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Cover photograph –Barn Owl (*Tyto alba*) at Owl's Hole Pit Cave courtesy of Elyse Vogeli

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LIGHT TRAP COLLECTIONS OF THE XYLOPHULIOUS DIPTERA ON GUANA CAY, ABACO, BAHAMAS

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ABSTRACT

The proposed development project for the northern end of Guana Cay included the preparation of an integrated pest management plan. To fulfill a part of this requirement CDC light traps were places at five locations to capture pest and nuisance insect species. The study focuses on the guild of wood-loving diptera distributed over the predominantly broad leaf evergreen formations on the Cay. Other habitat areas include the coastal and inland mangroves and the anthropogenically modified *Casuarina* stands. Collections from the light traps yielded insects from 7 orders and 29 families. Dipterans constituted the majority (48%) of families collected. The Sciaridae was the dominant family with an average of 11.72 individuals per trap, Culicidae next with 7.34 individuals and Cecidomyiidae with 4.94 individuals. The guild association of the Diptera can be used to develop baseline information on habitat types and to show changes with alteration of the habitats by anthropogenic and natural processes.

INTRODUCTION

Xilophilous Diptera include those species of flies that have their larval stages associated with wet and sodden wood. Fungal mycelia present in wood soften the tissues and allow insect larvae to enter, typically the nematocerans which are numerically dominated by the Cecidomyiidae (gall midges), Sciaridae (black fungus gnats), Ceratopogonidae (biting midges), and Chironomidae (midges) (Krivosheina 2006). Eventually the wood becomes soft, fragmented and incorporated into the humus of the soil. Macroinvertebrates such as insect larvae, influence decomposition by changing the abundance of micro-decomposers (Lawrence and Wise, 2000). The full process is poorly understood and may take several decades (Brown 2005).

Dipterans (true flies) are among the most numerous of insects – they rank in the top three worldwide along with the Coleoptera and Hymenoptera (Triplehorn and Johnson 2005). True flies are widely distributed in many habitat types and play a significant role in food webs and nutrient cycling (Keiper *et al* 2002). Unfortunately, the flies are possibly the least studied of the megadiverse groups of insects. Among the difficulties cited are the cryptic nature of the developing stages and general taxonomic impediment. (Keiper *et al* 2002). Gibbs (2006) laments this obscurity and cites the example of the Tachinidae, that the second-largest family of flies which is commonly encountered and equal in species richness to birds but does not even have a common name by which it is known to the public.

There are generally more species of flies in the tropics than in the temperate regions and the New World tropics appear to be the most diverse of all, similar to the diversity patterns of birds and butterflies. In respect of their taxonomy, Sciaridae is probably the least studied of the large Nematoceran families and which might include 20 000 undescribed species in addition to 1700 described ones (Brown 2005 & Menzel *et al* 2006). Families such as Culcidae, Cecidomyiidae and Tephritidae are among the most well know Dipterous families with pest species

The focus of this study was to collect information on the pest and vector species on Guana Cay and to ultimately develop an integrated pest management program. The use of light traps to collect these pests and vector species yielded significant numbers of non-target groups. The scope of the study was extended to include all the other dipterans collected and to use this information to decipher ecological relationships between these families. This project describes the composition of the xylophilous dipteran guild and makes predictions on changes in the guild structure due to the impending habitat modifications. Xilophilous Diptera represent a guild in the sense of Simberloff and Dayan (1991) of sympatric species using a shared resource.

Site Description

Guana Cay is seven miles long and is the longest and largest Cay associated with Abaco in the northern Bahamas. It lies on the eastern side of Abaco and is fringed by a large barrier reef which extends out

into the Atlantic Ocean. The dominant vegetation type (62%) at Guana Cay is the broadleaf evergreen community (coppice) (Figure 1). The other vegetation types present are *Casuarina* stands (anthropogenetically modified areas), coastal mangroves and creeks, and wetlands and coastal vegetation. (EIA – Guana Cay, 2005). The substrate type of the coppice vegetation include a layer of humus or sand over a rocky limestone substrate (EIA – Guana Cay, 2005).

