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Brief comparison between the Diptera fauna at a native forest edge and at a nearby house backyard, in Wellington, New Zealand.

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Abstract

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The New Zealand environment underwent extensive anthropogenic environmental change. Although habitat modification is a known factor leading to the displacement or elimination of indigenous species, many invertebrates may be able to exploit anthropic environments. In this short investigation we compared the Diptera fauna collected in adult traps set c. 150 m apart, at the edge of native forest and at a house yard. Considerably more specimens and species were collected in the native forest, and there was some indication of shift in species assemblage in the yard. However, despite the clearance of native forest to give way to settlements, the fauna in the anthropic habitat was still made up mostly of indigenous species.

Additional key words: biodiversity, exotic, indigenous, light traps, urban

Resumen

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El entorno natural de Nueva Zelanda ha sufrido extensos cambios ambientales antropogénicos. Aunque la modificación del hábitat es un factor conocido en el desplazamiento o eliminación de especies autóctonas, muchos invertebrados pueden ser capaces de explotar ambientes antrópicos. En esta corta investigación se comparó la fauna de dípteros adultos colectados en trampas colocadas a 150 m unas de otras, en el borde de un bosque nativo y en el patio de una casa. Se colectaron considerablemente más ejemplares y especies en el bosque nativo, y se detectaron algunos indicios de cambio en las composición de especies en el patio. Sin embargo, a pesar de la eliminación del bosque nativo para dar paso a los asentamientos, la fauna en el hábitat antrópico todavía está principalmente compuesta por especies autóctonas.

Palabras clave adicionales: autóctonas, biodiversidad, exóticas, trampas de luz, urbano.

Introduction

The New Zealand environment has suffered dramatic changes since the arrival of humans c.800 years ago (Higham et al. 1999; McGlone and Wilmshurst 1999; Derraik and Slaney 2007). According to some estimates native forests and woodlands for instance, have been reduced from approximately 78% to 23% of the country's land area (King 1990). Most of the mid-altitudes and lowlands are now free hold land (Derraik et al. 2001), as they have the greatest agricultural value and, as a result, are often highly modified (Watt 1979).

Such modified habitats may still harbour high biodiversity, particularly amongst the invertebrate fauna (e.g. Crisp et al. 1998). In New Zealand, Young & Mitchell (1994) and Davies-Colley et al. (2000) suggested that 50 m and 40 m wide respectively, edge buffer zones are necessary for the conservation of indigenous species. Disturbed forest edge habitats not only have a considerably different microclimate to the forest interior, but they also function as staging areas which can facilitate the invasion of the surrounding landscape by exotic species (Center et al. 1995). In this short investigation we aimed to obtain an insight into the assemblages of adult Diptera species from two disturbed habitats: the edge of a native forest and a nearby house backyard.

Materials and Methods

Sampling was carried out in late summer 2002 in two different sites in the suburb of Wilton, Wellington City, New Zealand (lat 41°16'S, long 174°45'E). Adult Diptera were sampled at two localities: c.5 to 10 m from the edge of forest at Otari-Wilton's Bush (a 90 ha urban native coniferous-broadleaved forest), and c.150 m away in the front and back yards of a house.

Two CO_2-baited light traps were set overnight at each site, being placed against tree trunks for shade and protection. Sampling was carried out over three nights, under dry and relatively windless conditions, as insect catches by adult traps decrease with rainfall and increasing wind speed (Strickman et al. 1995; Southwood and Henderson 2000). Traps were set up approximately one hour before sunset and collected approximately one hour after sunrise. Note that the type of traps adopted aimed to target in particular the Culicidae fauna as part of a larger research project into the ecology of mosquitoes in New Zealand (Derraik 2006).

Specimens were identified using a range of taxonomic guides, viz Marshall (1896), Edwards (1923), Tonnoir and Edwards (1927), and McAlpine et al. (1981). Names of taxa and their ranks were brought up to date following Evenhuis (1989). Some identifications were conservative due to damaged specimens and consequent loss of key characters. Note that we have used Matile (1989) in recognising the Keroplatidae as a family separate from the Sciaridae, although some authors do not agree (e.g. Vockeroth 1981).

Non-metric multidimensional scaling (MDS) ordinations (based on Bray-Curtis dissimilarity measures) were carried out using PRIMER-E (Plymouth Marine Laboratory, UK) to compare the assemblages of taxa between the two disturbed habitats (forest edge and backyard), and were run from 30 random restarts. One-way analyses of similarities (ANOSIM) were used to test whether the taxon assemblages were statistically different from each other. It should be highlighted that the R statistic given by ANOSIM provides a useful comparative measure of the degree of separation of sites, and according to Clarke and Warwick (2001) the value of the R statistic is as important as its statistical significance if not more so. Note that if $R = 1$, within-site replicates are significantly more similar to each other in comparison to any replicates from other sites (Clarke and Warwick 2001).

Results

The 12 traps yielded a total of 102 adult Diptera specimens, which equated to 8 different families (Cecidomyiidae, Chironomidae, Chloropidae, Culicidae, Keroplatidae, Mycetophilidae, Stratiomyidae and Tipulidae),

Table 1. List of adult Diptera recorded in CO_2-baited light traps set overnight at a native forest edge and at a nearby house backyard, in Wellington. Note that n = 6 for each site. Species origins are indicated by nat (native) and exo (exotic). The numbers of specimens collected for each species are indicated, with the value in brackets indicating the number of traps in which a particular taxon was recorded if it happened more than once.

