

Aphididae (Hemiptera: Sternorrhyncha) from Costa Rica, with new records for Central America

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ABSTRACT

Sixty-four aphid species (Hemiptera, Sternorrhyncha: Aphididae) were caught by the authors in Costa Rica during 2008. The Costa Rican aphid catalogue is presented from our data and the records in the literature; it consists of 88 species. Data on the species are given and the faunistic composition is discussed. Nine species are recorded for the first time in Central America and another 10 are recorded for the first time in Costa Rica. A list relationships of “host plant species/aphid species” is presented, 79 of which are new for the world and 97 are new for Costa Rica.

Key words: Aphididae, Aphids, Costa Rica, Central America

RESUMEN

Aphididae (Hemiptera: Sternorrhyncha) de Costa Rica, con nuevas citas para América Central. A partir de las capturas en Costa Rica de 64 especies durante 2008 y de los datos registrados se establece el catálogo de los áfidos (Hemiptera, Sternorrhyncha: Aphididae) de Costa Rica, que consta de 88 especies. Nueve especies se citan por primera vez en Centroamérica y otras 10 más por primera vez en Costa Rica. Se ofrecen datos sobre las especies citadas, se comenta la composición faunística y se presenta una lista de relaciones “especie de planta hospedadora/especie de pulgón”, con 79 nuevas relaciones para el Mundo y otras 97 para Costa Rica.

Palabras clave: Aphididae, áfidos, Costa Rica, América Central

INTRODUCTION

Aphids (Hemiptera Aphididae) are known by a wide sector of the population because some species live on crops in large, easily visible colonies. Farmers and agricultural experts are also aware of their importance as pests and vectors of viral diseases, though only a few of the total number of species in the world affect plants of economic importance (BLACKMAN & EASTOP, 2000).

The greatest diversity of aphids can be found in ancient Laurasia, though one group of subfamilies has a Gondwanan distribution. Some ancient Gondwanan territories (India, Africa, South America) have received aphid lineages from the corresponding Laurasian territories with which they came into contact. In the last few hundreds of years, human activity has greatly influenced the dispersal of aphid species associated with crops or weeds. Current data show that aphid faunas in tropical regions are less diverse than in temperate regions situated further north, and also that the diversity of aphids increases with the altitude of a tropical territory (EASTOP, 1998).

Central America is situated in the tropical region and connects ancient Nearctic and Gondwanan territories. Its mountains and volcanoes determine great differences in altitude and therefore in temperatures and rainfall. As occurs in other regions of America, a large number of crops come from other parts of the world, and in the last century trade and the movement of people has increased progressively. As a result, the study of aphid fauna from Central American countries is important because it can increase our knowledge of their distribution patterns.

Recently, new data on Central American aphid fauna were given in a detailed study of aphids from Panama, which is now the country with the largest number of recorded species, 71 of the 106 known throughout Central America (QUIRÓS *et al.*, 2009).

Until 2003, there were very few records of aphids or species that attack crops of economic importance in Costa Rica. In that year, VOEGTLIN *et al.* (2003) published an extensive study devoted to viviparous alatae and the important role that knowledge of them plays in the prevention and control of attacks on crops; information on general aspects of morphology, biology, keys for identifying alatae and data on each species, are provided in this study.

To increase our knowledge of the aphid fauna of Costa Rica, we carried out two intensive collection campaigns in February and December 2008, covering almost the entire territory, as well as other sporadic expeditions that year and in 2009. As a first result of the study, the presence and very

wide distribution of *Greenidea psiidi* were made known by PÉREZ HIDALGO *et al.* (2009).

MATERIAL AND METHODS

Costa Rica is situated 8-11°N and 82-85°W, with an area of 51,100 km², 23 % of which consists of conservation areas, nature reserves or national parks. It has two mountain ranges, reaching 3,829 m in the “Cerro Chirripó”. The territory is distributed in seven provinces: Alajuela, Cartago, Guanacaste, Heredia, Limón, Puntarenas and San José.

A total of 650 samples of aphids were studied. The aphids were mainly collected by prospecting the plants, but other —registered as vagrants— was caught beating plants over a tray or capturing alatae in flight; host-plants registered belong to 51 families. The captured specimens were fixed in ethanol 70° or placed with their host plant in raising boxes (plastic boxes with a large opening covered with hairnet of nylon for ventilation), and the adults were removed during the following days. The aphids were studied and identified for the authors in alcohol or in microscopic slides. They are now in the University of Leon Zoological Collection and in the University of Costa Rica (Centro de Biología Celular y Molecular) collection.

The plants were identified by the authors or by personnel from the *Instituto Nacional de Biodiversidad* (INBIO) or the *Escuela de Biología* of the *Universidad de Costa Rica*, and their names have been checked with the Tropicos data base (MISSOURI BOTANICAL GARDEN, 2009).

RESULTS AND DISCUSSION

Aphids (Aphididae) from Costa Rica

Sixty-four aphid species were identified, bringing the number of species known in Costa Rica to 88, which are listed in alphabetical order without including the name of the subgenus.

The following data are given for each species, though not always in the same order: (1) The taxonomic adscription, based on REMAUDIÈRE & REMAUDIÈRE (1997), NIETO NAFRÍA *et al.* (1998), QUEDNAU (1999, 2003), EASTOP & BLACKMAN (2005); (2) Distribution known worldwide, generally in America, and in Central America, based on BLACKMAN &

EASTOP (1994, 2000, 2006), VOEGTLIN *et al.* (1986), SÁNCHEZ *et al.* (2000), VOEGTLIN *et al.* (2003), ÉTIENNE (2005), CERMELI (2007) and QUIRÓS *et al.* (2009); (3) Host plants (mainly based on BLACKMAN & EASTOP, 1994, 2000, 2006), and the life cycle and harmfulness of some species; (4) Known distribution in Costa Rican provinces based on VOEGTLIN *et al.* (2003), CALVO (1978), CHACÓN (1980), GÓMEZ (1987), HERNÁNDEZ & MENESES (1988), MENESES & AMADOR (1988), MENESES *et al.* (1990), RIVERA *et al.* (1994), SÁNCHEZ *et al.* (2001), BLACKMAN & EASTOP (2006), PÉREZ HIDALGO *et al.* (2009) and ZAMORA MEJÍAS *et al.* (in print).

The records of each species are arranged in alphabetical order and successively by plant, province and locality. One asterisk (*) before the name of a province indicates a new record of an aphid in this province.

***Acyrtosiphon bidenticola* Smith, 1960** (Aphidinae Macrosiphini)

Of American origin, perhaps Nearctic. Known from Mexico, Jamaica, Cuba, Puerto Rico, Nicaragua, Panama, Venezuela and Brazil. It lives on Asteraceae and some species of other families. Already known from Alajuela and Cartago, Costa Rica.

New records.—*Tithonia rotundifolia*: ALAJUELA: San Josecito.

***Acyrtosiphon malvae* (Mosley, 1841)** (Aphidinae Macrosiphini)

Of non-American origin, possibly Palearctic. Subcosmopolitan currently, recorded in North and South America, and Panama. It has a wide feeding spectrum and shows preference for species of Malvaceae.

First record for Costa Rica.—*Geranium guatemalense*: *SAN JOSÉ: Cerro de la Muerte. The specimens are adscribed to the nominotypical subspecies.

***Aphis amaranthi* Holman, 1974** (Aphidinae Aphidini Aphidina)

American species, perhaps neotropical, recorded in the United States, Cuba, Venezuela and Brazil. Typically found on species of *Amaranthus* and preferably radicolous. Known in Alajuela and San José, Costa Rica. No new records have been made.

***Aphis coreopsisidis* (Thomas, 1878)** (Aphidinae Aphidini Aphidina)

Possibly of Nearctic origin, usually recorded on species of Asteraceae in several South American and Caribbean countries, and in Africa (Ghana and Uganda); also, in Honduras and Panama. Already known in Alajuela and Cartago, Costa Rica.

New records.—Asteraceae: *HEREDIA: Santo Domingo; *PUNTARENAS: San Vito. *Bidens pilosa*: CARTAGO: Banderilla; Cervantes; PUNTARENAS: Agua Buena; *SAN JOSÉ: Aserrí, Frailes, San Pedro de Montes de Oca.

***Aphis craccivora* Koch, 1854** (Aphidinae Aphidini Aphidina)

Non-American in origin (possibly Palearctic), with a cosmopolitan distribution. This polyphagous species is frequently recorded due the damage it causes as a vector of over 30 viruses in certain crops, particularly legumes. Recorded in Honduras, Nicaragua and Panama. Already known from Costa Rica, in Alajuela, Cartago and San José.

New records.—*Arachis pintoi*: SAN JOSÉ: San Pedro de Montes de Oca. *Desmodium* sp.: *PUNTARENAS: Agua Buena, Coto Brus. Fabaceae: ALAJUELA: Monterrey, San Carlos. *Pteridium aquilinum*: *GUANACASTE: Filadelfia. *Trifolium* sp.: CARTAGO: San Juan de Chicué; SAN JOSÉ: San Pedro de Montes de Oca. *Vicia* sp.: CARTAGO: San Juan de Chicué. Vagrant: *LIMÓN: Siquirres.

***Aphis forbesi* Weed 1889** (Aphidinae Aphidini Aphidina)

Native of North America, introduced in the Caribbean islands, South America, Europe and Japan. It lives on strawberry plants where it causes damage directly or as a viral vector. Recorded in Costa Rica, in Cartago and San José. No new records have been made.

***Aphis gossypii* Glover, 1877** (Aphidinae Aphidini Aphidina)

Of non-American origin, possibly Palearctic, but currently cosmopolitan. It is polyphagous, and as a vector of over 50 viruses, it has wide phytosanitary repercussions. Known from all countries in Central America. Recorded on more than 50 species of plants, in Alajuela, Cartago, Guana-

caste, Heredia, Limón and Puntarenas, Costa Rica; the record for San José (see below) confirms its presence in all of the country.

New records.—*Arachis pintoi*: PUNTARENAS: Agua Buena, Coto Brus. *Blechnum pyramidatum*: ALAJUELA: La Fortuna. *Capsicum* sp.: GUANACASTE: Nicoya. *SAN JOSÉ: San José. *Chamaesyce* sp.: ALAJUELA: Venecia. *Commelina* sp.: HEREDIA: Sarapiquí; SAN JOSÉ: San Pedro de Montes de Oca. *Cuphaea carthagenensis*: ALAJUELA: San Josecito. *Cyathula achyranoides*: ALAJUELA: Venecia. *Cyphomandra betacea*: ALAJUELA: Fraijanes. *Digitaria setigera*: GUANACASTE: La Tejona. *Erechtites hieracifolius*: PUNTARENAS: San Vito. *Glycine max*: ALAJUELA: Upala. *Helianthus annuus*: HEREDIA: Santo Domingo. *Hibiscus rosa-sinensis*: GUANACASTE: Nicoya; SAN JOSÉ: San Pedro de Montes de Oca. *Hibiscus schizopetalus*: LIMÓN: Puerto Viejo. *Hibiscus* sp.: GUANACASTE: La Tejona. Malvaceae: ALAJUELA: La Fortuna. *Neuro-laena lobata*: ALAJUELA: La Fortuna. *Psidium guajava*: ALAJUELA Bijagua; San Rafael de Guatuso; GUANACASTE: Liberia; HEREDIA: Braulio Carrillo. *Rauvolfia tetraphylla*: GUANACASTE: 27 de Abril. *Spermacoce* sp.: HEREDIA: Braulio Carrillo. *Thunbergia grandiflora*: SAN JOSÉ: San Pedro de Montes de Oca. Unidentified plant: ALAJUELA: La Fortuna, San Rafael de Guatuso; GUANACASTE: Tilarán; HEREDIA Santo Domingo; SAN JOSÉ: San Pedro de Montes de Oca.

