A SURVEY OF PARASITOIDS OF *TRIALEURODES VAPORARIORUM* AND *BEMISIA TABACI* (HOMOPTERA: ALEYRODIDAE) IN EASTERN GUATEMALA

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Trialeurodes vaporariorum (Westwood), the greenhouse whitefly, and *Bemisia tabaci* (Gennadius), the sweetpotato whitefly, are serious economic pests of agronomic, horticultural, and ornamental crops throughout warm regions of the world (Byrne et al. 1990, Brown 1994). Both species also affect glasshouse production of plants in temperate regions (Byrne et al. 1990). In the tropics, *T. vaporariorum* is more common above elevations of 500 m, and *B. tabaci* tends to be the predominant species below 500 m (Caballero 1994).

Whitefly nymphs are sessile and susceptible to parasitism (Gerling 1990). *Trialeurodes vaporariorum* has been successfully managed in glasshouse systems with parasitoids (primarily *Encarsia formosa* Gahan, Hymenoptera: Aphelinidae) (Vet et al. 1980). Efforts to reduce populations of *B. tabaci* with both introduced and native natural enemies are ongoing (Roltsch & Pickett 1995, Hoelmer 1996, Goolsby & Ciomperlik 1999).

There is very little information available on whitefly parasitoids from Guatemala. A preliminary survey was carried out during April-May 1998 in eastern Guatemala to determine which whitefly parasitoid species were present. The survey was carried out at the end of the dry season, when whitefly populations, and presumably populations of whitefly parasitoids, are at their highest levels. Parasitized whitefly nymphs were collected from three areas: the Salamá Valley (approx. 1000 meters above sea level [masl]), Sanarate (approx. 850 masl), and the Motagua Valley (230-340 masl). Preliminary observations indicated that *T. vaporariorum* is the predominant whitefly species on horticultural crops in the Salamá Valley and in the Sanarate area, and *B. tabaci* is the predominant species in the Motagua Valley.

Material was collected in the Salamá Valley from the Instituto de Ciencia y Tecnología Agrícolas (ICTA) field station in San Jerónimo (15°03'40"N, 90°15'00"W) and at the farms of René Santos and Margarito Cordova. In the Sanarate area, material

was collected from Finca Monte Grande (14°47'02"N, 90°12'15"W), Finca El Comun, and the farm of Francisco del Cid. In the Motagua Valley, material was collected from Usumatlán (14°56'45"N, 90°W), San Augustin, and the banks of the Rio Hato where it crosses beneath the Atlantic highway. San Jerónimo is about 30 km north of Sanarate. Usumatlán is about 50 km southeast of San Jerónimo and about 50 km northeast of Sanarate.

Parasitized whitefly nymphs were collected from common bean (*Phaseolus vulgaris* L.), cucumber (*Cucumis sativus* L.), guisquïl (*Sechium edule* Schwartz., a cucurbit), squash (*Cucurbita pepo* L.), tomato (*Lycopersicon esculentum* Mill.) and watermelon (*Citrullus vulgaris* Schrad.). Cucumber and tomato were the only plant species collected from each of the three general areas. Plants were examined in the field, and leaves which appeared to have high numbers of late-instar and parasitized nymphs were placed in unwaxed cylindrical 0.95-liter cardboard cartons (Fonda Group Inc., Union, NJ, USA) for parasitoid emergence. After 4 wk, dead parasitoid adults were removed from the containers and placed on cotton wool in gel capsules. These were then mailed to the Division of Plant Industry and Consumer Services in Gainesville, FL, for identification. The dried host plant material was placed in plastic bags and mailed to Dr. Andrew Jensen, formerly of the United States Department of Agriculture in Beltsville, MD, who identified the whitefly species from nymphs on the dried leaves.

Trialeurodes vaporariorum was the only whitefly species found in material collected from the Salamá Valley and Sanarate, and *B. tabaci* was the only whitefly species identified from material collected in the Motagua Valley (Table 1). The parasitoid species recovered consisted of *Encarsia pergandiella* Howard, *Eretmocerus* sp. (Hymenoptera: Aphelinidae), and *Signophora aleyrodis* Ashmead (Hymenoptera: Signaphoridae), a hyperparasitoid (Table 1). In the Salamá Valley, all but one of the 1150 parasitoid adults collected were *E. pergandiella*. One *Eretmocerus* sp. was collected from cucumber in that area. *Encarsia pergandiella* predominated in the material from Sanarate, although *Eretmocerus* sp. was present in higher numbers than in the Salamá Valley (Table 1). The ratio of *E. pergandiella* to *Eretmocerus* from the Sanarate area was 158 to 8 (20:1). *Eretmocerus* was present in higher numbers than *E. pergandiella* in material collected from the Motagua Valley. The ratio of *E. pergandiella* to *Eretmocerus* was 409 to 555 (1:1.4). One *S. aleyrodis* female was recovered from cucumber in the Motagua Valley. It is unclear from this study if the shift in parasitoid ratio was due to changes in elevation, changes in whitefly host, or a combination of both.

There are apparently two distinct color forms of *E. pergandiella*. The light form is entirely yellowish in color and the dark form has dark brown areas on the mesoscutum, axillae, and gaster. Light and dark individuals were collected from *T. vaporariorum* on cucumber, guisquïl, squash, and tomato in the Salamá Valley, and from *B. tabaci* on cucumber and tomato in the Motagua Valley.

