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INTERCEPTIONS OF ANTHOCORIDAE, LASIOCHILIDAE, AND LYCTOCORIDAE AT THE MIAMI PLANT INSPECTION STATION (HEMIPTERA: HETEROPTERA)

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Abstract

Specimens of Anthocoridae, Lyctocoridae, and Lasiochilidae (Hemiptera: Heteroptera) intercepted at various ports-of-entry and housed at the Animal and Plant Health Inspection Services (APHIS) Miami Plant Inspection Station (Miami, FL) were examined and identified to species or genus. The collection comprised 127 specimens intercepted primarily at the Miami Inspection Station. Specimens were distributed among 14 genera and 26 identified species in 3 families: Anthocoridae (99 specimens), Lyctocoridae (9 specimens), and Lasiochilidae (19 specimens). Seventy-eight of the 127 specimens could be identified to species. The remaining 49 specimens were identified to genus, except for 2 specimens that could not be identified below tribal level. For each identified species, we provide brief descriptions of habitat and prey preferences (where known), and a summary of currently known geographic range. Fifty-six of the 127 specimens were of a single genus: *Orius* Wolff, 1811 (Anthocoridae: Oriini). The specimens of *Orius* comprised at least 9 different species; 17 specimens could not be identified to species. The 127 specimens were intercepted on a variety of commodities, including ornamental plants, cut flowers, bouquets, agricultural produce, ceramic tiles, and wood products. Fourteen of the identified species do not currently occur in the continental U.S.; moreover, the 49 specimens that we could identify only to genus very likely also are of species not currently established in the continental U.S. The majority of intercepted specimens (93 of 127) arrived on shipments from the Neotropics and Europe. Specimens of Lasiochilidae and Scolopini (Anthocoridae) were entirely from shipments arriving from the Neotropical region. Specimens of *Orius* were intercepted on shipments from the Neotropics, Mexico, Europe, and Sub-Saharan Africa. Finally, 10 species were intercepted on shipments arriving from countries not previously listed as being part of their known geographic ranges. One Old World species, *Cardiastethus affinis* Poppius, 1909, known previously only from East Africa and India, was intercepted in 2 separate shipments arriving from Central America and the West Indies.

Key Words: minute pirate bugs, flower bugs, port interceptions, non-indigenous species, Anthocoridae

Resumen

Se examinaron e identificaron a nivel de especie o de género especímenes de Anthocoridae, Lyctocoridae y Lasiochilidae (Hemiptera: Heteroptera) interceptados en diversos puertos de entrada de los Estados Unidos y depositados en la Estación de Inspección de Plantas en Miami, Florida del Servicio de Inspección de Salud Animal y Vegetal (APHIS). La colección consiste de 127 especímenes interceptados principalmente en la Estación de Inspección de Miami. Las muestras fueron distribuidas entre 14 géneros y 26 especies identificadas en tres familias: Anthocoridae (99 especimenes), Lyctocoridae (9 especimenes) y Lasiochilidae (19 especimenes). Setenta y ocho de los 127 especímenes podrían ser identificados a especie. Se identificaron las otras 49 especimenes a nivel de género, excepto para 2 muestras que no pudieron ser identificados por debajo del nivel de tribu. Para cada especie identificada, proveemos una breve descripción de las preferencias de hábitat y presas (si se conoce) y un resumen del rango geográfico conocido actualmente. Cincuenta y seis de los 127 especímenes fueron de un solo género: *Orius* Wolff, 1811 (Anthocoridae: Oriini). Los

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especímenes de *Orius* pertenecen al menos 9 especies diferentes; 17 especimenes de ellos no pudieron ser identificados a nivel de especie. Las 127 muestras fueron interceptadas en una variedad de productos, incluyendo plantas ornamentales, flores, ramos, productos agrícolas, losas cerámicas y productos de madera. Catorce de las especies identificadas no estan presentes en al territorio de EE.UU actualmente y además, de los 49 especimenes que pudimos identificar solamente a nivel de género, es muy probable que también pertenescan a especies no establecidas en los EE.UU. La mayoría de los especímenes interceptados (93 de 127) llegaron en envíos procedentes de la región Neotropical y Europa. Todos los especímenes interceptados de Lasiochilidae y Scolopini (Anthocoridae) fueron de envíos procedentes de la región Neotropical. Los especímenes de *Orius* fueron interceptados en los envíos de la región Neotropical, México, Europa y África Sub-Sahariana. Finalmente, 10 especies fueron interceptados en los envíos procedentes de países no mencionados anteriormente como parte de su rango geográfico conocido. Una de las especies del Mundo Antiguo, *Cardiastethus affinis* Poppius, 1909, conocida anteriormente sólo de África Oriental y la India, fue interceptada en dos envíos separados que llegaron de América Central y las Antillas.

Palabras Clave: chinches minutos piratas, chinches de flores, intercepciones portuarias, especies no indígenas, Anthocoridae

Introductions of insect species into regions outside of their native ranges can have important effects on ecosystem health, agriculture, and human health (Liebhold et al. 1995; Vitousek et al. 1996; Mack et al. 2000). A primary means by which non-indigenous species become established is through unintentional introductions associated with international commerce (Haack 2001; McCullough et al. 2006). Insects are common stowaways on shipments of imported goods, and are regularly intercepted at U.S. ports-of-entry. Non-endemic species of insects may arrive on imports encompassing a variety of commodities, including agricultural produce, greenhouse and ornamental plants, nursery stock, cut flowers, wood products, stored products, or packing materials (Haack 2001; McCullough et al. 2006). Additionally, aircraft, ships, vehicles, or other means of conveyance may themselves harbor hitchhiking arthropods, and these possible sources of infestation also are examined at ports (Dobbs & Brodel 2004).

