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A CONTRIBUTION TO THRIPS-PLANT ASSOCIATIONS RECORDS (INSECTA: THYSANOPTERA) IN COSTA RICA AND CENTRAL AMERICA

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ABSTRACT
Thrips are small, cosmopolitan insects directly or indirectly associated with plants. Records of these associations in the neotropics add greatly to better understanding of Thysanoptera, not the least because some thrips species are economically important in agriculture and amenity plantings. In this paper we report new plant associations of Franklinothrips vespiformis (Crawford), Gastrothrips sp. Hood, Haplothrips goudeyi Franklin, Leptothrips astatus Johansen, Leptothrips obesus Johansen, Liothrips spp. Uzel, Torvothrips martinezi Johansen, Arorathrips mexicanus Crawford, Caliothrips fasciapennis (Hinds), Caliothrips nanus (Hood), Caliothrips punctipennis (Hood), Echinothrips caribbeanus Hood, Echinothrips selaginellae Mound, Frankliniella cephalica Crawford, Frankliniella standleyana Hood, Hoodothripiella ignacio Retana-Salazar, Microcephalothrips abdominalis (Crawford) and Retanathrips silvestris (Hood). Some records of the presence of thrips species are new for Costa Rica and Central America.

Key Words: amenity plantings, arvenses, banana, ecology, weeds, accomplice species, host

RESUMEN
Los thrips son pequeños insectos cosmopolitas asociados a las plantas directa o indirectamente. El conocimiento de asociaciones con plantas es información valiosa para un mejor conocimiento de este grupo, poco es conocido en las regiones neotropicales donde algunas especies son plagas agrícolas importantes. En este escrito se presentan nuevos registros de asociaciones con plantas para Franklinothrips vespiformis (Crawford), Gastrothrips sp. Hood, Haplothrips goudeyi Franklin, Leptothrips astatus Johansen, Leptothrips obesus Johansen, Liothrips spp. Uzel, Torvothrips martinezi Johansen, Arorathrips mexicanus Crawford, Caliothrips fasciapennis (Hinds), Caliothrips nanus (Hood), Caliothrips punctipennis (Hood), Echinothrips caribbeanus Hood, Echinothrips selaginellae Mound, Frankliniella cephalica Crawford, Frankliniella standleyana Hood, Hoodothripiella ignacio Retana-Salazar, Microcephalothrips abdominalis (Crawford) y Retanathrips silvestris (Hood). Algunos reportes son nuevos para Costa Rica y para Centroamérica.

Translation provided by the authors.

With more than 2000 thrips species currently described in the Neotropics, this region has great diversity within the Thysanoptera (Mound 2002). Species from 1.0 mm or less to 10.0 mm long can be found just in Central America (Mound et al. 1993) where they can be collected from a wide array of habitats; forests, grasslands, desserts, crops and gardens (Soto-Rodriguez et al. 2009). Feeding habits vary among different taxa (Mound et al. 1993; Soto-Rodriguez et al. 2009) and, commonly, phytophagous species are considered of economic importance in various crops (Childers & Nakahara 2006; González et al. 2010a), especially in the tropics (Johansen & Mojica 2007). Phytophagous species cause economic damage by feeding directly on vulnerable plant species, by vectoring virus causing major crop losses (Jones 2005) or requiring the erection of quarantine barriers to their spread (Vierbergen et al. 2006; González et al. 2010b). On the other hand, other thrips species serve beneficially as pollinators and decomposers (Pinent et al. 2006), and some species have been suggested as biological control agents against various arthropod pests (Zegula et al. 2003) or weeds (Cock et al. 2000; Mound & Zapater 2003; Soto-Rodriguez et al. 2009). Weeds often are very important in agriculture because they compete with the crop, or they serve as hosts or accomplices of pests or pathogens including some thrips species (González et al. 2010b). Hernández-Ayar et al. (2009), for example, found that the number of thrips taxa present at a given site varied according to the type of plants that grow associated with the crop, in this case, Persian lime, Citrus latifolia (Tan.).
According to Mound (2002), the majority of thrips studies in the neotropics have been limited to insecticide trials or taxonomic studies. Therefore it is especially important to conduct plant-association surveys in order to understand the role of thrips species in the ecosystems, to ascertain which plant species aid and abet various species of thrips pests (González et al. 2010b), and to assess the impact of different thrips species on populations of other organisms within crops, amenity plantings or noncultivated areas. In this paper we present the findings of Neotropical and cosmopolitan thrips species collected from weeds from banana farms and neighboring areas such as paddocks and roadsides.

