



## An annotated checklist of scale insects (Hemiptera: Coccoidea) of Saint Lucia, Lesser Antilles

CHRIS MALUMPHY

The Food and Environment Research Agency, Sand Hutton, York YO41 1LZ, U.K. E-mail: [chris.malumphy@fera.gsi.gov.uk](mailto:chris.malumphy@fera.gsi.gov.uk)

### Abstract

An annotated list of 83 scale insect species (Hemiptera: Sterorrhyncha: Coccoidea) recorded from Saint Lucia is presented, based on data gathered from UK quarantine interceptions, samples collected in an urban coastal habitat in the North West of the Island in 2013, and published records. Thirty-three species (40%) are recorded for the first time for the country, including *Dysmicoccus joannesiae* (Costa Lima), a South American mealybug, and *Poliaspoides formosana* (Takahashi), an Asian armoured scale insect pest of bamboo, which are new for the Caribbean region. The economic, environmental and social impacts caused by introduced exotic species of scale insect are discussed. Two predatory midges *Diadiplosis ?coccidivora* (Felt) and *Diadiplosis multifila* (Felt) (Diptera: Cecidomyiidae) are recorded for the first time from Saint Lucia. The latter species was observed causing 90% mortality of a large infestation of passion vine mealybug *Planococcus minor* (Maskell) on soursop fruit.

**Key words:** Caribbean, West Indies, *Poliaspoides formosana*, *Dysmicoccus joannesiae*, exotic introductions, impact

### Introduction

Scale insects (Hemiptera: Sterorrhyncha: Coccoidea) are plant parasitic bugs closely related to aphids, whiteflies and psyllids. They are one of the most commonly transported groups of insects in plant trade and one of the most successful invasive insect groups (Miller & Miller, 2003; Pellizzari & Dalla Montá, 1997; Smith *et al.*, 2007; Thomas, 2006). Stocks (2013) reviewed 19 species of exotic scale insect that had recently invaded Florida (USA) and the Caribbean Region. Several of these species have had a high economic, environmental and social impact in the Caribbean region: For example, pine tortoise scale *Toumeyella parvicornis* (Cockerell), has devastated the pine forest in the Turks and Caicos Islands since 2004 (Malumphy *et al.*, 2012); lobate scale *Paratachardina pseudolobata* Kondo & Gullan has damaged woody dicotyledonous plants in Florida and the Bahamas since the 1990s (Kondo & Gullan, 2007); croton scale *Phalacrocooccus howertoni* Hodges & Hodgson has become a major pest of croton and other ornamentals in Florida since 2008, and is spreading in the Caribbean (Hodges & Hodgson, 2010); papaya mealybug *Paracoccus marginatus* Williams & Granara de Willink has become a serious pest of tropical fruits and ornamentals in the Caribbean since the 1990s (Miller *et al.*, 1999; Walker *et al.*, 2003); and the pink hibiscus mealybug *Maconellicoccus hirsutus* (Green) has spread widely in the Caribbean since 1994 (Williams, 1996). The latter species attacks more than 330 plant species (Chong, 2009), including many agricultural and horticultural crops, and has caused significant economic losses (Kairo *et al.*, 2000). Yet despite the negative economic, environmental and social impact of invasive scale insect species, the scale insect fauna of the majority of territories within the Caribbean are poorly known.

Saint Lucia is an island country in the eastern Caribbean Sea on the boundary with the Atlantic Ocean. It forms part of a chain of islands known as the Lesser Antilles, and lies between 13°42' to 14°07' N latitude and 60°52' to 61°05' W longitude. It is located 40 km north/northeast of the island of St. Vincent, and 30 km south of Martinique. It is roughly tear-drop in shape, with a length of 43.5 km and is 22.5 km at its widest (in the southern half). It is a mountainous volcanic island, 616 km<sup>2</sup> in area, with a maximum elevation of 950 m. It is a lush tropical island heavily altered by agriculture, but with a significant area of undisturbed sub-montane rainforest in the island's

interior. Rainfall is heavy and varies seasonally, usually with a dry season from mid-November to mid-June and a rainy season from mid-June to mid-November. The January daily average high temperature is 27°C at the south-western coastal capital city of Castries, with a nightly low of 20°C. The July daily average is 29°C and the nightly low is 22°C. Saint Lucia has always been an isolated oceanic island, never with a land bridge connection to other islands.

A provisional checklist of scale insects of Saint Lucia published by Malumphy (2012) included 48 species in 35 genera and 8 families. Some relatively old pest-distribution maps published by CAB International (CABI, 1957a, 1957b, 1960, 1966a, 1966c, 1967, 1969, 1976, 1981a), suggested that a further nine species of scale insect occurred throughout the whole of the Lesser Antilles. However, there were no specific references or voucher specimens to verify the presence of these scales in Saint Lucia and these records were not accepted by Malumphy (2012), ScaleNet (2014, an online world catalogue of scale insects <http://www.sel.barc.usda.gov/scalenet/scalenet.htm>), Crop Protection Compendium (2014, <http://www.cabi.org/cpc/>), Invasive Species Compendium (2013, <http://www.cabi.org/isc/>), or in any other published catalogues. Territories in the Lesser Antilles whose scale insect faunas (Hemiptera: Coccoidea) have been studied in some detail, based on the number of species recorded by ScaleNet (2014) and recent publications, include: Antigua and Barbuda—59 spp.; Guadeloupe—126 spp. (Matile-Ferrero & Étienne, 2006; Étienne & Matile-Ferrero, 2008); Martinique—75 spp. (Matile-Ferrero & Étienne, 2006); Trinidad and Tobago—112 spp. (Laurence, 1991); and the US Virgin Islands—82 spp. (Nakahara, 1983).

The purpose of this study is to provide an up-dated checklist of scale insects of Saint Lucia, including brief biological data to aid an assessment of the potential impact of invasive species in the country. This will provide baseline data from which future faunistic changes due to factors such as international trade and tourism, can be monitored and accurately assessed.

## Methods

Data on the scale insects of Saint Lucia were collated from three main sources: quarantine interception data recorded in England by the Plant Health and Seeds Inspectorate (PHSI) during phytosanitary inspections of plant material imported from Saint Lucia; collections/observations made by the author mostly in Rodney Bay in 2013; and literature and internet searches.

Plant material is regularly imported from Saint Lucia into the UK, via daily direct flights between the two countries, or less frequently via Barbados. The country of origin of the plant material was confirmed on the phytosanitary certificates. The risk of cross contamination, that is, the plant material from Saint Lucia becoming infested in transit or after arrival in Britain, is considered negligible as scale insects have a low natural dispersal potential (adult females are wingless and usually sessile, being firmly attached to the host by their mouthparts), and the plant material is examined on arrival at the UK airports, or shortly after arrival at botanical gardens and commercial nurseries. Samples collected by the PHSI were submitted to The Food and Environment Research Agency (FERA) laboratory for analysis and identification.