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service, Plant Protection and Quarantine (APHIS-PPQ), has historically been responsible for inspecting imports of agricultural products arriving at U.S. ports, to ensure that the imported materials are free of exotic arthropods, plant pathogens, and weeds. In 2003, many of these inspectional duties were transferred to the newly created Department of Homeland Security, although identification of suspected quarantine pests remains the responsibility of APHIS-PPQ. Inspections are done at designated facilities located at or near major ports-of-entry (airports, seaports), and these efforts have led to the creation of large data bases summarizing types and numbers of non-indigenous arthropods arriving at U.S. ports (Haack 2001; McCullough et al. 2006).

The Anthocoridae (Hemiptera: Heteroptera) is a complex of 500-600 predatory true bug species distributed virtually worldwide (Ford 1979; Lattin 1999a). These insects are frequent interceptions at ports-of-entry (e.g., Hawaii Department of Agriculture 2009), as a consequence of their relatively small size, wide geographic distribution, and occurrence in a variety of habitats, often including cryptic habitats (Lattin 1999a). Unsurprisingly, these taxa are also common representatives of the non-indigenous true bug faunas in many geographic areas (Lattin 1999a; Rabitsch 2010). Even in fairly isolated geographic regions, such as oceanic island systems, non-indigenous Anthocoridae have become a noticeable part of the true bug fauna (Herring 1966, 1967; Walker & Deitz 1979; Yasunaga 2000; Aukema et al. 2006; Lattin 2005a, 2007a,b).

Specimens of Anthocoridae are commonly intercepted in Miami, Florida and other ports-of-entry, from cargo shipments or in passenger luggage. Over 100 intercepted specimens, now housed at the Miami Plant Inspection Station, had been mounted on points, labeled, and put into storage, but had not been identified to species. We have now examined and identified these specimens, and here summarize those identifications. Geographic sources of shipments and types of cargoes are also summarized. From checklists and catalogs of the North American anthocorid fauna, coupled with our familiarity with the North American fauna, we determined which intercepted specimens were of species not known to be currently established in the continental U.S. Lastly, the extensive literature on taxonomy and zoogeography of the Anthocoridae was examined to determine for each identified interception whether the species had arrived from a country outside of its known geographic distribution. Results of this final objective led to presumed new geographic records for several species.

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Materials and Methods

APHIS Protocols and History of Specimens

Interceptions of suspected quarantine pests are submitted to APHIS-PPQ identifiers located at designated facilities throughout the United States. Specimens are identified to the lowest level needed to determine whether the shipments involve required quarantine measures. Regulatory officials with APHIS-PPQ do not require quarantine treatments for predatory species such as members of the Anthocoridae, thus almost none of the specimens of these insects in the Miami collection had been identified beyond the family level. Once the regulatory status of an intercepted specimen is resolved, the specimen is placed in a port reference collection and the data associated with it are entered into a national database. One of us (TTD) served in Miami, FL as Plant Protection and Quarantine's specialist in Heteroptera from 2001 to 2010, and in that capacity additionally acquired several specimens of Anthocoridae that had been intercepted at ports other than Miami.

Identification of Specimens

Insects were identified by use of published keys (including as needed examination of genitalia), by examination of descriptions in the primary literature, and by inspection of geographically relevant checklists or catalogs of the Heteroptera. Specimens were generally identified to species, although some specimens within difficult complexes such as *Orius* Wolff, 1811, and *Lyctocoris* Hahn, 1835, were identified only to genus. Female specimens in difficult groups could often not be identified other than to genus because examination of the male genitalia is needed for full identification. Specimens of *Xylocoris* Dufour, 1831, and *Orius* that could not be identified to species are given subgeneric classifications when possible (Carayon 1972b; Péricart 1972). Label information with most specimens included geographic source and commodity of the shipment from which the specimen had been collected. Each specimen was categorized according to zoogeographic region from which the intercepted specimen had arrived (Darlington 1957): Neotropical (specimens arriving from South America/Central America/West Indies); Nearctic (Mexico); Ethiopian (Sub-Saharan Africa); Oriental (Asia); and Palearctic (Europe/Mediterranean).

Higher-level classification of the Anthocoridae is not completely settled. Beginning with Carayon (1972a), systematic treatments of the Anthocoridae have not always agreed on whether these insects belong in a single family (Anthocoridae) composed of 3 subfamilies (Anthocorinae, Lasiochilinae, Lyctocorinae), or whether the subfamilies deserve family rank (Cassis & Gross 1995; Schuh & Slater 1995). We follow the treatment of Schuh & Slater (1995), and allocate genera among 3 families (Anthocoridae, Lyctocoridae, Lasiochilidae) and 7 tribes within the family Anthocoridae.

Results and Discussion

We examined 127 specimens from port interceptions (Tables 1 and 2). The specimens comprised 14 genera distributed among all 3 families, and included 6 of the 7 tribes within the Anthocoridae (Tables 1 and 2). The majority of the specimens had been intercepted at the Miami Inspection Station, but we also examined 24 specimens housed at the Miami site but known to have been intercepted elsewhere: airports in New York, New York (John F. Kennedy); Los Angeles, California; Savannah, Georgia; Jacksonville, Florida; San Francisco, California; San Diego, California; Dallas, Texas; Charleston, South Carolina; and New Orleans, Louisiana (Table 2). Over 40% (57 of 127) of the specimens were in the tribe Oriini (Anthocoridae), represented almost exclusively (56 of 57 specimens) by a single genus, *Orius* Wolff, 1811. The Cardiastethini (Anthocoridae) were represented by 16 specimens distributed

Table 1. Distribution of the 127 intercepted specimens across families, tribes, and genera.

Family/Tribe	Number of specimens	Genera
Anthocoridae		
Oriini	57	*Orius*, *Caffrocoris*
Cardiastethini	16	*Amphiareus*, *Cardiastethus*, *Physopleurella*, *Alofa*, *Buchananiella*
Scolopini	6	*Calliodis*, unidentified
Xylocorini	10	*Xylocoris*
Anthocorini	9	*Anthocoris*, *Dufouriellus*
Blaptostethini	1	*Blaptostethus*
Lyctocoridae	9	*Lyctocoris*
Lasiochilidae	19	*Lasiochilus*

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TABLE 2. SPECIES OR GENERA INTERCEPTED, SEPARATED BY FAMILY (ANTHOCORIDAE, LYCTOCORIDAE, LASIOCHILIDAE), TRIBE, AND ZOOGEOGRAPHIC REGION. (*) SPECIES IS NOT CURRENTLY ESTABLISHED IN THE CONTINENTAL U.S. IDENTIFICATIONS BY T.M. LEWIS UNLESS OTHERWISE STATED.