***Aphis helianthi* Monell, 1879** (Aphidinae Aphidini Aphidina)

Nearctic species, recorded in Cuba. Probably anholocyclic in Costa Rica. It is an important vector of two diseases in sunflowers. Recorded in Alajuela, Guanacaste and San José, on sunflowers and *Aloe vera*.

New records.—*Yucca guatemalensis*: SAN JOSÉ: San Pedro de Montes de Oca, San Ramón de Tres Ríos.

***Aphis illinoisensis* Shimer, 1866** (Aphidinae Aphidini Aphidina)

Of Nearctic origin, widely distributed outside North America, with records in Greece, Turkey and Israel, a large part of South America, on a number of Carribean islands, Honduras and Panama. It lives on *Vitis* and is a viral vector, though it has not been associated with any vine viruses. Already known from Alajuela and Cartago, Costa Rica.

New records.—*Vitis vinifera*: *SAN JOSÉ: San José.

***Aphis (Protaphis) middletonii* Thomas, 1879** (Aphidinae Aphidini Aphidina)

Of North American origin. Recorded in Brazil, Venezuela and Cuba, also in Australia and South Africa. It is oligophagous and radicolous. Known from Cartago, Costa Rica. No new records have been made.

***Aphis nerii* Boyer de Fonscolombe, 1841** (Aphidinae Aphidini Aphidina)

Of non-American origin (Palearctic or Oriental), distributed world wide in temperate-warm to tropical climates, and living mainly on species of Apocinaceae and Asclepiadaceae; it is a virus vector on sugar cane, papaya and citrus fruits. It is known in Honduras, Nicaragua, Panama and Costa Rica, in Alajuela, Cartago, Heredia and San José.

New records.—*Asclepias curassavica*: *PUNTARENAS: Ciudad Neily. *Asclepias* sp.: ALAJUELA: Monterrey, Venecia; *GUANACASTE: La Tejona, Tilarán, Santa Elena.

***Aphis sambuci* Linnaeus, 1758** (Aphidinae Aphidini Aphidina)

Origin not yet identified (Palearctic or Holarctic), widely distributed in Europe, a large part of Asia and North America, also recorded in Argentina and Brazil. Its primary hosts are species of *Sambucus* and it is oligophagous and normally radicolous on its secondary host.

First records for Central America.—*Sambucus nigra*: SAN JOSÉ: Sabanilla; ALAJUELA: Alajuela.

***Aphis spiraecola* Patch, 1914** (Aphidinae Aphidini Aphidina)

Origin not yet identified (Palearctic or Oriental), cosmopolitan, polyphagous, of phytosanitary importance as it is a vector of several viruses. Recorded in Belize, Honduras, El Salvador, Nicaragua and Panamá. Known from Costa Rica, in Alajuela, Cartago, Guanacaste and San José.

New records.—*Ageratina pichinchensis*: SAN JOSÉ: Jardín. *Ageratum conyzoides*: GUANACASTE: Liberia. *Alpinia purpurata*: ALAJUELA: La Fortuna. *HEREDIA: Santo Domingo. Apiaceae: PUNTARENAS: San Vito; SAN JOSÉ: San Pedro de Montes de Oca, Uruca. Asteraceae: GUANACASTE: La Tejona; LIMÓN: Puerto Viejo, SAN JOSÉ: Rancho Redondo, San Ramón de Tres Ríos; CARTAGO: Ujarrás; GUANACASTE: Liberia. *Bidens pilosa*:

*PUNTARENAS: Agua Buena, Coto Brus. *Bougainvillea* sp.: SAN JOSÉ: San Pedro de Montes de Oca; GUANACASTE: La Tejona. *Citrus*.sp.: ALAJUELA: Monteverde, HEREDIA: Santo Domingo. *Commelina* sp.: ALAJUELA: La Fortuna; SAN JOSÉ: San Pedro de Montes de Oca. *Conyza canadensis*: HEREDIA: Braulio Carrillo. *Crataegus azarolus*: GUANACASTE: La Cruz. *Desmodium incanum*: ALAJUELA: La Fortuna. *Emilia fosbergii*: GUANACASTE: Nuevo Arenal. *Erechtites hieracifolius*: ALAJUELA: Venecia. *Erigeron* sp.: ALAJUELA: Monterrey. *Eriobothrya* sp.: ALAJUELA: Monteverde. *Gamochaeta americana*: ALAJUELA: Monteverde. *Garcinia madruno*: GUANACASTE: Liberia; SAN JOSÉ: San José. *Hibiscus rosa-sinensis*: SAN JOSÉ: San Pedro de Montes de Oca. *Iresine diffusa*, GUANACASTE: Nuevo Arenal. *Ixora* sp.: ALAJUELA: Aguas Zarcas, San Carlos, La Fortuna; GUANACASTE: Liberia. *Jacaranda mimosifolia*: SAN JOSÉ: San Pedro de Montes de Oca. *Ludwigia* sp.: CARTAGO: El Copal, Turrialba, Clavillo; ALAJUELA: Fraijanes; Upala. *Melanthera nivea*: GUANACASTE: Liberia. *Monochaetum* sp: ALAJUELA: Volcán Poás. *Oyedaea verbesinoides*: SAN JOSÉ: Jardín. *Pectis* sp.: GUANACASTE: Liberia. *Phenax rugosus*: ALAJUELA: La Fortuna. *Psidium guajava*: CARTAGO: Ujarrás. *Rumex nepalensis*: SAN JOSÉ: San Pedro de Montes de Oca. Scrophulariaceae: GUANACASTE: Dos de Tilarán. *Senecio* sp.: ALAJUELA: La Fortuna. *Tabebuia impetiginosa*: HEREDIA: Santo Domingo. *Vanilla* sp: GUANACASTE: Nicoya. *Valeriana* sp.: ALAJUELA: Monteverde. *Viburnum costaricanum*: ALAJUELA: Monteverde.

Aulacorthum solani (Kaltenbach, 1843) (Aphidinae Macrosiphini)

Of non-American (Palearctic) origin, cosmopolitan and harmful to potato crops and a number of horticultural crops as it is vector of over 40 viruses. Recorded in Honduras, Nicaragua and Panama. In Costa Rica, it has been recorded in Alajuela, Cartago and San José.

New records.—*Ageratum conyzoides*: ALAJUELA: Monteverde. Asteraceae: ALAJUELA: Monteverde; SAN JOSÉ: San Ramón de Tres Ríos. *Desmodium incanum*: ALAJUELA: Monteverde. Fabaceae: CARTAGO: San Juan de Chicué. *Fuchsia paniculata*: SAN JOSÉ: Emplame. *Hibiscus rosa-sinensis*: SAN JOSÉ: San Pedro de Montes de Oca. *Lactuca sativa*: ALAJUELA: Monteverde. *Myrica pubescens*: SAN JOSÉ: Cerro de la Muerte. *Nasa triphyla*: SAN JOSÉ: San Ramón de Tres Ríos. *Pteridium aquilinum*: SAN JOSÉ: Tarbaca. *Quercus costaricensis*: SAN JOSÉ: Cerro de la Muerte, Ojo de Agua, Villa Mills. *Rubus* sp.: SAN JOSÉ: San Ramón de Tres Ríos. *Rumex* sp.: CARTAGO: San Juan de Chicué. *Sonchus* sp.: SAN JOSÉ: Tarbaca. *Tulipa* sp.: SAN JOSÉ: San José. Vagrant: CARTAGO: La Pastora; GUANACASTE: La Cruz.

***Brachycaudus helichrysi* (Kaltenbach, 1843)** (Aphidinae Macrosiphini)

Of non-American (Palearctic) origin, cosmopolitan and harmful to several crops, even to non-host plants due to its capacity to transmit viruses. Recorded in Nicaragua and Panama. Known from Costa Rica, in Alajuela, Cartago and San José.

New records.—*Ageratina ixiocladon*: CARTAGO: Volcán Irazú. *Ageratum conyzoides*: ALAJUELA: Fraijanes, Monteverde. *Andryala* sp.: SAN JOSÉ: Rancho Redondo. Asteraceae: SAN JOSÉ: División, Jardín, Ojo de Agua, San Ramón de Tres Ríos; ALAJUELA: San Josecito. *Conyza canadensis*: *HEREDIA: Braulio Carrillo. *Desmodium intortum*: SAN JOSÉ: La Ese. *Diplostephium costaricense*: SAN JOSÉ: Cerro de la Muerte. *Erechtites hieracifolius*: SAN JOSÉ: Jardín, San Pedro de Montes de Oca. *Erechtites valerianifolia*: SAN JOSÉ: Jardín. *Gnaphalium* sp.: ALAJUELA: Monteverde, Volcán Poás. *Hemichaena fruticosa*: SAN JOSÉ: Jardín. *Liabum bourgeauii*: SAN JOSÉ: Jardín, La Ese. *Rumex* sp.: CARTAGO: San Juan de Chicué. *Senecio cooperi*: ALAJUELA: Monteverde. *Sigesbeckia jorullensis*: SAN JOSÉ: Cerro de la Muerte. *Sonchus* sp.: *GUANACASTE: Quebrada Grande (Tilarán). *Valeriana* sp.: ALAJUELA: Monteverde.

***Brachycaudus (Mordvilkomemor) rumexicolens* (Patch, 1917)** (Aphidinae Macrosiphini)

Of Palearctic origin, recorded widely in Europe and Asia, also found in the rest of the world, including South America; recorded in Panama. Monoic on species of *Rumex*. Known from Cartago and San José, Costa Rica. No new records have been made.

***Brevicoryne brassicae* (Linnaeus, 1758)** (Aphidinae Macrosiphini)

Of Palearctic origin with a cosmopolitan distribution having been introduced by man. Associated with several genera of Brassicaceae and can cause damage in the corresponding crops as it is known to be a vector of 16 viruses. In Central America it has been recorded in Guatemala, El Salvador and Honduras. Known from Alajuela and Cartago in Costa Rica.

