

STATUS AND DISTRIBUTION OF *MONTANDONIOLA MORAGUESI* (HEMIPTERA: ANTHOCORIDAE) IN THE CONTINENTAL UNITED STATES

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ABSTRACT

The exotic anthocorid *Montandoniola moraguesi* (Puton) was intentionally introduced in Hawaii and Bermuda for the control of thrips on outdoor plantings of ornamental *Ficus*. These successful programs resulted in similar efforts to introduce this predator at several locations within the continental United States. Such attempts to establish the bug as a component of biological control systems aimed at pest thrips apparently have been unsuccessful. Our surveys and requests for museum records revealed detections of *M. moraguesi* in four states: Alabama, Florida, Louisiana, and Mississippi. Circumstances surrounding detections in Alabama, Louisiana, and Mississippi suggest that viable populations may not currently exist in those states. *M. moraguesi* occurs widely throughout peninsular Florida, wherever outdoor plantings of exotic, ornamental *Ficus* spp. are found. An updated distribution of *M. moraguesi* is provided along with field observations and new thrips host records.

Key Words: biological control, predator, thrips, Thysanoptera, Florida

RESUMEN

El antocórido exótico *Montandoniola moraguesi* (Puton) fue introducido intencionalmente en Hawaii y Bermuda para el control de trips en las siembras de campo de plantas ornamentales del género *Ficus*. Estos programas con éxito resultaron en esfuerzos similares para introducir este depredador en varios lugares en el continente de los Estados Unidos. Los intentos para establecer este chinche como un componente de un sistema de control biológico dirigido a las plagas de trips aparentemente no se han logrado. Nuestras búsquedas y pedidos de registros de museo revelaron que *M. moraguesi* fue detectado en cuatro estados: Alabama, Florida, Louisiana, y Mississippi. Las circunstancias alrededor de las detecciones en Alabama, Louisiana, y Mississippi sugieren que poblaciones viables tal vez ya no existen en estos estados. *Montandoniola moraguesi* esta ampliamente distribuida por la península del Florida, donde se encuentra siembras de campo de plantas ornamentales exóticas de *Ficus* spp. Se provee una distribución mas actualizada de *M. moraguesi* adjunto con las observaciones de campo y nuevos registros de los hospederos de trips.

Montandoniola moraguesi (Puton) (Hemiptera: Anthocoridae) (Fig. 1) is an important predator of several species of economically important thrips. Although originally described in France, *M. moraguesi* now is thought to be native to Southeast Asia (Herring 1967; Lattin 2000). Its reported distribution is essentially Old World. Populations are known from Africa (Algeria, Egypt, Morocco, Senegal, South Africa, Sudan, Western Sahara), Asia (Japan, Israel, Philippines, Micronesia), Australia, Europe (Canary Islands, France, Italy, Portugal, Sicily, Spain) and Bermuda (Carayon & Ramade 1962; Funasaki 1966; Herring 1967; Lewis 1973; Muraleedharan 1977; Muraleedharan & Ananthkrishnan 1978; Péricart & Halperin 1989; Postle et al. 2001). In the Western Hemisphere, it has been reported only from South America (Muraleedharan & Ananthkrishnan 1978), although it may exist throughout much of

the Caribbean and Latin America. Its prey includes more than 20 species of gall-forming thrips (Table 1) from a wide variety of host plants (Muraleedharan & Ananthkrishnan 1978).

Because of its broad host range, *M. moraguesi* sometimes is a useful biological control agent against thrips. It has been successfully introduced for the biological control of *Gynaikothrips ficorum* (Marchal) (Thysanoptera: Phlaeothripidae) in Bermuda (Leighton 1978) and Hawaii (Funasaki 1966). In both areas, the bug became established and provided good, long-term control, but its establishment in Hawaii has caused biotic interference (Reimer 1988). In the continental United States, however, two attempted introductions in California (1965 and 1996) and at least one in Texas (1992) apparently have not been successful (Clausen 1978; Henry 1988; Paine 1992; Hanlon & Paine 2003).



Fig. 1. *Montandoniola moraguesi*, dorsal view.