Taxon	Source of interception	Number and sex of specimens	Year of interception	Commodity (label: verbatim)[1]	Interception point (label: verbatim)[2]
ANTHOCORIDAE					
ORIINI					
South America/Central America/West Indies					
Orius insidiosus (Say, 1832)	Ecuador	7f	2001-08	*Helianthus* sp.	Miami PPQ + USDA
O. insidiosus	Ecuador	2f	2006-07	cut flowers	Miami
O. insidiosus	Peru	1f	2008	*Lactuca* sp.	Miami 367594
O. insidiosus	Colombia	1f	2001	*Limonium*	Miami USDA
O. insidiosus	Colombia	1f	2003	*Chrysanthemum*	—
O. insidiosus	Colombia	1f	2005	*Helianthus*	Miami PPQ
O. insidiosus	Costa Rica	1f	2005	*Alpinia purpurata*	Miami PPQ
O. insidiosus	Trinidad/Tobago	1f	2009	*Eleocharis* sp.	Miami USDA
O. insidiosus	U.S. Virgin Islands	1f	2000	*Ocimum basilicum*	Miami (mail) PPQ
Orius florentiae Herring 1966 (*)	Ecuador	1m	2003	bouquets	Miami
O. florentiae	Ecuador	1f	2004	*Phlox* sp.	Miami
O. florentiae	Ecuador	3f	2007	cut flowers	Miami PPQ + USDA
Orius championi Herring 1966 (*)	Colombia	1m	2003	*Dianthus*	—
O. championi	Colombia	1m	2009	*Hydrangea* sp.	MIA 405521
Orius sp.	Ecuador	1f	2001	flower bouquets	—
Orius sp.	Peru	1f	2005	cut flowers	Miami
Orius sp.	Colombia	1f	2000	*Aconitum* sp.	Miami
Orius sp.	Colombia	1f	2003	*Alstroemeria* sp.	Miami
Orius sp.	Colombia	2f	2005	*Helianthus* sp.	Miami PPQ
Mexico					
Orius insidiosus	Mexico	1f	2001	*Limonium* sp.	208982
Orius sp.	Mexico	1f	2000	*Limonium* sp.	—

[1]C/F or c/f indicates cut flowers
[2]Missing data indicate information not provided on specimen label
[3]Genus nr. *Guayascoris* Carpintero and Dellapé, 2012
[4]Identified by T.J. Henry
[5]Identified by T. Dobbs

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Taxon	Source of interception	Number and sex of specimens	Year of interception	Commodity (label: verbatim)[1]	Interception point (label: verbatim)[2]
Europe/Mediterranean					
Orius vicinus (Ribaut, 1923)	The Netherlands	1m	2002	*Amaranthus*	—
Orius majusculus (Reuter, 1879) (*)	The Netherlands	1f	2002	*Amaranthus*	—
O. majusculus	The Netherlands	1f	2008	cut flowers	Miami
O. majusculus	Turkey	1f	2006	ceramic tiles	Miami USDA
Orius niger Wolff, 1811 (*)	The Netherlands	2f	2006	cut flowers	Miami PPQ
O. niger	The Netherlands	1f	2005	*Leucospermum*	L.A. 200242
O. niger	The Netherlands	1m	2005	*Astilbe* sp.	Miami PPQ
O. niger	The Netherlands	1f	2004	*Carthamus* sp.	Miami
O. niger	Israel	1f	2003	*Anemone*	Miami
O. niger	Israel	2f	2006	*Helianthus*	JFK 67354
Orius albidipennis (Reuter, 1884) (*)	Israel	1f	2005	*Helianthus*	JFK 161891
Orius minutus (Linnaeus, 1758) (*)	The Netherlands	1f	2008	cut flowers	Miami
Orius (*Dimorphella*) sp.	The Netherlands	1f	2005	*Ornithogallum* sp.	Miami
Orius (*Heterorius*) sp.	Italy	1f	2006	tile	Miami USDA
Sub-Saharan Africa					
Orius peri Carayon, 1976 (*)	South Africa	1m	2004	cut flowers	Miami PPQ
Orius (*Orius*) sp.	South Africa	1f	2000	*Erica* sp.	Miami USDA
Orius (*Heterorius*) sp.	South Africa	1f	2003	*Lactuca sativa*	New Orleans 050139
Orius (*Orius*) sp. 1	Kenya	1f	2006	unk. host	JFK 161976
Orius (*Orius*) sp. 2	Kenya	1f	2005	*Eryngium*	Miami PPQ
Orius (*Orius*) sp. 3	Kenya	3f	2005	*Eryngium*	Miami PPQ
Orius (*Orius*) sp. 3	Kenya	1f	2005	*Veronica*	Miami PPQ
Caffrocoris brincki Carayon, 1961 (*)	South Africa	1f	(no data)	cut flowers	140528