The author visited Saint Lucia between the 15<sup>th</sup> and 29<sup>th</sup> August 2013 for a private family holiday. A small number of samples were collected, mainly from exotic ornamental plants, palms and fruit trees planted at a resort in Rodney Bay (Parish Gros Islet), a coastal urban habitat in the North West of the island, where the author stayed. Preserved samples were taken to FERA, slide-mounted according to the procedures published by Malumphy (2002), and identified using Hamon & Williams (1984), Williams & Granara de Willink (1992), Miller & Davidson (2005), and further references cited below. Slide-mounted voucher specimens are deposited at FERA. Many of the host plants were identified using Graveson (2012).

## Results

Eighty-three species of scale insect assigned to 54 genera in 8 families are recorded from Saint Lucia. Thirty-three species are recorded here for the first time (marked with an asterisk in the list below): *Antonina graminis* (Maskell), *Ceroplastes cirripediformis* Comstock, *Chrysomphalus dictyospermi* (Morgan), *Coccus longulus*

(Douglas), *Crypticerya genistae* (Hempel), *Duplachionaspis divergens* (Green), *Dysmicoccus joannesiae* (Costa Lima), *Eucalymnatus tessellatus* (Signoret), *Ferrisia dasylirii* (Cockerell), *F. virgata* (Cockerell), *Fiorinia fioriniae* (Targioni Tozzetti), *F. proboscidiaria* Green, *Hemiberlesia lataniae* (Signoret), *H. palmae* (Cockerell), *Howardia biclavis* (Comstock), *Hypogeococcus pungens* Granara de Willink, *Insignorthezia insignis* (Browne), *Lepidosaphes tokionis* (Kuwana), *Morganella longispina* (Morgan), *Mycetaspis personata* (Comstock), *Phenacoccus solani* Ferris, *Philephedra broadwayi* (Cockerell), *P. tuberculosa* Nakahara & Gill, *Pinnaspis buxi* (Bouché), *Pinnaspis* sp., *Poliaspoides formosana* (Takahashi), *Praelongorthezia praelonga* (Douglas), *Pseudaonidia trilobitiformis* (Green), *P. cockerelli* (Cooley), *Pseudococcus odermatti* Miller & Williams, *Pulvinaria urbicola* Cockerell, *Radionaspis indica* (Marlatt) and *Saissetia miranda* (Cockerell & Parrott). Information on the nomenclature, distribution, host range, and economic importance for each of the species are summarised in the notes below, and further details can be found on ScaleNet (2014).

## List of scale insects of Saint Lucia

### FAMILY ASTEROLECANIIDAE—pit scales

#### *Bambusaspis miliaris* (Boisduval)—miliaris pit scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; oligophagous on bamboo; a pest of bamboo in both native and ornamental stands. Recorded from Saint Lucia by Malumphy (2012, on *Arundinaria* (Poaceae)).

**Collection data.** Large populations of *B. miliaris* were frequently observed causing serious chlorosis to the foliage of ornamental bamboo. Gros-Islet Parish: Rodney Bay (widespread and very common), on *Bambusa multiplex* (Poaceae) hedges, 24–27.viii.2013, and near Pigeon Island, on *Bambusa vulgaris*, 20.viii.2013. Soufrière Parish: near Soufrière, on *B. vulgaris*, 26.vii.2013.

#### *Russellaspis pustulans* (Cockerell)—oleander pit scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Europe, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 69 families; an occasional pest of crops and ornamental plants, especially oleander. Recorded from Saint Lucia by CABI (1984), Stumpf & Lambdin (2006), and Malumphy (2012).

### FAMILY COCCIDAE—soft scales

#### \* *Ceroplastes cirripediformis* Comstock—barnacle scale

Occurs widely in the Americas, and in parts of South East Asia and the Pacific; polyphagous, feeding on plants belonging to 70 families; a serious pest of citrus and many ornamentals.

In addition to the records below, immature *Ceroplastes* morphologically consistent with *C. cirripediformis* were collected from *Ixora* spp. (Rubiaceae), Rodney Bay, 22 and 25.viii.2013.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Psidium guajava* (Myrtaceae), 19.viii.2013, on *Ruellia simplex* (Acanthaceae), 17–18.viii.2013 on *Lantana camara* (Verbenaceae), 24.viii.2013; Reduit beach, on unidentified herbaceous plants, 23.viii.2013.

#### *Ceroplastes floridensis* Comstock—Florida wax scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific, isolated records from southern Europe; polyphagous, feeding on plants belonging to 70 families; a major pest of citrus and many ornamental plants. Recorded from Saint Lucia by CABI (2010) and Malumphy (2012, on *Schefflera* (Araliaceae)).

**Collection data.** Gros-Islet Parish: Rodney Bay, Reduit beach, on *Nerium oleander* (Apocynaceae), 23.viii.2013.

***Ceroplastes stellifer*** (Westwood)—stellate scale (Fig. 1, A)

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 23 families, with a preference for palms and orchids; an occasional pest of ornamental plants. Recorded from Saint Lucia by Walters (1926) and Malumphy (2012, on Orchidaceae).

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Ixora*, 22.viii.2013, and *Mangifera indica* (Anacardiaceae), 25.viii.2013. Intercepted in the UK (Herefordshire, nursery), on *Dyopsis lutescens* (Arecaceae), 15.ix.1993, leg. Hardy.

***Coccus hesperidum*** L.—brown soft scale

Cosmopolitan, widespread in the Lesser Antilles; polyphagous, feeding on plants belonging to 130 families; a major pest of citrus and many other crops and ornamental plants. Recorded from Saint Lucia by CABI (1972a) and Malumphy (2012, on an unspecified plant).

\* ***Coccus longulus*** (Douglas)—long brown scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Europe, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 57 families, including many crop and ornamental plants, with a preference for Fabaceae.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Psidium guajava*, 19.viii.2013. Intercepted in the UK (London) on *Annona muricata* (Annonaceae), 23.ix.2013, leg. R. Waghorn, 25.v.2014, leg. J. Pollock (in association with Eupalopsellidae (Acarina: Prostigmata) predatory mites).

***Coccus viridis*** (Green)—green coffee scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 62 families, with a preference for Rubiaceae and Rutaceae; a major pest of many crop and ornamental plants in the Caribbean. Recorded from Saint Lucia by CABI (1972b), EPPO (2009), and Malumphy (2012, on *Citrus aurantifolia*).

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Ixora* and unidentified woody ornamentals, 16–20.viii.2013.

\* ***Eucalymnatus tessellatus*** (Signoret)—tessellated scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 53 families, with a preference for palms, Arecaceae.

**Collection data.** Gros-Islet Parish: Rodney Bay (widespread), on *Chrysalidocarpus lutescens*, *Cocos nucifera* and unidentified palms (Arecaceae), and an unidentified shrub, 16–24.viii.2013.

***Parasaissetia nigra*** (Nietner)—nigra scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, southern Europe, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 94 families, including many crop and ornamental plants; an economic pest in tropical areas of China and India. Recorded from Saint Lucia by CABI (1997) and Malumphy (2012).

