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SHORT NOTE

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Neotropical**OBSERVATIONS OF BIRDS FEEDING ON THE FRUIT OF A SUCCESSIONAL TREE, *TOPOBEA MULTIFLORA*, IN SOUTHWESTERN COSTA RICA**William Haffey¹ · Michael De Lea² · Brian Walker³¹14 Watering Lane, Norwalk CT 06850, USA.²1 Grand Ave, San Luis Obispo CA 93407, USA.³Dept. of Biology, Fairfield University, 1073 N. Benson Rd, Fairfield CT 06824, USA.E-mail: William Haffey · wrhaffey@gmail.com, Brian Walker · bwalker@fairfield.edu

Abstract · We observed several individuals of a tropical fruiting tree, *Topobea multiflora* (Melastomataceae), to determine the diversity and prevalence of bird species that use this plant as a food source. Conducted on the south Pacific slope of Costa Rica, these observations are of interest because *T. multiflora*, though it grows in early successional habitat, attracts many bird species typically associated with mature forest. Most of these species are potential candidates for dispersing the small seeds of mature forest species as they leave the forest to feed on the fruit of *T. multiflora*. In this study, we recorded 477 observations of 24 species belonging to seven families feeding on *T. multiflora* fruit during ten count periods of observation. The family *Thraupidae* (tanagers) had both the highest proportion of feeding observations (65.8%) and the greatest diversity of all visiting taxa (13 species). The five species with the highest overall prevalence (prevalence >5%) were Silver-throated Tanager (*Tangara icterocephala*), Cherrie's Tanager (*Ramphocelus costaricensis*), Thick-billed Euphonia (*Euphonia laniirostris*), Common Bush-tanager (*Chlorospingus ophthalmicus*), and Bay-headed Tanager (*Tangara gyrola*). Our results suggest that several species of Neotropical frugivores, because of their relationship to *T. multiflora*, may be considered indicator species of ongoing forest regeneration in southwestern Costa Rica.

Resumen · Observaciones de especies de aves alimentándose de frutos de *Topobea multiflora* en el sudoeste de Costa Rica

Observamos varios ejemplares de árboles con frutos de la especie *Topobea multiflora* (Melastomataceae) para determinar la diversidad y prevalencia de las especies de aves que se alimentan de esta planta. Estas observaciones, realizadas en la pendiente sud-Pacífica de Costa Rica, son de interés ya que *T. multiflora*, si bien crece en hábitats con disturbio o en regeneración, atrae muchas especies generalmente asociadas a bosques maduros. La mayoría de estas especies son candidatos potenciales para la dispersión de semillas de especies de plantas de bosques maduros cuando se alejan del bosque para alimentarse de los frutos de *T. multiflora*. En este estudio, registramos 477 observaciones de alimentación de frutos de *T. multiflora*, correspondientes a 24 especies pertenecientes a siete familias. La familia *Thraupidae* (tangaras) presentó la mayor abundancia (341 observaciones) y la mayor riqueza de especies (13 especies). Las cinco especies con mayor prevalencia (> 5%) fueron: Tangara goliplateada (*Tangara icterocephala*), Tangara costarricense (*Ramphocelus costaricensis*), Eufonia piquigruesa (*Euphonia laniirostris*), Clorospingo común (*Chlorospingus ophthalmicus*) y Tangara cabecibaya (*Tangara gyrola*). Nuestros resultados sugieren que varias especies de aves frugívoras Neotropicales, debido a que frecuentan plantas de *T. multiflora*, podrían ser consideradas especies indicadoras de procesos de regeneración de bosques.

Key words: Costa Rica · Dispersal · Forest succession · Frugivory · Fruit consumption · *Thraupidae* · *Topobea multiflora***INTRODUCTION**

Many species of Neotropical birds are dependent on fruit as a regular source of food (Moermond & Denslow 1985). The interdependence of many avian frugivores and fruit-bearing plants can significantly influence the abundance and composition of bird (Loiselle & Blake 1991) and plant communities (Wheelwright et al. 1984) at a given location.

Avian frugivores are found throughout the Neotropics, but their greatest diversity occurs in regions of tropical lowland wet forests, coinciding with elevated fruiting tree diversity and abundance (Gill 2007). Although

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many frugivorous forest-dwelling bird species are restricted to undisturbed tracts of land, others are willing to make limited use of altered landscapes, including edge habitats and secondary growth (Stotz et al. 1996). Forest species use adjacent disturbed areas for a variety of reasons, including feeding in fruiting trees (da Silva et al. 1996 and Stotz et al. 1996). Some of these species, while more tolerant of disturbed habitat, nonetheless rely on nearby patches of mature forest for the vast majority of their life cycle (Stotz et al. 1996). As deforested, newly reforested, and pastured land remains prevalent in the region (Zahawi et al. 2015), it becomes increasingly important to pinpoint which bird species are able to successfully utilize this habitat mosaic.