[1]C/F or c/f indicates cut flowers
[2]Missing data indicate information not provided on specimen label
[3]Genus nr. *Guayascoris* Carpintero and Dellapé, 2012
[4]Identified by T.J. Henry
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Taxon	Source of interception	Number and sex of specimens	Year of interception	Commodity (label: verbatim)[1]	Interception point (label: verbatim)[2]
CARDIASTETHINI					
South America/Central America/West Indies					
Amphiareus constrictus (Stål, 1860)	Brazil	1f	2001	Polypodiaceae	—
A. constrictus	Brazil	1f	2007	general cargo	Savannah GA
A. constrictus	Haiti	1f	2004	cut flowers	Miami PPQ
A. constrictus	Dominican Republic	1f	2002	*Momordica* sp. (fruit)	—
Cardiastethus affinis Poppius, 1909 (*)	Costa Rica	1m	2006	ornamental plants	Miami USDA
C. affinis	Haiti	1f	2005	C/F	Miami PPQ
Physopleurella mundula (White, 1877)	Guyana	1(?)	1990	flowers	—
P. mundula	Haiti	1f	2003	palmetto leaves in baggage	Miami Int. Airport
Alofa sodalis (White, 1878)	Brazil	1m	2001	in mail package	—
A. sodalis	Trinidad/Tobago	1f	2003	*Capsicum* sp.	Miami
Asia					
Amphiareus constrictus	China	1m	2009	granite	J'ville 901273
A. constrictus	Indonesia	1m	2002	handicrafts	San Francisco 103885
Physopleurella flava Carayon, 1956 (*)	Philippines	1f	2006	basketware	San Diego 041321
Cardiastethus affinis	Thailand	1f	1990	orchid	—
Cardiastethus minutissimus Usinger, 1946 (*)	Thailand	1f	2006	baggage	Dallas PPQ
Europe/Mediterranean					
Buchananiella continua (White, 1879)	Luxemburg	1f	2005	*Hydrangea*	Miami PPQ
SCOLOPINI					
South America/Central America/West Indies					
Calliodis pallescens (Reuter, 1884) (*)	Colombia	1m	2005	*Celosia* sp.	Miami PPQ
C. pallescens	Honduras	1f	2002	passenger baggage	Miami
C. pallescens	Jamaica	1f	2006	*Amaranthus*	Miami PPQ
Unidentified[3]	Colombia	1m	2008	*Hydrangea* sp.	Miami 355680
Calliodis sp.	Peru	1f	2008	*Davallia* sp.	Miami 345960
Unidentified	Venezuela	1f	1991	*Musa* (banana)	—

[1]C/F or c/f indicates cut flowers
[2]Missing data indicate information not provided on specimen label
[3]Genus nr. *Guayascoris* Carpintero and Dellapé, 2012
[4]Identified by T.J. Henry
[5]Identified by T. Dobbs

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Taxon	Source of interception	Number and sex of specimens	Year of interception	Commodity (label: verbatim)[1]	Interception point (label: verbatim)[2]
XYLOCORINI					
South America/Central America/West Indies					
Xylocoris afer (Reuter, 1884)	Costa Rica	1m	2006	herbs	Miami PPQ
Asia					
Xylocoris afer	India	3f 1m	2002	personal effects	Charleston, SC
X. afer	India	1m	2004	tiles	Miami PPQ
X. afer	India	1f	2006	tiles	Miami PPQ
X. afer	China	1m	2006	tiles	Miami PPQ
Xylocoris flavipes (Reuter, 1875)	Vietnam	1f	2000	unk. host	L.A. 156998
Xylocoris (*Proxylocoris*) sp.	Vietnam	1f	2007	cut flowers	Miami PPQ
ANTHOCORINI					
Mexico					
Anthocoris albiger Reuter 1884	Mexico	1f	(no data)	*Prosopsis* (sic)	L.A. 172059
Anthocoris sp.	Mexico	1f	2006	rosemary	Miami PPQ
Anthocoris variipes Champion, 1901 (*)	Mexico	1m	2005	*Zantedeschia* sp.	Dallas 035663
Europe/Mediterranean					
Anthocoris nemoralis (Fabricius, 1794)	Italy	2f	2002	*Grevillea* c/f	Miami PPQ
A. nemoralis	The Netherlands?	1m	2004	*Crocosmia* sp.	JFK 161107
Anthocoris nemorum (Linnaeus, 1761)[4] (*)	The Netherlands	1m	1991	mix C/F	—
A. nemorum[5]	Spain	1f	2004	*Brassica pekinensis*	New Orleans 050680
Dufouriellus ater (Dufour, 1833)	Italy	1f	2000	tile	Miami PPQ
BLAPTOSTETHINI					
Sub-Saharan Africa					
Blaptostethus sp.	Ghana	1f	2001	assoc. w/ wood	L.A. 160298

[1]C/F or c/f indicates cut flowers
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[3]Genus nr. *Guayascoris* Carpintero and Dellapé, 2012
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Taxon	Source of interception	Number and sex of specimens	Year of interception	Commodity (label: verbatim)[1]	Interception point (label: verbatim)[2]
LYCTOCORIDAE					
South America/Central America/West Indies					
Lyctocoris sp.	Ecuador	1f	1995	C/F	Miami 140977
Lyctocoris sp.	Ecuador	1m	2001	*Alstroemeria* sp.	APHIS PPQ
Lyctocoris sp.	Ecuador	1f	2002	*Delphinium* sp.	—
Lyctocoris sp.	Colombia	1f	1990	*Dianthus*	—
Lyctocoris sp.	Colombia	1f	2004	*Limonium* sp.	Miami USDA
Mexico					
Lyctocoris sp.	Mexico	1f	2005	*Helianthus* sp.	San Diego 037714
Lyctocoris sp.	Mexico	2f 1m	2005	*Daucus* sp.	San Diego 037669
LASIOCHILIDAE					
South America/Central America/West Indies					
Lasiochilus pallidulus Reuter, 1871[4]	Ecuador	1f	1990	*Muse*	—
L. pallidulus	Ecuador	1f	2004	*Trachelium* sp.	Miami
Lasiochilus sp.	Ecuador	1f	1990	*Limonium* sp.	Miami-USDA
Lasiochilus sp.[5]	Panama	13f 3m	1999	cargo aircraft	—

[1]C/F or c/f indicates cut flowers
[2]Missing data indicate information not provided on specimen label
[3]Genus nr. *Guayascoris* Carpintero and Dellapé, 2012
[4]Identified by T.J. Henry
[5]Identified by T. Dobbs

among 5 genera. The Lasiochilidae included 19 specimens in a single genus (Table 2). Less frequently intercepted were 4 other tribes of the Anthocoridae (Scolopini, Xylocorini, Anthocorini, Blaptostethini), and specimens from the family Lyctocoridae (Tables 1 and 2). Fourteen of the identified species are not currently known to be established in the continental U.S. (Table 2: species with asterisks).