New records.—*Brassica* sp.: *SAN JOSÉ: San Ramón de Tres Ríos. *Rhaphanus raphanistrum*: CARTAGO: San Juan de Chicué.

***Capitophorus elaeagni* (del Guercio, 1894)** (Aphidinae Macrosiphini)

Of non-American (Palearctic) origin and with a subcosmopolitan distribution, following plants belonging to the family Asteraceae which were originally its secondary host and may be their only sustenance. Reported in Honduras, Panama and Costa Rica, in Alajuela and Cartago.

New records.—**Carduus* sp.: *SAN JOSÉ: Cerro de la Muerte.

***Capitophorus hippophaes javanicus* (Hille Ris Lambers, 1953)** (Aphidinae Macrosiphini)

Its origin is difficult to determine, Palearctic or Oriental. Outside its possible area of origin, it has been recorded in tropical areas of Asia, Australia, Africa (Kenya), and widely in America, usually on *Polygonum*. Known from Panama and from Alajuela and Cartago in Costa Rica.

New records.—*Polygonum* sp.: CARTAGO: Banderilla; *HEREDIA: Braulio Carrillo; *SAN JOSÉ: Coronado.

***Carolinaia caricis* Wilson, 1911** (Aphidinae Macrosiphini)

Of Nearctic origin and frequently recorded in North America; known from some Carribean islands, Venezuela and Surinam. In Central America, it is only known from Costa Rica, in the province of Alajuela.

New records.—*Cyperus papyrus*: *HEREDIA: El Ángel.

***Cavariella aegopodii* (Scopoli, 1763)** (Aphidinae Macrosiphini)

Of non-American origin (Palearctic), extensively distributed world wide, affecting crops of a number of umbelliferous plants, its secondary host (or only host if anholocyclic). Vector of several viruses. In Central America, it is only known in Costa Rica, in Alajuela, Cartago and San José. One record on the willow, *Salix* sp., together with a previous one on this plant confirms that this species, or at least some of its populations, closes they dioecious cycle in Costa Rica.

New records.—Apiaceae: SAN JOSÉ: San Pedro de Montes de Oca. *Foeniculum vulgare*: SAN JOSÉ: Coronado. *Pimpinella anisum*: SAN JOSÉ: Coronado. *Salix* sp.: CARTAGO: Ochomogo. Vagrant: SAN JOSÉ: Rancho Redondo.

***Cerataphis brasiliensis* (Hempel, 1901)** (Hormaphidinae Cerataphidini)

Of non-American origin (Oriental) and pantropical distribution on palms and other monocotyledonae. Recorded in Honduras and Panama. Known from Alajuela and Cartago in Costa Rica.

New records.—*Chrysalidocarpus lutescens*: ALAJUELA: Alajuela, La Fortuna. *Chamaedorea costaricana*: *SAN JOSÉ: San Pedro de Montes de Oca. Unidentified palm: *PUNTARENAS: Agua Buena.

***Cerataphis orchidearum* (Westwood, 1879)** (Lachninae Eulachnini)

Of non-American origin (Oriental) with a pantropical distribution. Recorded in Honduras and Panama. Typical of orchids, whereas the previous species lives on palms. Known from Alajuela, Costa Rica.

New records.—*Alpinia purpurata*: *SAN JOSÉ: San José. Orchidaceae: *HEREDIA: Santo Domingo.

***Chaitophorus stevensis* Sanborn, 1904** (Chaitophorinae Chaitophorini)

Of Nearctic origin, usually found on *Populus* spp. Outside North America, it has only been recorded in Alajuela, Costa Rica. No new records have been made.

***Cinara atlantica* (Wilson, 1919)** (Lachninae Eulachnini)

Of Nearctic origin, widely distributed in North America and recorded in Cuba and Jamaica, always on pines, where dense populations of this aphid can cause damage. Already known from Costa Rica, in Alajuela and Cartago. No new records have been made.

***Cinara* (*Cupressobium*) *fresai* E.E. Blanchard, 1939** (Lachninae Eulachnini)

Although non-American in origin (Palearctic), it was described from Argentina; widely distributed throughout the world on species of *Cupressus*, *Juniperus* and other proximate genera. In Central America, it has only been recorded in Cartago, Costa Rica.

New records.—*Cupressus lusitanica*: *ALAJUELA: Monteverde; *GUANACASTE: La Tejona, Liberia; *PUNTARENAS: Agua Buena; *SAN JOSÉ: Aserri, Dulce Nombre, La Ese. Vagrant: SAN JOSÉ: Empalme.

Cinara (Cupressobium) lousianensis (Boudreaux, 1949) (Lachninae Eulachnini)

Of Nearctic origin, it is distributed in the southern United States (on *Thuja*), Mexico (on *Cupressus*) and Cuba (on *Thuja*) and has been introduced in Taiwan, Tasmania and New Zealand (on species of *Thuja* and *Chamaecyparis*).

First record for Central America.—*Thuja* sp.: GUANACASTE: La Tejona.

Cinara pergandei (Wilson, 1919) (Lachninae Eulachnini)

Of Nearctic origin, known from the eastern United States, Canada and Cuba, always on pines. Already known from Costa Rica, in Alajuela and Guanacaste. No new records have been made.

Cinara watsoni Tissot, 1939 (Lachninae Eulachnini)

Of Nearctic origin. Known on several species of pines in the eastern United States and Central America: in Panama and San José province, Costa Rica.

New records.—*Pinus* sp.: *GUANACASTE: La Cruz, La Tejona; SAN JOSÉ: San Pedro de Montes de Oca.

Eriosoma lanigerum (Hausmann, 1802) (Eriosomatinae Eriosomatini)

Possibly of Nearctic origin, widely distributed in temperate areas in the world, with records in some tropical countries such as the Dominican Republic, always on apple trees, where it can cause damage. In Central America, it has only been recorded in Alajuela, Costa Rica. No new records have been made.

***Eulachnus rileyi* (Williams, 1911)** (Lachninae Eulachnini)

Of non-American (Palearctic) origin, with a subcosmopolitan distribution, always on species of *Pinus*. Recorded in Panama.

First records for Costa Rica.—*Pinus* sp.: GUANACASTE: La Cruz, La Tejona; SAN JOSÉ: San Pedro de Montes de Oca.

***Geopemphigus floccosus* (Moreira, 1925)** (Eriosomatinae Fordini)

Geopemphigus is the only genus of Nearctic origin in its tribe, its distribution area having spread south towards Brazil. Relatively common in *Ipomaea* roots, where it causes damage in sweet potato crops (*I. batata*). In Central America, it has been recorded in Belize, El Salvador, Panama and Costa Rica, in Alajuela, Cartago and Guanacaste provinces. No new records have been made.

***Greenidea (Trichosiphum) psidii* van der Goot, 1916** (Greenideinae Greenideini)

Of Oriental origin and widely distributed in this zoogeographic region and also known north-east to Japan, and south-east to Australia. It has been recorded from Hawaii, California, Florida and Brazil and recently (PÉREZ HIDALGO *et al.*, 2009) all over Costa Rica on *Psidium guajava* and also on *P. friedrichsthalianum* and *Myrciaria cauliflora*. No new records have been made.

***Hyperomyzus carduellinus* (Theobald, 1915)** (Aphidinae Macrosiphini)

Possibly of Palearctic origin, and widely distributed in eastern Asia and other parts of the world with a warm climate, though in America it has only been recorded in Argentina, Bolivia, Guadalupe and the United States (in Florida), always on species of some genera of Asteraceae.

First records for Central America.—Asteraceae: ALAJUELA: Monteverde. *Sonchus oleraceus*: ALAJUELA: Fraijanes; SAN JOSÉ: El Empalme, San Ramón de Tres Ríos, San Pedro de Montes de Oca. *Sonchus* sp.: GUANACASTE: Dos de Tilarán, Tilarán; HEREDIA: Santo Domingo; SAN JOSÉ: San José.

***Hyperomyzus lactucae* (Linnaeus, 1758)** (Aphidinae Macrosiphini)

Of Palearctic origin, with a subcosmopolitan distribution, it is found on different liguliflorae (Asteraceae), where it acts as a virus vector. In Central America, it has been recorded in Honduras, Panama; and in Alajuela, Cartago and San José, Costa Rica. No new records have been made.

***Hysteroneura setariae* (Thomas, 1878)** (Aphidinae Aphidini Rhopalosiphina)

Of Nearctic origin, currently very widely distributed in warm parts of the world, on species of several genera of Poaceae and Cyperaceae; it is a known virus vector. Recorded in Honduras, Nicaragua and Panama. Recorded in Alajuela, Costa Rica.

New records.—*Axonopus* sp.: *GUANACASTE: Liberia. Cyperaceae: GUANACASTE: Santa Rosa. *Digitaria costaricensis*: *PUNTARENAS: Ceibo. *Digitaria setigera*: ALAJUELA: Upala. *Digitaria* sp.: ALAJUELA: Venecia. *Eleusine indica*: ALAJUELA: La Fortuna; HEREDIA: Puerto Viejo, Sarapiquí; PUNTARENAS: Ceibo; *SAN JOSÉ: San Pedro de Montes de Oca. *Oplismenus burmannii*: GUANACASTE: Santa Rosa. *Panicum* sp.: GUANACASTE: Santa Rosa. *Paspalum* sp.: ALAJUELA: Venecia. Poaceae: GUANACASTE: Liberia; SAN JOSÉ: San Pedro de Montes de Oca.

***Idiopterus nephrolepidis* (Davis, 1909)** (Aphidinae Macrosiphini)

Of American, possibly Neotropical origin, with a subcosmopolitan distribution, entering cold regions and taking advantage of buildings (houses, greenhouses, etc.). Typically found on species of several genera of fern. Recently recorded in Costa Rica, in San José province (ZAMORA MEJÍAS *et al.*, in print). No new records have been made.

***Illinoia morrisoni* (Swain, 1918)** (Aphidinae Macrosiphini)

Of Nearctic origin, and characteristic of *Cupressus*. Widely distributed in the western United States and Canada, and known from Mexico, Panama and Venezuela.

First records for Costa Rica.—*Cupressus lusitanica*: SAN JOSÉ: Empalme, La Ese, Dulce Nombre.

***Lipaphis pseudobrassicae* (Davis, 1914)** (Aphidinae Macrosiphini)

Possibly originating from the eastern Palearctic region, currently widely distributed throughout the world in areas with warm climates. Its dense population levels cause damage in cruciferae, and also because it is a virus vector. Recorded in Central America, in Belize, Honduras, Nicaragua, and Panama. Known from Alajuela and Cartago in Costa Rica.

New records.—*Brassica* sp.: CARTAGO: Banderilla. *Raphanus raphanistrum*: *SAN JOSÉ: Cerro de la Muerte.

***Lizerius (Paralizerius) cermelii* Quednau 1974** (Lizeriinae)

Of Neotropical origin, recorded in Brazil and Venezuela; typically found on *Ocotea*. Known from Belize and Panama, Central America and from Alajuela, Costa Rica. No new records have been made.