Family	Species	Origin	Native Forest Edge	Backyard
Cecidomyiidae	*Campylomyza* sp.	nat?	5 (2)	2
	Diadiplosis/Zeuxdiplosis sp.	?	34 (2)	4 (3)
Chironomidae	*Chironomus zealandicus* Hudson	nat	2	-
	?*Harrisius pallidus* Freeman	nat	2 (2)	-
	damaged	?	1	-
Chloropidae	*Aphanotrigonum* nr. *huttoni* Malloch	nat	-	1
Culicidae	*Culex (Culex) pervigilans* Bergroth	nat	1 (1)	-
	Aedes (Finlaya) notoscriptus Skuse	exo	3 (2)	1 (2)
Keroplatidae	*Chiasmoneura (Prochiasmoneura) fenestrata* Edwards	nat	3	-
	Macrocera unipunctata Tonnoir	nat	1	-
Mycetophilidae	*Mycetophila* ?*grandis* Tonnoir	nat	1	-
	Mycetophila ?*fagi* Marshall	nat	1	-
Stratiomyidae	*Exaireta spinigera* Wiedemann	exo?	-	1
Tipulidae	*Amphineurus horni* Edwards	nat	2 (2)	-
	Amphineurus ?*hudsoni* Edwards	nat	8 (3)	-
	Anisopus notatus Hutton	nat	2	-
	Dicranomyia sp.	?	-	3
	Limonia (Zelandoglochina) nr. *flavidipennis* Edwards	nat	16 (5)	3
	?*Gynoplistia sp.*	?	1	-
	Limnophilella ?*delicatula* Hudson	nat	1	-
	Leptotarsus (Chlorotipula) nr. *holochlorus* Nowicki	nat	-	1
	Molophilus (Molophilus) nr. *infantulus* Edwards	nat	1	-
	Molophilus ?*variegatus* Edwards	nat	3 (2)	-
	Dolichopeza ?*parvicauda* Edwards	nat	2	-

and approximately 23 taxa (Table 1). Out of the total number of specimens 85% (87) were collected at the forest edge with the remaining 15% (15) recorded at the house backyard. Three families (Chironomidae, Keroplastidae and Mycetophilidae) and 15 taxa were only found at the native forest edge, while two families (Chloropidae and Stratiomyidae) and four taxa were restricted in this study to the house yard (Table 1).

The MDS ordination gave an indication that the taxon assemblages between the two sites were indeed distinct (Figure 1). The samples taken at that native forest edge were clearly clustered together, while all but one of the samples recorded at the house yard were scattered away from the above cluster (Figure 1). The ANOSIM provided however, a low global R (0.144), and also a non-significant result with $P = 0.071$, which would indicate nearly similar taxon assemblages between the two habitats.

Discussion

Based on the considerably richer taxa recorded at the forest edge (Table 1) and the likely distinct assemblage of taxa between the two habitats (Figure 1), there was indication that the edge

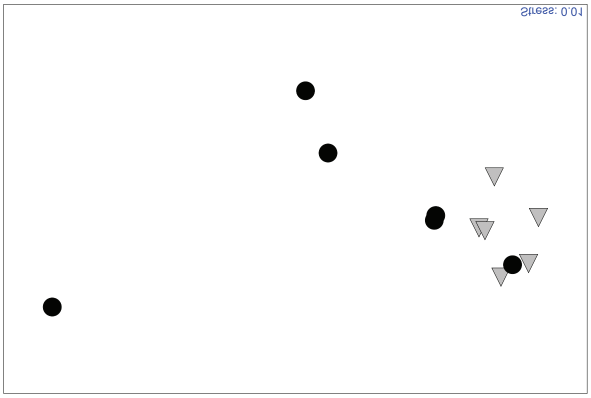

Figure 1. Two-dimensional MDS ordination for the taxon assemblages recorded at a native forest edge (gray triangles) and at a nearby house backyard (black circles).

of the native forest was a considerably more favourable habitat for indigenous invertebrates. Note that the non-significant result and low R from the ANOSIM were a likely result of the low replication and, most importantly, of the species-poor samples with many rare taxa. The numerous rare taxa meant that within-site samples tended to be as different from each other as they were to those in the other site.

The relatively high indigenous taxon diversity at the forest edge, even though expected, was a relevant finding as the edge habitat in question was highly modified with a very open understorey, and composed mostly of adult trees with numerous walking tracks through it. This highlights that even highly disturbed native habitats can still harbour numerous native dipteran species, and probably other invertebrate groups as well, which seems to imply the importance of urban fragments of native forest habitats for invertebrate biodiversity. Moreover, the overall presence of some native dipterans in the open and highly disturbed habitat at the house backyard indicate that many indigenous invertebrates are resilient and capable of exploiting the new habitats created by anthropogenic environmental change.

It should also be highlighted that there are considerable taxonomic impediments for New Zealand Diptera, which meant that many of the identifications here and in a previous related study were indicative (Heath and Derraik 2005). The New Zealand Diptera fauna is not only incompletely known, but there is also a lack of up-to-date revisions for many groups (Macfarlane and Andrew 2000).

Considerably more research is needed before we can adequately understand the patterns of invertebrate biodiversity in urban habitats in New Zealand. It has been suggested that even highly fragmented and disturbed patches of native habitat may be of particular relevance for biodiversity protection, particularly in lowlands and urban environments where pristine habitats are scarce (Crisp et al. 1998; Derraik et al. 2005). This study, although brief, seems to add further evidence to support the above hypothesis.

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