Midsouth Entomologist **3**: 33–38
ISSN: 1936-6019
www.midsouthentomologist.org.msstate.edu

Report

Butterfly Nectar Plants at Big Oak Tree State Park and Towosaghy State Historic Site, Mississippi County, Missouri.

Fothergill, K. [1]* and A. Vaughn[2]

[1]Conservation Seeding and Restoration, Inc. 506 Center St. West, Kimberly, ID 83341
[2] Department of Natural Resources, P.O. Box 176, Jefferson City MO 65101

*Current Address: University of Missouri Delta Research Center, PO Box 160, Portageville, MO. 63873
kent@csr-inc.com

Received: 9-XI-2009 Accepted: 11-XI-2009

Introduction

Butterflies are charismatic conservation taxa for reasons of public interest (Pyle 1984, Fox et al. 2006), their role as bioindicators (Hammond and McCorkle 1984, New 1990, Thomas et al. 2004), pollination services (Ehrlich 2003), and prey for other species (Guppy and Shepard 2001). The US endangered species list (USFWS 2009) contains 26 butterflies and two moths—not because moths are in less need of conservation, but because public concern does not extend to what are often cryptic and nocturnal species. The foundation of insect conservation is a basic understanding of species occurrence, distribution, density, biology, and public outreach.

Caterpillars are often limited to a single host plant, but adult butterflies utilize a wide variety of plants as nectar sources. For many holometabolous insects, the quality and availability of nutrient resources during the adult stage correlates with fecundity, egg weight, and longevity (Boggs 1997, Mevi-Schütz and Erhardt 2002, O'Brien et al. 2004). Nectar, a primary nutrient source for adult Lepidoptera, varies by plant species in both its carbohydrate and constituent components which can affect fecundity (Romeis and Wäckers 2002). Therefore, nectar resources for adult Lepidoptera influence species occurrence, distribution, and density, thus nectar sources are an important component of butterfly conservation.

Large scale ditching projects and timber harvest over the past 100 years have severely impacted the natural resources of southeast Missouri. Once part of a greater landscape of cypress swamps, backwater sloughs, and mesic bottomland forest complexes, Big Oak Tree State Park is now a remnant of what once stretched for over 800,000 hectares in the Missouri Bootheel. In 2007, about 97,000 hectares of Mississippi County's 107,000 hectares (or 91%) of land area were devoted to soybean, corn, and sorghum production (NASS 2009, NACO 2005).

For these reasons, adult butterfly use of flowering plants was documented opportunistically during butterfly population sampling at two divergent landscapes within Mississippi County of the Missouri Bootheel: Big Oak Tree State Park and Towosaghy State Historic Site. Both sites are located at the tip of the ancient geologic landform called the Mississippi Embayment. Plant and animal species composition is more similar to the southeast US more than anywhere else in Missouri. Historically dominated by swamps and wet-mesic forest communities, southeast Missouri and southern Illinois represent the northern extension of many plant and animal species, some of which are of conservation concern in their respective states.

Materials and Methods

During 2007 butterflies were photographed opportunistically during butterfly surveys performed weekly between 1 April and 10 November with the goal of documenting butterfly-plant interactions. The surveys were designed to document species occurrence and population density. Butterflies were identified by utilizing field guides (Brock and Kaufman 2003, Covell 2005); names were standardized to the taxonomy of Pelham (2008). Plants were identified by using the key of Steyermark (1964) from fresh material or from photographs. All photographic documentation data were sent to Tim Smith for confirmation of plant identification. In order to be classified as nectaring, the photograph must show that the butterfly has its proboscis in or on the flower.

Site Descriptions. Big Oak Tree SP (BOT in Table 1) is 415 hectares that are managed as a nature preserve. Plant species such as *Asclepias perennis* Walter, *Clematis crispa* L., and *Trepocarpus aethusae* Nutt. Ex DC inhabit Big Oak Tree SP in a forest and woodland setting dominated by pin oak (*Quercus palustris* Müenchh.), bald cypress (*Taxodium distichum* L.), Shumard oak (*Q. shumardii* Buckl.), and hackberry (*Celtis laevigata* Willd.), the latter being a relict of fire suppression and altered hydrology. The park's altered hydrology proves the greatest threat to the health and sustainability of the resources. Major ditching projects in the 1950s successfully drained the last remaining swamp (labeled Grassy Pond in survey records) in the park's perimeter. A small, largely diminished shrub swamp remains on roughly 20 hectares, dominated by buttonbush (*Cephalanthus occidentalis* L.), black willow (*Salix nigra* Marsh.), and sedges such as *Carex grayi* Carey, *Carex lupulina* Muhl. Ex Willd., and *Carex tribuloides* Wahlenb. Less than 1 hectare of the park is regularly mowed and maintained for recreational use. These small areas support known populations of dandelion (*Taraxacum officinale* FH Wigg.) and clover (*Trifolium repens* L.).