\* ***Philephedra broadwayi*** (Cockerell) (Fig. 1, B)

Occurs widely in South America and the Caribbean (including the Lesser Antilles); polyphagous, feeding on plants belonging to 5 families; a pest of tropical fruit including banana, citrus, guava, mango, and soursop.

**Collection data.** Intercepted in UK (London) on *Annona muricata*, 15.vii.2013, leg. D. Dennis (abundant, eggs attacked by the larvae of *Diadiplosis ?coccidivora* (Felt) (Diptera: Cecidomyiidae), det. Keith Harris), and 14.iv.2014, leg. R. Waghorn.

\* *Philephedra tuberculosa* Nakahara & Gill

A Neotropical species that has been spreading rapidly in the Caribbean region in recent years; polyphagous, feeding on plants belonging to 26 families, including many crop and ornamental plants. A major pest of croton and other ornamentals.

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant female scales with oviscas on *Codiaeum variagatum* (Euphorbiaceae), and unidentified herbaceous ornamental plants, 25.viii.2013.

*Protopulvinaria pyriformis* (Cockerell)—pyriform scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, southern Europe, and parts of Asia; polyphagous, feeding on plants belonging to 35 families, including many crop and ornamental plants. Recorded from Saint Lucia by Hodgson (1994) and Malumphy (2012).

**Collection data:** Gros-Islet Parish, Rodney Bay, sparse on *Ixora*, 22.viii.2013, abundant on *Psidium guajava*, 19.viii.2013, and abundant on *Schefflera arboricola*, 25.viii.2013.

\* *Pulvinaria urbicola* Cockerell—urbicola soft scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Australia and the Pacific; polyphagous, feeding on plants belonging to 43 families, including many crop and ornamental plants.

**Collection data:** Gros-Islet Parish, Rodney Bay, on *Ruellia simplex*, 18.viii.2013, and on *Psidium guajava*, 19.viii.2013.

*Saissetia coffeae* (Walker)—hemispherical scale

Cosmopolitan, widespread in the Lesser Antilles; polyphagous, feeding on plants belonging to 115 families; an important pest of many ornamental plants. Recorded from Saint Lucia by CABI (1973b) and Malumphy (2012, on *Plerandra* (= *Dizygotheca*) (Araliaceae)).

**Collection data.** Gros-Islet Parish: Rodney Bay, sparse on *Cycas* (Cycadaceae), 27.viii.2013.

\* *Saissetia miranda* (Cockerell & Parrott)—Mexican black scale

Occurs widely in tropical areas of the Americas, southern Africa and Asia; polyphagous, feeding on plants belonging to 28 families; a potential pest of citrus and a minor pest of many ornamentals in the USA.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Cocos nucifera*, 16.viii.2013.

*Saissetia neglecta* De Lotto—Caribbean black scale

Occurs widely in tropical areas of the Americas, also recorded from Hong Kong (China) and parts of the Pacific; polyphagous feeding on plants in 35 families; a pest of citrus in Florida. Recorded from Saint Lucia by Malumphy (2012, on *Annona muricata* and *A. squamosa*).

*Saissetia oleae* (Olivier)—black scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 80 families, including many crop and ornamental plants. Recorded from Saint Lucia by CABI (1973a).

**FAMILY DIASPIDIDAE**—armoured scale insects

*Aonidiella aurantii* (Maskell)—Californian red scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 88 families, including many crop and ornamental plants; major pest of citrus. Recorded from Saint Lucia by CABI (1996a) and Malumphy (2012).

*Aonidomytilus albus* (Cockerell)—cassava or tapioca scale

Occurs widely in tropical areas of the Americas (including the Lesser Antilles), Africa and Asia; polyphagous,

feeding on plants belonging to 12 families; a serious pest of cassava. Recorded from Saint Lucia by Woodruff *et al.* (1998) and Malumphy (2012).

***Aspidiotus destructor*** Signoret—coconut or transparent scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 71 families; a pest of coconut, banana, mango and many ornamentals, particularly palms. Recorded from Saint Lucia by CABI (1966b) and Malumphy (2012, on *Annona muricata*).

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Cocos nucifera*, 16.viii.2013. Intercepted in the UK (Herefordshire, nursery), on *Dypsyis lutescens*, 30.viii.1993, 9.ix.1993 and 15.ix.1993, leg. Hardy.

***Aspidiotus excisus*** Green—Aglaonema scale or cyanotic scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Asia and the Pacific; polyphagous, feeding on plants belonging to 19 families; a pest of woody ornamental plants. Recorded from Saint Lucia by Malumphy (2012, on *Aglaonema crispum* (Araceae)).

***Aulacaspis tubercularis*** Newstead—white mango scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 18 families; serious pest of mangos. Recorded from Saint Lucia by Watson (2002), Malumphy (2012, on *Mangifera indica*) and Stocks (2013).

***Chrysomphalus aonidum*** (Linnaeus)—Florida red scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 77 families; major pest of several crop and many ornamental plants. Recorded from Saint Lucia by CABI (1988) and Malumphy (2012).

\* ***Chrysomphalus dictyospermi*** (Morgan)—dictyosperm scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 83 families; major pest of citrus.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Psidium guajava*, 19.viii.2013, abundant on *Ixora*, 22.viii.2013.

***Clavaspis herculeana*** (Cockerell & Hadden)—Herculeana scale

Occurs widely in tropical areas of the Americas, Africa, parts of Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 25 families, including many crop and ornamental plants. It is highly cryptic as the scales can burrow beneath the bark. Recorded from Saint Lucia by Malumphy (2012, on *Annona muricata*).

**Collection data.** Intercepted in the UK (London) on *A. muricata* fruit, 12.xi.2012, leg. R. Waghorn, 29.vii.2013, leg. D. Dennis (abundant), 4.viii.2013, leg. J. Pollock, and 12.viii.2013, leg. D. Dennis.

***Diaspis boisduvalii*** Signoret—Boisduval scale

Cosmopolitan, widespread in the Lesser Antilles, restricted to indoor plantings in cooler temperate regions; polyphagous feeding on plants in 38 families; a pest of orchids and woody ornamental plants, particularly palms. Recorded from Saint Lucia by Malumphy (2012, on *Archontophoenix cunninghamiana* (Arecaceae) and *Dypsyis lutescens*).

**Collection data.** Gros-Islet Parish: Rodney Bay (widespread), on *Chrysalidocarpus lutescens*, *Cocos nucifera* and unidentified palms, 16–27.viii.2013.

***Diaspis bromeliae*** (Kerner)—pineapple scale

Cosmopolitan, widespread in the Lesser Antilles, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 12 families; pest of pineapple and other bromeliads. Recorded from Saint Lucia by Watson (2002) and Malumphy (2012).

\* *Duplachionaspis divergens* (Green) (Fig. 1, C)

An Asian species that has a patchy distribution in tropical areas of North and South America, and Australia; oligophagous on grasses (Poaceae); a minor pest of sugarcane and lemon grass.

**Collection data.** In all cases the scales were present in large numbers causing chlorosis and distinct purple marks on the foliage. Gros-Islet Parish: Rodney Bay, on *Cymbopogon citratus* (Poaceae) and various grasses, 19 and 28.viii.2013, Mt. Pimard, on various broad-leaved grasses, 25–29.viii.2013.