Anthocoridae: Oriini

The Oriini is composed of 16 genera (Carayon 1972a; Péricart 1996) including the widespread *Orius* with 75-80 described species (Ford 1979; Yasunaga 1997; Jung et al. 2011). Interceptions included 2 genera: *Orius*; and a single specimen of *Caffrocoris brincki* Carayon, 1961, known only from South Africa (Carayon 1961; Ford 1979). The interceptions of *Orius* comprised 56 specimens from 9 identified species distributed among 4 zoogeographic regions (Table 2). Seventeen specimens could be identified only to genus, due either to lack of suitable keys, or because no male specimens (needed for examination of genitalia) were available in the interceptions. Members of this genus are commonly associated with flowers and other produce, and are regular interceptions at ports on cut flowers, ornamental plants, and agricultural produce (Herring 1967). Virtually all intercepted specimens were associated with cut flowers, bouquets, or ornamental plants (Table 2). *Orius* commonly occurs in flowers and bloom clusters under field conditions (Miliczky & Horton 2011). Cut flowers are known important sources of arthropod interceptions in general (Work et al. 2005; McCullough et al. 2006).

Intercepted specimens of *Orius* that we were able to identify to species included both Old and New World taxa. *Orius niger* (Wolff, 1811), *O. minutus* (Linnaeus, 1758), *O. majusculus* (Reuter, 1879), and *O. vicinus* (Ribaut, 1923) are Old World species distributed throughout Europe and parts of Asia (Péricart 1996), and were intercepted on shipments from The Netherlands, Israel, and Turkey (Table 2). A fourth Old World species, *O. albidipennis* (Reuter, 1884) is found throughout North Africa and Asia (Péricart 1996), and was intercepted on *Helianthus* arriving from Israel (Table 2). *Orius peri* Carayon, 1976, apparently has been collected only from South Africa (Hernández & Stonedahl 1999), and was intercepted on a shipment of cut flowers from South Africa (Table 2). Two South American species, *O. florentiae* Herring, 1966, and *O. championi* Herring, 1966, were intercepted on shipments from Ecuador and Colombia (Table 2). *Orius insidiosus* (Say, 1832) was intercepted in shipments from Mexico, Central America, the West Indies, and South America. This species is native to the Nearctic/Neotropical Regions, and is geographically widespread in eastern North America and southwards into Central/South America and the West Indies (Henry 1988; Carpintero 2002).

Species of *Orius* frequently become established in geographic regions outside of their native ranges (Herring 1967; Yasunaga 2000; Lattin 2007ab; Henry 2008; Lewis & Lattin 2010) following accidental introduction into those regions. Two of the Old World species detected in our interceptions, *O. albidipennis* and *O. niger*, are currently established in several geographic regions outside of their respective native ranges (Péricart 1996). *Orius vicinus*, another Old World species intercepted on shipments from Europe (Table 2), is known to be established in North America, apparently since at least the 1930s (Lewis & Lattin 2010). It is also an established introduction in New Zealand, where it is found feeding on pest arthropods in apple orchards (Larivière & Wearing 1994). *Orius insidiosus* has become established in Hawaii, although possibly as a consequence of intentional introduction (Lattin 2007b). The European/Asian species, *O. minutus*, was at one time thought to be an established introduction in North America (Lattin et al. 1989), but has since been removed from the North American faunal list (Lewis & Lattin 2010). North American records of this species are actually mistakes in identifications of the non-indigenous *O. vicinus* (Lewis & Lattin 2010).

Anthocoridae: Cardiastethini

The Cardiastethini presently includes 16 genera of often uncertain systematic affinities distributed extensively in the Old and New World tropics (Ford 1979; Schuh & Slater 1995; Carpintero 2002; Carpintero & Dellapé 2008). Five genera within the Cardiastethini were identified in interceptions from 3 zoogeographic regions (Tables 1 and 2). Specimens were collected from plants, cut flowers, basketware, and luggage (Table 2). *Amphiareus constrictus* (Stål, 1860) was intercepted in shipments from the Neotropics (South America/Central America/West Indies) and Asia (Table 2). This species is geographically widespread, particularly in the Old and New World tropics (Herring 1967; Ford 1979; Yamada 2008b), and is established as an introduction in many parts of the world, including on a number of oceanic islands (Hawaii – Lattin 2007b; the Galápagos – Herring 1966, Lattin 2007a; Micronesia – Herring 1967; and the Cook Islands – Walker & Deitz 1979). The species apparently is established in western North America, probably through accidental introduction (Lattin & Lewis 2001; Lattin 2007c). As occurs with other members of the Cardiastethini, species of *Amphiareus* Distant, 1904, are commonly associated with dead leaf clusters, dead trees, decaying fungi, or stacked logs, where they presumably feed on small soft-bodied ar-

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thropods such as Psocoptera and mites (Lattin & Lewis 2001; Yamada & Hirowatari 2003; Henry et al. 2008; Yamada 2008b; Jung & Lee 2011a).

Cardiastethus Fieber, 1860 is a large genus of approximately 45 species distributed extensively in tropical and subtropical regions (Ford 1979; Yamada & Hirowatari 2007a). Members of the genus often occur in association with dead plant tissues and leaf litter, where they feed on psocids or other soft-bodied arthropods (Carayon 1957; Styles 1962; Lattin 1999b); some taxa occur on agricultural plants as predators of pest arthropods (Yamada et al. 2008). *Cardiastethus* is common in shipments of grain and other food stuffs (Herring 1967). Interceptions included 4 specimens from Central America, the West Indies, and Thailand associated with ornamental plants, cut flowers, or baggage (Table 2). *Cardiastethus minutissimus* Usinger, 1946 is known from Guam, Micronesia, and the Ogasawara Islands, Japan (Usinger 1946; Herring 1967; Yamada & Hirowatari 2007a), and is established as an introduction in Hawaii (Lattin 2007b). *Cardiastethus affinis* Poppius, 1909 is known from East Africa and India (Yamada et al. 2008).