METHODS AND MATERIALS

Five locations were monitored on a weekly basis using the CDC miniature light trap. The traps were located at the following sites. (Figure 2):

1. Locker room tent
2. Guana Seaside Village
3. Native nursery
4. Mangrove Preserve
5. Lot #94

Insect were collected from the traps and placed in labeled bottles and sent to the College of the Bahamas to be identified. All specimens were identified to family.

RESULTS

A total of 13 dipterous families were collected, 69% were from the Suborder Nematocera and accounted for 94% of individuals. The suborder Brachycera was represented by 31% of families and only 6% of individuals. The Nematocera are recognized as a paraphyletic group out of which the Brachycera arose. The Sciaridae had the largest number of individuals and averaged 11.7 individuals per trap. (Table 1.).

The results confirm that the Sciaridae are among the most abundant diptera in wooded areas (Krivosheina 2006). Other families use sodden wood to a much lesser extent such as mosquito larvae (Culicidae) in water logged tree holes, while others such as the Chironomids have developing stages in deeper water. Monthly collections of individuals showed fluctuations with a least 5 families represented each month. (Figure 3).

Although the habitats in which the light traps were placed had different vegetation types there were no significant differences among the numbers of individuals collected from the various families. (Kruscal Wallis test, H=4.44; p=0.35). (Figure 4).

Family	Total No. individuals	Mean number individuals/ trap
Scaridae	586	11.72
Culicidae	367	7.34
Cecidomyiidae	247	4.94
Chironomidae	75	1.50
Psychodidae	62	1.24
Muscidae *	35	0.70
Tephritidae*	34	0.68
Ceratopogonidae	16	0.32
Tipulidae	16	0.32
Tachinidae*	12	0.24
Caliphoridae*	1	0.02
Mycetophilidae	1	0.02
Ptychopteridae	1	0.02

Table 1. Abundance of dipterous families in study site, Guana Cay. * Suborder Brachycera

Figure 5 shows the rainfall data from the Bahamas collected between 1935 and 1975 (Bosart and Schwartz 1979) superimposed on the abundance data for 4 families. The amount of rainfall will have a direct influence on sodden wood. Despite the incomplete data set there was no obvious synchrony between abundance levels and rainfall.

Mosquitoes (Culicidae) are the most abundant pest family collected. Identification of specimens show the presence of floodwater species *Ochlerotatus taeniorhynchus (Aedes taeniorhynchus)* and *Deinocerites cancer.*

DISCUSSION

The Sciaridae is the most abundant family in the study area. This conclusion is in agreement with the studies mentioned in the introduction. This little studied family was most abundant at 3 of the 5 sampling sites. There was a uniform composition of abundances for families at each study site, despite the differences in habitat types.

Sites had varying degrees of "wetness" as indicated by the large numbers of crabhole and flood water mosquitoes. However, this level of wetness did

not directly influence the abundance of the different families of Diptera collected. The larvae of *Ctenosciara hawaiiensis* were found to be very susceptible to drowning and the species showed preference for particular tree species and stage of decomposition of fallen trees. (Stephan (1972). These species specific preferences and other factors such as drift and migration were not taken in to account in analyzing the composition and abundances at the various light trapping sites.

The impending change in the study site will reduce much of the existing vegetation and in most cases the entire guild structure will disappear. However, the wetter mangrove sites will remain and continuous monitoring will indicate the process of succession in this guild.