MATERIALS AND METHODS

Implementation of Project CONICIT FV 24-07, UCR 813-A8-506, involved the monthly collection of foliar samples (leaves, stems and flowers in few cases) of several weed species in Limón, Costa Rica throughout 2008 and 2009. Weed samples were collected in plastic bags and sealed with adhesive tape to prevent the escape of captured specimens. Plants samples were identified in situ and their identities were verified by Steven Brenes of the Weed Laboratory of the University of Costa Rica. Most of the samples were collected within banana farms, other samples were obtained from neighboring areas and pasture fields.

To extract the thrips specimens, each weed sample was placed in a container filled with boiling water. After approximately 3 minutes, the water was poured through a 212 mesh sieve. The plant sample was washed twice in the container and the water was poured through the sieve. Specimens on the sieve were transferred to a petri plate, after which the thrips were stored in 70% ethanol in labeled eppendorf tubes for further identification. The thrips specimens were mounted on microscope slides and were identified by Axel Retana-Salazar of the Centro de Investigación en Estructuras Microscópicas (CIEMIC), University of Costa Rica, according to the keys provided by Johansen (1980, 1987); Mound et al. (1993); Mound & Marullo (1996); Soto-Rodríguez & Retana-Salazar (2003); Retana-Salazar (2007) and the Official Collection of Thysanoptera of the University of Costa Rica, CIEMIC.

RESULTS AND DISCUSSION

Locations and dates of sampling for thrips reported in this project are elaborated in Table 1. In total 829 plant samples were collected and examined. Three thrips families, 13 genera and 19 species were identified in this research, and these 19 species were involved in 45 different thrips-plant associations (Table 2).

Most of the thrips specimens were found on samples collected from outside the banana farms, and this distribution is consistent with other arthropod taxa observed during this research (Fig. 1). Weed samples belonged to 70 different

| Location code | Date of sampling | Location name | Detail |
|---------------|-----------------|---------------|--------|
| 1             | 3-IV-2008       | La Teresa Banana Farm | Cariari, Limón. |
| 2             | 3-IV-2008       | Junior Jiménez Paddock | Guácimo, Limón. |
| 3             | 12-IV-2008      | Est. Exp. Diamantes, INTA (Paddock) 1 | Guápiles, Limón. |
| 4             | 7-V-2008        | Agrícola 2 Banana Farm | Cariari, Limón. |
| 5             | 8-V-2008        | Roadside to Guácimo | Guácimo, Limón. |
| 6             | 8-V-2008        | San Diego Pineapple Farm (nearby) | Guácimo, Limón. |
| 7             | 27-V-2008       | Bonanza Campo Cinco Banana Farm | Cariari, Limón. |
| 8             | 28-V-2008       | Est. Exp. Diamantes, INTA (Paddock) 2 | Guápiles, Limón. |
| 9             | 6-VIII-2008     | Rio Palmas Hotel surrounding forest | Guácimo, Limón |
| 10            | 4-IX-2008       | San Pablo Banana Farm | Matina, Limón. |
| 11            | 4-IX-2008       | 28 Millas, CORBANA facilities | Matina, Limón. |
| 12            | 9-X-2008        | Calinda Banana Farm | Guácimo, Limón |
| 13            | 10-X-2008       | 6 years Organic Banana Farm, EARTH | EARTH University, Guácimo, Limón |
| 14            | 11-II-2009      | Támesis Banana Farm | Cariari, Limón. |
| 15            | 11-II-2009      | Valquirias Banana Farm | Cariari, Limón. |
| 16            | 12-III-2009     | Bananos Dora Banana Farm | Siquirres, Limón |
| 17            | 13-III-2009     | Ecolturismo Banana Farm | Siquirres, Limón |
| 18            | 8-VII-2009      | La Estrella Banana Farm | Siquirres, Limón |
| 19            | 16-IX-2009      | Verde Azul Banana Farm | Siquirres, Limón |
### TABLE 2. ASSOCIATIONS OF THYSANOPTERAN FAMILIES AND SPECIES WITH FAMILIES AND SPECIES OF PLANTS AT THE LOCATIONS SAMPLED IN LIMÓN PROVINCE, COSTA RICA IN 2008-2009.