Physopleurella Reuter, 1884 is a tropical/subtropical genus of 16 described species almost entirely of Old World origin (Yamada & Ishikawa 2011). Members of this genus may often inhabit dead-leaf habitats. Collection records include dead leaves of palmetto, cane, fan- flower, and banana; dead leaves of evergreen trees; dried leaves of hula skirts; and nests of weaverbirds (Usinger 1946, 1951; Lattin 2005b; Yamada & Hirowatari 2007b; Jung & Lee 2011b). Psocids in these habitats may be preferred prey (Swezey 1905; Lattin 2005b). Interceptions included specimens of 2 species from Guyana, Haiti, and the Philippines (Table 2). *Physopleurella mundula* (White, 1877) was intercepted at the Miami Airport on flowers and on palmetto leaves in luggage; this species is known to occur in Florida, probably as an introduction (Lattin 2005b). According to Lattin (2005b), *P. mundula* has also been intercepted at airports in Philadelphia (from Mexico) and New Orleans (from Honduras). *Physopleurella flava* Carayon, 1956 was intercepted on basketware arriving from the Philippines. The species was described from West Africa and appears to be distributed in tropical Africa, Madagascar, and Southeast Asia (Ford 1979; Yamada & Hirowatari 2007b). Its biology is generally unknown, although specimens have been collected from the nests of weaverbirds (Carayon 1958).

Alofa Herring, 1976, includes only a single species, *Alofa sodalis* (White, 1878). The species was described from Hawaii, originally as a species of *Cardiastethus*. *Alofa sodalis* has been collected in dead leaf habitats, detritus, stored goods, and bird nests, where its primary prey may often be psocids (Usinger 1951; Carayon 1958). The insect is also a predator of pest Lepidoptera on coconut in India (Nasser & Abdurahiman 1990). *Alofa sodalis* is geographically widespread, described as "cosmopolitan except Australia" (Ford 1979), and is established as an introduction in the Galápagos Islands (Herring 1966; Lattin 2007a), Cook Islands (Walker & Deitz 1979), and on Easter Island (Carpintero 2002). Specimens were intercepted on *Capsicum* sp. arriving from Trinidad/Tobago, and in a mail package arriving from Brazil (Table 2). *Alofa sodalis* may now be established as an introduction in southern Florida (FDACS 2010).

Buchananiella continua (White, 1879) is a widespread species described from the island of Madeira but of uncertain geographic origin (Lattin et al. 2001). The species commonly is found in dead leaf habitats often in association with Psocoptera and mites (Lattin et al. 2001; Aukema 2007); dead leaf habitats are commonly used by other species in this genus (Yamada & Hirowatari 2007c; Yamada & Yasunaga 2008). It has been introduced into Europe and appears to be spreading in both Great Britain and continental Europe (Aukema 2007; Rabitsch 2010). The species may also be established in Hawaii (Brenner & Lattin 2001). A female of *B. continua* was intercepted at the Miami airport associated with *Hydrangea* from Europe (Table 2). *Buchananiella continua* has been present in the western United States as an introduction since at least the late 1920s (Lattin et al. 2001).

Anthocoridae: Scolopini

The Scolopini is composed of approximately 18 genera of wide geographic distribution and with heavy representation in the Neotropics (Ford 1979; Schuh & Slater 1995; Carpintero 2002; Carpintero & Dellapé 2012). *Calliodis* Reuter, 1871, includes at least 12 species distributed almost exclusively in the New World tropics (Carpintero & Dellapé 2012). Biology of this group is relatively poorly known, although members of the genus have been collected beneath bark, in dead or dying trees, and in dead leaf habitats, where they are likely to be predaceous on small soft-bodied arthropods (Kelton 1978; Lattin 1999b; Ulyshen et al. 2012). *Calliodis pallescens* (Reuter, 1884) is distributed throughout Central America, South America, and the West Indies (Champion 1900; Ford 1979; Carpintero 2002; Carpintero & Dellapé 2012), and was intercepted on 3 separate shipments from these regions (Table 2). There is no evidence that this species currently occurs in the United States (Lattin 2001).

Anthocoridae: Xylocorini

The Xylocorini includes only a single genus, *Xylocoris* Dufour, 1831, of cosmopolitan distribution

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and comprising about 50 described species (Ford 1979). Species of *Xylocoris* occur in stored products, in granaries, in manure heaps, beneath the bark of trees, and in nests of birds (Carayon 1958; Kelton 1978; Lattin 2000; Yamada et al. 2006), and are commonly introduced into new geographic regions through transport of food products or other commodities (Southwood & Leston 1959; Carayon 1961; Herring 1967; Palta 2012). Ten specimens of 2 identified species and one unidentified species were found in interceptions (Table 2). Specimens were found in association with unidentified plants, personal effects, and "tiles", from 2 zoogeographic regions (Table 2); marble and ceramic tiles are a common source of insect interceptions at U.S. seaports (Work et al. 2005; McCullough et al. 2006). *Xylocoris afer* (Reuter, 1884) occurs in sub-Saharan Africa, South America, Central America, Europe, Australia, and Israel (Ford 1979; Péricart & Halperin 1989; Péricart 1996; Carpintero 2002). The species has not been reported in the literature as occurring in the U.S. (Henry 1988), although we have now collected it in south Florida (in 2001, by sweep net; TTD unpublished), and in Weslaco, Texas (in 2012, on sticky traps placed in potato fields; TML unpublished). *Xylocoris flavipes* (Reuter, 1875) is a common predator of stored grain insects (Lattin 2000). This species is a common interception at ports, and apparently has been widely spread by commerce (Carayon 1961; Lattin 2007b,c). *Xylocoris flavipes* is apparently established in Hawaii (Lattin 2005a, 2007b), and is widely distributed in the continental U.S., probably as an introduction (Lattin 2007c).

