NOTE

Beneficial Insects and Insect Pollinators on Milkweed in South Georgia[1]

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Beneficial insects, both parasitoids and predators of pest insects, can play an important role in reducing or controlling populations of pest insects in agricultural farmscapes. Many beneficial insects and insect pollinators depend on nectar for their survival in these farmscapes. Laboratory and field cage studies demonstrate that parasitoids provided with sugar have greater longevity, fecundity, and more female biased sex ratios than starved parasitoids (Idris and Grafius 1995, Environ. Entomol. 24: 1726 - 1735; Dyer and Landis 1996, Environ. Entomol. 25: 1192 - 1201; Berndt et al. 2002, Agric. For. Entomol. 4: 39 - 45). Parasitoids have been observed to feed on floral nectar in the field (Jervis et al. 1993, J. Nat. Hist. 27: 67 - 105). However, the insects that use floral nectar in these diversified habitats are largely unknown.

In general, the flowers of milkweed species are attractive to butterflies, bees, and other insect pollinators, as well as hummingbirds, and they provide a rich supply of nectar to these pollinator species (Robertson 1929, Flowers and Insects, The Science Press, Lancaster, PA; Betz et al. 1994, Insect pollinators: 12 milkweed species, pp. 45 - 60 *In* Proc. 13th North American Prairie Conf.). Even though milkweed is self-compatible, it depends on these insects and other pollinators to pollinate flowers in the field (Wyatt and Broyles 1997, Biotropica 29: 232 - 234).

It may be important to provide nectar as a food source to beneficial insects and insect pollinators in agricultural landscapes especially at critical times during the season when nectar may not be available from other sources. Because the flowers of milkweed provide a rich supply of nectar, and they bloom continuously from spring through the fall in temperate zones, establishing a habitat of milkweed could possibly enhance beneficial insects and pollinators in south Georgia farmscapes. However, the feeding activity of beneficial insects and insect pollinators on milkweed on-farm is unknown for Georgia. Thus, the purpose of this preliminary study was to monitor feeding activity of these insects on nectar of tropical milkweed, *Asclepias curassavica* L., near a corn field in south Georgia.

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Eight potted plants of flowering tropical milkweed were placed 1 m apart in a line parallel to the outside row of a corn field in Mystic, GA. The "Silky Gold" cultivar with yellow flowers was used. Insects visiting these milkweed plants were observed weekly throughout the corn-growing season in 2008. Each plant was observed for 2 min on an hourly basis from 0900 - 1700. Every known insect that fed on nectar of these plants during this observation period was recorded in the field. Small parasitoids and any unknown insects that fed on milkweed nectar were collected and brought into the laboratory for identification to family, genus, or species. Voucher specimens of all insects are held in the USDA-ARS, Crop Protection & Management Research Laboratory (Tifton, GA). Feeding behavior of 12 *Trichopoda pennipes* (F.) females and 14 *Cylindromyia* sp. females was observed and recorded as these stink bug adult parasitoids fed on nectar of the tropical milkweed. Mean number of nectar-feeding insects per plant for each observation day and over the time of day were obtained for lady beetles, *Orius insidiosus* (Say), free-living wasps and flies, bees, and stink bug egg and adult parasitoids using PROC MEANS (SAS Institute 2003, SAS/STAT user's guide, version 9.1).

The tropical milkweed plants flowered throughout the corn-growing season, and many species of beneficial insects and insect pollinators fed on nectar in flowers of the plants (Table 1). This is the first detailed report of insects feeding on nectar of tropical milkweed, but families, genera, or species of many of the bees, free-living flies and wasps, and adult parasitic flies in the Tachinidae family previously have been reported to feed on nectar and pollinate other species of milkweed and other flowering plants. A reference for feeding on nectar and pollinating milkweed was not found for Bombyliidae. *Rivellia* sp. may be too small to pollinate milkweed and other flowering plants. In general, less research has been conducted on *Euthera tentatrix* Loew than on the other 2 stink bug adult parasitoids, *Trichopoda pennies* (F.) and *Cylindromyia* sp., which may explain why there are no references of the former species on milkweed flowers. Only 5 *E. tentatrix* individuals were observed during this study and none were carrying milkweed pollinia. The tachinid *Archytas marmoratus* (Townsend) is a parasitoid of *Helicoverpa zea* (Boddie) and has been reported parasitizing this host in young corn (Quaintance and Brues 1905, USDA Bur. Entomol. Div. Bull. 50: 1 - 55). Males and females of this parasitoid were observed feeding on nectar of tropical milkweed.