The fruit of *Topobea multiflora* (family Melastomataceae), a species of tree found in disturbed and successional habitats, is both seasonally abundant and readily consumed by birds (Frank 2001). In the foothills of southwestern Costa Rica, this species is most common in a patchwork mosaic of mature secondary forest and early successional areas, preferring landscapes with sparse canopy cover (Boukili 2013). Because of its high fruit yield (Frank 2001) and widespread presence in patchily disturbed and successional areas, it is of value to know which bird species use it as a food source. Here, we present observations that preliminarily describe the diversity and prevalence of the bird species that feed on the fruit of *T. multiflora*, at two sites in Costa Rica.

MATERIALS AND METHODS

Study site. This research was conducted at two sites roughly 1.5 km apart near the town of San Vito, Costa Rica (8°50'24"N, 82°58'12"W), at an elevation of 1000–1100 m a.s.l. Historically (pre-1950), the study sites were covered with mature expanses of tropical pre-montane moist forest (Hartshorn 1983), but the current vegetation of the area is much more typical of cattle pastures and agricultural land (Juarez 1994). In several areas across the region, forest regeneration has begun, particularly under the auspices of the San Vito Bird Club and the Organization for Tropical Studies, most notably in areas close to Las Cruces Biological Station (8°47'7"N, 82°57'32"W). Prominent plant taxa near the study sites include members of the families *Melastomataceae*, *Laurentiae*, and *Urticaceae*. *Topobea multiflora*, a member of *Melastomataceae*, is particularly conspicuous, especially on gently sloping terrain with heavily vegetated understory and little to no canopy cover. This species, like many in *Melastomataceae*, produces many small (5–10 mm), pulpy, watery fruits during seasonal fruiting periods (Kessler-Rios & Kattan 2012). Small streams were found within 200 m of each site, as were larger stands of more mature forest that lacked *T. multiflora*. The foothills around San Vito are particularly rich in avian species, with over 400 species recorded at Las Cruces Biological Station (Zook et al. 1999).

Data collection. At each site, we located two groves (closely growing individuals isolated from other groves) of fruiting *T. multiflora* superficially appearing to be similar in size, fruit yield and proximal habitat. One site had four individuals, the second five. Three observers recorded observations most mornings (05:00h–09:00 h CST) and evenings (15:30–17:00 h CST) over a 7-day span (10 count periods in total) between 29 June and 5 July 2011 using binoculars to maintain a 20 m distance from the closest tree.

Each session involved recording the species that visited the tree, as well as the number of visitations per species. A visitation was tallied when a bird alighted in an individual plant to forage, indicated by diagnostic behavior such as actively seeking out the fruiting regions of the tree, mashing fruit with the bill and swallowing fruit. Despite our vigilance some individuals were almost certainly recorded more than once, though individuals that left a tree momentarily and then returned were counted as a single visitation in an effort to give a general idea of local abundance. Due to the relatively distinct plumages of all species involved and the high degree of observer competency, all individuals were identified to the species level.

Data analysis. A two-way chi-square test was conducted to determine if the pattern of species visitation (by family) was different between the two sites. Due to 0 values in some blocks, we added 1 to each block prior to the chi-square (L. McSweeney pers. comm.).

RESULTS

Family abundance differed between the two sites ($\chi^2 = 36.64$, $p < 0.001$). Thraupidae showed by far the greatest number of visitations overall (386), followed by Fringillidae (57), while the remaining families had much lower numbers (Table 1). The number of species per family was also greatest for Thraupidae. Thirteen species of this family visited *T. multiflora*, while only three species were recorded in the second-most diverse family, Fringillidae. Other families displayed even less diversity, with two registering only a single species. Five species also displayed prevalence greater than 5 %. Three of the five species, Silver-throated Tanager (*Tangara icterocephala*) (29.12%), Cherrie's Tanager (*Ramphocelus costaricensis*) (21.76%), and Bay-headed Tanager (*Tangara gyrola*) (6.01%), are members of the *Thraupidae* family, the other two being Common Bush-tanager (*Chlorospingus ophthalmicus*) (8.32%, Passerellidae), and Thick-billed Euphonia (*Euphonia lanirostris*) (10.27%, Fringillidae). Silver-throated Tanagers and Cherrie's Tanagers comprised 50.9% of total visitations observed.

DISCUSSION

This study provides an introductory look into the relationship between several species of Neotropical birds

Table 1. The total number of visitations of frugivorous birds per species and family at each *Topobea multiflora* grove during six (Pino Colina) and four (Finca Sofia) observation periods (27.5 hours total), near San Vito, Costa Rica in June–July 2011.