| Thrips species/weed species | Host Botanical Family | Location Code |
|-----------------------------|-----------------------|---------------|
| **AEOLOTHRIPIDAE**          |                       |               |
| *Franklinothrips vespiiformis* | Synedrella nodiflora L. | Asteraceae 1 |
| **PHLAEOTHRIPIDAE**         |                       |               |
| *Idolothripinae*            |                       |               |
| *Gastrothrips* sp.          | *Solanum nigrum* L.   | Solanaceae 17 |
| *Phlaeothripinae*           |                       |               |
| *Haplothrips goudreyi*      | *Digitaria setigera* Roth ex Roem. et Schult. | Poaceae 18 |
| *Eleusine indica* L.       |                       | Poaceae 17, 19 |
| *Emilia sonchifolia* L.    |                       | Poaceae 17    |
| *Spermacoce assurgens* Ruiz & Pavón | *Synedrella nodiflora* L. | Asteraceae 8, 9 |
| *Leptothrips astatus*      | *Stachytarpheta jamaicensis* L. | Verbenaceae 4 |
| *Synedrella nodiflora* L.  |                       | Asteraceae 1, 5, 6, 9 |
| *Leptothrips obesus*       | *Lantana trifolia* L. | Verbenaceae 2, 8 |
| *Liothrips* sp.1            | *Synedrella nodiflora* L. | Asteraceae 5, 7, 8, 19 |
| *Liothrips* sp.2            | *Gouania polygama* Jacq. | Rhamnaceae 3, 8, 13 |
| *Torvothrips martinezi*    | *Sida ulmifolia* Mill. | Malvaceae 8   |
| **THRIPIDAE**               |                       |               |
| *Arorathrips mexicanus*     |                       |               |
| *Drymaria cordata* L.      | *Caryophyllaceae*     | 2, 6, 10, 17 |
| *Eleusine indica* L.       |                       | 2, 7, 10, 16  |
| *Caliothrips faciapennis*  | *Scleria melaleuca* Rchb.f. ex. Schtdl.Cham. | Cyperaceae 2, 3, 6, 8, 15, 17 |
| *Caliothrips nanus*        | *Gouania polygama* Jacq. | Rhamnaceae 3, 11,13 |
| *Caliothrips punctipennis* | *Eleusine indica* L. | Poaceae 4, 10, 12, 16, 18 |
| *Echinothrips caribbeanus* |                       |               |
| *Alternanthera sessilis* L. | *Amaranthaceae*       | 10            |
| *Cytathula prostrata* L.   | *Amaranthaceae*       | 15, 17        |
| *Drymaria cordata* L.      | *Caryophyllaceae*     | 2, 8, 15      |
| *Eleusine indica* L.       | *Poaceae*             | 4, 16         |
| *Emilia sonchifolia* L.    | *Asteraceae*          | 17            |
| *Laportea aestuans* L.     | *Urticaceae*          | 1, 3, 12, 13, 14, 15, 16 |
| *Ludwigia decurrens* Walt. | *Onagraceae*          | 16            |
| *Melothria pendula* L.     | *Cucurbitaceae*       | 1, 17         |
| *Mikania micrantha* Kunth ex H.B.K | *Asteraceae* | 15            |
| *Oxalis barrelieri* L.     | *Oxalidaceae*         | 7             |
| *Phenax sonneratii* Poir.  | *Urticaceae*          | 17            |
| *Philodendron hederaceum* (Jacq.) Schott | *Araceae* | 12, 17 |
| *Ricinum humilis* L.       | *Phytolacaceae*       | 16, 17        |

1Each Location Code is defined in Table 1.
species and the thrips specimens were found on 17 of 28 botanical families represented at the sampling sites. The highest number of thrips species (Fig. 2) was found on members of the Asteraceae. *Echinothrips caribbeanus* Hood was found on 16 plant species (Fig. 3), the most for any thrips species herein. Twelve thrips species were narrowly specific in their plant preferences; each being found on a single plant species (Fig. 3). Information of other locations and weed species sampled are detailed in Sánchez-Monge (2010).