ACKNOWLEDGMENTS

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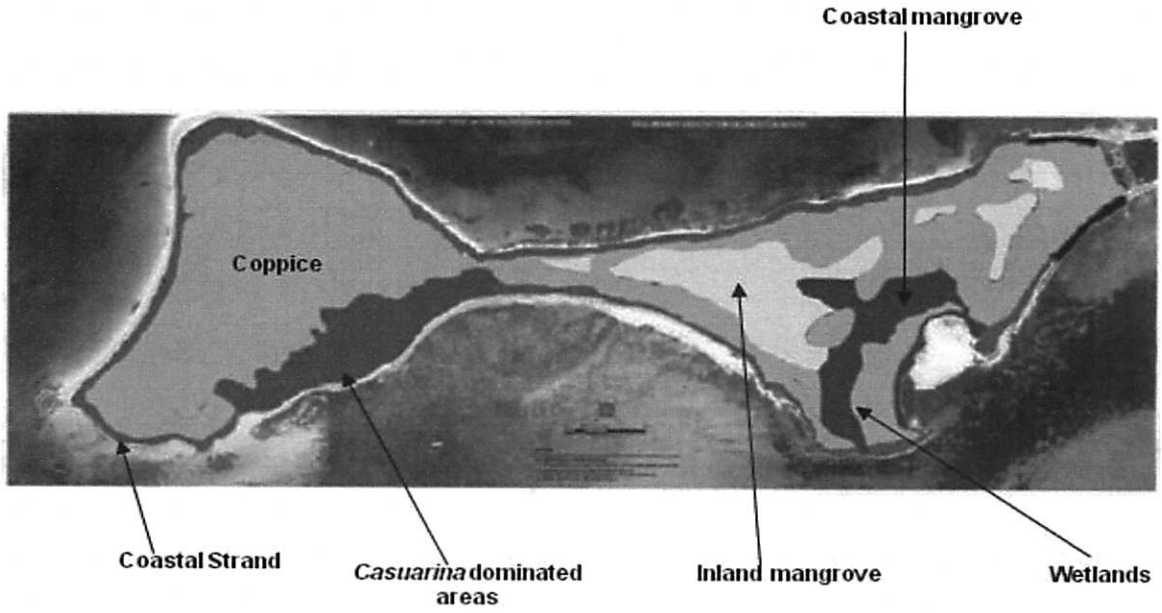