***Macrosiphoniella sanborni* (Gillette, 1908)** (Aphidinae Macrosiphini)

Of non-American (possibly Palearctic) origin, with a subcosmopolitan distribution, always found on species of *Chrysanthemum* or proximate genera; can cause damage to flower crops of this type. Recorded in Honduras and Panama.

First record for Costa Rica.—*Chrysanthemum* sp.: SAN JOSÉ: San Pedro de Montes de Oca.

***Macrosiphum cyatheae* (Holman, 1974)** (Aphidinae Macrosiphini)

Described in Cuba and recorded in Venezuela and Mexico. This species lives in very small scattered populations on ferns, *Pteridium* and *Cyathea*.

First records for Central America.—*Pteridium aquilinum*: SAN JOSÉ: Ojo de Agua, Tarbaca. Vagrant: SAN JOSÉ: Frailes.

***Macrosiphum euphorbiae* (Thomas, 1878)** (Aphidinae Macrosiphini)

Of Nearctic origin, subcosmopolitan distribution, recorded in Honduras, Nicaragua and Panama. This polyphagous species can be harmful to many crops, both directly and indirectly as it is a vector of over 40 viruses. Already recorded in Cartago, Costa Rica.

New records.—Asteraceae: SAN JOSÉ: Rancho Redondo. Vagrant: SAN JOSÉ: La Ese, Pérez Zeledón.

***Macrosiphum mesosphaeri* Tissot, 1934** (Aphidinae Macrosiphini)

Of American, possibly Nearctic origin, recorded in several countries, from the United States to Argentina. Known from Panama. Recorded on species of arboreous dicotyledons from primitive families and also on species of Lamiaceae. Recorded in Costa Rica by BLACKMAN & EASTOP (2006) on *Quercus* sp. based on specimens in the *Natural History Museum*, London, collected in the Cerro Chirripó National Park (province of SAN JOSÉ) in February, 1983, J.H. Martin leg.

New records.—*Hyptis capitata*: *GUANACASTE: Liberia. *Hyptis pectinata*: GUANACASTE: La Cruz. *Hyptis* sp.: GUANACASTE: Liberia, Tilarán; SAN JOSÉ: Frailes. *Pogostemon cablin*: *HEREDIA: Santo Domingo. *Salvia lasiocephala*: GUANACASTE: La Cruz.

***Macrosiphum rosae* (Linnaeus, 1758)** (Aphidinae Macrosiphini)

Of no-American (possibly Palearctic) origin, with a subcosmopolitan distribution on *Rosa* spp., which is its primary and often its only host, causing considerable damage to crops for cut flowers, greenhouses and gardens; it is a vector of several viruses, none of which affect roses. Recorded in Honduras, Nicaragua and Panama. Known from Alajuela, Cartago and San José, Costa Rica.

New records.—*Rosa* sp.: SAN JOSÉ: San José, San Pedro de Montes de Oca.

***Macrosiphum salviae* Bartholomew, 1932** (Aphidinae Macrosiphini)

Of American, possibly Nearctic origin, its feeding regime and life cycle are similar to *M. mesosphaeri*. Recorded in the United States,

Cuba, Puerto Rico, Venezuela and in El Salvador and Honduras, Central America.

First records for Central America.—*Tetrademia riparia*: SAN JOSÉ: San José (*Natural History Museum* collection, London, J.H. Martin leg.), Coronado, Sabanilla, Cartago: Tres Ríos. *Alnus acuminata*: SAN JOSÉ: Coronado. *Morella cerifera*: SAN JOSÉ: Ojo de Agua.

***Melanaphis sacchari* (Zehntner, 1897)** (Aphidinae Aphidini Rhopalosiphina)

Possibly of eastern Palearctic origin, widely distributed in all tropical and subtropical regions in the world, on species of several genera of Poaceae, mainly on sugar cane and sorghum, causing damage to these crops as a virus vector. Recorded in Panama and Alajuela and San José in Costa Rica. No new records have been made.

***Metopolophium dirhodum* (Walker, 1849)** (Aphidinae Macrosiphini)

Of western Palearctic origin, subcosmopolitan with very few records in tropical areas. Typically found on *Rosa* spp, its primary host and some small gramineae; it is a virus vector. In Central America, only known in Cartago, Costa Rica. No new records have been made.

***Mexicallis panamensis* Quednau & Remaudière, 1996** (Calaphidinae Panaphidini Myzocallidina)

Only known from Chiriquí province (Panama), on *Quercus* sp.
First record for Costa Rica.—**Quercus oocarpa*: PUNTARENAS: Las Cruces

***Micromyzus pojanii* (Cermeli & Smith, 1979)** (Aphidinae Macrosiphini)

Of Neotropical origin, known from several countries in South America and Mexico, on ferns. In Central America, recorded (in combination with *Microparsus*) in Costa Rica, in Cartago and San José. No new records have been made.

***Microparsus (Picturaphis) brasiliensis* (Moreira, 1925)** (Aphidinae Macrosiphini)

Of American, possibly Neotropical origin; recorded from the southern United States to Argentina. Typically found on *Phaseolus* and can cause damage to the crops. Recorded in Honduras, Nicaragua and Panama. Already known from all Costa Rican provinces.

New records.—*Phaseolus vulgaris*: ALAJUELA: Upala; PUNTARENAS: Agua Buena. Vagrant: PUNTARENAS: Agua Buena, Las Cruces, Paso Real, San Vito.

***Microparsus olivei* Smith & Tuatay, 1960** (Aphidinae Macrosiphini)

Of American origin, possibly Nearctic, monoecious on species of *Desmodium*, records in the United States, Mexico, Cuba, Puerto Rico and Venezuela; also in Panama and Costa Rica, in Cartago.

New records.—*Desmodium incanum*: *ALAJUELA: La Fortuna. *Desmodium* sp.: *GUANACASTE: La Cruz.

***Myzocallis (Lineomyzocallis) pepperi* Boudreaux & Tissot, 1962** (Calaphidinae Panaphidini Myzocallidina)

Of American origin, possibly Nearctic. It is not possible to determine the subspecies (the nominotypical one or *M. pepperi iturbide* Remaudière & Quednau, 1992, respectively known on *Quercus laurifolia* in Florida, on *Q. castaea* and *Q. crassipes* in Mexico) from the characters of the collected specimens, and need to be studied, as well as other known specimens of the species to establish their exact taxonomical position and even the validity of the subspecific division.

First record for Central America.—*Quercus sapotifolia*: SAN JOSÉ: Frailes.

***Myzocallis (Neomyzocallis) discolor* (Monell, 1879)** (Calaphidinae Panaphidini Myzocallidina)

Of American, possibly Nearctic origin, widely distributed in the United States, recorded in Cuba, on several species of *Quercus*.

First records for Central America.—*Quercus oleoides*: GUANACASTE: Liberia, Santa Rosa; *Quercus bumelioides*: Heredia: Santo Domingo.

***Myzodium modestum* (Hottes, 1926)** (Aphidinae Macrosiphini)

Possibly of Palearctic origin. These aphids are typically found on moss, with records in a number of continental European countries, islands in the North Atlantic (Iceland, Jan Mayen), Greenland and North America.

First records for Central America.—*Pogonatum* sp.: SAN JOSÉ: Cerro de la Muerte.

***Myzus (Nectarosiphon) ascalonicus* Doncaster, 1946** (Aphidinae Macrosiphini)

The origin of this species is unclear, in any case, it is non-American, and has a subcosmopolitan distribution. It is polyphagous and can cause damage in a number of horticultural plants. Known from Panama.

First records for Costa Rica.—*Lepidium virginicum*: CARTAGO: La Pastora. Ranunculaceae: CARTAGO: La Pastora.

***Myzus hemerocallis* Takahashi, 1921** (Aphidinae Macrosiphini)

Of non-American (Palearctic or Oriental) origin, currently widely distributed throughout the world, especially in warm and temperate-warm areas, on species of *Hemerocallis* and proximate genera. Recorded in Panama.

First records for Costa Rica.—*Hemerocallis* sp.: SAN JOSÉ: San Pedro de Montes de Oca.

***Myzus ornatus* Laing, 1932** (Aphidinae Macrosiphini)

Of non-American (possibly Palearctic) origin, with a subcosmopolitan distribution. It is polyphagous and, as a vector of several viruses, is potentially harmful to many crops. Recorded in Honduras and Panama. Already known from Costa Rica, in Alajuela and Cartago.

New records.—*Ageratum conyzoides*: ALAJUELA: Fraijanes. *Ageratum* sp.: *SAN JOSÉ: Empalme; ALAJUELA: Monteverde. Asteraceae: SAN JOSÉ:

Jardín, Cerro de la Muerte, Ojo de Agua, Rancho Redondo. *Bidens pilosa*: SAN JOSÉ: San Ramón de Tres Ríos. *Castilleja* sp.: SAN JOSÉ: Cerro de la Muerte; CARTAGO: Volcán Irazú. *Cirsium mexicanum*: SAN JOSÉ: Cerro de la Muerte. *Cirsium subcoriaceum*: SAN JOSÉ: Ojo de Agua. *Conyza primulifolia*: ALAJUELA: Monteverde. *Fuchsia microphylla*: CARTAGO: La Pastora. *Fuchsia paniculata*: SAN JOSÉ: Empalme. *Fuchsia* sp.: SAN JOSÉ: Cerro de la Muerte. **Gnaphalium attenuatum*: ALAJUELA: Volcán Poás. *Gnaphalium* sp.: SAN JOSÉ: La Pastora. *Helianthus annuus*: *HEREDIA: Santo Domingo. *Holcus lanatus*: SAN JOSÉ: Jardín. *Lepidium virginicum*: CARTAGO: La Pastora; SAN JOSÉ: San Ramón de Tres Ríos. *Lupinus costaricensis*: CARTAGO: La Pastora. *Melampodium* sp.: ALAJUELA: Fraijanes. *Monochaetum* sp.: SAN JOSÉ: Ojo de Agua. *Morella cerifera*: SAN JOSÉ: Ojo de Agua. *Phenax* sp.: SAN JOSÉ: Empalme. *Phytolacca* sp.: CARTAGO: La Pastora. *Polygonum punctatum*: SAN JOSÉ: Empalme. *Quercus copeyensis*: SAN JOSÉ: Cerro de la Muerte, Villa Mills. *Rosa* sp.: ALAJUELA: Volcán Poás. *Rubus* sp.: SAN JOSÉ: Villa Mills. *Rumex acetosella*: CARTAGO: Volcán Irazú. *Rumex* sp.: CARTAGO: San Juan de Chicué, Volcán Irazú; SAN JOSÉ: San Pedro de Montes de Oca, San Ramón de Tres Ríos. *Salvia carnea*: SAN JOSÉ: División. *Senecio oerstedianus*: SAN JOSÉ: Cerro de la Muerte. *Solanum* sp.; CARTAGO: Volcán Irazú. *Trifolium dubium*: CARTAGO: La Pastora. *Trifolium* sp.: SAN JOSÉ: Cerro de la Muerte, Jardín. *Valeriana pricnophylla*: SAN JOSÉ: Cerro de la Muerte. *Wigandia urens*: SAN JOSÉ: Jardín. Vagrant: ALAJUELA: Monteverde; CARTAGO: Cervantes, San Juan de Chicué, La Pastora; SAN JOSÉ: Ojo de Agua, San Pedro de Montes de Oca, San Ramón de Tres Ríos.