Family	Common name	Scientific name	Pino Colina	Finca Sofia
Momotidae	Lesson's Motmot	<i>Momotus lessonii</i>	3	0
Furnariidae	Ruddy Woodcreeper	<i>Dendrocincla homochroa</i>	1	0
Pipridae	White-ruffed Manakin	<i>Corapipo altera</i>	0	5
	Orange-collared Manakin	<i>Manacus aurantiacus</i>	0	2
Turdidae	White Throated Thrush	<i>Turdus assimilis</i>	9	0
	Clay-colored Thrush	<i>Turdus grayi</i>	8	5
Thraupidae	Cherrie's Tanager	<i>Ramphocelus costaricensis</i>	75	33
	Blue-gray Tanager	<i>Thraupis episcopus</i>	6	1
	Golden-hooded Tanager	<i>Tangara larvata</i>	18	5
	Speckled Tanager	<i>Tangara guttata</i>	6	1
	Bay-headed Tanager	<i>Tangara gyrola</i>	12	15
	Silver-throated Tanager	<i>Tangara icterocephala</i>	68	66
	Scarlet-thighed Dacnis	<i>Dacnis venusta</i>	11	6
	Blue Dacnis	<i>Dacnis cayana</i>	2	2
	Green Honeycreeper	<i>Chlorophanes spiza</i>	1	0
	Yellow-faced Grassquit	<i>Tiaris olivaceus</i>	3	1
	Bananaquit	<i>Coereba flaveola</i>	1	0
	Buff-throated Saltator	<i>Saltator maximus</i>	3	3
	Streaked Saltator	<i>Saltator striatipectus</i>	1	1
Passerellidae	Common Bush-tanager	<i>Chlorospingus flavopectus</i>	40	5
	Black-striped Sparrow	<i>Arremonops conirostris</i>	1	0
Fringillidae	Thick-billed Euphonia	<i>Euphonia lanirostris</i>	11	32
	Spot-crowned Euphonia	<i>Euphonia imitans</i>	5	8
	Lesser Goldfinch	<i>Spinus psaltria</i>	0	1

and *T. multiflora* in southwestern Costa Rica. This relationship supports the idea that *T. multiflora* is, at least during the period of fruiting, such as during June and July in our study, an important part of many species' diet, particularly the Thraupidae that were so abundant in this study. Because of this close relationship, *T. multiflora* may act as a magnet, capable of drawing some birds typically associated with mature forest to its abundant fruit. The presence of two thraupids, Bay-headed and Silver-throated Tanager, is particularly indicative of this, as they exhibit a relatively stronger association with mature forest for breeding and feeding (Sekercioglu et al. 2007, Robinson 2001) than some of the other species. While they and other similar species might be moderately tolerant of anthropogenic disturbances, including vegeta-

tion alteration, they retain a strong link to nearby mature forest (Stotz et al. 1996). The relative proximity of each *T. multiflora* grove to such forest (no more than 200 m for any grove) might be a factor in the observed diversity and prevalence, as fewer species are likely to visit more distant groves while still acting as effective dispersers (Wunderle 1997).

There was a significant difference in species composition between our two sites. While this was unexpected due to the locations' superficial similarity, it may be related to a disparity in the maturity of each grove. Forests in various stages of regeneration often have different avian community compositions, especially relative to nearby mature forest (Schemske & Brokaw 1981). Additionally, regeneration in seemingly similar forests can be influenced by various less-

obvious factors like climate, topography and soil type (Schemske & Brokaw 1981). Consequently, it seems possible our two sites, while both partially composed of *T. multiflora* trees, were different enough in age to warrant unique avian communities. Some of the species recorded in this study, such as Cherrie's Tanager and Clay-colored Thrush (*Turdus grayi*), have little or no association with mature forest. It appears that *T. multiflora* may provide an appealing food source for these and other similar species, as they are all found exclusively in areas exhibiting some degradation. Furthermore, during our observations, we saw a fledgling Cherrie's Tanagers feeding with adults, which may indicate a link between breeding periods and the fruiting cycles of *T. multiflora*. Though concurrent timing of nesting and fruiting is not necessarily found amongst tropical frugivores, which become largely insectivorous when rearing young (Levey 1988), other studies have shown high fruit availability to be beneficial to breeding success (Bancroft et al. 2000) and an advantage in meeting energetic requirements for taxed juveniles and adults (Kessler-Rios & Kattan 2012). While only young Cherrie's Tanagers were observed feeding on *T. multiflora*, it is possible that other species might use its fruit in much the same manner. Despite its brevity, this study highlights the relationship of a single early-successional tree species and an array of frugivorous birds, a perspective that is an important touchstone for future assessments of avian distribution and forest conservation.

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