The primary pest target of *M. moraguesi* in the United States has been the Cuban laurel thrips, *G. ficorum*. Feeding by this thrips, a pest of Chinese banyan *Ficus microcarpa* L. (Moraceae) (Paine 1992), causes the leaves to fold upward into galls where the thrips breeds and forms large colonies. Recently, a second species *G. uzeli* Zimmerman has become established in the United States (Held et al. 2005). *Gynaikothrips uzeli*, a pest of weeping fig, *F. benjamina* (L.), was accidentally introduced into Florida and is now being spread throughout the southeastern United States in shipments of ornamental weeping fig originating from nurseries in South Florida (Held et al. in press). The primary morphological difference between these thrips is the relative lengths of the pronotal posterolateral pair of setae, but a more practical way to distinguish *G. ficorum* from *G. uzeli* is by host-plant association: *G. ficorum*

with *F. microcarpa* and *G. uzeli* with *F. benjamina* (Mound et al. 1995). *Ficus microcarpa* survive in plant zones 9-11, whereas *F. benjamina* survive in zones 10-11 (Turner & Wasson 1997).

The Cuban laurel thrips occurs in California, Florida, and Texas (Denmark 1967) in the continental United States. Even though the thrips has been known from Florida since at least 1887 (Denmark 1967), *M. moraguesi* was not detected in that state until 1990. The discovery of this anthocorid in Florida was based on adults and nymphs collected from curled and deformed *Ficus* leaves in Palm Beach County (Bennett 1995). No records of intentional introductions of *M. moraguesi* in Florida are available and its presence there might be due to unintentional spread through commerce or through natural means.

Although *M. moraguesi* has been detected in Palm Beach County, Florida, exact locality data have not been reported. Herein we confirm the establishment of *M. moraguesi* in South Florida 15 years after its initial detection, provide updated information on distribution, report records from museum searches in several states where the bug potentially could become established outdoors, summarize our field observations, and provide new prey records.

MATERIALS AND METHODS

In the continental United States, plant zones 9-11, i.e., those areas capable of supporting outdoor populations of ornamental *Ficus* spp., encompass peninsular Florida, coastal Louisiana, southern areas of Texas and Arizona, and coastal California. Based on the premise that the distribution of *M. moraguesi* coincides with that of its prey (Bennett 1995), we surveyed these areas and/or requested specimen data from major entomological museums.

We conducted surveys in Alabama, Arizona, Florida, Louisiana, Mississippi, and Texas. Various techniques were employed, including visual inspection and shaking of leaves and stems of ornamental *Ficus* spp. over a collecting net. Adults were aspirated, preserved in alcohol, and transported to the laboratory for curation and identification.

Museum records were solicited from Alabama (Auburn University Entomology Museum, Auburn), Arizona (Arizona Department of Agriculture, Phoenix; University of Arizona, Tucson), California (California Academy of Sciences, San Francisco; California Department of Agriculture, Sacramento; San Diego Natural History Museum, San Diego; University of California, Berkeley; University of California, Davis; University of California, Riverside), Florida (Florida State Collection of Arthropods, Gainesville), Louisiana (Louisiana State University, Baton Rouge), Mississippi (Mississippi State University, Starkville), Texas (Texas A & M University, College Station), and

TABLE 1. THRIPS TAKEN AS PREY BY *MONTANDONIOLA MORAGUESI* AND THEIR ASSOCIATED HOST PLANTS.