***Myzus (Nectarosiphon) persicae* (Sulzer, 1776) (Aphidinae Macrosiphini)**

Of non-American (possibly Palearctic) origin, with a cosmopolitan distribution. Recorded in Guatemala, El Salvador, Honduras, Nicaragua, Panama. This polyphagous aphid is one of the most harmful to plants of interest for humans as it is a vector of over 100 viruses. Already known from all the provinces in Costa Rica.

New records.—Asteraceae: ALAJUELA: Monteverde. Caryophyllaceae: SAN JOSÉ: San Pedro de Montes de Oca. *Catharanthus roseus*: SAN JOSÉ: San Francisco de Dos Ríos. Brassicaceae: CARTAGO: Banderilla. *Bouganvillea* sp.: SAN JOSÉ: San Pedro de Montes de Oca. Fabaceae: CARTAGO: San Juan de Chicué. *Epidendrum ibaguense*: SAN JOSÉ: San José. *Ludwigia* sp.: ALAJUELA: La Fortuna. *Neurolaena lobata*: ALAJUELA: La Fortuna. *Sonchus* sp.: GUANACASTE: Quebrada Grande, Tilarán. *Valeriana* sp.: ALAJUELA: Monte-

verde. Unidentified plant: SAN JOSÉ: San Pedro de Montes de Oca. Vagrant: ALAJUELA: La Fortuna.

***Neomyzus circumflexus* (Buckton, 1876)** (Aphidinae Macrosiphini)

Of unknown origin, very possibly no-American, with a subcosmopolitan distribution, though not frequently found in temperate-cold or temperate areas outside greenhouses. It is widely polyphagous and not at all gregarious, thus causing very little damage to crops. Recorded in Nicaragua and Panama. Already known from Alajuela, Cartago and San José in Costa Rica.

New records.—Asteraceae: SAN JOSÉ: San Pedro de Montes de Oca. Caryophyllaceae: SAN JOSÉ: San Pedro de Montes de Oca. *Catharanthus roseus*: SAN JOSÉ: San Pedro de Montes de Oca. *Hibiscus rosa-sinensis*: SAN JOSÉ: San Pedro de Montes de Oca. *Liabum bourgeaui*: SAN JOSÉ: La Ese. *Solanum* sp.: SAN JOSÉ: Villa Mills. *Trifolium* sp.: SAN JOSÉ: San Pedro de Montes de Oca. *Youngia japonica*: SAN JOSÉ: San Vito. Vagrant: ALAJUELA: Monteverde; CARTAGO: Cartago; SAN JOSÉ: Ojo de Agua.

***Neophyllaphis araucariae* Takahashi, 1937** (Neophyllaphidinae)

Of non-American origin, perhaps native to the Norfolk Islands or Australia, or south east Asia. Typically found on *Araucaria* and recorded in Mauritius, Hawaii, Java, New Guinea and also Venezuela, and in Costa Rica, in San José province.

New records.—*Araucaria* sp.: *ALAJUELA: La Fortuna, Upala.

***Neotoxoptera oliveri* (Essig, 1935)** (Aphidinae Macrosiphini)

Of non-American origin, possibly Oriental origin, its distribution area is currently very wide; recorded in Panama. It lives on plants from several families. Already known from San José, Costa Rica. No new records have been made.

***Pentalonia nigronervosa* (Coquerel, 1859)** (Aphidinae Macrosiphini)

Of non-American (Oriental) origin; pantropical; recorded on many Caribbean islands and in all Central American countries on Musaceae or proximate

families. As a vector of several viruses, it can cause considerable damage in the corresponding crops. Known from all Costa Rican provinces.

New records.—*Musa* sp.: ALAJUELA: Upala; HEREDIA: Río Frío; LIMÓN: Cahuita. *Spathiphyllum floribundum*: SAN JOSÉ: San José.

***Pseudoregma panicola* (Takahashi, 1921)** (Hormaphidinae: Cerataphidini)

Of Asiatic origin (east and south east Asia) it has been recorded in south India, Africa, New Zealand, Venezuela, Cuba, Puerto Rico and Guadalupe, usually on Poaceae.

First record for Central America.—*Panicum* sp.: ALAJUELA: La Fortuna.

***Rhodobium porosum* (Sanderson, 1901)** (Aphidinae Macrosiphini)

Possibly of Nearctic origin, subcosmopolitan distribution, recorded on species of *Rosa* and it is a known vector of several viruses. Recorded in Honduras, Nicaragua, Panama. Already known from all Costa Rican provinces.

New records.—*Rosa* sp.: SAN JOSÉ: San José.

***Rhopalosiphoninus latysiphon* (Davidson, 1912)** (Aphidinae Macrosiphini)

Of uncertain origin, possibly non-American (Palearctic or Oriental), with a subcosmopolitan distribution; recorded in Panama. Characteristically radicolous, it lives on potatoes, and is frequently found potatoes in storage. A vector of several viruses, it is known from Cartago in Costa Rica.

New records.—Vagrant: *ALAJUELA: Monteverde; *SAN JOSÉ: Ojo de Agua.

***Rhopalosiphum maidis* (Fitch, 1856)** (Aphidinae Aphidini Rhopalosiphina)

Of non-American origin, possibly Oriental, with a cosmopolitan distribution on a large number of graminiae; it can cause damage to many cereal crops and other graminiae, and is also a known virus vector. Recorded in

all Central American countries; in Alajuela, Cartago, Guanacaste and San José, Costa Rica.

New records.—*Coix lacryma-jobi*: SAN JOSÉ: La Ese; ALAJUELA: Monterrey. *Eleusine indica*: SAN JOSÉ: San Pedro de Montes de Oca. **Panicum* sp.: GUANACASTE: Liberia; LIMÓN: Cahuita. *Penisetum* sp.: ALAJUELA: Monteverde. Poaceae; CARTAGO: El Humo; ALAJUELA: Upala; SAN JOSÉ: San José. *Zea mays*: ALAJUELA: La Fortuna, San Josecito.

***Rhopalosiphum padi* (Linnaeus, 1758)** (Aphidinae Aphidini Rhopalosiphina)

Of Palearctic origin, it has a dioecious cycle with species of *Prunus* as primary host. It has a subcosmopolitan distribution on gramineae, which were originally the secondary host and often the only host. This species is a known vector of several viruses. Recorded in Panama and Costa Rica, in Alajuela, Cartago and San José.

New records.—*Holcus lanatus*: CARTAGO: San Juan de Chicué; SAN JOSÉ: Ojo de Agua. Poaceae: Heredia: Vara Blanca. *Sporobolus indicus*: ALAJUELA: Monteverde. Vagrant: CARTAGO: La Pastora; SAN JOSÉ: Ojo de Agua.

***Rhopalosiphum rufiabdominale* (Sasaki, 1899)** (Aphidinae Aphidini Rhopalosiphina)

Of non-American origin, possibly Oriental, with a subcosmopolitan distribution, recorded in Honduras and Panama. It lives on species of some genera of Cyperaceae and Poaceae, and is potentially harmful to some gramineae crops, mainly rice; it is a virus vector. In Costa Rica recorded in Alajuela, Cartago, Guanacaste and San José provinces.

New records.—Cyperaceae: ALAJUELA: Volcán Poás. *Oryza sativa*: SAN JOSÉ: San Pedro de Montes de Oca. Poaceae: SAN JOSÉ: Cerro de la Muerte. Vagrant: GUANACASTE: La Cruz; SAN JOSÉ: La Ese.

***Sarucallis kahawaluokalani* (Kirkaldy, 1906)** (Calaphidinae Panaphidini Panaphidina)

Of non-American origin, possibly Oriental, with a wide distribution area, including Venezuela, Puerto Rico and the Dominican Republic. It is characteristic of *Lagerstroemia indica*. Recorded in Honduras and Panama.

First records for Costa Rica.—*Lagerstroemia indica*: GUANACASTE: 27 de Abril, Nicoya; SAN JOSÉ: San Pedro de Montes de Oca, San Francisco.

***Schizaphis graminum* (Rondani, 1852)** (Aphidinae Aphidini Rhopalosiphina)

Of Palearctic origin, currently with a subcosmopolitan distribution, in North and South America. It lives on many species of Poaceae and, as a virus vector, is harmful to gramineae crops. Recorded in Panama. Already known from Costa Rica, in Alajuela and Cartago. No new records have been made.

***Schizaphis rotundiventris* (Signoret, 1860)** (Aphidinae Aphidini Rhopalosiphina)

Of uncertain origin (possibly Palearctic) widely distributed on species of Cyperaceae and Poaceae in warm areas of the world: southern Europe, east Africa, Mauritius, Australia, New Zealand, Hawaii, east and south Asia and the southern United States. Already known in Costa Rica from Cartago.

New records.—Cyperaceae: *GUANACASTE: Nicoya; *PUNTARENAS: Ceibo. *Cyperus thyrsoiflorus*: ALAJUELA: Monteverde. *Cyperus* sp.: ALAJUELA: Upala. Poaceae: *ALAJUELA: Monteverde, Upala. Vagrant: Cartago: La Cruz.

***Schizolachnus parvus* (Wilson, 1915)** (Lachninae Eulachnini)

Of Nearctic origin, only known from the eastern United States, on *Pinus* spp.

First record for Central America.—*Pinus* sp.: GUANACASTE: La Cruz.

***Sipha flava* (Forbes, 1884)** (Chaitophorinae Siphini)

Of Nearctic origin, widely distributed in America, from the United States to Argentina, recorded in El Salvador, Honduras, Nicaragua and Panama. Typically found on species of Poaceae, where damage can be caused by dense populations of this aphid, and also because it is a virus vector. Known from Cartago and San José, Costa Rica.

New records.—*Lasiacis* sp.: *GUANACASTE: Nuevo Arenal. Poaceae: GUANACASTE: Tilarán; *HEREDIA: Las Horquetas; *ALAJUELA: Montes del Aguacate. Vagrant: *PUNTARENAS: Paso Real.

***Siphonatrophia cupressi* (Swain, 1918)** (Aphidinae Aphidini Aphidina)

Of Nearctic origin, recorded on *Cupressus* in the eastern United States and Mexico. Introduced in France and Italy. Known from Honduras.

First record for Costa Rica.—*Cupressus lusitanica*: SAN JOSÉ: La Ese.