**AEOLOTHRIPIDAE**

Frankliniella cephaliaca

Drymaria cordata L.

Frankliniella standleyana

Conostegia subcrustulata Beurl.

Mikania micrantha Kunth ex H.B.K

Hoodothripiella ignatio

Spermacoce latifolia Aubl.

Microcephalothrips abdominalis

Wedelia trilobata L.

Retanathrips silvestris

Alternanthera sessilis L.

Spermacoce latifolia Aubl.

Spermacoce assurgens Ruiz & Pavón

Synedrella nodiflora L.

**PHLAEOTHRIPIDAE**

Idolothripinae

Gastrothrips Hood 1912

Gastrothrips sp.

The specimen collected on black nightshade, *Solanum nigrum* L., (Table 2) has the major characteristics of the genus according to Mound & Marullo (1996), however the tube is not constricted at the apex, as is usually the case in New World species (Mound & Marullo 1996). Since *Gastrothrips* is a fungal spore feeding genus, there is not a direct

**TABLE 2. (CONTINUED) ASSOCIATIONS OF THYSANOPTERAN FAMILIES AND SPECIES WITH FAMILIES AND SPECIES OF PLANTS AT THE LOCATIONS SAMPLED IN LIMÓN PROVINCE, COSTA RICA IN 2008-2009.**

| Thrips species/weed species | Host Botanical Family | Location Code |
|-----------------------------|-----------------------|---------------|
| *Solanum nigrum* L. | Solanaceae | 17 |
| *Spermacoce assurgens* Ruiz & Pavón | Rubiaceae | 15 |
| *Synedrella nodiflora* L. | Asteraceae | 10, 19 |
| *Echinothrips selaginellae* | | |
| Alternanthera sessilis L. | | |
| Laportea aestuans L. | | |
| Scleria melaleuca Rchb.f. ex. Schtdl.Cham. | | |
| Frankliniella cephalica | | |
| Drymaria cordata L. | Caryophyllaceae | 2, 11 |
| Frankliniella standleyana | Melastomataceae | 6 |
| Conostegia subcrustulata Beurl. | Asteraceae | 7, 14, 15 |
| Mikania micrantha Kunth ex H.B.K | | |
| Hoodothripiella ignacio | Rubiaceae | 2, 7, 8, 9 |
| Spermacoce latifolia Aubl. | | |
| *Microcephalothrips abdominalis* | | |
| Wedelia trilobata L. | Asteraceae | 10, 11 |
| *Retanathrips silvestris* | | |
| Alternanthera sessilis L. | Amaranthaceae | 16 |
| Spermacoce latifolia Aubl. | Rubiaceae | 7, 9 |
| *Spermacoce assurgens* Ruiz & Pavón | Rubiaceae | 8, 16 |
| *Synedrella nodiflora* L. | Asteraceae | 5, 6, 7, 8, 9 |

*Each Location Code is defined in Table 1.*
The host relationship of *Gastrothrips* sp. with *S. nigrum*; however, the plant species on which this thrips subfamily is found are always recorded (Sakimura & Bianchi 1977), and, indeed, some species in the Idolothripinae can also be found on dead leaves on hanging broken branches (Hoddle et al. 2004). It is interesting to point out that this specimen was found on just 1 of the 70 plant species sampled, and samples of the weeds surrounding in this location did not have any other specimens of *Gastrothrips*. A few Thysanoptera larvae were isolated from a *S. nigrum* sample at location 9 (Table 1), but we could not define their identity because diagnostic information on larval taxonomy is inadequate.