Thrips prey	Host plant	Reference
<i>Alcothrips hadrocerus</i> (Karny)	<i>Gymnosporia</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Androthrips flavipes</i> Schmutz	Unknown	Muraleedharan & Ananthakrishnan 1978
<i>Androthrips ramachandrai</i> Karny	<i>Ficus microcarpa</i>	FSCA ¹ E2002-1796
<i>Aneurothrips punctipennis</i> Karny	<i>Cordia</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Arrhenothrips dhumrapaksha</i> Ramak.	<i>Ficus bengalensis</i>	Muraleedharan & Ananthakrishnan 1978
<i>Arrhenothrips ramakrishnae</i> Hood	<i>Mimusops elengi</i>	Muraleedharan & Ananthakrishnan 1978
<i>Austrothrips cochinchinensis</i> Karny	<i>Calycopteris floribundus</i>	Muraleedharan & Ananthakrishnan 1978
<i>Brachythrips dantahasta</i> Ramak.	<i>Memecylon</i> sp.	Muraleedharan & Ananthakrishnan 1971
<i>Cercothrips nigrodentatus</i> (Karny)	<i>Planchona valida</i>	Muraleedharan & Ananthakrishnan 1978
<i>Crotonothrips gallarum</i> Anan.	<i>Memecylon</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Frankliniella occidentalis</i> (Pergande)	Unknown	Sabelis & Van Rijn 1997
<i>Gynaikothrips bengalensis</i> Anan.	<i>Ficus benjamina</i>	Muraleedharan & Ananthakrishnan 1978
<i>Gynaikothrips ficorum</i> (Marchal)	<i>Ficus microcarpa</i>	Mound et al. 1995
<i>Gynaikothrips flaviantennatus</i> Moulton	<i>Casseearia tomentosa</i>	Muraleedharan & Ananthakrishnan 1978
<i>Gynaikothrips malabaricus</i> Ramak.	<i>Ficus bengalensis</i>	Muraleedharan & Ananthakrishnan 1978
<i>Gynaikothrips uzeli</i> Zimm.	<i>Ficus benjamina</i>	Mound et al. 1995
<i>Holopothrips</i> sp.	<i>Tabebuia pallida</i>	FSCA ¹ E2002-5207
<i>Liothrips ramakrishnae</i> Anan. & Jag.	<i>Schefflera racemosa</i>	Muraleedharan & Ananthakrishnan 1978
<i>Liothrips africanus</i> Vuil.	<i>Guiera senegalensis</i>	Carayon & Ramade 1962
<i>Liothrips citricornis</i> Anan.	<i>Maytenus senegalensis</i>	Muraleedharan & Ananthakrishnan 1971
<i>Liothrips fluggeae</i> Bourn.	<i>Gluggea virosa</i>	Carayon & Ramade 1962
<i>Liothrips indicus</i> Anan.	<i>Maytenus senegalensis</i>	Muraleedharan & Ananthakrishnan 1978
<i>Liothrips oleae</i> Costa	<i>Olea europea</i>	Carayon & Ramade 1962
<i>Liothrips pallierus</i> (Karny)	<i>Vitis</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Liothrips pallipes</i> (Karny)	<i>Peperomia</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Liothrips urichi</i> Karny	<i>Clidemia hirta</i>	Reimer 1988
<i>Lygothrips jambuvasi</i> (Anan.)	<i>Terminalia</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Mesothrips extensivus</i> Anan. & Jag.	<i>Mallotus philippinus</i>	Muraleedharan & Ananthakrishnan 1978
<i>Mesothrips jordani</i> Zimm.	<i>Ficus benjamina</i>	Muraleedharan & Ananthakrishnan 1978
<i>Nesothrips</i> sp.	<i>Ficus aurea</i>	FSCA ¹ E2001-2090
<i>Phorinothrips loranthis</i> Anan.	<i>Loranthus</i> sp.	Muraleedharan & Ananthakrishnan 1978
<i>Psenothrips priesneri</i> (Anan.)	<i>Walsura piscidea</i>	Muraleedharan & Ananthakrishnan 1978
<i>Schedothrips orientalis</i> Anan.	<i>Ventilago maderaspatana</i>	Varadarasan and Ananthakrishnan 1981
<i>Tetradothrips foliiperda</i> (Karny)	<i>Pothos scandans</i>	Muraleedharan & Ananthakrishnan 1978
<i>Teuchothrips longus</i> Priesner	<i>Pavetta hispidula</i>	Varadarasan and Ananthakrishnan 1981
<i>Thrips</i> sp.	<i>Ficus craterostoma</i>	Carayon & Ramade 1962
<i>Thrips tabaci</i> (Lindeman)	Unknown	Sabelis & Van Rijn 1997
<i>Trichothrips houardi</i> Vuil.	<i>Guiera senegalensis</i>	Carayon & Ramade 1962

¹Florida State Coll. of Arthropods, Florida Dept. Agr. and Cons. Serv, Div. of Plant Ind.

the District of Columbia (National Museum of Natural History, Smithsonian Institution, Washington, D.C.). We also solicited data from the collections of John D. Lattin (retired) (Oregon State University, Corvallis, OR) and Tamera Lewis (USDA, ARS, Wapato, WA), both of whom have collected anthocorids from southern California.