\* *Fiorinia fioriniae* (Targioni Tozzetti)—palm fiorinia scale

An Eastern Asian species that has spread widely in tropical and subtropical areas of the Americas, Africa, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 23 families, but with a preference for Arecaceae; a serious pest of many palms.

**Collection data.** Intercepted in the UK (Herefordshire, nursery) on *Dypsis lutescens*, 9.ix.1993, leg. Hardy.

\* *Fiorinia proboscidaria* Green (Fig. 1, D)

Occurs widely in southern Asia, introduced to East Africa, the Caribbean (Jamaica, Guadeloupe and Martinique) and the Pacific; polyphagous, feeding on plants belonging to 12 families. A large population was found causing significant chlorosis to lime fruit, which could affect marketability of the produce.

**Collection data.** Intercepted in the UK (London) on *Citrus aurantifolii* (Rutaceae), 9.ix.2013, leg. N. Finnis (together with thrips larvae suspected to be a *Karnyothrips* sp. (Phlaeothripidae)).

*Furcaspis biformis* (Cockerell)—red orchid scale or orchid scale

Occurs widely in tropical areas of the Americas (including the Lesser Antilles), Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 13 families; pest of orchids. Recorded from Saint Lucia by Williams *et al.* (2006), and Malumphy (2012).

\* *Hemiberlesia lataniae* (Signoret)—latania scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, recorded from (mostly woody) host plants belonging to 116 families; serious pest of many agricultural crops and ornamental plants.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Yucca* (Asparagaceae), 18.viii.2013, and *Psidium guajava*, 19.viii.2013. Also found indoors in Rodney Bay on *Anthurium* (Araceae), 17.viii.2013.

\* *Hemiberlesia palmae* (Cockerell)—tropical palm scale

Occurs widely in tropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 56 families; it is a pest of many tropical crops including banana, cassava, coconut palm, oil palm, and cocoa.

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Cocos nucifera*, 16–24.viii.2013, and *Musa* spp., 20.viii.2013. Intercepted in the UK (Herefordshire, nursery), on *Dypsis lutescens*, 15.ix.1993, leg. Hardy.

\* *Howardia biclavis* (Comstock)—burrowing scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 78 families; an economic pest of many woody ornamentals. This species is highly cryptic, often feeding beneath the host's epidermis.

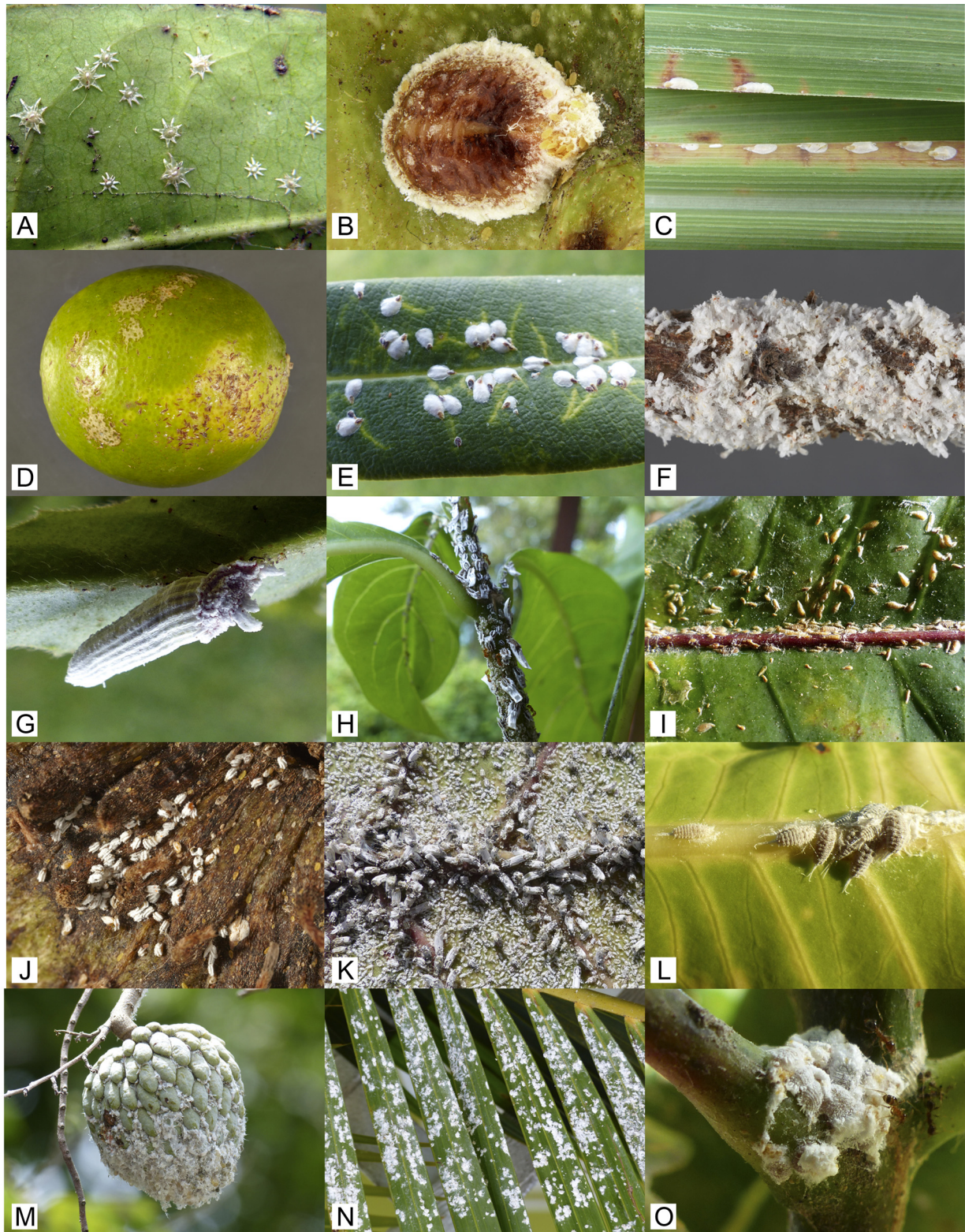
**Collection data.** Gros-Islet Parish: Rodney Bay, Mount Pimard, abundant on bark of ?*Acacia*, 25.viii.2013, and *Ixora*, 27.vii.2013. Intercepted in the UK (London) on *A. muricata*, 25.v.2014, leg. J. Pollock.

*Lepidosaphes beckii* (Newman)—purple scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, southern Europe, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 27 families; a pest of *Citrus*. Recorded from Saint Lucia by CABI (1982) and Malumphy (2012).