***Sitobion avenae* (Fabricius, 1775)** (Aphidinae Macrosiphini)

Of non-American (possibly Palearctic) origin, with a subcosmopolitan distribution, on Poaceae. Dense populations of the species can cause damage to some gramineae crops, and also because it is a virus vector. In Central America, it is only known from Costa Rica, in Cartago and San José provinces.

New records.—*Anthoxanthum odoratum*: SAN JOSÉ: Cerro de la Muerte. *Holcus lanatus*: *ALAJUELA: Fraijanes; SAN JOSÉ: Ojo de Agua, San Ramón de Tres Ríos. *Penisetum purpureum*: ALAJUELA: Monterrey, Monteverde; *PUNTARENAS: Agua Buena, Coto Brus; SAN JOSÉ: Monte del Aguacate; *GUANACASTE: La Cruz, Nuevo Arenal. Poaceae: SAN JOSÉ: Cerro de la Muerte, San José, Villa Mills. **Polypogon elongatus*: SAN JOSÉ: San Ramón de Tres Ríos. Vagrant: SAN JOSÉ: Frailes, Ojo de Agua; GUANACASTE: Liberia.

***Sitobion luteum* (Buckton, 1876)** (Aphidinae Macrosiphini)

Of non-American origin, Ethiopian or Oriental, currently widely distributed mainly in the tropical and subtropical region of the world, including several American countries. In Central America, it is only known from Alajuela and San José, Costa Rica. It lives on species of orchids. No new records have been made.

***Sitobion pauliani* (Remaudière, 1957)** (Aphidinae Macrosiphini)

Of non-American (possibly Ethiopian) origin and pantropical in distribution on several genera of Graminae. Recorded in Honduras and Panama.

Already known from Alajuela and San José, Costa Rica. No new records have been made.

***Sitobion ptericolens* (Patch, 1919)** (Aphidinae Macrosiphini)

Of Nearctic origin, known outside North America, in Cuba, Brazil and Great Britain. Typically found on ferns, though also recorded on other plants. Already known in Costa Rica, from Alajuela and San José. No new records have been made.

***Tetraneura fusiformis* Matsumura, 1899** (Eriosomatinae Eriosomatini)

Possibly of Palearctic origin, it has spread widely through warm regions of the world on gramineae, originally its secondary host. Frequently recorded as *Tetraneura nigriabdominalis* (Sasaki, 1899). Recorded in Honduras, Nicaragua and Panama. Already known in Cartago, Limón and Puntarenas, Costa Rica.

New records.—*Eleusine indica*: *ALAJUELA: La Fortuna. Vagrant: PUNTARENAS: Agua Buena, San Vito, Las Cruces; SAN JOSÉ: La Ese.

***Toxoptera aurantii* (Boyer de Fonscolombe, 1841)** (Aphidinae Aphidini Aphidina)

Of non-American (Oriental) origin, widely distributed in temperate-warm and warm areas in the world. It lives on a large number of plant species, mainly *Citrus* and proximate genera, and, as a virus vector, is potentially harmful to a number of crops. Known from all Central American countries and all Costa Rican provinces.

New records.—*Amaranthus* sp.: SAN JOSÉ: San José. Asteraceae: ALAJUELA: Monteverde; SAN JOSÉ: Agua Buena. *Citrus limetoides*: SAN JOSÉ: San Pedro de Montes de Oca. *Citrus x limonia*: SAN JOSÉ: San José. *Citrus* sp.: ALAJUELA: San Josecito; HEREDIA: Santo Domingo de Heredia; SAN JOSÉ: Coronado. *Coffea arabica*: ALAJUELA: Monteverde. *Hibiscus rosa-sinensis*: SAN JOSÉ: San Pedro de Montes de Oca. *Inga* sp.: GUANACASTE: La Tejona. *Jacaranda mimosifolia*: SAN JOSÉ: San Pedro de Montes de Oca. *Pleurothallis* sp.: ALAJUELA: La Fortuna. *Theobroma cacao*: ALAJUELA: Upala. *Valeriana* sp.: SAN JOSÉ: San Pedro de Montes de Oca; ALAJUELA: Upala.

Vagrant: ALAJUELA: Upala; GUANACASTE: La Cruz; SAN JOSÉ: El Jardín, La Ese; HEREDIA: Sarapiquí.

***Toxoptera citricidus* (Kirkaldy, 1907)** (Aphidinae Aphidini Aphidina)

Of non-American (Oriental) origin, widely distributed in warm areas and, to a lesser extent in temperate-warm climates. Recorded in Belize, Honduras, Nicaragua and Panama. It has fewer hosts than the previous species, though as a virus vector, is equally as or more harmful. Known from all Costa Rican provinces.

New records.—*Crescentia cujete*: HEREDIA: Sarapiquí. *Citrus limetoides*: HEREDIA: Sarapiquí. *Citrus* sp.: ALAJUELA: Monteverde. *Ruellia inundata*: GUANACASTE: Liberia. Vagrant: ALAJUELA: San Josecito.

***Tuberolachnus salignus* (Gmelin, 1790)** (Lachninae Lachnini)

Of unknown origin, possibly Palearctic, with a subcosmopolitan distribution. Typically found on species of *Salix*. In Costa Rica, it is only known in Alajuela. No new records have been made.

***Uroleucon (Lambersius) ambrosiae* (Thomas, 1878)** (Aphidinae Macrosiphini)

Of Nearctic origin, distributed throughout the continent with records in Honduras, Nicaragua and Panama. The species is placed in the subgenus *Lambersius* as suggested by NIETO NAFRÍA *et al.* (2007) and not in the nominotypical one (REMAUDIÈRE & REMAUDIÈRE, 1977). Recorded on species of several genera of Asteraceae. The study of the collected specimens has not clarified which subspecies it belongs to, the nominotype or *U. ambrosiae lizerianum* (Blanchard, 1922) which seem to be typical respectively of North America and the south of the Tropic of Capricorn, on species of Asteraceae of the same or proximate genera. Already known from Costa Rica, in Alajuela, Cartago, Heredia and San José.

New records.—Asteraceae: SAN JOSÉ: San Pedro de Montes de Oca; San Ramón de Tres Ríos; Santo Domingo de Heredia. *Bidens pilosa*: SAN JOSÉ: San Ramón de Tres Ríos. *Conyza canadensis*: ALAJUELA: Tilarán. *Hypochoeris radicata*: SAN JOSÉ: Tarbaca; San Ramón de Tres Ríos. *Sonchus oleraceus*:

SAN JOSÉ: San Ramón de Tres Ríos. *Tithonia rotundifolia*: ALAJUELA: San Josecito. *Verbesina gigantea*: SAN JOSÉ: San José.

Uroleucon (Lambersius) erigeronense (Thomas, 1878) (Aphidinae Macrosiphini)

Of Nearctic origin, very widely distributed in temperate-warm and warm areas of the world, on species of *Erigeron*, *Conyza* and other proximate species. Recorded in Panama and already known from San José, Costa Rica. No new records have been made.

Uroleucon (Lambersius) gravicorne (Patch, 1919) (Aphidinae Macrosiphini)

Of Nearctic origin, found in most of America on species of Asteraceae. Recorded in Panama. Known from Alajuela, Cartago and San José, Costa Rica.

New records.—Asteraceae: SAN JOSÉ: San Ramón de Tres Ríos. *Conyza canadensis*: *GUANACASTE: Liberia; SAN JOSÉ: San Pedro de Montes de Oca.

Uroleucon (Lambersius) zayasi (Holman, 1974) (Aphidinae Macrosiphini)

Of American, possibly Nearctic origin, though it was described from specimens collected on *Solidago sepervirens* in Cuba, and has only been recorded (BLACKMAN & EASTOP, 2006) in Costa Rica from specimens deposited in the *Natural History Museum*, London, collected on an unknown plant in Monteverde [province of ALAJUELA], 11-VI-1983 (R. Kiester *leg.*). No new records have been made.

Utamphorophora commelinensis (Smith, 1960) (Aphidinae Macrosiphini).

Of American, possibly Neotropical origin. Typically found on species of Commelinaceae. Recorded in South America (Venezuela and Brazil), the Caribbean (Cuba, Puerto Rico and Guadalupe) and Central America (Guatemala, Panama and Costa Rica). Known from San José. No new records have been made.

Frequency of capture

The predominant species (those most frequently captured during the study period) were *Aphis gossypii*, *Aphis spiraecola* and *Myzus ornatus*, which must have a stable extensive presence on a considerable number of plants all over the country. *Aphis coreopsidis*, *Aphis craccivora*, *Aulacorthum solani*, *Brachycaudus helichrysi*, *Hysteroneura setariae*, *Myzus persicae* and *Toxoptera aurantii*, were also frequently captured, and, like the previously mentioned species, are alochthonous in Central America and distributed world wide feeding on a large range of species. Most of the remaining species were captured only once or very rarely.

In this study, no new records were made of 24 previously recorded species. This could be because (1) the crops that are the only or most frequent host were not prospected (for example the strawberry for *Aphis forbesi*, apple tree for *Eriosoma lanigerum*, pine trees for *Cinara*, sugar cane for *Melanaphis sacchari*, sweet potato for *Geopemphigus floccosus*, or *Ocotlea* for *Lizerius cermelii*), or (2) the populations of these species are usually very scarce or small and therefore difficult to locate.

First records for Central America and Costa Rica

Nine species have been recorded for the first time in Central America, which can be classified in three groups. Those originating from North America: *Cinara lousianensis*, *Myzocallis discolor*, *Myzocallis pepperi* and *Schizolachnus parvus*. Those with a discontinuous distribution in America, including Costa Rica: *Macrosiphum cyatheae*. Non-American species that have spread to other parts of the world: *Hyperomyzus carduellinus*, *Myzodium modestum* and *Pseudoregma panicola*, and perhaps also *Aphis sambuci*.

Another ten species are first records for Costa Rica. *Mexicallis panamensis* was only known from Panama, in Chiriquí province, on the border with Costa Rica. *Illinoia morrisoni*, *Siphonatrophia cupressi* and *Macrosiphum salviae* are known from North America and some Central American or even South American countries. The six remaining species (*Acyrtosiphon malvae*, *Eulachnus rileyi*, *Macrosiphonella sanborni*, *Myzuscallis ascalonicus*, *Myzuscallis hemerocallis* and *Sarucallis kahavaluokalani*) are widely or very widely distributed, even subcosmopolitan, due to anthropic dispersion, and in Central America, this species had only been recorded in Panama.

A comparison between aphid fauna from Costa Rica and other Central American countries

The number of aphids (Aphididae) recorded from Costa Rica has increased the total by 21.6%, and accounts for 75.9% of the 116 species known in Central America. In Central America, the Caribbean island and northern South America, Costa Rica have the largest number of recorded species of aphids, after Venezuela, which is at the top of the list with 94 recorded species; in Cuba, Panama, Puerto Rico, Honduras and Guadalupe 82, 71, 58, 44 and 41 aphid species have been recorded, respectively.