Anthocoridae: Anthocorini

The Anthocorini is composed of at least 10 genera, with strong representation in the Palearctic (Carayon 1972a; Ford 1979; Carpintero 2002). The largest genus is *Anthocoris* Fallén, 1814, with over 50 described species (Ford 1979). Members of this genus occur often on trees and shrubs, and are important sources of biological control in orchards (Lattin 1999a, 2000). Interceptions included 2 genera, *Anthocoris* (8 specimens) and a single specimen of *Dufouriellus ater* (Dufour, 1833). The specimens of *Anthocoris* comprised 4 identified species and one unidentified specimen, from 2 geographic regions intercepted on plant material (Table 2). *Anthocoris albiger* Reuter, 1884, is a New World species found in Central America, Mexico, and the southwestern U.S. (Carpintero 2002; Lewis et al. 2005). The insect often occurs on *Prosopis* (Ward et al. 1977; Lewis et al. 2005), and this plant species was the source of the single interception (Table 2). *Anthocoris variipes* Champion, 1901, is known from South America, Central America, and Mexico, but has yet to be reported from the U.S. *Anthocoris nemoralis* (Fabricius, 1794) and *Anthocoris nemorum* (Linnaeus, 1761) are common and widespread species in Europe, and are important sources of biological control in agriculture (Lattin 1999a, 2000). *Anthocoris nemoralis* was intentionally released into North America to control a psyllid pest of pears, and is now established throughout the western U.S. (Horton et al. 2004).

Dufouriellus ater is the sole representative of *Dufouriellus*. This genus has historically been included within the Cardiastethini, but was moved to the Anthocorini by Carpintero and Dellapé (2008). *Dufouriellus ater* has been found under bark in association with bark beetles or other soft-bodied prey, in stored products, and in bee hives (Southwood & Leston 1959; Kelton 1978; Arbogast 1984; Lattin 2000). The species is an established introduction in Hawaii (Lattin 2005a, 2007b) and North America (Ford 1979). A single specimen was intercepted in a shipment from Italy, associated with "tile" (Table 2).

Anthocoridae: Blaptostethini

The Blaptostethini is a poorly known group of 2 genera occurring in the Old World tropics (Ford 1979). *Blaptostethus* Fieber, 1860, includes 6 described species of relatively poorly known biology from the Asian/African tropics (Ford 1979; Yamada 2008a). Members of this genus have been found in dead plant habitats, in nests of birds, in stored grains, on living plants, and in agricultural fields (Carayon 1958; Tawfik & El-Husseini 1971; Rajasekhara 1973; Yamada 2008a; Kaur & Virk 2011). Interceptions included 1 unidentified species from Ghana associated with "wood" (Table 2).

Lyctocoridae

The Lyctocoridae is composed of 2 genera (Ford 1979), including the geographically widespread *Lyctocoris* Hahn, 1836. These insects are often found in stored products, beneath bark, in manure piles and chicken houses, in nests of birds and small mammals, and in dead vegetation (Southwood & Leston 1959; Lattin 2000, 2007b). One species, *Lyctocoris campestris* (Fabricius, 1794), known as the "debris bug", appears to be almost cosmopolitan in distribution, apparently because of unintentional introductions (Lattin 2007b; Rabitsch 2010). Port interceptions included 9 specimens of unidentified species from 2 zoogeographic regions associated with plants and cut flowers (Table 2).

Lasiochilidae

The Lasiochilidae is a poorly studied group of 10 genera with a strong presence in the Neotropical region (Carayon 1972a; Ford 1979; Carpintero 2002). *Lasiochilus* Reuter, 1871, includes nearly 50 described species associated primarily with the Neotropics and Pacific Islands (Herring 1967; Ford

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1979; Carpintero 2002; Yamada & Hirowatari 2005). Members of this genus are collected from dead plant material, rotting logs, and decaying fruit (Blatchley 1926; Usinger 1946; Herring 1967; Yamada & Hirowatari 2005; Jung & Lee 2007). Nineteen specimens of (mostly unidentified) *Lasiochilus* were intercepted on shipments from Ecuador and Panama. Two specimens intercepted from Ecuador could be identified to species: *Lasiochilus pallidulus* Reuter, 1871 (Table 2). *Lasiochilus pallidulus* is widely distributed in Central America, South America, the West Indies, and the southern U.S. (Ford 1979; Henry 1988; Carpintero 2002), and is a relatively common part of the true bug fauna in south Florida (Blatchley 1926). Lattin (2007a) included it in his list of species introduced into the Galápagos. Herring (1966) reported its presence on Cook Island and the Galápagos.

Sources of Interceptions

We observed differences among geographic regions in numbers and taxonomic composition of interceptions (Table 3), probably because of the combined effects of zoogeography, types of products being shipped and tendency of those products to host these insects in the country of origin, and numbers of shipments arriving from each region. Interceptions arriving from South and Central America included several taxa not encountered in shipments from other regions, notably Scolopini (Anthocoridae) and Lasiochilidae (Table 3). Both of these groups are common in the New World tropics (Ford 1979; Carpintero 2002). Oriini (Anthocoridae) were intercepted from all regions except Asia. Nine of 10 intercepted specimens of *Xylocoris* (Anthocoridae: Xylocorini) arrived on shipments from Asia (Table 3). Interceptions arriving from South America and Central America were taxonomically the most diverse, with 9 genera identified in the interceptions (Table 3). The Anthocorini (Anthocoridae) are most heavily represented in the Palearctic and western Nearctic regions (Ford 1979). Nine specimens of Anthocorini were intercepted; the specimens were intercepted in shipments arriving from Europe and Mexico (Table 3).