Regarding adult parasitic wasps, only individuals in the Ichneumonidae family have been reported to feed on and pollinate milkweed (Table 1). So, this is the first record of scelionids and other small parasitoids feeding on nectar of any milkweed species. The braconid *Cardiochiles nigriceps* Viereck is a solitary endoparasitoid of the tobacco budworm, *Heliothis virescens* (F.), and can contribute substantially to the biological control of its host (Tillman 2006, J. Entomol. Sci. 41: 305 - 320). This parasitoid readily fed on nectar of tropical milkweed flowers. The scelionids, *Trissolcus basalis* (Wollaston), *Telenomus podisi* (Ashmead), and *Telenomus* sp., the encyrtid *Ooencyrtus* sp., and the eupelmid *Anastatus* sp. are parasitoids of stink bug eggs (Jones 1988, Ann. Entomol. Soc. Am. 81: 262 - 273). These tiny parasitoids fed on nectar usually near the side of the flower between 2 cuculli probably to avoid drowning in nectar.

Adults of 4 species of Coccinellidae were observed feeding on nectar of tropical milkweed flowers (Table 1). These predators are commonly found preying on a variety of prey in corn (Quaintance and Brues 1905, USDA Bur. Entomol. Div. Bull. 50: 1 - 55; P. G. T., unpubl. data). Most insects that feed on nectar of milkweed flowers in turn pollinate the flowers. However, a reference for lady beetles pollinating milkweed was not found, and none of the many lady beetle individuals observed on milkweed plants

Table 1. Species of insects feeding on nectar of tropical milkweed in Mystic, GA, in 2008 and associated references (indicated by superscript numbers)

Insect Group	Family	Species	Milkweed nectar feeder	Milkweed pollinator	General pollinator
Bees	Apidae	*Apis mellifera* L.	species[1,2,3,4]	species[1,2,3,4]	species[7]
		Bombus spp.	genus[1,2,3,4]	genus[1,2,3,4]	genus[7]
		Xylocopa virginica (L.)	species[3]	species[3]	genus[7]
	Megachilidae	*Megachile* sp.	genus[1,2,4]	genus[1,2,4]	family, genus[7]
	Halictidae		family[1,4]	family[1,4]	family[7]
Free-living flies	Syrphidae	*Toxomerus marginatus* (Say)	species[4]	family[6]	family, species[7]
	Platystomidae	*Rivellia* sp.	genus[5]		
	Muscidae	*Musca domestica* L.	family[4]	family[4]	family[7]
	Bombyliidae				family[7]
	Conopidae	*Physocephala* sp.	genus[4]	genus[4]	family, genus[7]
Free-living wasps	Vespidae*	*Polistes carolina* (L.)	genus[1]	genus[1]	family, genus[7]
		Polistes fuscatus (F.)	species[2,4]	species[2,4]	
	Crabronidae	*Cerceris* sp.	genus [3,4]	genus [3,4]	
	Scoliidae*	*Scolia nobilitata* F.	genus[4]	genus[4]	family, genus[7]
		Campsomeris plumipes fossulana (F.)	species[4]	species[4]	

Table 1. continued.

	Sphecidae*	*Prionyx parkeri* Bohart and Menke	genus[1,2,4]	genus[1,2,4]	family[7]
		Sphex ichneumoneus (L.)	species[1,2,3,4]	species[1,2,3,4]	species[7]
	Tiphiidae	*Myzinum maculata* (F.)	genus[1,2,3,4]	genus[1,2,3,4]	
		Myzinum sp.			
	Pompilidae		family[4]	family[4]	family[7]
Parasitic flies	Tachinidae*	*Trichopoda pennipes* (F.)	genus[4]	genus[4]	family, species[7]
		Cylindromyia sp.	genus[4]	genus[4]	
		Euthera tentatrix Loew			
		Archytas marmoratus (Townsend)	genus[4]	genus[4]	
		Unknown tachinids			
Parasitic wasps	Scelionidae*	*Trissolcus basalis* (Wollaston)			
		Telenomus podisi Ashmead			
		Telenomus sp.			
	Encyrtidae	*Ooencyrtus* sp.			
	Eupelmidae	*Anastatus* sp.			
	Eurytomidae				

Table 1. continued.

