

**ASSOCIATED PLANTS AND DISTRIBUTION
OF THE ORCHID BEE GENUS *EULAEMA* (APIDAE:
BOMBINAE: EUGLOSSINI) IN VENEZUELA**

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ABSTRACT.- Orchid bees (*Eulaema* spp.) were observed and collected with chemical baits in 14 of the 23 States of Venezuela, from 1989 to 1998. Ten species are present, and *Eulaema meriana flavescens*, *E. nigrata* and *E. bombiformis* are the most abundant. Nine species bore orchid pollinaria or visited orchids, but bees also visited plant species other than orchids (mainly Caesalpinaceae). Certain orchids have probably evolved in response to euglossine pollination pressure, but there is no clear indication that reciprocal evolution has taken place. *Received:* 24 August 1998, *accepted:* 06 November 1998.

Key words: Orchid bees, *Eulaema*, Apidae, Euglossini, orchid - bee relationships, Caesalpinaceae, distribution, Venezuela, chemical baits.

**PLANTAS VISITADAS Y DISTRIBUCIÓN
DE LAS ABEJAS DE ORQUÍDEAS DEL GÉNERO
EULAEMA (APIDAE: BOMBINAE: EUGLOSSINI)
EN VENEZUELA**

RESUMEN.- Abejas de orquídeas (*Eulaema* spp.) fueron observadas y colectadas en Venezuela (en 14 de los 23 estados) desde 1989 hasta 1998, con la ayuda de cebos químicos. Se listan diez especies, de las cuales *Eulaema meriana flavescens*, *E. nigrata* y *E. bombiformis* son las más abundantes. Nueve especies portaron los pollinarios de orquídeas o visitaron orquídeas, pero las abejas también

visitaron otras especies de plantas (mayormente las Caesalpinaceae). Algunas orquídeas probablemente han co-evolucionados en respuesta a la presión de los Euglossini a polinizarlas, no encontrándose evidencia clara de una evolución recíproca. *Recibido:* 24 Agosto 1998, *aceptado:* 06 Noviembre 1998.

Palabras claves: Abejas polinizadoras de orquídeas, *Eulaema*, Apidae, Euglossini, relaciones abeja-orquídea, Caesalpinaceae, distribution, Venezuela, cebos químicos.

INTRODUCTION

The Euglossini are Neotropical bees important as pollinators of a wide range of plants, but are best known for their association with orchids. Males visit some orchid genera to gather floral fragrance chemicals, possibly to convert into pheromones to attract females (Dressler 1982, Williams 1982). *Eulaema* is a genus of this tribe with only 13 described species, and whose taxonomy is rather well known (Dressler 1979, Kimsey and Dressler 1986, Moure 1950, Moure 1967), but unfortunately based mostly upon male characteristics.

Although *Eulaema* is a genus of particularly large and common bees in tropical forests throughout the Neotropics, research on the biology of this group is surprisingly limited. In Venezuela, preliminary lists, descriptions and bionomics of the Euglossini or members of it are known for some areas (González and Gaiani 1989a, 1989b, 1990a, 1990b; González 1996), but little is still known about the distribution of members of the genus *Eulaema*, and the plants visited for food and/or chemical sources. In this paper, further data about the associated plants and distribution of orchid bees (*Eulaema*) in Venezuela are presented.

MATERIALS AND METHODS

From 1989 to 1998, orchid bees were observed and collected at several sites throughout the 23 States of Venezuela, and a variety

of chemical baits were used (Table 1). Information was also obtained from the Colección Entomológica Dr. Francisco Fernández Yépez, Museo del Instituto de Zoología Agrícola, Universidad Central de Venezuela (MIZA-UCV); and three private collections: Romero family and Mr. C. Bordón, Maracay, Aragua State, and M. Gaiani, Boconó, Trujillo State).