Acronyms used are FSCA (Florida State Collection of Arthropods, Gainesville, FL), LSU (Louisiana State University Entomology Museum, Baton Rouge, LA), MIS (United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Miami Inspection Station, Miami, FL), NMNH (United States National Museum of Natural His-

tory, Washington, D.C.), and SHL (United States Department of Agriculture, Agricultural Research Service, Southern Horticultural Laboratory, Poplarville, MS).

RESULTS AND DISCUSSION

Based on field searches and museum records, specimens of *M. moraguesi* are reported from Alabama, Florida, Louisiana, and Mississippi (Fig. 2). In Alabama and Mississippi, it was taken only in retail garden centers, therefore, field populations might not occur in those states. Little is known concerning the circumstances surrounding the single specimen housed at LSU. If popula-

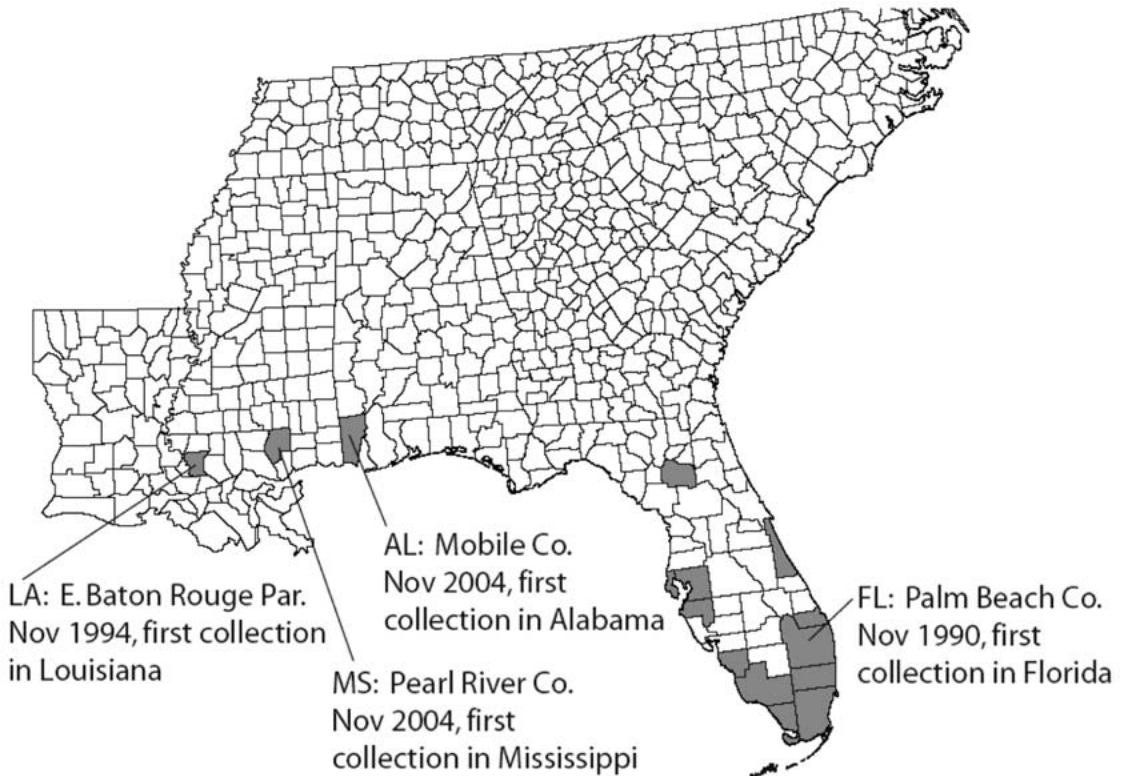


Fig. 2. Current distribution of *Montandoniola moraguesi* in the southeastern United States based on field captures and museum records.

tions persisted in that state, one might expect the LSU collection to contain additional specimens.