**Collection data.** Gros-Islet Parish: Gros Islet, abundant on *Citrus* (Rutaceae), 19.viii.2013.





**FIGURE 1.** Examples of scale insect pests in Saint Lucia. A, *Ceroplastes stellifer*; B, *Philephedra broadwayi* on sour sop; C, *Duplacionaspis divergens* on grass; D, *Fiorinia proboscidea* on lime; E, *Pseudaulacaspis cockerelli* on oleander; F, *Pseudaulacaspis pentagona*; G, *Crypticerya genistae*; H, *Insignorthezia insignis*; I, *Lepidosaphes tokionis* on croton; J, *Pinnaaspis strachani* on sour sop; K, *Praelongorthezia praelonga* on sea grape; L, *Ferrisia dasylii* on croton; M, *Ferrisia virgata* and other mealybugs on sugar apple; N, *Nipaeococcus nipae* on palm; O, *Planococcus minor* on croton. © C. Malumphy, except B, D, F, FERA



***Lepidosaphes rubrovittata*** Cockerell—guava scale

Occurs widely in tropical Asia and the Pacific, and in parts of the Caribbean and Central America; polyphagous, feeding on plants in 8 families. Recorded from Saint Lucia by Malumphy (2012, misspelt in part as *L. rubrovittata*) on *Annona muricata*. In addition to the new record below *Lepidosaphes rubrovittata* was intercepted in the UK (Herefordshire, nursery), on *Dyopsis lutescens*, 9.ix.1993 and 15.ix.1993, leg. Hardy.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Psidium guajava*, 19.viii.2013.

\* ***Lepidosaphes tokionis*** (Kuwana)—croton mussel scale (Fig. 1, I)

Occurs widely in tropical areas of Asia, Australia and the Pacific, scattered distribution in North America, the Caribbean and Africa; polyphagous, feeding on plants belonging to 6 families; a pest of croton.

**Collection data.** Gros-Islet Parish: Rodney Bay, huge population on *Codiaeum variegatum*, 20.viii.2013.

\* ***Morganella longispina*** (Morgan)—plumose scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 22 families; a pest of several woody fruit crops including citrus.

**Collection data.** Intercepted in the UK (London) on *A. muricata*, 25.v.2014, leg. J. Pollock.

\* ***Mycetaspis personata*** (Comstock)—masked scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, also recorded from Hawaii and on indoor plantings in Europe; polyphagous, feeding on plants belonging to 17 families; a pest of *Citrus* and mango.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Psidium guajava*, 19.viii.2013.

***Odonaspis greenii*** Cockerell—Green's scale

Occurs widely in the tropical areas of Asia, scattered records from the Americas and the Pacific, and restricted to indoor plantings in Europe; oligophagous on bamboo (Poaceae). Recorded from Saint Lucia by Ben-Dov (1988) and Malumphy (2012).

**Collection data.** Gros-Islet Parish: Rodney Bay, near Pigeon Island, on *Bambusa vulgaris*, 20.viii.2013.

***Palinaspis quohogiformis*** (Merrill)—quohog-shaped scale

Recorded from Florida (USA), Cuba and Puerto Rico; polyphagous, feeding on plants in 8 families. Recorded from Saint Lucia by Ferris (1941) and Malumphy (2012).

***Parlatoria cinerea*** Hadden—tropical grey chaff scale

Occurs widely in tropical areas of the Americas, Asia and the Pacific, scattered distribution in Africa; broadly polyphagous, being recorded on plants belonging to 13 families; a pest of *Citrus*. Recorded from Saint Lucia by Morrison (1939) and Malumphy (2012).

***Parlatoria crotonis*** Douglas—croton parlatoria scale

Occurs widely in tropical areas of the Americas, Africa, Asia and the Pacific, restricted to indoor plantings in Europe; polyphagous, feeding on plants belonging to 12 families; a pest of ornamentals. Recorded from Saint Lucia by Merrill (1953) and Malumphy (2012).

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Codiaeum variegatum*, 20.viii.2013.

***Parlatoria pergandii*** (Comstock)—chaff scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Europe, Asia, Australia and the Pacific; broadly polyphagous, being recorded on plants belonging to 37 families; a pest of *Citrus*. Recorded from Saint Lucia by Schotman (1989) and Malumphy (2012).

\* ***Pinnaspis buxi*** (Bouché)—screw pine scale

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 46 families; a pest of palms and screw pines.

**Collection data.** Intercepted in the UK (Herefordshire, nursery), on *Dyopsis lutescens*, 15.ix.1993, leg. Hardy.

***Pinnaspis strachani*** (Cooley)—lesser snow scale (Fig. 1, J)

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 84 families; a serious pest of many crops and ornamentals. Recorded from Saint Lucia by Crop Protection Compendium (2014) and Malumphy (2012, on *Annona muricata*). Often found in large numbers on *A. muricata* fruit, the male tests forming conspicuous white patches on the fruit.

**Collection data.** Intercepted in the UK (London) on *A. muricata*, 12.xi.2012, leg. R. Waghorn, 2.vii.2013, leg. J. Pollock, 29.vii.2013, leg. D. Dennis, 4.viii.2013, 25.v.2014, leg. J. Pollock (abundant, many scales were parasitized by an unidentified Aphelinidae, and found in association with a predatory stigmatid mite (Stigmatidae)), 12.viii.2013, leg. D. Dennis, and 23.ix.2013, leg. R. Waghorn (in association with a predatory Eupalopsellidae mite).

\* ***Pinnaspis*** sp.

A single specimen that does not key out to any of the three species known to occur in the Caribbean region.

**Collection data.** Intercepted in the UK (London) on *Annona muricata* fruit, 29.vii.2013, leg. D. Dennis.

\* ***Poliaspoides formosana*** (Takahashi)

Scattered distribution in tropical areas of Africa and Asia; recently recorded from ornamental bamboo at two plant nurseries in Florida, USA (Stocks, 2014); oligophagous on bamboo (Poaceae).

**Collection data.** Gros-Islet Parish: near Pigeon Island, on *Bambusa vulgaris* (Poaceae), 20.viii.2013 (abundant on stems beneath leaf sheaths).

\* ***Pseudaonidia trilobitiformis*** (Green)—trilobite scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 50 families.

**Collection data.** Gros-Islet Parish: Rodney Bay (widespread and very common), abundant on *Nerium oleander*, *Ixora* and unidentified shrubs, 18-27.viii.2013.

\* ***Pseudaulacaspis cockerelli*** (Cooley)—false oleander scale (Fig. 1, E)

Occurs widely in tropical and subtropical areas of the Americas, Africa, Europe, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 78 families; a serious pest of many woody ornamental plants.

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Asparagus* (Asparagaceae) and *Cocos nucifera*, 16.viii.2013, massive populations damaging *Nerium oleander*, 21-24.viii.2013, and *Plumeria pudica* (Apocynaceae), 25.viii.2013.

***Pseudaulacaspis pentagona*** (Targioni Tozzetti)—white peach scale (Fig. 1, F)

Cosmopolitan; polyphagous, feeding on plants belonging to 89 families; a major pest of fruit trees and many woody ornamental plants. Recorded from Saint Lucia by CABI (1996b) and Malumphy (2012).

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Nerium oleander*, 21-22.viii.2013.

\* ***Radionaspis indica*** (Marlatt)—mango scale

Occurs widely in tropical areas of Asia and has a scattered distribution in the Americas, Africa and the Pacific; feeds only on mango, on which it is a pest.

