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POLLINATION NETWORKS- WHAT'S THE BUZZ? A PRELIMINARY STUDY OF COASTAL COMMUNITY POLLINATION DYNAMICS ON SAN SALVADOR ISLAND, THE BAHAMAS

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ABSTRACT

Coastal ecosystems are dynamic systems, sculpted by wind and water. The importance of coastal conservation is well recognized, particularly in light of increased pressure by anthropogenic use and sea level rise due to climate change. Further, climatologists predict an increase in the frequency and intensity of tropical storms and hurricanes. While these storms are natural disturbance events common in The Bahamas, little is known of how increased storm frequency and intensity will affect the natural cycle of disturbance and recovery in coastal ecosystems.

The purpose of this preliminary study is to describe plant-pollinator interactions in four coastal plant communities: sand strand, *Coccothrinax*-shrub, shrub-thicket, and thicket-coppice. These communities form a successional series on San Salvador Island, The Bahamas. The data will be used in the future to construct pollination networks for each community type. Pollination networks describe the direct and indirect interactions between plant species and animal pollinators. An understanding of the dynamics of pollination networks is necessary for successful conservation efforts in coastal ecosystems because most plant species in these systems rely on animal pollinators for reproductive success.

Here we describe the plant and animal species that appeared to be most important on San Salvador Island in July and December 2010. For this preliminary study, the relative importance of plant and pollinator species is determined by the number of interaction partners and whether they were active during both July and December.

INTRODUCTION

Coastal ecosystems have great ecological and economic importance because they provide significant ecosystems services; they stabilize coastal sediments (Kumara et al. 2010, Laurance et al. 2011) and build dunes (Miller et al. 2010), buffer adjacent inland communities against storm surge (Gedan et al. 2011, Miller et al. 2010, Krauss et al. 2009) and act as nurseries for marine fishes (Barbier et al. 2011; Beck et al. 2001). Further, coastal ecosystems are dynamic systems vulnerable to a number of anthropogenic and natural disturbances, including human economic development (Dahdouh-Guebas et al. 2004, Ellison and Farnsworth 1996), sea level rise associated with climate change (Krauss et al. 2010, Kumara et al. 2010), and hurricanes (Tanner et al. 1991, Rathcke 2000, Rathcke 2001, Franklin et al. 2006, Middleton 2009, Smith et al. 2009, Landry 2011), as well as interactions between disturbance types (e.g. sea level rise and hurricanes, Ross et al. 2009; sea level rise and agriculture, Eslami-Andargoli et al. 2010). This study is warranted because investigation of the reproductive ecology of organisms in coastal communities, including the effects of disturbance on pollination mutualisms (Ashman et al. 2004, Benedek et al. 2007, Horvitz et al. 2010), is critical for successful conservation, restoration, or mitigation efforts (Kearns et al. 1998).

For animal-pollinated plants, an understanding of the dynamics of pollination networks is necessary for successful conservation, restoration, or mitigation efforts. Pollination networks describe the direct interactions between plants and pollinators found in a particular location (Bascompte et al. 2003). Many plant species rely on animal pollinators for successful reproduction, and the lack of consistent pollination services from these animals can result in reduced seed production (Waser 1978, Campbell 1987, Harder and Barrett 1996, Jurgens et al. 2009). If pollination services are reduced for a prolonged period, then plant species that rely exclusively on animal pollinators may gradually disappear from that community. Further, many pollinator species in the tropics and sub-tropics are active year-round residents, but few plant species provide year-round floral resources. This means that each pollinator species uses different plant species depending on the time of year, so plant species can be indirectly connected to one another through shared pollinators (Waser and Real 1979, Lazaro et al. 2009).

The Bahama archipelago is an ideal location for ecological studies of pollination networks. Each island is a complete system that contains a subset of the species found among all the islands in the archipelago, which allows for comparisons based on the species composition of networks in addition to network size comparisons. Most plant species in The Bahamas are animal-pollinated, and many have generalist flowers that are visited by a number of pollinator species. However, some plant species have flowers specialized for a subset of pollinators, so it is possible to investigate the indirect interactions between specialist and generalist plants. In addition, non-native plant species have invaded native plant communities on some islands but not others, which allows for comparisons between pollination networks with and without invasive species. Coastal ecosystems on Bahamian islands include a number of community types, but not all community types are found at every location. Therefore, it is also possible to investigate the effect of indirect, pollinator-mediated, interactions between plants in different communities.

