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Research Article

Preliminary Study of Pan Trapping in Longleaf Pine Flatwoods in Central Florida, USA

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Abstract: It is well documented that pan trap color greatly influences arthropod catch composition. Additionally, it has been demonstrated that pan trapping catch varies with habitat. The goal of this study is to present preliminary data on pan trap yield from an imperiled ecosystem marked by high rates of endemicity, longleaf pine flatwoods. Yellow, blue, and white pan traps were evaluated in a section of longleaf pine flatwoods in June 2017 in central Florida, USA. A total of 360 arthropod specimens representing nine taxonomic orders were recovered, with 117 individuals from yellow traps, 125 from blue, and 118 from white. Contrary to previously published data from various ecosystems, yellow pan traps yielded a catch composed primarily of Diptera (57.3%), while blue and white pan traps had nearly equal abundances of Diptera and Hymenoptera (34.4% and 36.8%; 35.6% and 32.2%, respectively). All colors yielded an appreciable amount of Psocoptera. Bray-Curtis similarity analysis suggests that the blue and white traps are most similar in catch composition and both distinct from yellow pan trap data. Our data present interesting discrepancies with previous studies and add to the scant data available for pan trap use in longleaf pine flatwoods.

Key Words: pollinators, color, biodiversity, pan trapping, arthropoda

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Introduction

Pan trapping is an inexpensive, passive, and unbiased arthropod capture technique used to sample flower-visiting (anthophilic) arthropods (Vrdoljak and Samways 2011). The method has seen a recent surge in use with increased interest in pollinator monitoring (Campbell and Hanula 2007; Roulston et al. 2007). For this reason, the vast majority of studies have focused on bees (Hymenoptera: Apoidea) (e.g., Leong and Thorp 1999; Bartholomew and Prowell 2005; Toler et al. 2005; Roulston et al. 2007; Gonçalves and Oliveira 2013). Few studies have evaluated pan trap yield in a broad sense, tending instead to focus on particular taxa.

In addition, some ecosystems are severely underrepresented in terms of pan trapping data, and it has been demonstrated that pan trap yield varies significantly with habitat type (Saunders and Luck 2013). For example, very little information is available regarding pan trapping in longleaf pine flatwoods, a rare ecosystem marked by high rates of endemicity (Noss et al.1995). This southeastern Coastal Plain ecosystem has seen a decline of 97% from its original range, with less than 1.2 million ha remaining (Outcalt and Sheffield 1996). Noss et al. (1995) ranked longleaf pine forests the third most endangered ecosystem in the United States, making it a priority for biodiversity monitoring. Therefore, the goal of this study is to present preliminary data on pan trap yield and composition from longleaf pine flatwoods.

Materials and Methods

A 90-meter transect with a haphazardly selected origin was laid in a stretch of semi-managed longleaf pine flatwoods in central Florida, USA (28°36'12.1"N, 81°11'37.3"W). Thirty 17.74 cl (6 oz.) plastic bowls were placed at 3-meter intervals along the transect. Following an established protocol (e.g. see Bartholomew and Prowell 2005), one third of the bowls were painted with Ace Hardware™ brand fluorescent yellow paint, a third with Ace Hardware™ brand fluorescent blue paint, and a third were unpainted and remained white. Traps were placed in an alternating white-blue-yellow pattern and above ground rather than in the ground to avoid incidental pitfall captures. Each trap contained a solution of tap water and unscented Dawn® dish detergent to a depth of approximately 3 cm. Pans were placed at 0630 and recovered at 1500 on 24 June 2017, and replaced with newly mixed soapy solution on 25 June 2017 for a second round of sampling. Weather conditions each day were sunny, humid (≈85%), and warm (24°C to 33°C).

Samples were isolated using a fine-mesh metal sieve and stored in 70% ethanol. Specimens were identified to taxonomic order and deposited in the University of Central Florida Collection of Arthropods (UCFC). To compare taxa caught in different colored pan traps, catch data were pooled by trap color and subjected to cluster analysis using Bray-Curtis dissimilarity. Analysis was performed in the Vegan package (Dixon 2003) of R version 3.3.2 (R Development Core Team 2016).