The following locality label data are provided for *M. moraguesi* in the continental United States: Alabama: Mobile Co., Mobile, Home Depot Garden Center, 30.674N, 88.224W, 1♀, *Ficus benjamina* infested with *Gynaikothrips uzeli*, 12-XI-2004, D. Boyd (SHL). FLORIDA: ALACHUA CO., 3♂ 1♀, on *Ficus* sp., 21-V-2005, J. Brambila (MIS); Florida: Brevard Co., Indialantic, 1♀, *Ficus retusa*, 23-XII-1991, K. Garret-Kraus (NMNH); Broward Co., Pompano Beach, 10 specimens, pred. on *Gynaikothrips ficorum*, 30-VIII-1991, F. D. Bennett (FSCA); Pompano Bch, 6♂, 6♀, Pred/*Gynaikothrips ficorum*/*Ficus*, 19-XI-1991, F. D. Bennett (FSCA); Pompano Beach, 6 specimens, pred. on *Gynaikothrips ficorum* on *Ficus* sp., 19-XI-1991, F. D. Bennett (FSCA); Collier Co., Everglades City, 2 specimens, ex *Gynaikothrips ficorum* on *Ficus* sp., 3-V-1992, F. D. Bennett (FSCA); Hillsborough Co., Tampa, Busch Gardens, 3♂, 1♀, on *Gynaikothrips ficorum* on *Ficus*, 6-XI-1992, F. D. Bennett (USNM); Lee Co., Ft. Myers, 7♀, host *Gynaikothrips ficorum* on *Ficus*, 2-V-1992, F. D. Bennett (NMNH); Manatee Co., Bradenton, 2♂, 9♀, host *Gynaikothrips ficorum*, on *Ficus*, 8-XI-1992, F. D. Bennett (NMNH); Martin Co., Stuart, 7♂, 8♀,

host *Gynaikothrips ficorum*/*Ficus microcarpa*, 12-VIII-1992, F. D. Bennett (NMNH); Miami-Dade Co., Miami, 3 specimens, 143 Ave., ex *Ficus aurea*, 15-V-2001, Ed Putland FSCA# E2001-2090 (FSCA); Miami, SW 137 Ave. and 172 St., 6 specimens, ex *Tabebuia pallida*, 14-X-2002, Holly Glenn, FSCA# E2002-5207 (FSCA); Miami, 68 St. and 102 Ave., 3 specimens, sweep net, 7-IV-2004, J. Durand (FSCA); Miami, 68 St. and 102 Ave., 1 specimen, sweep net, 31-III-2004, J. Durand (FSCA); Goulds, SW 232 Ave., 7 specimens ex *Ficus benjamina*, 21-IV-2004, Eduardo Camero, FSCA# E2004-2958 (FSCA); Homestead 232 St. and 137 Ave., 1 specimen, ex *Ficus microcarpa*, 9-V-2002, Mario Hernandez FSCA# E2002-1796 (FSCA); Miami, 143 Ave., on *Ficus aurea* Nutt., 15-V-2001, Ed Putland, FSCA# E2001-2090 (FSCA); Miami, 68 St. at 102 Ave., 3♂, 2♀, ex *Ficus* sp., 31-III-2004, J. Durand (MIS); Miami, 68 St. at 102 Ave., 3♂, 1♀, ex *Ficus* sp., 7-IV-2004, J. Durand (MIS); Miami, 68 St. at 102 Ave., 7♂, 2♀, ex *Ficus* sp., 17-II-2005, T. Dobbs (MIS); MONROE CO., Key Largo, 91421 U.S. 1, 1♂, 2♀, ex *Ficus* sp. with *Gynaikothrips* sp., 5-IV-2005, T. Dobbs (MIS); Key Largo, 103880 U.S. 1, 3 nymphs ex *Ficus* sp. with *Gynaikothrips* sp., 5-IV-2005, T. Dobbs (MIS); Palm Beach Co., West Palm Beach, 4

