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DIFFERENCES IN FOOD AVAILABILITY FOR VENUS FLYTRAPS IN RESIDENT AND RESTORED POPULATIONS

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ABSTRACT: Expanding on a previous two-year study of resident and restored populations of Venus flytraps in Lewis Ocean Bay Heritage Preserve, the arthropod populations at resident and restored sites were sampled and compared to determine if there was a significant difference between them. Fourteen orders of invertebrates were collected from the sites, with the most numerous being Collembola (springtails) and Hymenoptera of the Family Formicidae (ants). There was no significant difference between the sample groups, though two of the traps from the restored sites were unusable. This study suggests that the arthropod population size and composition does not differ between the restored and resident Venus flytrap populations.

Introduction

The Venus flytrap (*Dionaea muscipula*) is a carnivorous plant endemic to the edges of Carolina bays within a small region of North and South Carolina (Luken, 2005a). This species has a unique feeding mechanism, whereby mechanical stimulation of trigger hairs located inside of the leaf-trap initiates a change in the shape of the leaf via pressure differentials between layers of leaf tissue, closing the trap in less than a tenth of a second (Volkov et al, 2009; Volkov et al., in press). The traps do not select for prey size or species,

and will indiscriminately capture any arthropod that triggers the hairs (Hutchens and Luken, 2009). The consumption of the captured arthropods yields valuable nitrogen, which allows the Venus flytrap to have a higher growth rate than other species in its boggy habitat (Schulze et al., 2000; Brewer et al., 2011).

The Venus flytrap's natural habitat is the ecotone that forms around Carolina Bays in a small coastal portion of the Carolinas (Luken, 2005a; Sharitz, 2003). These ecotones are areas of high species diversity, supporting fast-growing plants that can outcompete and smother the growth of Venus flytraps, if given a stable habitat (Laliberte et al., 2007, Kirkman and Sharitz 1994). Historically, the Venus flytrap's natural range was prone to large-scale wildfires that kept other plants from dominating, and provided a niche for the flytraps (Luken, 2005b).

Large-scale wildfires are now unfeasible for regular forest management due to the area's increasing development, so alternative means of disturbance are being tested. From 2003 to 2005, Luken experimented with restoring populations of Venus flytraps along power-line corridors through Lewis Ocean Bay Heritage Preserve (LHOBP). For the experiment, nine sites were selected adjacent to a power line. They were cleared by large mechanical mowers and had their root mats removed by hand in an attempt to create a stable seed bed. Venus flytraps were transplanted and seeded in these plots in June of 2003, with no other Venus flytraps observed prior to planting. However, suppressed flytraps within the seedbed emerged during the experiment. Plant size, size distribution and flowering percentage were compared to reference populations of resident flytraps in LOBHP. The results indicated that the restored populations had high survivorship and relatively high leaf number per plant compared to the resident populations, as well as higher flowering percentages (Luken,

2005b). However, another study found that just exposure to more light does not increase flytrap growth, flowering, or survivorship (Luken, 2007).Given this, it is possible that the size and composition of the arthropod populations in the aforementioned restored and resident flytrap populations could have affected the results found in the 2005 study.

In this study, I sought to determine the composition of the arthropod populations in the two flytrap populations and if there was a significant difference in their composition and size. I expected for the populations in the restored sites to have a larger size than the populations from the resident sites.

MATERIALS AND METHODS

Study and Sampling Area

The sampling of arthropods was conducted at eight sites at LOBHP. Four sites were located on patches previously cleared for research and maintained by Santee Cooper (Luken, 2005b), whereas the other four sites were resident populations of *D. muscipula*. Specimens were collected by using pitfall traps, made by embedding a plastic drinking cup into the soil, then filling the bottom fourth with water and adding a small amount of detergent to serve as a surfactant. Four traps were placed at each sampling site and were deployed for approximately 48 hours before retrieval, after which time the contents were passed through a 500µm sieve. All captured arthropods were preserved in 70% ethanol for later identification.

Sampling was conducted from August 14 to August 16; the weather was clear and the temperature stayed around 32°C. Two of the restored sites had been disturbed during the trapping, resulting in the complete loss of one trap at one site and the emptying of a trap at the other.