The purpose of this preliminary study is to describe plant-pollinator interactions that occur in four coastal plant communities on San Salvador Island, The Bahamas, specifically sand-strand, *Coccothrinax*-shrub, shrub-thicket, and thicket-coppice communities. These communities form a coastal ecosystem successional series, from the early-successional sand-strand community to the late-successional thicket-coppice community. Our characterization of the plant assemblages found in coastal ecosystems differs from that of Smith (1993) in three ways: 1) several species assemblages that we term "communities" are described as "sub-communities" by Smith; 2) we use terms not used by Smith to describe mid- to late-successional communities in order to emphasize differences in vertical structure of the communities; and 3) in the sand-strand community, Smith places emphasis on one species, *Uniola paniculata* (sea oats), which is not present in all communities. Here we use the term "plant community" to describe discrete assemblages of interactive plant species that occur within the successional series, which is appropriate in systems that are strongly influenced by disturbance (*sensu* Franklin and Steadman 2010). These data will be used in the future to construct pollination networks for each community, which will provide a framework for testing hypotheses concerning the maintenance of biodiversity, competition for pollinators between co-flowering plant species, and facilitation between co-flowering and sequentially flowering plants that share pollinators.

METHODS

This preliminary study was conducted during two time intervals in 2010 (July 18-27, Landry and Finkle; and December 2-10, Landry, Elliott, and Kass), at five locations on San Salvador Island, The Bahamas: East Beach, Grahams Harbour, Grotto Beach, Rocky Point, and Sandy Hook (Figure 1). At these locations, work was performed in four different plant communities:

sand-strand, *Coccothrinax*-shrub, shrub-thicket, and thicket-coppice (see Table 1 for community types found at each location). To describe the web of interactions within each community, we identified all animal-pollinated plant species in flower during the July and December time intervals, and observed, recorded, and identified all their floral visitors. A subset of insect visitors was collected and is housed at the Gerace Research Centre's insect collection, located in the Repository. All observations were made between 8 am and 6 pm.

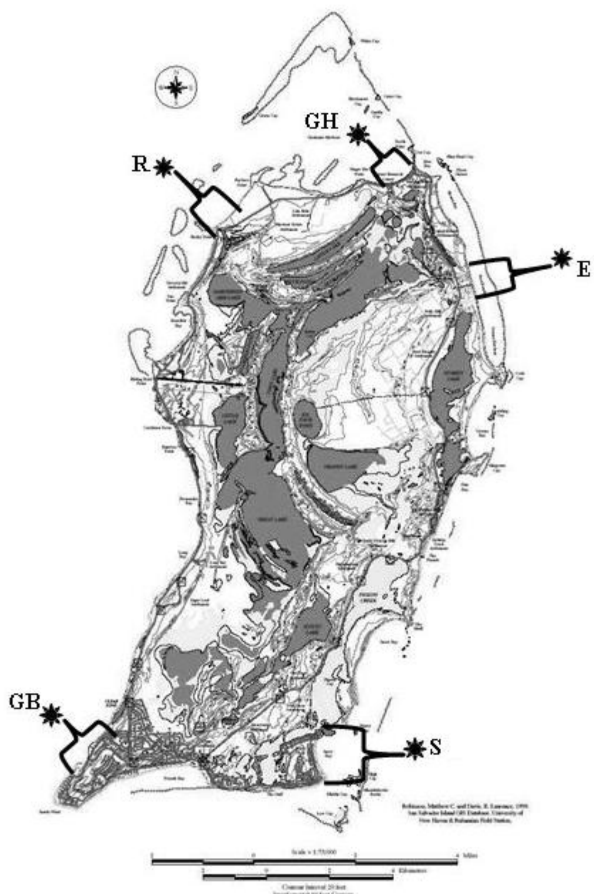

Figure 1. Map of San Salvador Island, Bahamas, with study locations indicated. Location codes: GH = Grahams Harbour; E = East Beach; S = Sandy Hook; GB = Grotto Beach; and R = Rocky Point. Image modified from Robinson and Davis 1999.

Plant identifications were confirmed using Kass (2009), Correll and Correll (1982), or Smith (1993). Insect identifications were confirmed directly by Elliott, by comparison of insects to previously identified specimens held in the Gerace Research Centre's Repository, or by using Elliott et al. (2009).