Figure 1. Vegetation types on Guana Cay

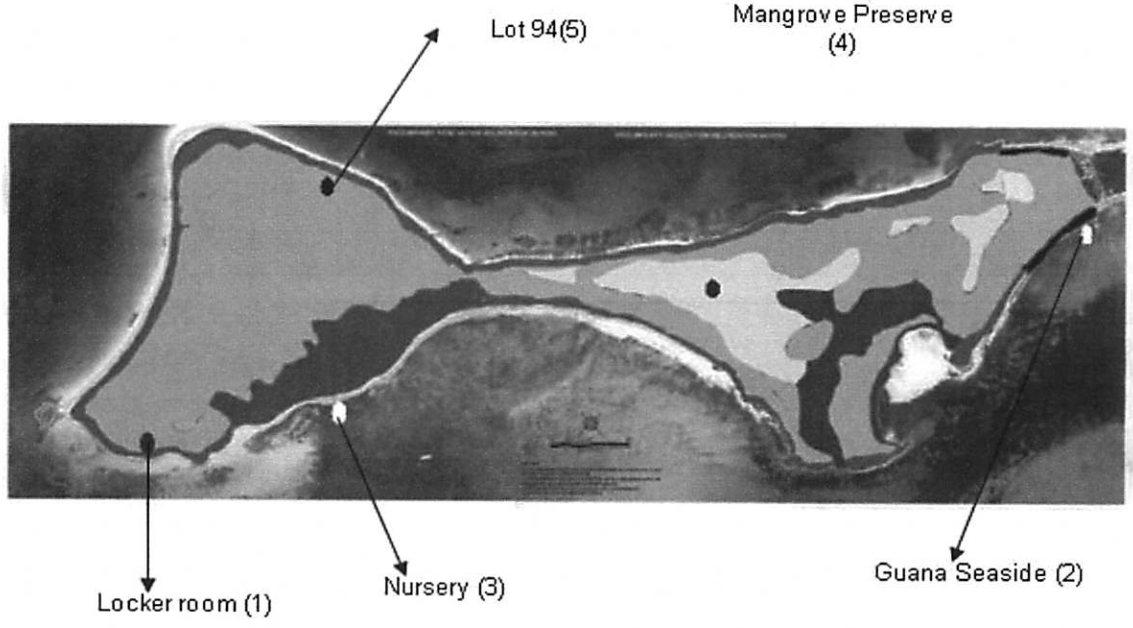

Figure 2. Light trap sites on Guana Cay

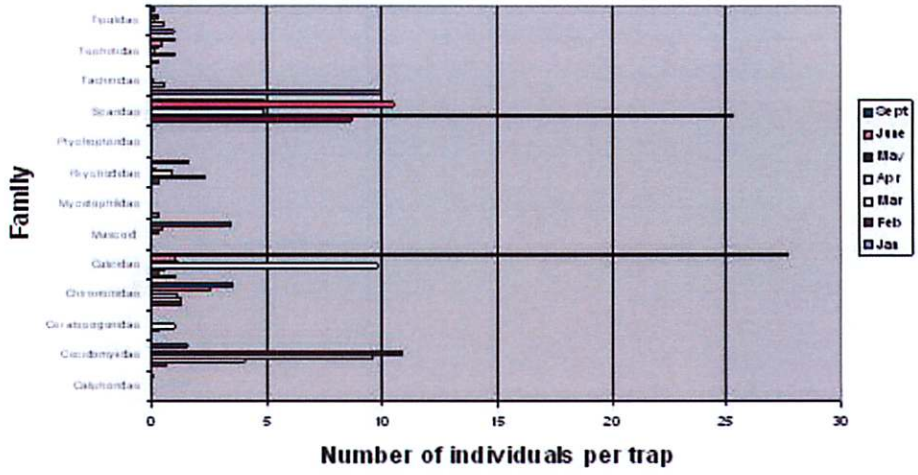

Figure 3. Abundance levels at light trap sites

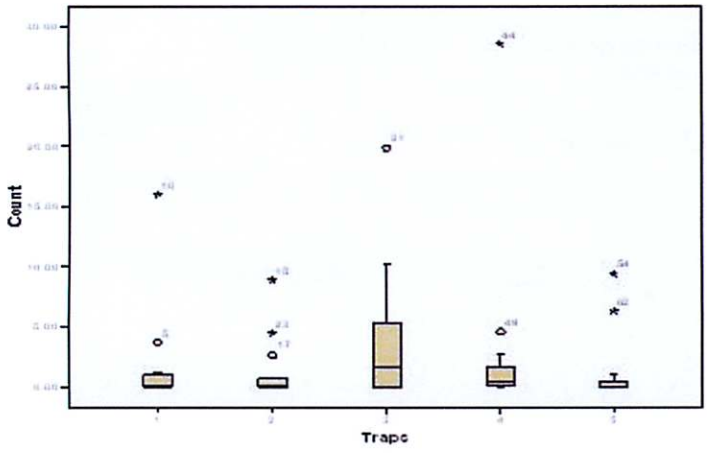

Figure 4. Number of Diptera collected at different light trap sites.

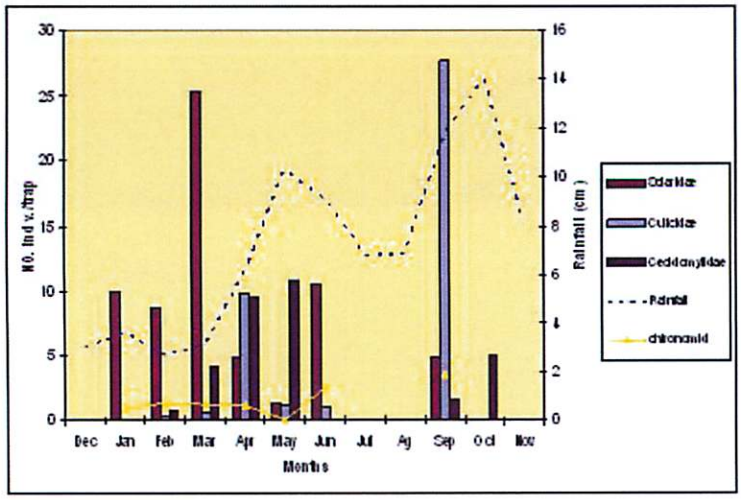

Figure 5. The relationship between rainfall and dipteran abundance