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Mangifera indica*, 25.viii.2013.

***Selenaspis articulatus*** (Morgan)—rufous scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 50 families; a pest of citrus and other crops. Recorded from Saint Lucia by CABI (1981b) and Malumphy (2012, on *Citrus aurantifolia* fruit).

**Collection data.** Intercepted in the UK (London) on *Annona muricata*, 12.xi.2012 and 23.ix.2013, leg. R. Waghorn (in association with Eupalopsellidae predatory mites).

*Unaspis citri* (Cockerell)—citrus snow scale

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 14 families; important pest of citrus. Recorded from Saint Lucia by Walters (1926), CABI (1962) and Malumphy (2012, on *Citrus aurantifolia* fruit (Rutaceae)).

#### FAMILY MONOPHLEBIDAE—giant scales

\* *Crypticerya genistae* (Hempel) (Fig. 1, G)

Occurs in the USA (Florida), Brazil and Guadeloupe, and introduced to West Africa; polyphagous, feeding on plants belonging to 19 families, with a strong preference for Asteraceae and Fabaceae, and to a lesser degree Euphorbiaceae.

**Collection data.** Gros-Islet Parish: Rodney Bay and Mt Pimard (widespread, common and frequently abundant), on ?*Acacia* and *Mimosa pudica* (Fabaceae), Asteraceae, and many other unidentified woody and herbaceous plants, 19-28.viii.2013.

*Icerya purchasi* Maskell—cottony cushion scale

Cosmopolitan; polyphagous, feeding on plants belonging to 69 families; a major pest of many ornamental plants. Recorded from Saint Lucia by CABI (1971) and Malumphy (2012).

#### FAMILY ORTHEZIIDAE—ensign scales

*Newsteadia trisegmentalis* Howell

Recorded from Mexico, USA, Venezuela and Saint Lucia. Found in orchid and bromeliad debris, and on *Quercus* (Fagaceae) and *Panicum* (Poaceae). Recorded from Saint Lucia by Kozár (2004, listed from Saint Lucia in the index and Santa Lucia under the species entry) and Malumphy (2012).

\* *Insignorthezia insignis* (Browne)—lantana or Kew bug

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 46 families; a pest of citrus and many ornamental plants.

**Collection data.** Gros-Islet Parish: Rodney Bay and Mt Pimard (widespread, occasionally abundant, ant attended), on *Lantana camara* and many other unidentified woody and herbaceous plants, 24-25.viii.2013.

\* *Praelongorthezia praelonga* (Douglas)—citrus orthezia (Fig. 1, K)

Occurs from southern Mexico to northern South America and widespread in the Caribbean; polyphagous, feeding on plants belonging to 32 families; a pest of citrus.

**Collection data.** Widespread, common, and frequently found in enormous numbers. Gros-Islet Parish: Cas en Bas, massive population on *Coccoloba uvifera* (Polygonaceae), 22.viii.2013; Rodney Bay, *Bougainvillea* (Nyctaginaceae), *Schefflera arboricola* and various woody and herbaceous plants, 16–25.viii.2013.

#### FAMILY PSEUDOCOCCIDAE—mealybugs

\* *Antonina graminis* (Maskell)—felted grass scale or rhodesgrass scale

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; oligophagous on Poaceae and Cyperaceae; a pest of grasses, especially Rhodes-grass and occasionally sugarcane.

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Cymbopogon citratus* and several unidentified grasses (Poaceae), 19 and 28.viii.2013.

***Dysmicoccus brevipes*** (Cockerell)—pineapple mealybug

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 63 families; a major pest of pineapple on which it transmits the Pineapple Mealybug Wilt Disease. Recorded from Saint Lucia by Williams & Granara de Willink (1992) and Malumphy (2012).

**Collection data.** Intercepted in the UK (London) on *Annona muricata*, 12.xi.2012, leg. R. Waghorn, 2.vii.2013, 25.v.2014, leg. J. Pollock, 12.viii.2013 and 28.iv.2014, leg. D. Dennis (attacked by *Diadiplosis* sp., *Cryptolaemus* sp. (Coleoptera: Coccinellidae), and phytoseiid mites).

\* ***Dysmicoccus joannesiae*** (Costa Lima)

Previously only known from the original type material collected in Brazil on *Joannesia princeps*. Identified using the key and description provided by Williams & Granara de Willink (1992).

**Collection data.** Intercepted in the UK (London) on *Annona muricata*, 2.vii.2013, leg. J. Pollock.

\* ***Ferrisia dasyliirii*** (Cockerell) (Fig. 1, L)

Occurs widely in the Americas and introduced to Hawaii; polyphagous, feeding on plants belonging to 30 families; a pest of many crops and ornamentals.

**Collection data.** Gros-Islet Parish: Rodney Bay, on *Cocos nucifera*, 24.viii.2013, on *Codiaeum variegatum*, 28.viii.2013, on unidentified herbaceous ornamental plants, 25.viii.2013 (large population).

\* ***Ferrisia virgata*** (Cockerell)—striped mealybug (Fig. 1, M)

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 82 families; a pest of many crops and ornamentals.

**Collection data.** Gros-Islet Parish: Cas en Bas beach, on *Coccoloba uvifera*, 22.viii.2013 (massive population); Gros Islet, huge infestation on *A. muricata* fruit, causing serious damage and making fruit inedible, 19.viii.2013; Rodney Bay (widespread and common), on *Codiaeum variegatum*, 16.viii.2013 and 28.viii.2013, on *Ixora* spp., 16.viii.2013, on *Mussaenda* (Rubiaceae), 16.viii.2013, on *Ruellia simplex*, 17.viii.2013; Redit beach, on *C. uvifera*, 16–27.viii.2013. It was also found indoors in a shopping mall in Rodney Bay, on a potted *Anthurium*, 17.viii.2013.

\* ***Hypogeococcus pungens*** Granara de Willink

Native to South America, introduced to North America, Caribbean, Hawaii and Europe; used in Australia for the biological control of invasive cacti; oligophagous, feeding on plants belonging to 4 families, most hosts belong to the Cactaceae; of little economic importance.

**Collection data:** Gros-Islet Parish, Rodney Bay, abundant on *Alternanthera bettzickiana*, 24.viii.2013, (Amaranthaceae) and *Hibiscus rosa-sinensis* (Malvaceae), 19.viii.2013.

***Maconellicoccus hirsutus*** (Green)—pink hibiscus mealybug

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 78 families, including many crop and ornamental plants; major economic pest. Recorded from Saint Lucia by Kairo *et al.* (2000), CABI (2004), EPPO (2009) and Malumphy (2012, on *A. muricata*).