RESULTS

Each plant species was found in one to three community types at one to four localities on San Salvador Island (Table 1). Twenty-one plant species were flowering at one or more location during July, while 29 species were in flower during December; of these, 12 species were in flower during both time periods. Eleven species were found in flower at the same locations during July and December; only one species (*Croton linearis*) was not flowering at the same location during both time periods.

In July, we observed 103 floral visitors representing at least 19 animal species (Table 2a), although some individuals may have made multiple visits to the same plants. In December, 490 floral visitors were observed, representing at least 33 animal species (Table 2b); again, some individuals may have visited the same plants multiple times. Only plant species that received floral visitors during our observations are included on the visitor tables (Table 2a-b). Most animal visitors were insects, primarily hymenopterans and lepidopterans, although one Bahama woodstar and one bananaquit were observed at Sandy Hook in July, and several bananaquits were observed at Grotto Beach in December. In July, insects from at least 14 families in four orders were observed probing flowers, representing at least one family of beetles (Coleoptera), three families of flies (Diptera), five families of bees and wasps (Hymenoptera), and five families of butterflies and moths (Lepidoptera). In December, insects from at least 15 families in three orders were observed probing flowers, representing at least two families of flies (Diptera), seven families of bees and wasps (Hymenoptera), and six families of butterflies and moths (Lepidoptera).

DISCUSSION

In general, fewer plant species were in flower during late July relative to early December (Table 1), and fewer floral visitors were observed in July relative to December as well (Table 2a-b). Based on these preliminary data, a number of plant and animal species appear to be important to the pollination dynamics of these communities. *Erithalis diffusa* and *Croton discolor* were both flowering during July and December at multiple locations. *Erithalis diffusa* attracted seven floral visitor species in July and 12 in December, with only one animal species (*Ligyra cereberus*) visiting *E. diffusa* flowers during both time intervals. *Croton discolor* attracted eight floral visitor species in July and seven in December, again with one animal species (*Megachile poeyi*) observed on *C. discolor* flowers during both time intervals. Two other plant species attracted at least six floral visitor species in July, *Cordia bahamensis* and *Erithalis fruticosa*. The flowers of five additional plant species attracted more than 10 animal species in December: *Cakile lanceolata*, *Cynanchum bahamense*, *Ernodea littoralis*, *Lantana involucrate*, and *Pithecellobium keyense*.

Xylocopa cubaecola was observed visiting flowers in both July and December; individuals were observed visiting four different plant species in July and six species in December. The only plant species visited by *X. cubaecola* during both time intervals was *Scaevola taccada*. *Oxacis* beetles were seen visiting the flowers of five different plant species in July. Six additional insect species were observed visiting the flowers of five or more plant species in December: *Agraulis vanillae*, *Campsomeris trifasciata*, *Leptotes cassius*, *Megachile poeyi*, *Stictia signata*, and *Strymon acis*.

These preliminary data, in combination with additional data collected in the future, will serve as a basis for the construction of pollination networks in coastal plant communities on San Salvador Island. The use of complex networks to describe interactions within communities is a relatively recent practice in ecology that has provided considerable insight into the overall structure of interactions in communities (see Vazquez et al. 2009 for review). The value of a complex networks approach is that emergent patterns in the structure of the system *as a whole* can be identified, and this provides a framework for testing hypotheses concerning the maintenance of biodiversity (Bascompte et al. 2003, Bascompte and Jordano 2007). This approach has been particularly useful in the study of mutually beneficial interactions between species. Although mutualist interactions are ubiquitous and of great importance to community dynamics, most studies examine the interactions in terms of natural history, which emphasize the specific details of one or possibly both interacting partners (Bronstein 1994), and do not explicitly address indirect effects on the community as a whole (Jordano 1987) or interactions with adjacent communities. Understanding the indirect interactions that occur through shared mutualist partners is critical to understanding how species assemblages within communities evolve and are maintained (Thompson 1994, Vazquez et al. 2009).