specimens, pred. on *Gynaikothrips ficorum* on *Ficus microcarpa*, 23-III-1992, F. D. Bennett (FSCA); West Palm Beach, 5♂, 5♀, on *Gynaikothrips ficorum*/*Ficus microcarpa*, 23-III-1992, F. D. Bennett (NMNH); Pinellas Co., St. Petersburg, 9♂, 11♀, host *Gynaikothrips ficorum* on *Ficus*, 6-XI-1992, F. D. Bennett (NMNH). LOUISIANA: E. Baton Rouge Par., Baton Rouge, 1 specimen, on *Ficus*, 30-IX-1994, J. W. Tessmer (LSU). MISSISSIPPI: PEARL RIVER CO., Poplarville, 1 specimen, pred. *G. uzeli* on *F. benjamina*, 15-XI-2004, D. W. Boyd (SHL); Poplarville, 1 specimen, pred on *G. uzeli* on *F. benjamina*, 14-XII-04, D. Held (SHL); Poplarville, 1 specimen, pred. *G. uzeli* on *F. benjamina*, 05-I-2005, D. W. Boyd (SHL). We were unable to locate the original specimens detected in Palm Beach County in 1990.

Based on data from the Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, *M. moraguesi* is associated for the first time with *Androthrips ramachandrai* Karny on *F. microcarpa*, *Holopothrips* sp. on *Tabebuia pallida* (Lindl.) Miers, and *Nesothrips* sp. on *Ficus aurea* Nutt. (Table 1).

As stated by Bennett (1995), *M. moraguesi* is widespread in Florida where outdoor plantings of exotic ornamental *Ficus* spp. occur, and has now been detected as far north as Gainesville. In Miami-Dade Co., the bugs were observed in direct association with their thrips prey and were most easily detected by searching for untrimmed *Ficus* hedges with upcurled leaves. The anthocorids enter and remain in the curled leaves while feeding on all life stages of the thrips. Populations of *Gynaikothrips* and *M. moraguesi* were quite high in some instances, yet the plants we observed nearly always had significant new growth and showed no outward signs of ill health aside from moderate leaf distortion.

In Alabama, an adult *M. moraguesi* and associated nymphal exuviae were taken on a *Ficus benjamina* plant in a retail garden center in Mobile Co. No other specimens were located from that state. The plants at the garden center were obtained from a nursery in South Florida, and we assume that the *M. moraguesi* may have hitchhiked with plant material shipped from Florida to Alabama. Two adults and a nymph of *M. moraguesi* were collected in Pearl River Co., Mississippi, on *F. benjamina* plants infested with *G. uzeli*. The plants were traced to local retail nurseries that had, similar to the case in Alabama, originally received plant material from South Florida. An adult was captured in East Baton Rouge Parish, Louisiana, in 1994, two years after intentional releases in neighboring Texas. This record predates by a full decade similar finds in nearby Alabama and Mississippi. Whether the later records reflect a lack of concentrated collecting in the interim is unknown. We found no field populations of *M. moraguesi* in

any other states, nor did we find museum specimens from other states. We found no specimens of *M. moraguesi* from California or Texas, although the bug has been introduced into those states to control thrips on *Ficus* plantings (Bennett 1995; Hanlon & Paine 2003). Even though outdoor *Ficus* plantings with suitable thrips hosts are found in other states, we suggest that in the continental United States field populations of *M. moraguesi* currently are restricted to peninsular Florida. Further investigation will clarify this.

Collection of this anthocorid in Alabama and Mississippi on plants shipped from Florida indicates its potential for spread through commercial trade. Its establishment along the Gulf Coast could provide needed biological control of *G. ficorum* and *G. uzeli*. However, *M. moraguesi* has been implicated in biotic interference in at least two cases (Reimer 1988; Bennett 1995; Hanlon & Paine 2003) and potentially can feed on thrips being used for the biological control of weed species.

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