**Collection data.** Gros-Islet Parish: Gros Islet, huge infestation on *A. muricata*, causing serious damage and making fruit inedible, 19.viii.2013; Rodney Bay, abundant on *Hibiscus rosa-sinensis*, 18.viii.2013, sparse on *Ixora*, 22.viii.2013. Intercepted in the UK (London), on *A. muricata* fruit, 12.xi.2012 and 23.ix.2013, leg. R. Waghorn, 2.vii.2013 and 4.viii.2013, leg. J. Pollock, 12.viii.2013 and 28.iv.2014, leg. D. Dennis. The majority of the *A. muricata* samples contained huge infestations of mealybugs, but there were very high levels of parasitism (up to 90%) of third-instar nymphs by the wasp *Anagyrus kamali* Moursi (Encyrtidae). There were also many mealybug predators present in the samples including *Karnyothrips flavipes* Jones (Phlaeothripidae), *Cryptolaemus* sp. and other ladybird beetle larvae (Coccinellidae), Eupalopsellidae and Phytoseiidae predatory mites, and *Diadiplosis* sp. larvae feeding on the mealybug eggs.

***Nipaecoccus nipae*** (Maskell)—coconut mealybug (Fig. 1, N)

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Asia and the Pacific, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 48 families, including many crop and ornamental plants, exhibits a preference for palms. Recorded from Saint Lucia by Walters (1926), Williams & Granara de Willink (1992), CABI (2005) and Malumphy (2012, on *Annona muricata* fruit). Two distinct forms exist, one with females producing white wax, and the other yellow wax; both forms were observed by the author on Saint Lucia.

**Collection data.** Frequently abundant causing chlorosis. Gros-Islet Parish: Rodney Bay (widespread and common), on *Chrysalidocarpus lutescens* and *Cocos nucifera*, 16–27.viii.2013, *Psidium guajava*, 19.viii.2013, unidentified palms, 21.viii.2013, and *Asparagus*, 16.viii.2013. Intercepted in the UK (London), on *A. muricata*, 29.vii.2013, leg. D. Dennis (mealybug eggs were attacked by midge larvae *Diadiplosis multifila* (Felt), det. Keith Harris), and 23.ix.2013, leg. R. Waghorn (associated with predatory mites Eupalopsellidae).

***Paracoccus marginatus*** Williams & Granara de Willink—papaya mealybug

Occurs widely in tropical and subtropical areas of the Americas (including the Lesser Antilles), Africa, Asia and the Pacific; polyphagous, feeding on plants belonging to 59 families; a pest of many crops, particularly papaya and ornamental plants, such as hibiscus. Recorded from Saint Lucia by Jn Pierre (2008).

***Phenacoccus madeirensis*** Green—Madeira mealybug

Occurs widely in tropical and subtropical areas of the Americas, Africa, Europe and Asia; polyphagous, feeding on plants in 46 families; a pest of many crops and ornamentals. Recorded from Saint Lucia by Williams & Granara de Willink (1992), CABI (2000) and Malumphy (2012).

***Phenacoccus parvus*** Morrison—lantana mealybug

Occurs widely in tropical and subtropical areas of the Americas, Africa, Asia, Australia and the Pacific; polyphagous, feeding on plants in 27 families; a pest of ornamentals, particularly lantana. Recorded from Saint Lucia by Williams & Cox (1984), Williams & Granara de Willink (1992), CABI (1990) and Malumphy (2012).

\* ***Phenacoccus solani*** Ferris—solanum mealybug

Native to North America, in recent decades, it has spread widely in tropical and subtropical areas of South America, the Caribbean, southern Africa, southern Europe, Asia and the Pacific; broadly polyphagous, feeding on plants belonging to 33 families; a pest of crops and ornamentals.

**Collection data.** Gros-Islet Parish: Rodney Bay, at the base of the leaf sheaths of *Cymbopogon citratus*, 28.viii.2013.

***Planococcus citri*** (Risso)—citrus mealybug

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 88 families; pest of numerous crops, particularly citrus, and ornamentals. Recorded from Saint Lucia by CABI (1999) and Malumphy (2012, on *Codiaeum variegatum*).

***Planococcus halli*** Ezzat & McConnell—Hall's mealybug

Occurs widely in South and Central America, the Caribbean and Africa; polyphagous, feeding on plants belonging to 9 families, with a preference for yam *Dioscorea* (Dioscoreaceae). Recorded from Saint Lucia by Williams & Granara de Willink (1992) and Malumphy (2012).

***Planococcus minor*** (Maskell)—passion vine mealybug (Fig. 1, O)

Occurs widely in tropical and subtropical areas of the Americas, Asia, Australia and the Pacific; polyphagous, feeding on plants belonging to 71 families, including many crops and ornamentals. The full host range and distribution is unclear due to confusion between *P. minor* and the morphologically similar *P. citri*. Recorded from Saint Lucia by Cox (1989), Williams & Granara de Willink (1992) and Malumphy (2012, on *Annona muricata*, *A. squamosa* and *Artocarpus altilis* (Moraceae)).

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Codiaeum variegatum*, 20.viii.2013. Intercepted



in UK (London) on *Artocarpus altilis*, 10.x.2012, leg. D. Dennis, on *A. muricata*, 2.vii.2013, 25.v.2014, leg. J. Pollock, 29.vii.2013, leg. D. Dennis (massive population, attacked by *Diadiplosis multifila* (det. Keith Harris, causing 90%+ mortality, the midge was attacked by a chalcidoid parasitoid), 12.viii.2013, leg. D. Dennis (with *Diadiplosis* sp., ?*Cryptolaemus* sp. and phytoseiid mites), and 14.iv.2014, leg. R. Waghorn.

***Pseudococcus cryptus*** Hempel—cryptic mealybug

Occurs widely in tropical and subtropical areas of Asia, scattered distribution in South America and the Caribbean, and Africa; polyphagous, feeding on plants belonging to 41 families, including many crops and ornamentals; a pest of *Citrus*. This is a cryptic species that infests both the roots and aerial parts of its hosts. Recorded from Saint Lucia by Malumphy (2012, on *Annona muricata* and *A. squamosa*).

***Pseudococcus longispinus*** (Targioni Tozzetti)—long-tailed mealybug

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 95 families; pest of numerous crops, particularly citrus, and ornamentals. Recorded from Saint Lucia by CABI Crop Protection Compendium (2014) and Malumphy (2012, on *Alpinia purpurata* (Zingiberaceae), *Annona muricata* and *Hedychium coccineum* (Zingiberaceae), and unspecified cut flowers).

**Collection data.** Intercepted in the UK (London), on *A. muricata*, 29.vii.2013, leg. D. Dennis (attacked by *Diadiplosis multifila* (det. Keith Harris)), and 12.viii.2013, leg. D. Dennis (attacked by *Diadiplosis* sp., ?*Cryptolaemus* sp., and phytoseiid mites).

\* ***Pseudococcus odermatti*** Miller & Williams

Scattered distribution in tropical areas of the Americas and Asia; polyphagous, feeding on plants belonging to 8 families.

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Ixora*, 22.viii.2013.

***Saccharicoccus sacchari*** (Cockerell)—pink sugarcane mealybug

Occurs widely in tropical areas of the Americas (including the Lesser Antilles), Africa, Asia, Australia and the Pacific; oligophagous on Poaceae, a common pest of sugarcane and possible vector of diseases on rice. Recorded from Saint Lucia by Williams (1970), CABI (1977), and Malumphy (2012, incorrectly listed in the Diaspididae).