**Phlaeothripinae**

*Haplothrips* Amyot & Serville 1843

*Haplothrips gowdeyi* Franklin 1908

*H. gowdeyi* is a very common species in the Caribbean area (Mound & Marullo 1996), and it has been reported on pineapple, *Ananas comosus* (L.) Merr., species of *Aster* and *Bidens* (Asteraceae), *Salvia* (Lamiaceae), *Althaea* (Malvaceae)
Sánchez et al. (2009) found Thrips-plants associations in Costa Rica (Soto-Rodríguez et al., 2009), sugarcane leaves in South Africa (Way, 2008) and common pigweed, *Amaranthus hybridus* L., in Florida (Childers & Nakahara, 2006). Herein (Table 2) we report new associations with Asteraceae (*Emilia sonchifolia* (L.) DC, lilac tasselflower), Rubiaceae (*Spermacoce assurgens* Ruiz & Pav., woodland false buttonweed) and Poaceae (*Digitaria setigera* Roth ex Roem. & Schult., East Indian crabgrass; and *Eleusine indica* (L.) Gaertn., Indian goosegrass). On these same samples we found some Thysanoptera larvae but we could not determine their identity.

**Leptothrips Hood 1909**

**Leptothrips astutus** Johansen 1978

*L. astutus*, a predatory thrips species, was found on several plant species in several botanical families (Johansen, 1987) but our finding on *Stachytarpheta jamaicensis* (L.) Vahl, worrywine (Verbenaceae), is a first for this species (Table 2). This weed was sampled once and diverse organisms were isolated from it, i.e., Homoptera, Aphididae, nematodes and predatory mites. On *Synedrella nodiflora* (Asteraceae) and *Gouania polygama* (Jacq.) Urb., liane savon (Rhamnaceae), as well as new hosts for *Liothrips* species (Table 2); several adults were found in most samples of these weeds and they were found most frequently outside of banana farms (Table 2). We also found some Thysanoptera larvae on these plant species, but we could not identify them due to the lack of larval keys to genera in current literature.

**Liiothrips** Uzel 1895

**Liiothrips spp.**

Even though *Liiothrips* is the largest genus within the Thysanoptera (Mound & Morris, 2007), and even though some *Liiothrips* species have been proposed as biocontrol agents of weeds (Cock et al., 2000; Mound & Pereyra, 2008; Soto-Rodriguez et al., 2009), little is known about *Liiothrips* hosts and accomplices in Central America, since most neotropical species are reported from Brazil (Mound & Pereyra, 2008). Herein we report *Synedrella nodiflora* (Asteraceae) and *Gouania polygama* (Jacq.) Urb., liane savon (Rhamnaceae), as well as new hosts for *Liiothrips* species (Table 2); several adults were found in most samples of these weeds and they were found most frequently outside of banana farms (Table 2). We also found some Thysanoptera larvae on these plant species, but we could not identify them due to the lack of larval keys to genera in current literature.

**Torvothrips** Johansen 1977

**Torvothrips martinezi** Johansen 1980

According to the key provided by Johansen (1980), the specimen we collected corresponds to *T. martinezi*; nevertheless, some characters do not fit with the species description, which lacks data on associated plant species. We found *T. martinezi* on *Sida ulmifolia* Mill. *Torvothrips* is Mexican in origin (Johansen, 1982), and other species of this genus, i.e., *T. tremendous* (Johansen) and *T. kosztarabi* (Johansen), are associated with galls in *Quercus* spp. (Johansen, 1982, Kosztarab 1982). The genus *Torvothrips* includes only parasitoid species within galls of the coccids, *Olliffiella* spp. (Kermisidae) (Johansen & Mojica-Guzmán, 1996), but it is interesting that this taxon was not
found in any other sample during this research; not even in other samples collected at the same location. This is also the first record of T. martinezi for Costa Rica and Central America.

**THRIPIDAE**

*Arorathrips* Bhatti 1990

*Arorathrips mexicanus* Crawford 1909

A. *mexicanus* is widely distributed in neotropical where it is commonly associated with grasslands (Mound & Marullo 1996; Schuber et al. 2008), and it has been also reported from sugarcane leaves in South Africa (Way, 2008). We found A. *mexicanus* on 63% of Drymaria cordata L. (Caryophyllaceae) samples, and, other than on Eleusine indica, this thrips species has not been found on any monocotyledonous weed during this research (Table 2).

*Caliothrips* Daniel 1904

*Caliothrips fasciapennis* (Hinds 1902)

According to Mound & Marullo (1996), C. *fasciapennis* has been collected from grasslands in North America, i.e., from Massachusetts and Illinois to California, Florida and Texas as far as Mexico. Our report on Scleria melaleuca Rchb.f. ex. Schtdl. Cham. (Cyperaceae), a common weed on Neotropical grasslands (Gómez-Gómez et al. 2008), is a first of this thrips on a plant species in the Cyperaceae, and the first report of this thrips species for Central America. We found C. *fasciapennis* on all the samples from paddocks, a few specimens were isolated from 2 banana farm samples and 1 from another neighboring area (Table 2). Some thrips larvae were found on this weed species but their identities were not determined.