Towosahgy SHS (TOW in Table 1) is roughly 10 km from Big Oak Tree SP, an archaeological site representing a Mississippian Mound Builder site built between 1400 and 900 BCE. The three-hectare site consists of an anthropogenic old field, previously managed as a grazing field from the late 1800s until 1976 when the state bought the site for its archaeological significance. Dominated by non-native fescue (*Festuca elatior* L.), Johnson grass (*Sorghum halepense* (L.) Pers.), and old-field associates such as *Apocynum cannabinum* L., *Verbesina helianthoides* Michx., and *Passiflora incarnata* L., the site is edged by a vegetative screening project including Eastern red cedar (*Juniperus virginiana* L.), red maple (*Acer rubrum* L.), and hackberry planted in the 1980s. A small stand of red maples grows in the historic borrow pit, a 0.2-hectare depression created when the original inhabitants excavated soil to create the large mounds. This area in particular holds water during the winter months.

Maintenance of Towosahgy SHS includes biannual mowing of the entire site and regular mowing of a 1-kilometer path leading directly to the base of the mounds. Non-native plants such as dandelion and clover colonize the mowed areas, while weedy annuals such as *Vernonia gigantea* (Walter) Trel. flourish in the unmowed portions of the site.

Results and Discussion

One hundred and sixteen photographic records document 36 species of Lepidoptera utilizing 22 plant species (Table 1) as nectar sources. Eleven plant families were represented by these 22 plant species. Of these species, nine (41%) were members of the Asteraceae, three (14%) were members of the Fabaceae, and two (9%) were of the Convulvaceae. The remaining eight (36%) families were each represented by a single species. Of the plant species visited, five (24%) were introduced to Missouri. The most visited plant species were introduced *T. repens* (n = 25) and *T. officinale* (n = 23). Introduced plant species accounted for 43% of all nectaring interactions documented (52 out of 120 nectaring incidents).

The 36 species of Lepidoptera were from seven families with Nymphalidae (n = 10), Hesperidae (n = 9), and Pieridae (n = 8) accounting for 75% of the species documented nectaring. The moth families Noctuidae and Yponomeutidae each had a single species documented nectaring. *Strymon melinus* (Hübner) and *Phyciodes tharos* (Drury) were both documented nectaring on 14 occasions on eight species of plants, *Eurytides marcellus* (Cramer) was documented nectaring on 11 occasion on five

species of plants. Together these three species of Lepidoptera comprised 35% of the total nectaring interactions documented.

These data show adult use of floral nectar resources by all families of butterfly and two moth families found in the study area and reinforce the importance of nectar resources for Lepidoptera. Introduced plants were heavily utilized, but no information on the quality and suitability of nectar, the frequency of use, or preference can be made because of the nature of these data. At certain times introduced plants might be the only nectar resource available, and the drought of 2007 (University of Missouri Extension 2008) kept many shrub swamp species from blooming at Big Oak Tree SP. All of the nectaring interactions documented at Towosaghy SHS were on introduced and weedy species, indicative of this site's past and current management. A similar study of butterfly nectar plants in sagebrush steppe habitats in south central Idaho found that introduced plant species were 20% of the plant species mix utilized by butterflies for nectaring (Fothergill and Levy-Boyd 2008). The non-native plant, *Dipsacus sylvestrus* Huds., was the most utilized nectar source during this Idaho study (Fothergill and Levy-Boyd 2008). In New York City urban parks, high use of non-native plants by adult Lepidoptera was observed (Giuliano et al. 2004) and in California, larval use of non-native plants by many butterfly species in urban settings is documented (Shapiro 2002). More research is required to understand the role of non-native plants fully. It is recommended that the replacement of non-native plants with similar native plants is encouraged to avoid unintended cascading effects.