Identification and Data Analysis

All collected arthropods were examined, identified and tallied to at least Order, with insects and spiders being identified to Family whenever possible; Formicids were described to the Genus level. For data analysis the arthropods were kept at Order with the exception of Formicidae, due to their importance as a Venus flytrap food source (Hutchens and Luken, 2009). The two sample categories, resident and restored, had their arthropod populations compared using two-sample t-test assuming unequal variance, as did the populations of Formicidae and Collembola. The categories also had their percent composition of Arthropods collected compared.

RESULTS

The fourteen working traps from the restored flytrap populations yielded a total of 606 organisms, while the sixteen working traps in the resident flytrap populations yielded 505 organisms (Table 1).

	Restored		Resident	
Order	*n*	%	*n*	%
Coleoptera	8	1.32	10	1.98
Orthoptera	6	0.99	1	0.20
Hymenoptera (non-Formicid)	28	4.62	23	4.55
Formicidae	137	22.61	179	35.45
Araneae	26	4.29	30	5.94
Thysanura	1	0.17	2	0.40
Acari	32	5.28	46	9.11
Diptera	13	2.15	12	2.38
Hemiptera	35	5.78	11	2.18
Oligochaeta	2	0.33	1	0.20
Collembola	311	51.32	183	36.24
Diplopoda	2	0.33	0	0.00
Thysanoptera	5	0.83	3	0.59
Diplura	0	0.00	1	0.20
Lepidoptera	0	0.00	3	0.59
Total	606	100	505	100

Table 1.—Total organisms captured by Order for resident and restored sites, *n*, as well as the percent composition of each Order from the whole, %.

The orders represented are Coleoptera (beetles), Orthoptera (grasshoppers and crickets), Hymenoptera (wasps, bees and ants), Araneae (spiders), Thysanura (silverfish), Acari (mites and ticks), Diptera (flies), Hemiptera (leafhoppers, aphids), Oligochaeta (earthworms), Collembola (springtails), Diplopoda (millipedes), Thysanoptera (thrips), Diplura and Lepidoptera (moths and butterflies). Of these Orders those with the highest percent composition for the restored populations' Arthropods were Collembola (51.32%),

Formicidae (22.61%), Hemiptera (5.78%), Acari (5.28%), non-Formicid Hymenoptera (4.62%) and Araneae (4.29%); the resident populations' most prevalent Orders were Collembola (36.24%), Formicidae (35.45%), Acari (9.11%), Araneae (5.94%), non-Formicid Hymenoptera (4.55%), and Diptera (2.38%) (Figure 1).