RESULTS AND DISCUSSION

Of the known species of *Eulaema*, only ten were found in Venezuela (two species have two subspecies each). Baits like Methyl Salicylate, Benzyl Acetate and 1-8 Cineole, already known as major attractants (Pearson and Dressler 1985), attracted different *Eulaema* species, while Alpha-pinene, Beta-ionone, Skatole, Terpinen-4-ol and Para-di-methoxy-benzol were more species specific (Table 1). *Eulaema cingulata*, *E. polychroma*, *E. nigrita* and *E. meriana meriana* were collected at four of the baits, while *E. meriana flavescens* and *E. mocsaryi* were collected at only two baits.

Some of the bait attracted bees bore orchid pollinaria. It appears that certain orchids have evolved in response to Euglossini pollination pressure, but there is no clear indication that reciprocal evolution has taken place (Ackerman 1983, Roubik and Ackerman 1987). It has also been stated that dependency of orchids upon orchid bees is a well defined specialization via adaptation to specific pollinator gene pools (Ackerman 1983). In any case, pollinaria carried by orchid bees are good indicators of a bee-orchid relationship. Based on this, Dressler (1976) proposed studying orchids at any given area by analyzing the pollinaria attached to male bees attracted to baits. Table 2 lists the orchids (mainly genera) identified by their pollinaria and the orchid bees bearing them.

Nine of the *Eulaema* species bore pollinaria or visited orchids. *Eulaema boliviensis*, *E. mocsaryi* and *E. seabrai luteola* visited only one orchid species while *E. meriana meriana* and *E. seabrai mimetica* visited different orchid species in the genus *Catasetum* (Table 2). However, *E. bombiformis*, *E. cingulata* and *E. meriana flavescens* visited different orchid genera and species.

TABLE 1. Orchid bees (*Eulaema* spp.) attracted to chemical baits in Venezuela.

<i>Eulaema</i> spp.	Methyl Salicylate	Benzyl Acetate	Cineole	1-8 Vanillin	Betalone	Eugenol	Alphapinene	Skaetole	Para-di-methoxybenzyl	Terpinen-4-ol
<i>E. boliviensis</i>	x	x	x							
<i>E. bombiformis</i>	x	x	x						x	
<i>E. cingulata</i>		x	x	x	x	x			x	
<i>E. meriana</i>	x	x								
<i>E. flavescens</i>										
<i>E. meriana</i>	x	x	x			x			x	
<i>E. meriana</i>										
<i>E. mocsaryi</i>	x	x								
<i>E. nigrita</i>	x		x	x			x			
<i>E. peruviana</i>	x		x			x		x		
<i>E. polychroma</i>	x		x	x		x		x		x
<i>E. seabrai</i>	x									
<i>E. luteola</i>										
<i>E. seabrai</i>	x									
<i>E. mimetica</i>										
<i>E. speciosa</i>	x			x						

TABLE 2. Orchids and other plants visited (v) or orchid pollinaria found attached (p) to orchid bees (*Eulaema* spp.) in Venezuela.

<i>Eulaema</i> spp.	Orchid genera or species	Plants (other than Orchids)
<i>E. boliviensis</i>	<i>Anguloa</i> sp. (v)	
<i>E. bombiformis</i>	<i>Cochleantes</i> sp. (v)	
	<i>Coryanthes</i> sp. (p)	
	<i>Acineta</i> sp. (p)	
	<i>Cynoches</i> sp. (p)	
	<i>Notylia</i> sp. (p)	
	<i>Catasetum longifolium</i> (p)	
	<i>Catasetum pileatum</i> (v)	
	<i>Catasetum</i> spp. (p)	
<i>E. cingulata</i>	<i>Coryanthes macrantha</i> (p)	<i>Monotagma laxum</i> (v) (Marantaceae)
	<i>Notylia</i> sp. (p)	<i>Distictis</i> sp. (?) (v) (Bignoniaceae)
	<i>Gongora</i> sp. (p)	<i>Costus guanaiensis</i> (v) (Costaceae)
	<i>Vanilla planifolia</i> (v)	
	<i>Catasetum pileatum</i> (v)	
	<i>Catasetum</i> spp. (p)	
<i>E. meriana flavescens</i>	<i>Catasetum</i> spp. (p)	<i>Blakea grisebachii</i> (v) (Melastomataceae)
	<i>Acineta</i> sp. (p)	<i>Cassia</i> sp. (v) (Caesalpinaceae)
	<i>Gongora</i> sp. (p)	<i>Costus spiralis</i> (v) (Costaceae)
	<i>Houlettia</i> sp. (p)	
	<i>Stanhopea</i> sp. (p)	
<i>E. meriana meriana</i>	<i>Catasetum discolor</i> (p)	<i>Monotagma laxum</i> (v) (Marantaceae)
	<i>Catasetum</i> spp. (p)	
<i>E. mocsaryi</i>	<i>Catasetum</i> sp. (p)	
<i>E. nigrita</i>	<i>Kefersteinia</i> sp. (p)	<i>Lugwigia octovalvis</i> (v) (Onagraceae)
	<i>Mormodes</i> sp. (p)	<i>Macropitilium atropurpureum</i> (v) (Papilionaceae)