In addition to the mutualisms inherent to pollination networks, two general types of interactions are important, competition and facilitation. Competition for pollination services between co-flowering species can reduce fruit and seed set for one or more of the competing species (Waser 1978, Campbell 1987, Harder and Barrett 1996, Jurgens et al. 2009). Competition can also reduce plant fitness in self-compatible species that are capable of self-pollination, if selfing reduces seedling success due to inbreeding depression (Landry and Rathcke 2007, Bellusci et al. 2009, Gargano et al. 2009). Alternatively, co-flowering plant species in a community can facilitate one another, if the increase in floral density results in increased pollinator density, which can lead to an increase in fruit and seed set (Rathcke 1983, Hegland et al. 2009). Further, pollinators that are active year round require plants that flower sequentially; therefore, a set of sequentially flowering plant species can facilitate one another by providing floral resources to shared pollinators at different times of the year (Waser and Real 1979, Lazaro et al. 2009). The data collected during this preliminary study provide a framework for investigating potential competitive and facilitative interactions between plants and animals in this system.

Given the importance of coastal plant communities (Miller et al. 2010), the diversity of mutualist interactions (Bronstein 1994), variation in the strength of those interactions (Boscompte et al. 2006), the insular nature of island systems (MacArthur and Wilson 1967), and changes in the strength and direction of interactions in stochastic environments (Ashman et al. 2004, Horvitz et al. 2010), additional studies to determine the effects of direct and indirect interactions on pollination networks within coastal plant communities are warranted.

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Table 1. Phenological data for plants flowering in July and/or December 2010 at each of five locations on San Salvador Island, and the communities at each location within which the plants were observed. Location codes: GH = Grahams Harbour; E = East Beach; S = Sandy Hook; GB = Grotto Beach; and R = Rocky Point.

Family	Species	Location / Time period observed in flower										Community Type			
		GH		E		S		GB		R					
		Jul	Dec	Jul	Dec	Jul	Dec	Jul	Dec	Jul	Dec	Sand-strand	*Coccothrinax*-shrub	Shrub-thicket	Thicket-coppice
Aizoaceae															
	Sesuvium portulacastrum (L.) L.					X						S	-	-	-
Apocynaceae															
	Echites umbellata Jacq.					X						-	-	S	S
	Pentalinon luteum (L.) B.F. Hansen and Wunderlin	X				X						-	S	GH S	-
Asclepiadaceae															
	Cynanchum bahamense (Griseb.) Gillis						X		X		X	-	S GB R	S GB	-
Asteraceae															
	Bidens alba DC.		X						X			-	GB	GH	-
	Borrichia arborescens (L.) DC.	X										GH	-	-	-
	Gundlachia corymbosa (Urb.) Britt.		X				X					-	S	GH S	-
	Wedelia bahamensis (Britt.) Schulz ex Urb.				X							-	-	E	E
Boraginaceae															
	Bourreria baccata Raf.					X	X					-	-	S	S
	Cordia bahamensis Urb.					X	X					-	-	-	S
	Tournefortia gnaphalodes (L.) R. Br. Ex Roem and Schult.	X	X		X							GH E	-	-	-
Brassicaceae															
	Cakile lanceolata (Willd.) O.E. Schutz			X	X		X					E S	-	-	-
Convolvulaceae															
	Merremia dissecta (Jacq.) Hall. f.				X							-	-	E	-
	Jacquemontia cayensis Britt.						X		X		X	-	S GB R	S	-
Euphorbiaceae															
	Croton discolor Willd.					X		X				-	GB	S	S
	Croton linearis Jacq.	X			X							-	-	GH E	E

Fabaceae														
Calliandra haemotoma (Brit.) Benth.								X			-	-	GB	-
Canavalia rosea (Sw.) DC.				X		X					E	S	-	-
Chamaecrista lineata (Sw.) Green	X	X			X	X			X	X	-	S R	GH	-
Leucena leucocephala (Lam.) de Wit.		X									-	-	GH	-
Pithecellobium keyense Britt.Ex Britt.and Rose		X									-	-	GH	-
Stylosanthes hamata (L.) Taub				X							-	-	E	-
Goodeneaceae														
Scaevola plumieri (L.) Vahl	X				X		X		X		GH S GB R	-	-	-
Scaevola taccada (Gaertn.) Roxb.					X		X				S GB	-	S	-
Malvaceae/Tiliaceae														
Corchorus hirsutus L.		X		X							-	-	GH E	-
Passifloraceae														
Passiflora cupraea L.					X						-		S	-
Passiflora pectinata Griseb.					X						-	S	S	-
Rubiaceae														
Casasia clusiifolia (Jacq.) Urb.	X				X	X			X		-	R	GH S	-
Erithalis diffusa Correll	X	X			X	X	X	X	X	X	GH	S GB R	GH	-
Erithalis fruticosa L.					X	X	X	X		X	-	S GB R	S GB	-
Ernodea littoralis Sw.		X				X		X		X	-	S GB R	GH S	-
Solanaceae														
Solanum bahamense L.					X	X	X	X			-	S GB	S	-
Sterculiaceae														
Melochia tomentosa L.				X							-	-	E	E
Waltheria bahamensis Britt.		X		X							-	-	GH E S	-
Surianaceae														
Suriana maritima L.		X									GH	-	-	-
Turneraceae														
Turnera ulmifolia L.	X	X		X	X	X	X	X			-	S GB	GH E S GB	-
Verbenaceae														
Lantana involucrate L.		X		X	X	X		X	X	X	-	S GB R	GH E S GB	-
Stachytarpheta jamaicense L.				X							-	-	E S	-