A comparison of the list of aphid fauna of Costa Rica with those of the two bordering countries, Nicaragua (with 26 species) and Panama (with 71 species), can provide useful information on the faunistic composition of the region. Although only a few taxa were recorded in Nicaragua, four of them have not yet been found in Costa Rica: *Cerataphis lataniae* (Boisduval, 1867), *Dysaphis tulipae* (Boyer de Fonscolombe, 1841), *Myzus persicae nicotianae* Blackman, 1987 and *Neotoxoptera violae* (Pergande, 1900), though they could possibly be found in small, localized populations in Costa Rica.

Costa Rica and Panama have 55 species in common, 32 species known from Costa Rica have not been recorded in Panama and 16 species known from Panama have not been recorded in Costa Rica. Five of these species are Neotropical, three Nearctic and eight have a non-American origin. The five Neotropical species are: *Microparsus vignaphilus* (E.E. Blanchard, 1922), recorded in most of South America; *Mexicallis quirosae* Quednau & Remaudière, 1996, described from material from Panama; and *Impatiens americanum* Remaudière, 1981, *Stegophylla mugnozae* Remaudière & Quednau, 1985 and *Tuberculatus mexicanus* Remaudière & Quednau, 1983 which were described from Mexico. The three species of the most northern origin are *Carolinaia cyperi* Ainslie, 1915, *Illinoia goldamaryae* Knowlton, 1938 and *Myzocallis meridionalis* Granovsky, 1939.

Mexicallis quirosae, *Myzocallis meridionalis*, *Stegophylla mugnozae* and *Tuberculatus mexicanus* are associated with plants in the genus *Quercus* and were collected in localities in the higher areas of Chiriquí province, which shares the Talamanca mountain range with Costa Rica. This, together with the fact that *Mexicallis panamensis* Quednau & Remaudière, 1996 was captured in Costa Rica, leads one to think that these species, or some of them could also be found in Costa Rican territory.

Faunistic composition of Costa Rican aphid-fauna according to geographical origins

Bearing in mind the most probable geographical origin (taking *A. sambuci* to be Palearctic), 44.3% of the species recorded in Costa Rica are of American origin, in comparison with 55.7% of other or unknown origins; with 6.8% Neotropical species, 37.5% Nearctic (6 and 33, respectively), 34.1% Palearctic, 14.8% of Oriental origin and 6.8% of other or unknown origins.

With regard to the aphid fauna of Panama (QUIRÓS *et al.*, 2009) Neotropical and Nearctic species account for 14% and 24%, respectively. The difference in the Neotropical species is due to the previously mentioned species, whose distribution areas may reach as far as Costa Rica. The difference in the Nearctic species may be due to the fact that species originating from the north and now known in Costa Rica may not have reached Panama approximately 20 years ago when the Panamanian aphid fauna lists were drawn up. The low proportion of Neotropical species in both countries is because their distribution area is limited to temperate areas in southern Ecuador (particularly Argentina and Chile) and are unlikely to reach the high regions of Central America, whereas species spread throughout North America could reach them easily.

Host plants

Table I contains a list of “host plant species – aphid species” relationships cited in the text. Two asterisks [**] indicate the 79 plant-aphid relationships given for the first time in the world (especially based on BLACKMAN & EASTOP, 1994, 2000, 2006) and one asterisk [*] indicates the 97 relationships given for the first time for Costa Rica. Most of them are not of great interest because they involve polyphagous or oligophagous species (*Aphis craccivora*, *A. gossypii*, *A. spiraecola*, *Aulacorthum solani*, *Brachycaudus helichrysi*, *Myzus ascalonicus*, *M. ornatus*, *M. persicae*, *Neomyzus circumflexus*, *Toxoptera aurantii* and *T. citricidus*), or species with a wide feeding range, though limited to one or two families (such as *Acyrtosiphon bidenticola*, *A. malvae*, *Microparsus olivei*, *Rhopalosiphum padi*, *Schizaphis rotundiventris*, *Sipha flava* and *Sitobion avenae*).

Six relationships: *Chamaedorea costaricana* – *Cerataphis brasiliensis*, *Alpinia purpurescens* – *Cerataphis orchidearum*, *Spathiphyllum floribundum* – *Pentalonia nigronervosa*, *Myzocallis pepperi* – *Quercus sapotifolia*, *Macrosiphum salviae* – *Alnus acuminata* and *M. salviae* – *Morella cerifera* are

particularly worth mentioning. The first three (*Spathiphyllum floribundum* – *Pentalonia nigronervosa*, *Alpinia purpurescens* – *Cerataphis orchidearum* and *Chamaedorea costaricana* – *Cerataphis brasiliensis*) are of interest because the plants involved are of considerable commercial importance, though it is not uncommon to find the mentioned aphids living on these plants. *Myzocallis pepperi* was only known on *Quercus laurifolia* (nominotypical subspecies, in Florida) and on *Q. castanea* and *Q. crassipes* (subspecies *iturbide* in Mexico).

Macrosiphum salviae was already known on species of Lamiaceae and was thought to be able to live on species of *Quercus* (Fagaceae), as does *M. mesosphaeri*, which it has often been mistaken for. However, its ability to live on species of Betulaceae and Myricaceae is surprising, though the two families are close to each other and also to Fagaceae. The two aphid species co-exist in Costa Rica and were captured on their two host types, Lamiaceae and trees belonging to old families of Dicotyledons, thus opening up an interesting line of research to shed light on their life cycles, as yet unknown, and also to establish their taxonomical identity, which was questioned for years (REMAUDIÈRE & REMAUDIÈRE, 1997).

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Table I. List of host-plant–aphid relationships. One asterisk indicates a new relationships for Costa Rica (n= 97), two asterisks indicates a new relationships for the world (n= 97).

Tabla I. Lista de especies plantas hospedadoras. Un asterisco indica una nueva relación (planta huésped) para Costa Rica (n= 97), dos asteriscos indican una nueva relación a nivel mundial (n= 79)

<i>Ageratina ixiocladon</i> (Asteraceae)	<i>Toxoptera aurantii</i> *
<i>Brachycaudus helichrysi</i> **	<i>Andryala</i> sp. (Asteraceae)
<i>Ageratina pichinchensis</i> (Asteraceae)	<i>Brachycaudus helichrysi</i> *
<i>Aphis spiraeicola</i> **	<i>Anthoxanthum odoratum</i> (Poaceae)
<i>Ageratum conyzoides</i> (Asteraceae)	<i>Sitobion avenae</i> *
<i>Aulacorthum solani</i> *	<i>Arachis pintoii</i> (Fabaceae)
<i>Aphis spiraeicola</i> *	<i>Aphis craccivora</i> **
<i>Brachycaudus helichrysi</i>	<i>Aphis gossypii</i> **
<i>Myzus ornatus</i> *	<i>Araucaria</i> sp. (Araucariaceae)
<i>Ageratum</i> sp. (Asteraceae)	<i>Neophyllaphis araucariae</i>
<i>Myzus ornatus</i> *	<i>Asclepias curassavica</i> (Asclepiadaceae)
<i>Alnus acuminata</i> (Betulaceae)	<i>Aphis nerii</i> *
<i>Macrosiphum salviae</i> **	<i>Axonopus</i> sp. (Poaceae)
<i>Alpinia purpurata</i> (Zingiberaceae)	<i>Hysteroneura setariae</i> *
<i>Aphis spiraeicola</i> **	<i>Bidens pilosa</i> (Asteraceae)
<i>Cerataphis orchidearum</i> **	<i>Aphis coreopsidis</i>
<i>Amaranthus</i> sp. (Amaranthaceae)	<i>Aphis spiraeicola</i> *

- Myzus ornatus* *
Uroleucon ambrosiae *
Blechnum pyramidatum (Acanthaceae)
Aphis gossypii *
Bougainvillea sp. (Nyctaginaceae)
Aphis spiraeicola *
Myzus (Nectarosiphon) persicae *
Brassica sp. (Brassicaceae)
Brevicoryne brassicae
Lipaphis pseudobrassicae
Capsicum sp. (Solanaceae)
Aphis gossypii
Carduus sp. (Asteraceae)
Capitophorus elaeagni *
Castilleja sp. (Scrophulariaceae)
Myzus ornatus **
Catharanthus roseus (Apocynaceae)
Myzus (Nectarosiphon) persicae *
Neomyzus circumflexus **
Chamaedorea costaricana (Arecaceae)
Cerataphis brasiliensis **
Chamaesyce sp. (Euphorbiaceae)
Aphis gossypii **
Chrysalidocarpus lutescens (Arecaceae)
Cerataphis brasiliensis *
Chrysanthemum sp. (Asteraceae)
Macrosiphoniella sanborni
Cirsium mexicanum (Asteraceae)
Myzus ornatus **
Cirsium subcoriaceum (Asteraceae)
Myzus ornatus **
Citrus limetoides (Rubiaceae)
Toxoptera aurantii *
Toxoptera citricidus *
Citrus sp. (Rubiaceae)
Aphis spiraeicola
Toxoptera aurantii
Toxoptera citricidus
Citrus x limonia (Rubiaceae)
Toxoptera aurantii
Coffea arabica (Rubiaceae)
Toxoptera aurantii
Coix lacryma-jobi (Poaceae)
Rhopalosiphum maidis *
Commelina sp. (Commelinaceae)
Aphis gossypii *
Aphis spiraeicola *
Conyza canadensis (Asteraceae)
- Aphis spiraeicola*
Brachycaudus helichrysi *
Uroleucon (Lambersius) gravicorne
Uroleucon ambrosiae *
Conyza primulifolia (Asteraceae)
Myzus ornatus **
Crataegus azarolus (Rosaceae)
Aphis spiraeicola **
Crecentia cujete (Bignoniaceae)
Toxoptera citricidus **
Cuphea carthagenensis (Lythraceae)
Aphis gossypii **
Cupressus lusitanica (Cupressaceae)
Cinara (Cupressobium) fresai
Illinoia morrisoni *
Siphonatrophia cupressi
Cyathula achyranoides (Amaranthaceae)
Aphis gossypii **
Cyperus papyrus (Cyperaceae)
Carolinaia caricis *
Cyperus sp. (Cyperaceae)
Schizaphis rotundiventris
Cyperus thyrsiflorus (Cyperaceae)
Schizaphis rotundiventris **
Cyphomandra betaceae (Solanaceae)
Aphis gossypii *
Desmodium incanum (Fabaceae)
Aphis spiraeicola **
Aulacorthum solani **
Microparsus olivei **
Desmodium intortum (Fabaceae)
Brachycaudus helichrysi *
Desmodium sp. (Fabaceae)
Aphis craccivora *
Microparsus olivei
Digitaria costaricensis (Poaceae)
Hysteroneura setariae **
Digitaria setigera (Poaceae)
Aphis gossypii **
Hysteroneura setariae **
Digitaria sp. (Poaceae)
Hysteroneura setariae
Diplostephium costaricense (Asteraceae)
Brachycaudus helichrysi **
Eleusine indica (Poaceae)
Hysteroneura setariae
Rhopalosiphum maidis *
Tetraneura fusiformis *