	Eulophidae				
	Chalcididae				
	Pteromalidae				
	Braconidae*	*Cardiochiles nigriceps* Viereck			
	Ichneumonidae		family[4]	family[4]	family[7]
Lady beetles	Coccinellidae	*Hippodamia convergens* Guérin-Méneville	family[1]		
		Coccinella septempunctata (L.)	family[1]		
		Coleomegilla maculata (De Geer)	family[1]		
		Harmonia axyridis (Pallas)	family[1]		
Other predators**	Anthocoridae	*Orius insidiosus* (Say)			

REFERENCES: [1] Eastman 2003, The Book of Field and Roadside, Open-country weeds, trees, and wildflowers of Eastern North America, Stackpole Books, Mechanicsburg, PA; [2]Betz et al. 1994, Insect pollinators: 12 milkweed species, pp. 45 - 60 *In* Proc. 13th North American Prairie Conf; [3]Kephart and Theiss 2008, New Phytol. 161: 265 - 277; [4]Robertson 1929, Flowers and Insects, The Science Press, Lancaster, PA; [5]MacPherson 2008, *In* Signal fly – *Rivellia* [online]: http://bugguide.net/node/view/197954/bgimage; [6]Wigney 2008, *In* Hoverflies – Syrphidae [online]: http://www.pbase.com/crocodile/syrphidae; [7]Moisset 2006, *In* Insect pollinators, flowers best friends [online]: http://www.hometown.aol.com/insectpollinator.

*Some unknown individuals in family also collected.

**Possibly visiting flower to only feed on prey.

in this study were found with pollinia on their bodies. Apparently, lady beetles take nectar from milkweed flowers without providing any pollination service. The predator *Orius insidiosus* (Say) is an abundant natural enemy of *H. zea* in various cropping systems including corn (Quaintance and Brues 1905, USDA Bur. Entomol. Div. Bull. 50: 1 - 55). Like the tiny wasp parasitoids, many adults of this predator were located near the side of the flower between 2 cuclli and appeared to be feeding on nectar, but some individuals were also observed feeding on a thrips species in the flowers. A more detailed study on the feeding behavior of this predator on milkweed needs to be conducted in the laboratory.

The seasonal occurrence of lady beetles, *O. insidiosus*, free-living flies and wasps, bees, and stink bug egg and adult parasitoids feeding on nectar of tropical milkweed is shown in Fig. 1. The predators, including the 4 lady beetle species and *O. insidiosus*, were relatively the most abundant insects visiting milkweed flowers in May and early June. A second peak of lady beetles occurred the end of July. At this time, lady beetles apparently moved out of dying corn onto milkweed plants where they stayed for only a short period of time. Stink bug egg parasitoids were observed feeding on milkweed nectar early in the season which coincided with the time in which stink bug eggs occurred in corn (P. G. T., unpubl. data). The number of free-living flies feeding on milkweed nectar began to build the end of May and increase through the middle of June. Free-living wasps and bees fed on nectar of tropical milkweed throughout the season, but they began increasing in mid-to-late June and were relatively the most abundant insects visiting milkweed flowers the later half of the season. Stink bug adult parasitoids were observed feeding on milkweed nectar from early June through the rest of the season. The occurrence of these parasitoids coincided with the presence of adult stink bugs in corn (P. G. T., unpubl. data).

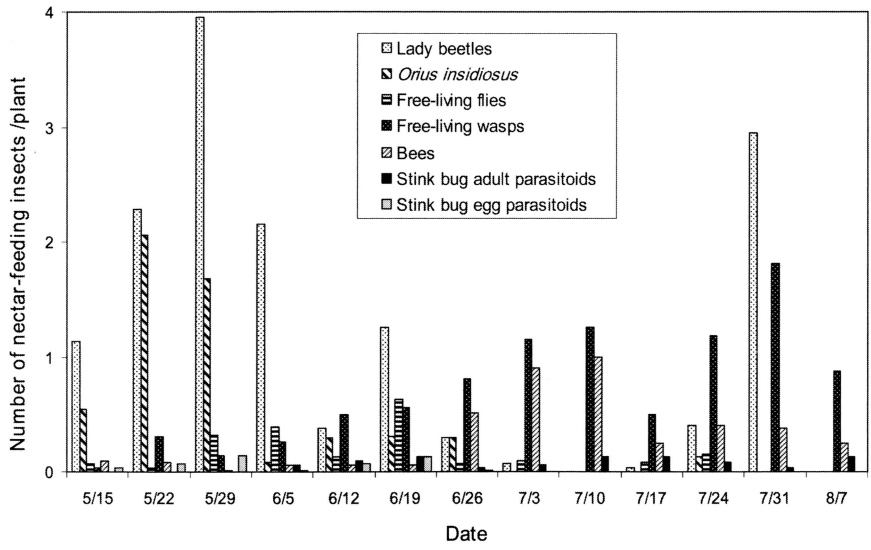

Fig. 1. Mean number of nectar-feeding insects per tropical milkweed plant over the growing season in Mystic, GA in 2008