Table 2. Number of animals recorded visiting plants in flower at five locations on San Salvador Island during a) July and b) December, 2010. Location codes: GH = Grahams Harbour; E = East Beach; S = Sandy Hook; GB = Grotto Beach; and R = Rocky Point. Tentative = identification is pending. An asterisk (*) indicates that the observed visitor could not be identified further because key characteristics were not seen.

a.

			Plant Species visited														
Location code	Visitor Species	Order Family	Bourreria baccata	Cakile lanceolata	Chamaecrista lineata	Cordia bahamensis	Croton discolor	Erithalis diffusa	Erithalis fruticosa	Gundlachia corymbosa	Lantana involucrata	Passiflora cupraea	Passiflora pectinata	Scaevola plumieri	Scaevola taccada	Solanum bahamense	Turnera ulmifolia
E	Lepidoptera																
E	Hesperiidae	unidentified species*		1													
GB	Coleoptera																
GB	Oedemeridae	*Oxacis* sp. (tentative)					2	2	1								
GB	unknown*	unidentified species*					1										
GB	Diptera																
GB	Bombyliidae	*Chrysanthrax macropennis*							1								
GB	Bombyliidae	*Ligyra cereberus*					2	1									
GB	Bombyliidae	*Poecilanthrax lucifer*							1								
GB	Sarcophagidae	unidentified species*				1											
GB	Syrphidae	unidentified species*					1	1									
GB	unknown*	unidentified species*					1		1								
GB	Hymenoptera																
GB	Tiphiidae	*Myzinum apicale*						1	11								
GB	Lepidoptera																
GB	Heliconiidae	*Agraulis vanillae*															1
GB	Lycaenidae	*Leptotes cassius*															1
GB	Nymphalidae	*Euptoieta hegesia*					1										1
GB	Pierdiae	*Kricogonia lyside*						1	1								
GB	Pieridae	*Phoebis agarithe*															1
GH	Diptera																
GH	Bombyliidae	*Poecilanthrax lucifer*						1									
GH	Syrphidae	unidentified species*						2									

Location code	Visitor Species	Order Family	Bourreria baccata	Cakile lanceolata	Chamaecrista lineata	Cordia bahamensis	Croton discolor	Erithalis diffusa	Erithalis fruticosa	Gundlachia corymbosa	Lantana involucrata	Passiflora cupraea	Passiflora pectinata	Scaevola plumieri	Scaevola taccada	Solanum bahamense	Turnera ulmifolia
GH	Lepidoptera																
GH	unknown*	unidentified species*												1			
R	Coleoptera																
R	Oedemeridae	*Oxacis* sp. (tentative)			3			23			1						
R	Diptera																
R	Bombyliidae	*Ligyra cereberus*						2									
R	Bombyliidae	unidentified species*						1									
R	Syrphidae	unidentified species*			1												
R	Hymenoptera																
R	Apidae	*Centris versicolor*			5												
S	Apodiformes																
S	Trochilidae	*Calliphlox evelynae*										1					
S	Passeriformes																
S	Emberizidae	*Coereba flaveola*	1														
S	Diptera																
S	Bombyliidae	*Ligyra cereberus*						1									
S	Bombyliidae	*Poecilanthrax lucifer*				1											
S	Syrphidae	unidentified species*				1											
S	unknown*	unidentified species*				1											
S	Hymenoptera																
S	Apidae	*Centris versicolor*			2											2	
S	Apidae	*Xylocopa cubaecola*				2							1		1	6	
S	Megachilidae	*Coelioxys* sp.					2										
S	Megachilidae	*Megachile poeyi*					1										
S	Sphecidae	*Stictia signata*				2											
S	Vespidae	*Polistes bahamensis*								1							
S	Lepidoptera																
S	unknown*	unidentified species*				1											

b.