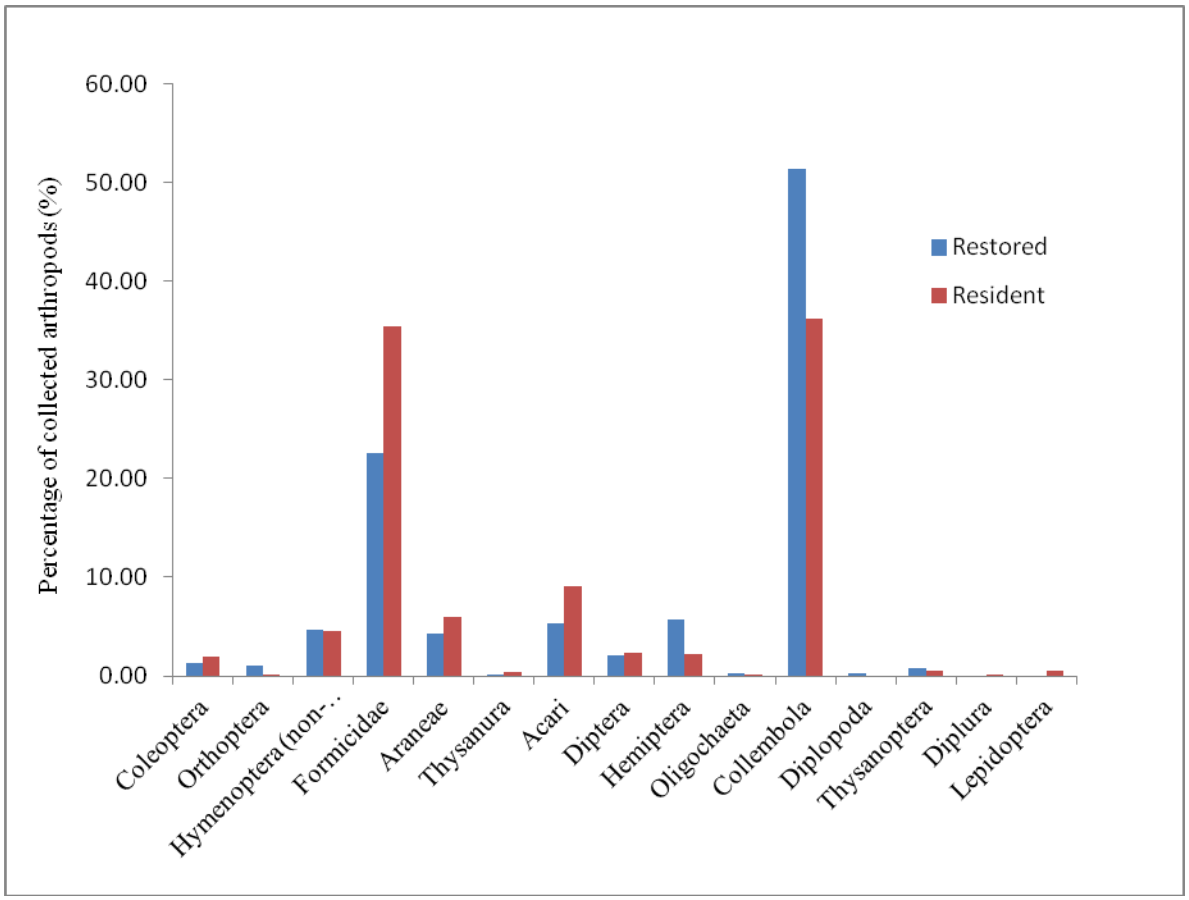

Figure 1.—Percentage of the total collected arthropods from the restored and resident sites for each Order.

When comparing the samples from resident Venus flytrap populations to those from the restored populations, it was found that there is no statistically significant difference between the two groups (df = 5, t Stat = 1.13401, P = 0.308215, t Crit =2.570581). There was also no significant difference between the Formicidae populations (df = 4, t Stat = -

0.655025, P = 0.548208, t Crit = 2.776445) and no significant difference between the Collembola populations (df = 4, t Stat = 1.297638, P = 0.264187, t Crit = 2.776445)

Discussion

My results did not support my hypothesis that there would be a significant difference in the size and composition of the arthropod populations from the restored and resident Venus flytrap populations. The differences in the total populations of Collembola and Formicidae between the restored and resident populations can be attributed to individual sample sites which contained numbers arthropods from a single Order much higher than the other sites.

Considering effect of forest management practices on soil arthropod populations and composition the lack of a significant difference in the arthropod populations between the sites is not unusual; many of the sites, both resident and restored, had been disturbed within the past few years in the same manner, different disturbance types encouraging different arthropod populations (Greenberg and McGrane, 1996). The high proportion of Formicidae relative to most other Orders is possibly due to the early stages of ecological succession that the flytrap prefers also being one that Formicids thrive in (Gómez et al, 2003; Luken 2005b) Also given the prevalence of Araneae as a flytrap food source it is almost unusual how absent they are from the samples, though the lack of thick ground cover is one potential reason for their relative scarcity (Hutchens and Luken, 2009; Costello and Daane, 1998)

The loss of the two traps from the two restored has skewed the data by reducing the total of the arthropods captured for the restored cites, though to what extent is unknown as even if there was a significant number of arthropods within those two traps they might not

have been enough to make any of the differences between the groups significant. Though this study suggests that there is no significant difference between the two groups, more data is required before a more concrete assessment can be made of the differences between the two populations.

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