90% of observations in natural habitats), and 16 are considered habitat generalists, being found frequently in both natural and disturbed habitat (Table 1). Five of the 10 disturbance specialists (*Leptothorax ambiguus* (Emery), *Solenopsis molesta* (Say), *Formica lasioides* (Emery), *Lasius niger* (L.), and *L. pallitarsis* (Provancher)) were sampled three or less times during the course of the study (Table 1). We believe this represents true rarity rather than collection bias as most of these species were readily detected, being found in epigeous habitat. Only *Ponera pennsylvanica* (Buckley), *S. molesta* and *F. lasioides*, might have been overlooked in nearby primary forest due to being found only under rocks and under litter at the soil surface.

Discussion

At first glance, ant species richness at Mont St. Hilaire—a forest reserve of limited area—is exceptionally high. Surveys of natural and disturbed biotopes in the much larger areas of Châteauguay and Huntington municipal counties in Québec just south of Montréal yielded 48 species (A. Francoeur, unpublished data), 81% of which exist at Mont St. Hilaire. However, when considering that only 30 of Mont St. Hilaire's 40 species were found in natural habitats, diversity "within" the interior of the reserve is not higher than within other similar forests. For example, Letendre et al. (1971) found 29 species (22 of which occur at Mont St. Hilaire), in post-fire Paper Birch (*Betula papyrifera*), poplar (*Populus* sp.) and Sugar Maple forest at the Université de Montréal field station (9 km^2), 80 km northwest of Montréal.

Two of the disturbance specialists are considered introduced. The presence of *Lasius niger* (L.) represents a significant extension to its range as it is known as a west coast species (Wilson 1955). While collections within the city of Montréal suggest that this species is established in the region, additional collecting may help determine if *L. niger* is introduced from the west or occupies an undocumented larger range. *Tetramorium caespitum* (L.), a globally distributed tramp species native to Europe (Bolton 1979), was found only along roadsides leading to the park's main entrance. Because the other eight disturbance specialists are native to the nearctic region, their historical presence or absence at Mont St. Hilaire is unknown. It is apparent, however, that within habitat modified by humans these ant species presently exhibit increased abundance relative to natural areas such that within the protected reserve human activity has altered ant community structure.

Anthropogenically disturbed and fragmented habitat becomes increasingly vulnerable to the establishment of introduced ant species (Tschinkel 1988; Suarez et al. 1998). Human traffic could potentially serve as a vector for further ant introductions in the reserve's disturbed areas that represent a small percentage of Mont St. Hilaire's total area, but already house a large number of unique species—nearly as many as natural areas. Although Québec presently lacks the most notorious invasive species that are ravaging the native ant faunas of other regions (Francoeur 2000; Holway et al. 2002), the introduction of any species should be closely monitored in reserves that are amongst the last remnants of their habitat type. While further research will be necessary to determine the nature of interactions between disturbance and natural specialists, we believe that the reserve's old-growth forest ant fauna should be considered as a community marked by scattered disturbance subpopulations. More generally, these findings illustrate the importance of clearly delineating natural from anthropogenically disturbed habitat when conducting biodiversity surveys within special reserves such as Mont St. Hilaire.

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