Location code	Visitor Species	Order Family	Bidens alba	Bourreria baccata	Cakile lanceolata	Calliandra haemotoma	Canavalia rosea	Casasia clusiifolia	Corchorus hirsutus	Croton discolor	Croton linearis	Cynanchum bahamense
			Plant Species visited									
E	Diptera											
E	unknown*	unidentified species*			2							
E	Hymenoptera											
E	Halictidae	*Agapostemon columbi*			2							
E	Halictidae	*Dialictus* sp. (tentative)				1			2		1	
E	Megachilidae	*Megachile poeyi*			1				1			
E	Scoliidae	*Campsomeris trifasciata*			10							
E	Sphecidae	*Cerceris watlingensis*									1	
E	Sphecidae	*Stictia signata*			1							
E	unknown*	unidentified species*			4							
E	Lepidoptera											
E	Arctiidae	*Composia fidelissima*										
E	Arctiidae	*Eunomia latenigra*			3							
E	Heliconiidae	*Agraulis vanillae*			27							
E	Hesperiidae	*Hylephila phyleus*			9							
E	Lycaenidae	*Leptotes cassius*	1		4							
E	Lycaenidae	*Strymon acis*			9							
E	Nymphalidae	*Euptoieta hegesia*			2							
E	Pieridae	*Ascia monuste*			1							
E	Pieridae	*Eurema chamberlaini*										
GB	Passeriformes											
GB	Emberizidae	*Coereba flaveola*		1								
GB	Diptera											
GB	Bombyliidae	*Ligyra cereberus*										
GB	Syrphidae	*Ocyptamus* sp.										
GB	unknown*	unidentified species*										1
GB	Hymenoptera											
GB	Megachilidae	*Megachile bahamensis*										6
GB	Megachilidae	*Megachile poeyi*										19
GB	Scoliidae	*Campsomeris trifasciata*										2
GB	Vespidae	*Pachodynerus cubensis*										
GB	Vespidae	*Pachodynerus* sp.*				1						
GB	Vespidae	*Polistes bahamensis*										1
GB	unknown*	unidentified species*										
GB	Lepidoptera											
GB	Arctiidae	*Empyreuma heros*										1
GB	Heliconiidae	*Agraulis vanillae*										
GB	Lycaenidae	*Strymon acis*										
GB	Nymphalidae	*Euptoieta hegesia*										
GB	Pieridae	*Kricogonia lyside*										

Plant Species visited

Erithalis diffusa	Erithalis fruticosa	Ernodea littoralis	Gundlachia corymbosa	Jacquemontia cayensis	Lantana involucrata	Leucena leucocephala	Pithecellobium keyense	Scaevola taccada	Solanum bahamense	Stachytarpheta	Suriana maritima	Tournefortia gnaphalodes	Turnera ulmifolia	Waltheria bahamensis	Wedelia bahamensis
														1	
															1
												5			
										8		1			
															4
															1
															2
1		8													
1		2		1	1										
	1								2						
					1										
2	1	1		3	10										
		2													
		6													
		1			1										
		2													
1		1											1		
									1						
		1			2										
					1										