Results and Discussion

In total, 360 arthropod individuals were collected: 117 from yellow, 125 from blue, and 118 from white. As expected, Hymenoptera and Diptera comprised the majority of arthropods caught. In terms of color-specific catch composition, Diptera constituted the bulk of yellow pan traps at 57.3%, followed by Hymenoptera at only 18.8%. In contrast, Diptera and Hymenoptera were approximately equally represented in blue traps (24.4% and 36.8%, respectively) and white traps (35.6% and 32.2%, respectively). A sizable portion of Psocoptera was present in each trap color (17.1%, 26.4%, and 16.9% for yellow, blue, and white, respectively) (Table 1).

Table 1. Number of individuals captured per taxonomic order for each pan trap color with respective percentage (%) in parentheses.

Order	**Yellow**	**Blue**	**White**
Hymenoptera	22 (18.8)	46 (36.8)	38 (32.2)
Diptera	67 (57.3)	43 (34.4)	42 (35.6)
Coleoptera	2 (1.7)	0 (0)	2 (1.7)
Araneae	1 (0.8)	2 (1.6)	4 (3.4)
Hemiptera	3 (2.7)	0 (0)	6 (5.1)
Psocoptera	20 (17.1)	33 (26.4)	20 (16.9)
Entomobryomorpha	1 (0.8)	1 (0.8)	4 (3.4)
Thysanoptera	0 (0)	0 (0)	2 (1.7)
Acari	1 (0.8)	0 (0)	0 (0)
Total	**117 (100)**	**125 (100)**	**118 (100)**

Cluster analysis grouped blue and white pan traps together, forming a distinct cluster apart from yellow traps (Fig 1). Blue and white trap catches were 85% similar while yellow was on average only 74% similar to either blue or white. The degree of similarity between trap colors are consistent with previous studies (e.g., Vrdoljak and Samways 2011) but differ in cluster organization. Whereas available data might predict that yellow pan traps would yield predominantly Hymenopteran insects (e.g., Toler et al. 2005), our data demonstrate that yellow pan traps in longleaf pine flatwoods are dominated by Diptera. Likewise, blue and white pan traps are generally thought to target Hymenopteran insects (Campbell and Hanula 2007; Krug and Alves-dos-Santos 2008) while our data suggest generally equal representations of flies and ants, bees, and wasps.

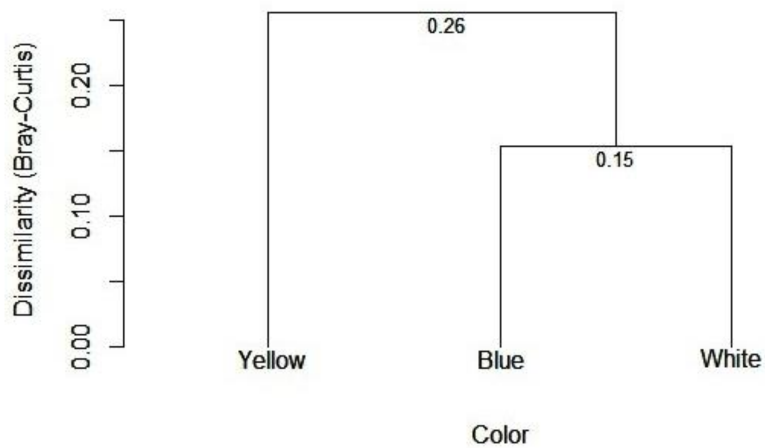

Figure 1. Cluster dendrogram based on catch composition of 30 pan traps from central Florida longleaf pine flatwoods, analyzed by pan trap color. Bray-Curtis dissimilarity is shown below each branch.

While preliminary, our data present interesting disparities from previous studies. In addition, the only previous study available in the literature that evaluated pan trap utility in longleaf pine forests was restricted to bees. Given the lack of relevant data from longleaf pine flatwoods and the knowledge that pan trap capture varies significantly between habitats (Saunders and Luck 2013), our broad evaluation of pan trap yield in longleaf pine flatwoods encourages future studies in this imperiled ecosystem.

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