While many of the species of plants that had nectaring associations were members of the Asteraceae, a wide variety of plant families with differing floral structures were utilized as nectar sources. From these data it appears that some Lepidopterans will utilize a wide variety of flowers as nectar sources.

The data presented here are a mere beginning of an understanding of the many interactions between Lepidoptera and plants in the Missouri Bootheel. Only documented Lepidoptera-plant interactions are reported within the tables, many more interactions remain to be documented. It is hoped that these data will inform land management decisions and that future studies will further increase our understanding of these interactions and their importance.

Acknowledgements

The authors would like to thank Tim Smith of Missouri Department of Conservation for his generous assistance.

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Table 1. Plant-butterfly interactions sorted by plant species with dates.

Plant Family	Plant Genus	Plant Species	First Date	Last Date	n	Park	Lepidoptera Genus	Lepidoptera Species
Apiaceae	*Torilis*	*arvensis*	4 Jun	-	1	BOT	*Danaus*	*plexippus*
Asclepiadaceae	*Asclepias*	*perennis*	5 Aug	-	1	BOT	*Phyciodes*	*tharos*
Asteraceae	*Bidens*	*discoidea*	30 Sep	-	1	BOT	*Phyciodes*	*tharos*
	Erigeron	*philadelphicus*	19 Apr	-	1	BOT	*Calycopis*	*cecrops*
			19 Apr	-	1	BOT	*Eurytides*	*marcellus*
			5 May	-	1	BOT	*Limenitis*	*archippus*
			22 Apr	-	1	BOT	*Phyciodes*	*tharos*
			19 Apr	-	1	BOT	*Strymon*	*melinus*
			5 May	-	1	BOT	Unknown	
	Packera	*glabella*	22 Apr	-	1	BOT	*Erynnis*	*horatius*
			20 Apr	-	1	BOT	*Eurytides*	*marcellus*
	Pluchea	*camphorata*	12 Sep	-	1	BOT	*Cupido*	*comyntas*
			12 Sep	-	1	BOT	*Epargyreus*	*clarus*
			12 Sep	-	1	BOT	*Phyciodes*	*tharos*
			12 Sep	-	1	BOT	*Strymon*	*melinus*
	Pyrrhopappus	*carolinianus*	30 Sep	-	1	BOT	*Lerema*	*accius*
	Solidago	*gigantea*	13 Sep	-	1	BOT	*Acontia*	*aprica*
			13 Sep	-	1	BOT	*Atteva*	*punctella*
			12 Sep	13 Sep	2	BOT	*Phyciodes*	*tharos*
			12 Sep	13 Sep	2	BOT	*Strymon*	*melinus*
	Symphyotrichum	*pilosum*	23 Sep	30 Sep	2	BOT	*Cupido*	*comyntas*
			30 Sep	-	1	BOT	*Euphyes*	*vestris*
			30 Sep	-	1	BOT	*Strymon*	*melinus*
		subulatum	10 Nov	-	1	BOT	*Colias*	*eurytheme*
			10 Nov	-	1	BOT	*Hylephila*	*phyleus*
			10 Nov	-	1	BOT	*Nathalis*	*iole*
			15 Oct	-	1	TOW	*Agraulis*	*vanillae*
			7 Oct	15 Oct	2	TOW	*Junonia*	*coenia*
			7 Oct	-	1	TOW	*Vanessa*	*cardui*
	Taraxacum	*officinale*	1 Apr	-	1	BOT	*Anthocharis*	*midea*
			4 Jun	27 Oct	2	BOT	*Colias*	*eurytheme*
			1 Apr	4 Jun	3	BOT	*Danaus*	*plexippus*
			1 Apr	-	1	BOT	*Erynnis*	*horatius*
			19 Apr	-	1	BOT	*Erynnis*	*juvenalis*
			1 Apr	22 Apr	3	BOT	*Eurytides*	*marcellus*
			27 Oct	-	1	BOT	*Nathalis*	*iole*
			1 Apr	-	1	BOT	*Papilio*	*glaucus*
			5 May	-	1	BOT	*Papilio*	*troilus*
			5 May	-	1	BOT	*Phoebis*	*sennae*
			1 Apr	-	1	BOT	*Poanes*	*zabulon*
			13 Jun	2 Jul	2	BOT	*Pontia*	*protodice*
			1 Apr	-	1	BOT	*Strymon*	*melinus*
			10 Nov	-	1	BOT	*Vanessa*	*cardui*
			27 Oct	-	1	TOW	*Hylephila*	*phyleus*

Table 1. Plant-butterfly interactions sorted by plant species with dates (continued).