TABLE 2.- Cont.

<i>Eulaema</i> spp.	Orchid genera or species	Plants (other than Orchids)
<i>E. nigrita</i> - cont.		<i>Senna pendula</i> (v) (Caesalpinaceae) <i>Psidium guineense</i> (v) (Myrtaceae) <i>Genipa americana</i> var <i>caruto</i> (v) (Rubiaceae)
<i>E. polychroma</i>		<i>Cassia</i> spp. (v) (Caesalpinaceae)
<i>E. seabrai luteola</i>	<i>Cynoches</i> sp. (p)	
<i>E. seabrai mimetica</i>	<i>Catasetum pileatum</i> (v)	
	<i>Catasetum</i> spp. (p)	
<i>E. speciosa</i>		<i>Bauhinia aculeata</i> (v) (Caesalpinaceae) <i>Eschweilera fendleriana</i> (v) (Lecythidaceae) <i>Maranta</i> sp. (v) (Marantaceae)

Orchid bees also gathered not only chemicals, but pollen, nectar, and even resins from plant species other than orchids (Table 2), pollinating some of them in the process. The bees visited different plant families. *Eulaema nigrita* was observed at five non-orchid species, and *E. cingulata*, *E. meriana flavescens*, and *E. speciosa* visited three plant species. *Eulaema* appeared to visit mainly plant species belonging to the Caesalpinaceae (Table 2). According to Ackerman (1983), there is a one-way evolutionary dependency of orchids upon bees, because members of *Eulaema* visit a wide diversity of plant species, whereas orchids show specificity to be pollinated only by bees.

Distribution.- *Eulaema* species were found in 14 of the 23 continental States of Venezuela (Table 3), and even though these states represent only slightly more than 60 % of the National territory, the collections covered all of its cardinal points. Most of the species appeared in Aragua (mainly at Henri Pittier National Park) and

TABLE 3: Distribution of orchid bees (*Eulaema* spp.) in Venezuela, according to State.

<i>Eulaema</i> spp.	D. F.	Amazonas	Aragua	Barinas	Bolivar	Carabobo	Guarico	Miranda	Monagas	Portuguesa	Sucre	Tachira	Trujillo	Zulia
<i>E. boliviensis</i>		x	x											
<i>E. bombiformis</i>		x	x			x		x			x			
<i>E. cingulata</i>		x	x		x									x
<i>E. meriana</i>	x	x	x	x		x		x		x			x	x
<i>E. flavescens</i>														
<i>E. meriana</i>		x			x									x
<i>E. meriana</i>														
<i>E. mocsaryi</i>		x	x		x									
<i>E. nigrita</i>	x	x	x		x	x		x		x		x	x	
<i>E. peruviana</i>		x												
<i>E. polychroma</i>	x	x	x							x		x	x	
<i>E. seabrai</i>	x		x					x				x		
<i>E. luteola</i>														
<i>E. seabrai</i>		x	x		x									
<i>E. mimetica</i>														
<i>E. speciosa</i>	x		x										x	