The significance of these dark and light forms is unclear. Laudonia and Viggiani (1993) found that *Encarsia partenopea* Masi produced light color individuals at temperatures around 30 C, and darker individuals at 15 C. In Guatemala, populations of both the dark and light form emerged from the same whitefly species collected on the same plant at the same time. This suggests that the observed color variation in *E. pergandiella* females is not induced by either differences in host, host plant, relative humidity, or temperature. Perhaps closer examination of these morphologically similar forms occurring sympatrically may reveal the existence of two distinct species.

Collections of whitefly parasitoids from tomato in the Salamá Valley from Nov.-Dec. 1998 indicate that parasitoid diversity may be greater in the rainy season than in the dry season (Smith 1999). The current study indicates that there are important regional differences in the species composition of whitefly parasitoids as well.

TABLE 1. IDENTITY AND NUMBER OF WHITEFLY PARASITOIDS COLLECTED FROM HORTICULTURAL CROPS IN EASTERN GUATEMALA, APRIL-MAY 1998.

Altitude	Area	Collection	Date	Whitefly species	Parasitoid spp.	Parasitoid Number	Host plant
1000 m	Salamá Valley	ICTA Station	8-iv	*Trialeurodes vaporariorum*	*Encarsia pergandiella*	41	*Sechium edule*
		"	13-iv	*T. vaporariorum*	*E. pergandiella*	389	
		"	13-iv	*T. vaporariorum*	*E. pergandiella*	203	*Cucurbita pepo*
		"	19-iv	*T. vaporariorum*	*E. pergandiella*	83	*Sechium edule*
		Cordova Farm	13-iv	*T. vaporariorum*	*E. pergandiella*	48	*Phaseolus vulgaris*
		"	13-iv	*T. vaporariorum*	*Eretmocerus sp.*	1	*Cucumis sativus*
		"		*T. vaporariorum*	*E. pergandiella*	108	
		"	19-iv	*T. vaporariorum*	*E. pergandiella*	2	"
		"	13-iv	*T. vaporariorum*	*E. pergandiella*	7	*Citrullus vulgaris*
		"	19-iv	*T. vaporariorum*	*E. pergandiella*	54	*Cucurbita pepo*
		"	19-iv	*T. vaporariorum*	*E. pergandiella*	42	*Phaseolus vulgaris*
		"	11-v	*T. vaporariorum*	*E. pergandiella*	2	*Lycopersicon esculentum*
		Santos Farm	12-iv	*T. vaporariorum*	*E. pergandiella*	6	"
		"	19-iv	*T. vaporariorum*	*E. pergandiella*	113	*Cucumis sativus*
		"	19-iv	*T. vaporariorum*	*E. pergandiella*	51	*Lycopersicon esculentum*
850 m	Sanarate	Finca *Monte* Grande	3-iv	*T. vaporariorum*	*E. pergandiella*	151	*Phaseolus vulgaris*
		Finca El Comun	20-iv	*T. vaporariorum*	*Eretmocerus sp.*	5	*Cucumis sativus*
				T. vaporariorum	*E. pergandiella*	4	
		"	27-iv	*T. vaporariorum*	*Eretmocerus sp.*	4	

[1]*Trialeurodes vaporariorum* and *Bemisia tabaci were* not identified from material collected at low and higher elevations, respectively. However, each species is known to be present at low densities outside of its optimal range (Caballero 1994, Smith 1999).

TABLE 1. (CONTINUED) IDENTITY AND NUMBER OF WHITEFLY PARASITOIDS COLLECTED FROM HORTICULTURAL CROPS IN EASTERN GUATEMALA, APRIL-MAY 1998.

Altitude	Area	Collection	Date	Whitefly species	Parasitoid spp.	Parasitoid Number	Host plant
				T. vaporariorum	*E. pergandiella*	3	
		del Cid Farm	27-iv	*T. vaporariorum*	*E. pergandiella*	4	*Lycopersicon esculentum*
230-340 m	Motagua Valley	Usumatlán	7-iv	*Bemisia tabaci*	*Eretmocerus sp.*	440	*C. sativus*
				B. tabaci	*E. pergandiella*	337	
		Rio Hato	7-iv	*B. tabaci*	*Eretmocerus sp.*	105	*C. sativus*
					E. pergandiella	60	
					Signophora aleyrodis	1	
		"	7- v	*B. tabaci*	*Eretmocerus sp.*	3	*Lycopersicon esculentum*
					E. pergandiella	1	
		"	14-iv	*B. tabaci*	*Eretmocerus sp.*	4	"
					E. pergandiella	9	
		San Augustin	29-v		*Eretmocerus sp.*	3	*Cucumis sativus*
					E. pergandiella	2	

[1]*Trialeurodes vaporariorum* and *Bemisia tabaci were* not identified from material collected at low and higher elevations, respectively. However, each species is known to be present at low densities outside of its optimal range (Caballero 1994, Smith l999).

SUMMARY

Primary parasitoids collected from *T. vaporariorum* and *B. tabaci* on a variety of horticultural crops in eastern Guatemala consisted of *Encarsia pergandiella* and *Eretmocerus* sp.

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