- Emilia fosbergii* (Asteraceae)
Aphis spiraecola **
- Epidendrum ibaguense* (Orchidaceae)
Myzus (Nectarosiphon) persicae **
- Erechtites hieracifolia* (Asteraceae)
Aphis gossypii *
Aphis spiraecola *
Brachycaudus helichrysi *
- Erechtites valerianifolius* (Asteraceae)
Brachycaudus helichrysi **
- Erigeron* sp. (Asteraceae)
Aphis spiraecola *
- Eryobothrya* sp. (Rosaceae)
Aphis spiraecola
- Foeniculum vulgare* (Apiaceae)
Cavariella aegopodii
- Fuchsia microphylla* (Onagraceae)
Myzus ornatus **
- Fuchsia paniculata* (Onagraceae)
Aulacorthum solani *
Myzus ornatus **
- Fuchsia* sp. (Onagraceae)
Myzus ornatus *
- Gamochaeta americana* (Asteraceae)
Aphis spiraecola *
- Garcinia madruno* (Clusiaceae)
Aphis spiraecola **
- Geranium guatemalense* (Geraniaceae)
Acyrtosiphon malvae **
- Glycine max* (Fabaceae)
Aphis gossypii *
- Gnaphalium attenuatum* (Asteraceae)
Myzus ornatus *
- Gnaphalium* sp. (Asteraceae)
Brachycaudus helichrysi *
Myzus ornatus *
- Helianthus annuus* (Asteraceae)
Aphis gossypii *
Myzus ornatus *
- Hemerocallis* sp. (Liliaceae)
Myzus hemerocallis
- Hemichaena fruticosa* (Scropholariaceae)
Brachycaudus helichrysi **
- Hibiscus rosa-sinensis* (Malvaceae)
Aphis gossypii *
Aphis spiraecola *
Aulacorthum solani *
Neomyzus circumflexus *
- Toxoptera aurantii*
- Hibiscus schizopetalus* (Malvaceae)
Aphis gossypii **
- Hibiscus* sp. (Malvaceae)
Aphis gossypii *
- Holcus lanatus* (Poaceae)
Myzus ornatus *
Rhopalosiphum padi
Sitobion avenae *
- Hypochoeris radicata* (Asteraceae)
Uroleucon ambrosiae *
- Hyptis capitata* (Lamiaceae)
Macrosiphum mesosphaeri *
- Hyptis pectinata* (Lamiaceae)
Macrosiphum mesosphaeri
- Hyptis* sp. (Lamiaceae)
Macrosiphum mesosphaeri
- Inga* sp. (Fabaceae)
Toxoptera aurantii *
- Iresine diffusa* (Amaranthaceae)
Aphis spiraecola **
- Ixora* sp. (Rubiaceae)
Aphis spiraecola **
- Jacaranda mimosifolia* (Bignoniaceae)
Aphis spiraecola
Toxoptera aurantii *
- Lactuca sativa* (Asteraceae)
Aulacorthum solani *
- Lagerstroemia indica* (Lythraceae)
Sarucallis kahawaluokalani
- Laciasis* sp. (Poaceae)
Sipha flava **
- Lepidium virginicum* (Brassicaceae)
Myzus (Nectarosiphon) ascalonicus **
Myzus ornatus **
- Liabum bourgeauii* (Asteraceae)
Brachycaudus helichrysi **
Neomyzus circumflexus **
- Ludwigia* sp. (Onagraceae)
Aphis spiraecola
Myzus (Nectarosiphon) persicae *
- Lupinus costaricensis* (Fabaceae)
Myzus ornatus **
- Melampodium* sp. (Asteraceae)
Myzus ornatus **
- Melanthera nivea* (Asteraceae)
Aphis spiraecola **
- Monochaetum* sp. (Melastomataceae)

- Aphis spiraeicola* **
Myzus ornatus *
- Morella cerifera** (Myricaceae)
Macrosiphum salviae **
Myzus ornatus **
- Musa sp.** (Musaceae)
Pentalonia nigronervosa
- Myrciaria cauliflora** (Myrtaceae)
Greenidea (Trichosiphum) psidii
- Myrica pubescens** (Myricaceae)
Aulacorthum solani **
- Nasa triphyla** (Loasaceae)
Aulacorthum solani **
- Neurolaena lobata** (Asteraceae)
Aphis gossypii **
Myzus (Nectarosiphon) persicae **
- Oplismenus burmannii** (Poaceae)
Hysteroneura setariae **
- Oryza sativa** (Poaceae)
Rhopalosiphum rufiabdominale
- Oyedeaea verbesinoides** (Asteraceae)
Aphis spiraeicola **
- Panicum sp.** (Poaceae)
Hysteroneura setariae *
Pseudoregma panicola
Rhopalosiphum maidis *
- Paspalum sp.** (Poaceae)
Hysteroneura setariae *
- Pectis sp.** (Asteraceae)
Aphis spiraeicola **
- Penisetum purpureum** (Poaceae)
Sitobion avenae **
- Penisetum sp.** (Poaceae)
Rhopalosiphum maidis *
- Phaseolus vulgaris** (Fabaceae)
Microparsus (Picturaphis) brasiliensis
- Phenax rugosus** (Urticaceae)
Aphis spiraeicola **
- Phenax sp.** (Urticaceae)
Myzus ornatus **
- Phytolacca sp.** (Phytolaccaceae)
Myzus ornatus **
- Pimpinella anisum** (Apiaceae)
Cavariella aegopodii
- Pinus sp.** (Pinaceae)
Cinara watsoni
Eulachnus rileyi
Schizolachnus parvus
- Pleurothallis sp.** (Orchidaceae)
Toxoptera aurantii *
- Pogonatum sp.** (Polytrichaceae)
Myzodium modestum
- Pogostemon cablin** (Lamiaceae)
Macrosiphum mesosphaeri *
- Polygonum punctatum** (Polygonaceae)
Myzus ornatus **
- Polygonum sp.** (Polygonaceae)
Capitophorus hippophaes javanicus
- Polypogon elongatus** (Poaceae)
Sitobion avenae *
- Psidium guajava** (Myrtaceae)
Aphis gossypii *
Aphis spiraeicola *
Greenidea (Trichosiphum) psidii
- Psidium friedrichsthalianum** (Myrtaceae)
Greenidea (Trichosiphum) psidii
- Pteridium aquilinum** (Dennstaedtiaceae)
Aphis craccivora **
Aulacorthum solani *
Macrosiphum cyatheae **
- Quercus bumelioides** (Fagaceae)
Myzocallis (Neomyzocallis) discolor
- Quercus copeyensis** (Fagaceae)
Myzus ornatus **
- Quercus costaricensis** (Fagaceae)
Aulacorthum solani **
- Quercus oleoides** (Fagaceae)
Myzocallis (Neomyzocallis) discolor *
- Quercus oocarpa** (Fagaceae)
Mexicallis panamensis *
- Quercus sapotifolia** (Fagaceae)
Myzocallis (Lineomyzocallis) pepperi **
- Raphanus raphanistrum** (Brassicaceae)
Brevicoryne brassicae *
Lipaphis pseudobrassicae *
- Rauvolfia tetraphylla** (Apocynaceae)
Aphis gossypii
- Rosa sp.** (Rosaceae)
Macrosiphum rosae (Linnaeus, 1758)
Myzus ornatus *
Rhodobium porosum
- Rubus sp.** (Rosaceae)
Aulacorthum solani *
Myzus ornatus *
- Ruellia inundata** (Acanthaceae)
Toxoptera citricidus **

- Rumex acetosella** (Polygonaceae)
Myzus ornatus *
- Rumex nepalensis** (Polygonaceae)
Aphis spiraeicola *
- Rumex sp.** (Polygonaceae)
Aulacorthum solani
Brachycaudus helichrysi *
Myzus ornatus *
- Salix sp.** (Salicaceae)
Cavariella aegopodii
- Salvia carnea** (Lamiaceae)
Myzus ornatus **
- Salvia lasiocephala** (Lamiaceae)
Macrosiphum mesosphaeri *
- Sambucus nigra** (Caprifoliaceae)
Aphis sambuci *
- Senecio cooperi** (Lamiaceae)
Brachycaudus helichrysi **
- Senecio oerstedianus** (Asteraceae)
Myzus ornatus **
- Senecio sp.** (Asteraceae)
Aphis spiraeicola *
- Sigesbeckia jorullensis** (Asteraceae)
Brachycaudus helichrysi **
- Solanum sp.** (Solanaceae)
Myzus ornatus
Neomyzus circumflexus *
- Sonchus oleraceus** (Asteraceae)
Hyperomyzus carduellinus
Uroleucon ambrosiae *
- Sonchus sp.** (Asteraceae)
Aulacorthum solani
Brachycaudus helichrysi *
Hyperomyzus carduellinus
Myzus (Nectarosiphon) persicae
- Spathiphyllum floribundum** (Araceae)
Pentalonia nigronervosa **
- Spermacece sp.** (Rubiaceae)
Aphis gossypii *
- Sporobolus indicus** (Poaceae)
Rhopalosiphum padi **
- Tabebria impetiginosa** (Bignoniaceae)
Aphis spiraeicola **
- Tetradenia riparia** (Lamiaceae)
Macrosiphum salviae **
- Theobroma cacao** (Sterculiaceae)
Toxoptera aurantii
- Thuja sp.** (Cupressaceae)
Cinara (Cupressobium) lousianensis
- Thunbergia grandiflora** (Acanthaceae)
Aphis gossypii
- Tithonia rotundifolia** (Asteraceae)
Acyrtosiphon bidenticola **
Uroleucon ambrosiae *
- Trifolium dubium** (Fabaceae)
Myzus ornatus *
- Trifolium sp.** (Fabaceae)
Aphis craccivora *
Myzus ornatus *
Neomyzus circumflexus
- Tulipa sp.** (Liliaceae)
Aulacorthum solani
- Valeriana prisophylla** (Valerianaceae)
Myzus ornatus *
- Valeriana sp.** (Valerianaceae)
Aphis spiraeicola
Brachycaudus helichrysi *
Myzus (Nectarosiphon) persicae *
Toxoptera aurantii *
- Vanilla sp.** (Orchidaceae)
Aphis spiraeicola **
- Verbesina gigantea** (Asteraceae)
Uroleucon ambrosiae
- Viburnum costaricanum** (Caprifoliaceae)
Aphis spiraeicola **
- Vicia sp.** (Poaceae)
Aphis craccivora *
- Vitis vinifera** (Vitaceae)
Aphis illinoisensis
- Wigandia urens** (Hydrophyllaceae)
Myzus ornatus **
- Youngia japonica** (Asteraceae)
Neomyzus circumflexus *
- Yucca guatemalensis** (Liliaceae)
Aphis helianthi **
- Zea mays** (Poaceae)
Rhopalosiphum maidis