*Caliothrips nanus* (Hood 1927)

C. *nanus* is easy to recognize by the 2 dark stout grooved setae near the forked vein in the forewing, this species is known from Trinidad and West Indies (Wilson 1975), and has been reported from Panama by Mound & Marullo (1996). It was collected from Parkinsonia aculeate L., Jerusalem thorn (Fabaceae), in Trinidad, Mucuna (Fabaceae) leaves in Panama and from Glicidium sepium (Jacq.) Kunth ex Walp., quickstick (Fabaceae), and Ipomoea (Convolvulaceae) leaves in Costa Rica. Although the specimens were isolated from few samples, all samples correspond to the same weed species: Gouania polygama (Rhamnaceae).

*Caliothrips punctipennis* (Hood 1912)

Apparently C. *punctipennis* is a grass feeder (Sakimura 1991), and it was previously reported in Mexico and Texas (Mound & Marullo 1996). Recent literature reports its presence in avocado trees in Mexico (Johansen & Mojica 2007). This is the first report (Table 2) on the grass Eleusine indica and the first report for Costa Rica and Central America.

*Echinothrips* Moulton 1911

*Echinothrips caribbeanus* Hood 1955

E. *caribbeanus* was collected in Panama and has been reported on at least 3 botanical families, i.e., Capparidaceae, Menispermaceae and Cucurbitaceae (Mound & Marullo 1996). The hosts reported in this paper (Table 2) are new records at the species and family level, except for Cucurbitaceae. Its occurrence on Laportea aestuans L. (Urticaceae) is remarkable since E. *caribbeanus* was present at 7 different locations, most of them banana farms (Table 1). E. *caribbeanus* was also particularly common at location 17, Ecoturismo Banana Farm (Table 2).

*Echinothrips selaginellae* Mound 1994

E. *selaginella* was collected on Selaginella eurynota A. Braun, spikemoss (Selaginellaceae) (Mound et al. 1994; Mound & Marullo 1996), and it is known only from Costa Rica. Our report on Alternanthera sessilis (Amaranthaceae), Laportea aestuans (Urticaceae) and Scleria melaleuca (Cyperaceae) are new association records for this species (Table 2), implying that this thrips might not has a strict monophagous habit, as it was asserted by Mound (2002). Unfortunately, we did not find any thrips larvae on these weeds species; but it is important to point out that E. *selaginellae* was present only on these weeds throughout 2 years of sampling, involving 70 weed species and 829 samples.

*Frankliniella* Karny 1909

*Frankliniella cephalica* Crawford 1910

F. *cephalica* is widely distributed in the Caribbean and it has been collected in Costa Rica from different locations and altitudes (Mound & Marullo 1996). This species has been reported on several hosts species and botanical families (Masis & Madrigal 1994) including mangroves (Frantz & Mellinger 1990). Herein we present the first report of F. *cephalica* on Drymaria cordata L. (Caryophyllaceae).

*Frankliniella standleyana* Hood 1935

F. *standleyana* was reported from Conostegia subcrustulata (Beurl.) Triana (Melastomataceae) flowers (Mound & Marullo 1996), but our finding is the first record for this species on Mikania mi-
crantha Kunth ex H.B.K and its botanical family (Asteraceae). Some unidentified Thysanoptera larvae were associated with *M. micrantha* at locations 7, 17 and 19 (Table 1), however, this Asteraceae was the only weed (other than *C. subcrus-tulata*) on which we found *F. standleyana*.

**Hoodothripiella Retana-Salazar 2007**

**Hoodothripiella ignacio Retana-Salazar 2007**

*H. ignacio* was found previously in several areas in Costa Rica; but the relevant plant species for these samples were not determined because they were collected with Malaise Traps (Retana-Salazar 2007). The presence of *H. ignacio* on *Spermacoce latifolia* Aubl. (Rubiacae) is the first report on this weed species and its botanical family; this is important biological data on this thrips species. Interestingly, *H. ignacio* was found more frequently at locations outside the banana farms (Table 2) and it was not found on related weed species (*Spermacoce assurgens* or *S. capitata* Ruiz & Pav.).