Location code	Visitor Species	Order Family	Bidens alba	Bourreria baccata	Cakile lanceolata	Calliandra haemotoma	Canavalia rosea	Casasia clusiifolia	Corchorus hirsutus	Croton discolor	Croton linearis	Cynanchum bahamense
			Plant Species visited									
GH	Diptera											
GH	Bombyliidae	*Ligyra cereberus*										
GH	Syrphidae	*Palpada albifrons*							1			
GH	unknown*	unidentified species*										
GH	Hymenoptera											
GH	Apidae	*Xylocopa cubaecola*										
GH	Halictidae	*Agapostemon columbi*							3			
GH	Halictidae	*Dialictus* sp. (tentative)										
GH	Megachilidae	*Megachile bahamensis*										
GH	Megachilidae	*Megachile poeyi*							1			
GH	Scoliidae	*Campsomeris trifasciata*							3			
GH	Sphecidae	*Stictia signata*										
GH	Tiphiidae	*Myzinum* sp.*										
GH	Lepidoptera											
GH	Arctiidae	*Composia fidelissima*										
GH	Arctiidae	*Empyreuma heros*										
GH	Heliconiidae	*Agraulis vanillae*										
GH	Hesperiidae	*Hylephila phyleus*										
GH	Lycaenidae	*Chlorostrymon* sp.										
GH	Lycaenidae	*Leptotes cassius*	1									
GH	Lycaenidae	*Strymon acis*	1									
GH	Nymphalidae	*Junonia genoveva*										
GH	Nymphalidae	*Memphis intermedea*										
GH	Pieridae	*Ascia monuste*	1									
GH	Pieridae	*Kricogonia lyside*										
GH	Pieridae	*Phoebis agarithe*										
R	Diptera											
R	Bombyliidae	*Chrysanthrax macropennis*										
R	Bombyliidae	*Ligyra cereberus*										
R	unknown*	unidentified species*										
R	Hymenoptera											
R	Megachilidae	*Megachile poeyi*										
R	Scoliidae	*Campsomeris trifasciata*										19
R	Sphecidae	*Cerceris watlingensis*										
R	Sphecidae	*Stictia signata*										1
R	unknown*	unidentified species*										1

Plant Species visited															
Erithalis diffusa	Erithalis fruticosa	Ermodea littoralis	Gundlachia corymbosa	Jacquemontia cayensis	Lantana involucrata	Leucena leucocephala	Pithecellobium keyense	Scaevola taccada	Solanum bahamense	Stachytarpheta	Suriana maritima	Tournefortia gnaphalodes	Turnera ulmifolia	Waltheria bahamensis	Wedelia bahamensis
		1													
						1									
2															
							3								
							1								
							1								
							2								
		2	1		1		6				1	2		2	
							3								
			2												
							3								
		1					15								
							1						3		
													1		
							1								
							5								
							1						1		
							1								
							2								
					1										
							1								
							2						1		
1															
2		1		1											
1															
2				3											
7				6	4										
				1											
1															

			Plant Species visited									
Location code	Visitor Species	Order Family	Bidens alba	Bourreria baccata	Cakile lanceolata	Calliandra haemotoma	Canavalia rosea	Casasia clusiifolia	Corchorus hirsutus	Croton discolor	Croton linearis	Cynanchum bahamense
S	Diptera											
S	Bombyliidae	*Ligyra cereberus*										
S	Bombyliidae	unidentified species*								1		
S	unknown*	unidentified species*										1
S	Hymenoptera											
S	Apidae	*Centris versicolor*										
S	Apidae	*Xylocopa cubaecola*		4			1					2
S	Halictidae	*Agapostemon columbi*							1			
S	Megachilidae	*Megachile poeyi*							1	26		5
S	Scoliidae	*Campsomeris trifasciata*		2				1				4
S	Sphecidae	*Cerceris watlingensis*										1
S	Sphecidae	*Stictia signata*								1		
S	Vespidae	*Pachodynerus cubensis*										
S	Vespidae	*Pachodynerus scrupeus*										
S	Vespidae	*Pachodynerus* sp.*								2		
S	Vespidae	*Polistes bahamensis*										
S	unknown*	unidentified species*										
S	Lepidoptera											
S	Arctiidae	*Composia fidelissima*										2
S	Heliconiidae	*Agraulis vanillae*		13						2		
S	Lycaenidae	*Leptotes cassius*								6		
S	Lycaenidae	*Strymon acis*								2		
S	Nymphalidae	*Euptoieta hegesia*										

Plant Species visited

Erithalis diffusa	Erithalis fruticosa	Ermodea littoralis	Gundlachia corymbosa	Jacquemontia cayensis	Lantana involucrata	Leucena leucocephala	Pithecellobium keyense	Scaevola taccada	Solanum bahamense	Stachytarpheta	Suriana maritima	Tournefortia gnaphalodes	Turnera ulmifolia	Waltheria bahamensis	Wedelia bahamensis
					3										
1															
					3			1							
								1							
		1						27							
	1			5	7										
1		4			2									5	
				2	6				1					3	
1		1													
		1													
					1										
		1			1										
					1										
					3										
2															
					1										