Plant Family	Plant Genus	Plant Species	First Date	Last Date	n	Park	Lepidoptera Genus	Lepidoptera Species
Asteraceae	*Taraxacum*	*officinale*	10 Nov	-	1	TOW	*Nathalis*	*iole*
			10 Nov	-	1	TOW	*Pontia*	*protodice*
Convolvulaceae	*Ipomoea*	*lacunosa*	2 Sep	-	1	BOT	*Epargyreus*	*clarus*
			5 Aug	-	1	BOT	*Phoebis*	*sennae*
Cornaceae	*Cornus*	*foemina*	11 May	-	1	BOT	*Celastrina*	*neglecta*
Fabaceae	*Strophostyles*	*helvola*	13 Sep	-	1	BOT	*Ancyloxypha*	*numitor*
	Trifolium	*pratense*	7 Oct	-	1	TOW	*Agraulis*	*vanillae*
			27 Oct	-	1	TOW	*Colias*	*philodice*
		repens	5 May	-	1	BOT	*Amblyscirtes*	*aesculapius*
			14 May	-	1	BOT	*Atteva*	*punctella*
			5 May	4 Jun	2	BOT	*Celastrina*	*neglecta*
			4 Jun	-	1	BOT	*Cupido*	*comyntas*
			19 Apr	-	1	BOT	*Danaus*	*plexippus*
			19 Apr	4 Jun	3	BOT	*Epargyreus*	*clarus*
			4 Jun	-	1	BOT	*Erynnis*	*horatius*
			21 May	20 Jun	3	BOT	*Euphyes*	*vestris*
			4 Jun	-	1	BOT	*Euptoieta*	*claudia*
			19 Apr	2 Jul	5	BOT	*Eurytides*	*marcellus*
			5 Aug	-	1	BOT	*Nathalis*	*iole*
			6 Jun	-	1	BOT	*Papilio*	*glaucus*
			20 Apr	-	1	BOT	*Phyciodes*	*tharos*
			4 Jun	12 Sep	3	BOT	*Strymon*	*melinus*
Lamiaceae	*Lamium*	*amplexicaule*	10 Nov	-	1	TOW	*Colias*	*eurytheme*
Polygonaceae	*Polygonum*	*hydropiperoides*	23 Sep	7 Oct	2	BOT	*Calycopis*	*cecrops*
			2 Sep	-	1	BOT	*Celastrina*	*neglecta*
			5 Aug	-	1	BOT	*Euphyes*	*vestris*
			2 Sep	-	1	BOT	*Pyrisitia*	*lisa*
			2 Jul	-	1	BOT	*Lerema*	*accius*
			17 Sep	-	1	BOT	*Libytheana*	*carinenta*
			30 Sep	-	1	BOT	*Limenitis*	*arthemis*
			2 Sep	30 Sep	4	BOT	*Phyciodes*	*tharos*
			26 Aug	17 Sep	3	BOT	*Strymon*	*melinus*
Saururaceae	*Saururus*	*cernuus*	29 May	-	1	BOT	*Vanessa*	*atalanta*
Verbenaceae	*Phyla*	*lanceolata*	20 Jun	13 Sep	2	BOT	*Ancyloxypha*	*numitor*
			2 Jul	-	1	BOT	*Eurytides*	*marcellus*
			22 Jul	-	1	BOT	*Libytheana*	*carinenta*
			5 Aug	21 Aug	2	BOT	*Nathalis*	*iole*
			22 Jul	13 Sep	3	BOT	*Phyciodes*	*tharos*
			12 Sep	13 Sep	2	BOT	*Strymon*	*melinus*
Violaceae	*Viola*	*sororia*	12 Apr	-	1	BOT	*Danaus*	*plexippus*
			1 Apr	-	1	BOT	*Epargyreus*	*clarus*