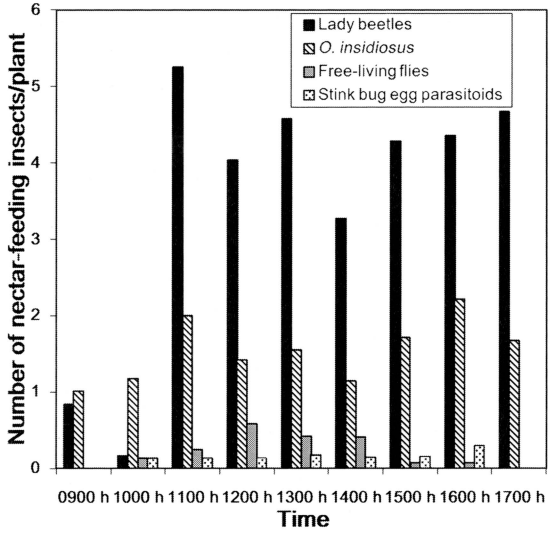

Fig. 2. Mean number of nectar-feeding insects per tropical milkweed plant from 0,900 h to 1700 h on 29 May 2008 in Mystic, GA

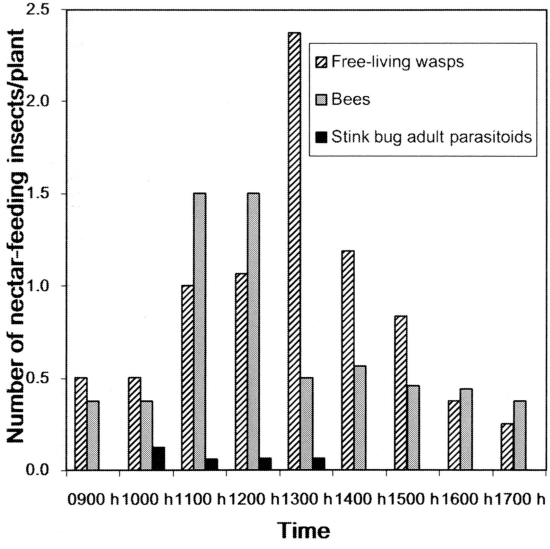

Fig. 3. Mean number of nectar-feeding insects per tropical milkweed plant from 0900 h to 1700 h on 3 July 2008 in Mystic, GA

Because the mean number of lady beetles, *O. insidiosus*, free-living flies, and stink bug egg parasitoids feeding per milkweed plant was relatively high on 29 May, the diurnal feeding activity of these insects was examined on this day (Fig. 2). Ladybeetles were most active from 1100 h through 1700 h. Adults of *O. insidiosus* appeared to be equally active throughout the day. Free-living flies and stink bug egg parasitoids fed on milkweed nectar from 1000 h to 1600 h. The mean number of free-living wasps, bees, and stink bug adult parasitoids was relatively high on 3 July, and so the diurnal activity of these insects was examined on this day (Fig. 3). Bees were most actively feeding on nectar from 1100 h to 1200 h. Free-living wasps were most actively feeding on nectar at 1300 h. Stink bug adult parasitoids were observed feeding on milkweed nectar from 1000 h to 1300 h. Examining overall activity of insects feeding on tropical milkweed nectar, it appears that the best time to observe nectar-feeding activity of these insects would be from 1000 h to 1400 h during the summer months.

Some feeding behavior of *T. pennipes* and *Cylindromyia* sp. was observed as these stink bug adult parasitoids fed on nectar of tropical milkweed. For the 12 *T. pennipes* females observed, a range of 1 - 13 flowers were fed on during the time the females were searching for food in the milkweed habitat, and feeding time per flower ranged from 3 - 35 sec. For the 14 *Cylindromyia* sp. females observed, a range of 1 - 16 flowers were fed on when females were searching for food in the habitat, and feeding time per flower ranged from 3 - 18 sec.

In conclusion, the flowers of tropical milkweed are attractive to beneficial insects and insect pollinators, and they provide nectar to these insects on-farm in south Georgia. Corn is a host plant of stink bugs, and several predators and parasitoids attack the various developmental stages of this pest in this crop (P. G. T., unpubl. data). So, a future experiment will be conducted to determine if the addition of a habitat of nectar-producing tropical milkweed plants will enhance beneficial insects and insect pollinators in corn fields.