Specimens representing 10 species arrived on shipments from countries outside of the species' listed geographic distributions (Table 4), suggesting that we identified several new country records in the interceptions. The assumption underlying this conclusion is that the commodity from which a given specimen was recovered (column 5 in Table 2) actually originated in the source country listed in column 2 of the table. This assumption is probably true for the majority of records in Table 2, with the most likely exceptions being specimens that were intercepted in passenger luggage or baggage. The majority of new records listed in Table 4 comprise geographic regions (countries)

TABLE 3. GEOGRAPHICAL DISTRIBUTION OF INTERCEPTIONS.

Geographical source of shipment	Number of genera	Number of specimens							
		Oriini	Cardiastethini	Scolopini	Xylocorini	Anthocorini	Blaptostethini	Lyctocoridae	Lasiochilidae
South America/ Central America/ West Indies	9	29	10	6	1	0	0	5	19[1]
Mexico	3	2	0	0	0	3	0	4	0
Europe/ Mediterranean	4	16	1	0	0	6	0	0	0
Sub-Saharan Africa	3	10	0	0	0	0	1	0	0
Asia	4	0	5	0	9	0	0	0	0

[1]16 specimens in single shipment from Panama.

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Table 4. List of intercepted species which arrived on shipments from countries not currently listed as part of the species' known geographic range.

Species intercepted	Origin of shipment	Known distribution of species
Orius insidiosus	(1) Ecuador (2) Trinidad/Tobago	Eastern North America, Central America, South America, West Indies (Champion 1900; Henry 1988; Carpintero 2002)
Amphiareus constrictus	(1) Haiti (2) Dominican Republic	Nearly cosmopolitan, including many oceanic islands – Micronesia, Hawaii, the Cook Islands, and the Galápagos (Champion 1900; Herring 1967; Ford 1979; Walker & Deitz 1979, Cassis & Gross 1995; Péricart 1996; Lattin & Lewis 2001; Carpintero 2002; Yamada & Hirowatari 2003; Lattin 2007ab; Yamada 2008b)
Physopleurella mundula	Haiti	Hawaii, Guam, Micronesia, Florida (Usinger 1946; Herring 1967; Ford 1979; Lattin 2005b)
Physopleurella flava	Philippines	Thailand, Malaysia, Mauritius, Madagascar, Congo, Benin, Côte-d'Ivoire (Yamada & Hirowatari 2007b)
Alofa sodalis	(1) Brazil (2) Trinidad	Cosmopolitan (except Australia), including many oceanic islands – Hawaii, the Galápagos, Micronesia, and Easter Island (Usinger 1946; Herring 1967; Ford 1979, Carpintero 2002; Lattin 2007ab)
Cardiastethus affinis	(1) Thailand (2) Haiti (3) Costa Rica	East Africa, India (Ford 1979; Yamada et al. 2008)
Cardiastethus minutissimus	Thailand	Guam, Micronesia, Hawaii, Ogasawara Islands - Japan (Herring 1967; Lattin 2007b; Yamada & Hirowatari 2007a)
Buchananiella continua	Luxemburg	Europe, North Africa, Asia, tropical Africa, Reunion, North America, South America, Madeira, Azores (Carayon 1958; Ford 1979; Péricart 1996; Lattin et al. 2001; Carpintero 2002; Aukema 2007)
Calliodis pallescens	(1) Colombia (2) Honduras (3) Jamaica	South America, Central America, Grenada (Champion 1900; Ford 1979; Carpintero 2002)
Xylocoris afer	(1) Costa Rica (2) India (3) China	Sub-Saharan Africa, Turkey, South America, Central America, Australia, Israel, Great Britain, United States (Southwood & Leston 1959; Ford 1979; Péricart & Halperin 1989; Cassis & Gross 1995; Péricart 1996; Carpintero 2002; United States records from TML and TTD collections)

that neighbor the known geographic range of the species. More interesting are interceptions of species from countries well outside of the species' known geographic range. The most striking geographic anomalies in the interceptions were for 2 species of *Cardiastethus*. The first of these, *Cardiastethus affinis*, was intercepted in shipments from Thailand, Haiti, and Costa Rica (Table 4). Previous records for this species include only India and East Africa. Secondly, a specimen of *Cardiastethus minutissimus* was intercepted in baggage on a flight from Thailand. Previous records for *C. minutissimus* are limited to a number of Pacific Islands (Table 4).

Conclusions

The Anthocoridae and related taxa are common elements in the non-indigenous insect faunas of many geographic regions (Lattin 1999a; Rabitsch 2010), including in the faunas of isolated oceanic islands (Lattin 2007ab; Herring 1967; Yasunaga 2000; Carpintero 2002; Aukema et al. 2006). Although some of these introduced species have become established as a consequence of classical biological control programs (e.g., Horton et al. 2004), the majority of established introductions of Anthocoridae has almost certainly been accidental, likely as stowaways on international shipments of goods. Indeed, specimens of Anthocoridae, Lyctocoridae, and Lasiochilidae may be particularly effective at dispersing in this manner. These taxa occupy a variety of different habitats, often including cryptic habitats (Lattin 1999), and were intercepted on a number of different products: cut flowers, ornamental plants, agricultural produce, tile, and wood products (Table 2). The insects are small in body size and often flattened in shape, and may thus occupy microsites easily overlooked by inspectors. Many of the specimens that we were able to fully identify were of species not currently established in the continental United States (the species marked with asterisks in Table 2). These 33 specimens comprised 14 identified species scattered among several zoogeographic regions. Moreover, in addition to the 33 specimens that could be identified to species, another 49 specimens distributed among 7 genera (*Orius*, *Calliodis*, *Xylocoris*, *Blaptostethus*, *Lyctocoris*, *Lasiochilus*) were new enough to us that we were not able to identify them (Table 2). Given our familiarity with the North American fauna of the Anthocoridae, our lack of success in identifying these 49 specimens probably is an indication that these unidentified species are not part of the true bug fauna in the continental U.S. In sum, 82 of the 127 total specimens that were examined in this study are very likely to be species that are not part of the current U.S. fauna.

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