D. F. = Distrito Federal.

Amazonas (formerly Amazonas Territory), probably due to the specific interests of the collectors. *Eulaema meriana flavescens*, *E. nigrita* and *E. bombiformis* are the most common and abundant *Eulaema* collected in Venezuela. Some species are restricted to certain areas like *E. boliviensis*, which is uncommon and restricted to forests in Aragua and Amazonas. *Eulaema mocsaryi* (only found south of the Orinoco River), and *E. peruviana* (only present in Amazonas and Táchira), are the scarcest *Eulaema* in Venezuela (Table 3).

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LITERATURE CITED

- ACKERMAN, J. D. 1983. Specificity and mutual dependency of the orchid-Euglossini bee interaction. *Biol. J. Linn. Soc.* 20: 301-314.
- DRESSLER, R. L. 1976. How to study orchid pollination without any orchids. *Tagungsbericht Welt - Orchideen - Konferenz 1975* 8: 534-537.
- DRESSLER, R. L. 1979. *Eulaema bombiformis*, *E. meriana*, and Mullerian mimicry in related species (Hymenoptera: Apidae). *Biotropica* 11: 144 - 151.

- DRESSLER, R. L. 1982. Biology of the orchid bees (Euglossini). *Ann. Rev. Ecol. Syst.* 13: 373-394.
- GONZÁLEZ, J. M. AND M. A. GAIANI. 1989a. Lista preliminar de los Euglossini (Hymenoptera: Apidae) del Marahuaka, Parque Nacional Duida-Marahuaka, T. F. A., Venezuela. *Acta Terramaris* 1: 81-83.
- GONZÁLEZ, J. M. AND M. A. GAIANI. 1989b. New species of *Eufriesea* (Hymenoptera: Apidae: Bombinae: Euglossini) from Venezuela. *Rev. Biol Trop.* 37(2): 149-152.
- GONZÁLEZ, J. M. AND M. A. GAIANI. 1990a. Lista preliminar de los Euglossini (Hymenoptera: Apidae) del Cerro Arakamuni, T. F. A., Venezuela. *Acta Terramaris* 3: 19-21.
- GONZÁLEZ, J. M. AND M. A. GAIANI. 1990b. Datos bionómicos de *Euglossa cordata* Moure (Apidae:Euglossini). *Bol. Ent. Venez.* (N.S.)5(18): 141-143.
- GONZÁLEZ, J. M. 1996. Fauna del Parque Nacional "Henri Pittier": Euglossini (Hymenoptera: Apidae: Bombinae). Claves y lista preliminar. *Mem. Fund. Cienc. Nat. La Salle* 56(145): 45-54.
- KIMSEY, L. S. AND R. L. DRESSLER. 1986. Synonymic species list of Euglossini (Insecta: Hymenoptera: Apidae). *Pan-Pacific Entomol.* 62: 229-236.
- MOURE, J. S. 1950. Contribuição para o conhecimento do género *Eulaema* Lepeletier (Hymen.-Apoidea). *Dusenias* 1: 181-200.
- MOURE, J. S. 1967. A check-list of the known Euglossine bees (Hymenoptera: Apidae). *Atas Simp. Biota Amazonica* 5: 395-415.
- PEARSON, D. L. AND R. L. DRESSLER. 1985. Euglossine bees (Hymenoptera: Apidae) of the Tambopata reserved zone, Madre de Dios, Perú. *Rev. Per. Entomol.* 27: 75-79.

- ROUBIK, D. W., AND J. D. ACKERMAN. 1987. Long-term ecology of euglossine bees (Apidae: Euglossini) in Panama. *Oecologia* 73: 321-333.
- WILLIAMS, N. H. 1982. The biology of orchids and euglossine bees. Pp. 120-170, *in* J. Arditti (ed.), *Orchid biology, reviews and perspectives*, 2. Cornell University Press, Ithaca.