**Microcephalothrips Bagnall 1926**

**Microcephalothrips abdominalis** (Crawford 1910)

*M. abdominalis* is a pest in ornamentals (Vierbergen et al. 2006), and an important vector of the Tobacco Streak Virus in Tobacco (Greber et al. 1991). Previously *M. abdominalis* was reported on *Ageratum conizoides* Lam., goat weed (Compositae-Eupatoriae) (Mound & Marullo 1996), Chrysanthemum and *Bidens pilosa* L. (Aster-aceae) (Childers & Nakahara 2006). *M. abdominalis*, is commonly associated with various Asteraceae genera (Childers & Nakahara 2006; Pirec 2007), but this is the first report of *M. abdominalis* on *Wedelia trilobata* L. (Asteraceae). *M. abdominalis* was sampled twice on *Wedelia trilobata* L.; whereas it was not found on any of the other 69 weed species sampled.

**Retanathrips Mound & Nickle 2009**

**Retanathrips silvestris** (Hood 1935)

Several specimens of *R. silvestris* were collected from 4 different plant species belonging to 3 botanical families (Table 2). All of them are new records for this taxon since the description of the *Retanathrips* species was based on few specimens and the associated plant species were not reported in this original work. Mound & Marullo (1996) considered that this species probably lives on the leaves of forest trees, but our reports suggests that *R. silvestris* is common on some weed species, especially *Symedrella nodiflora* (Aster-aceae) (Table 2), on which specimens were found in 4 different locations and 1 banana farm (Table 1). The infrequent collection of this species may be result of incorrect searching and sampling procedures.

Few studies have focused on the diversity of Thysanoptera on plant species, whether beneficial or harmful, or on weeds associated with crops. As a matter of fact, the interaction of weeds and arthropods has been largely ignored in surveys of agricultural landscapes (Bàrberi et al. 2010). Most literature on Thysanoptera treats only taxonomy, pest species, control of pest populations and other practical topics (Mound 2005). Commonly, data on biology or ecology are not detailed in descriptions of species (Monteiro 2001). Consequently, the lack of such information, at best, results in sketchy and partial knowledge of the habits and behavior of Thysanopteran species. Childers & Nakahara (2006) found thrips species to be associated with weed cover, which varied seasonally. Moreover, Hernández-Ayar et al. (2009) found that the diversity of Thysanoptera was different according to the sample location and the vegetation at each site; that the number of captured thrips species was higher in locations with weed cover than where a crop was associated with a limited number of weeds; and that the number of thrips species was lower at locations with the crop and only 1 other plant species used as a cover. Such findings are predictable because diversity of substrates serves to maintain populations of different arthropod species; and through plant species diversity the number of possible ecological associations is increased. This principle has been applied in several agricultural landscapes and crops for increasing the diversity of insects and the presence of natural enemies for pests (Schellhorn & Sork, 1997).

According to Mound (2005), a thrips' host is commonly defined as a plant species on which a thrips species can successfully maintain a population; thus all life stages of a species of thrips must be able thrive on a plant species; and that the number of thrips species was lower at locations with weed cover than where a crop was associated with a limited number of weeds; and that the number of thrips species was lower at locations with the crop and only 1 other plant species used as a cover. Such findings are predictable because diversity of substrates serves to maintain populations of different arthropod species; and through plant species diversity the number of possible ecological associations is increased. This principle has been applied in several agricultural landscapes and crops for increasing the diversity of insects and the presence of natural enemies for pests (Schellhorn & Sork, 1997).

Surveys like that of Hernández-Ayar et al. (2009) and the results obtained in this paper (Fig. 1) point out the effect that a crop or farm has on various arthropod populations. Moreover, these 2
studies have elucidated the diversity of direct and indirect associations between specific thrips species and specific plant species (Figs. 2 and 3). Further surveys on abundance and diversity of Thysanoptera on weeds are needed to clarify the relationships of these insects and their environments in the tropics, their impacts on plant and arthropod populations, and their population dynamics in cultivated and non cultivated areas.

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