**Collection data.** Gros-Islet Parish: Cas en Bas, single adult female on young *Cocos nucifera* fruit lying on grass, 22.viii.2013. *Cocos nucifera* is not a host plant for *S. sacchari* and presumably the mealybug was merely sheltering on the fruit.

**FAMILY PUTOIDAE**—giant mealybugs

***Puto barberi*** (Cockerell)—Barber giant mealybug

Occurs widely in tropical and subtropical areas of South America and the Caribbean, introduced to the Canary Islands (Spain); polyphagous, feeding on plants belonging to 37 families; a serious pest of *Citrus* and ornamentals. Recorded from Saint Lucia by Williams & Granara de Willink (1992) and Malumphy (2012, on an unspecified plant.)

**Collection data.** Gros-Islet Parish: Rodney Bay, Reduit beach, on *Coccoloba uvifera*, 27.viii.2013.

**FAMILY RHIZOECIDAE**—root mealybugs

***Geococcus coffeae*** Green—coffee root mealybug

Cosmopolitan, restricted to indoor plantings in cooler temperate regions; polyphagous, feeding on plants belonging to 37 families; subterranean and highly cryptic. Recorded from Saint Lucia by Kozár & Konczné Benedicty (2007) and Malumphy (2012).

### ***Rhizoecus americanus*** (Hambleton)—root mealybug

Occurs widely in tropical and subtropical areas of the Americas, isolated records from Europe and Asia; polyphagous, feeding on plants belonging to 28 families; subterranean and highly cryptic. Recorded from Saint Lucia by Kozár & Konczné Benedicty (2007) and Malumphy (2012).

**Collection data.** Gros-Islet Parish: Rodney Bay, abundant on *Cymbopogon citratus* and various unidentified grasses and herbaceous plants, 27.viii.2013.

### ***Rhizoecus keyensis*** Hambleton

Recorded from the USA (Florida), and Saint Lucia (Kozár & Konczné Benedicty, 2007); oligophagous, on *Erithalis* (Rubiaceae), *Eugenia* (Myrtaceae) and *Morinda* (Rubiaceae); subterranean and highly cryptic.

## **Discussion**

Eighty-three species of scale insect belonging to 8 families have been recorded from Saint Lucia. Thirty-three (40%) of these species are recorded here as new for the country, including the South American mealybug *Dysmicoccus joannesiae* and an Asian armoured scale insect pest of bamboo *Poliaspoides formosana*, which are new for the Caribbean region.

Stocks (2013) reviewed the exotic scale insect species that had recently invaded Florida (USA) and the Caribbean Region, and several of these are having a negative economic and social impact in Saint Lucia. For example, the author observed enormous populations of the following scale insect species damaging ornamental plants in tourist resorts and along beaches, and damaging fruit trees and palms in private gardens in Rodney Bay: *Bambusaspis miliaris*; *Crypticerya genistae* (Fig. 1, G); *Ferrisia dasylirii* (Fig. 1, L); *F. virgata* (Fig. 1, M); *Insignorthezia insignis* (Fig. 1, H); *Lepidosaphes beckii*; *L. tokionis* (Fig. 1, I); *Maconellicoccus hirsutus*; *Nipaecoccus nipae* (Fig. 1, N); *Pinnaspis strachani* (Fig. 1, J); *Planococcus minor* (Fig. 1, O); *Praelongorthezia praelonga* (Fig. 1, K); *Pseudaonidia trilobitiformis*; *Pseudaulacaspis cockerelli* (Fig. 1, E); *P. pentagona* (Fig. 1, F); and *Rhizoecus americanus*. Details of the host plants that the insects were found on are given above. Almost all of these scale species occur widely in the Caribbean and would be expected to cause similar damage to ornamental and crop plants throughout the region. More significantly, some of the exotic introductions affect the quality and marketability of fruit for export. For example, 18 species of scale insect have been intercepted in the UK on *Annona* fruit imported from Saint Lucia and a large population of *Fiorinia proboscidaria* (Fig. 1, D) was intercepted on lime fruit that had caused conspicuous chlorotic spotting and uneven ripening. The environmental impact of these introductions in Saint Lucia is unknown, although large, potentially damaging populations of scales were found on the semi-natural Mt. Pimard: *Crypticerya genistae* (Fig. 1, G) and *Insignorthezia insignis* (Fig. 1, H) on woody and herbaceous plants; and *Duplachionaspis divergens* (Fig. 1, C) on grasses. There is, however, insufficient data available to quantify the impact of exotic introductions in Saint Lucia.

Natural enemies (predatory midge larvae, thrips, mites, coccinellids, and hymenopteran parasitoids) were frequently observed in the scale insect samples. Two notable predatory midge species recorded from Saint Lucia for the first time are: *Diadiplosis ?coccidivora* and *D. multifila*. The former was found eating the eggs of *Philephedra broadwayi* (new host), and occurs from southern USA southwards to Argentina, in Jamaica and Bermuda. It has previously been recorded feeding on the eggs of *Alichtensia*, *Coccus*, *Pulvinaria* and *Saissetia* (Coccidae), and *Eriococcus* (Eriococcidae) (Gagné, 1994; Harris, 1997). *Diadiplosis multifila* was found eating the eggs and early instars of *Planococcus minor*, *Pseudococcus longispinus* and *Nipaecoccus nipae* (all new hosts). It was observed causing 90%+ mortality of a large infestation of passionvine mealybug *Planococcus minor* on soursop fruit. It occurs widely in South America, the Caribbean and Fiji, feeding on the eggs of *Planococcus citri* (Pseudococcidae), and *Icerya montserratensis* (Monophlebidae) (Gagné, 1994; Harris, 1997). Several pest scale insect species have been successfully controlled in the Americas using natural enemies for classical biological programmes. A recent example is the control of the *Maconellicoccus hirsutus* using the wasps *Anagyrus kamali* Moursi and *Gyranusoidea indica* Shafee, Alam & Agarwal (Hymenoptera: Encyrtidae) (Roltsch *et al.*, 2006). Natural enemies found in the scale insect samples from Saint Lucia were recorded so that they may be considered as potential bio-control agents.

The majority of samples of scale insects recorded from Saint Lucia have been found on crop and ornamental

plants (most samples collected by the author in 2013 were from the grounds of a single hotel and neighbouring area (32 spp.)), and there appears to have been no study of scale insects in the extensive sub-montane rainforest in the interior of the island or specifically on plants endemic to Saint Lucia (9 species) or those endemic to the Lesser Antilles (108 taxa). It is highly probably therefore, that many other scale insect species remain to be discovered, and other species currently spreading in the Caribbean (e.g., most notably *Paratachardina pseudolobata* and *Phalacrocooccus howertoni*) are likely to be detected in Saint Lucia in the future.

## Acknowledgements

I would like to express my gratitude to Keith Harris for identifying the predatory midges and providing information on their biology and distribution; Dan Pye of Fera for making slide-mounts of the scale insects; and my family for allowing me time to record insects while on holiday.

## References

- Ben-Dov, Y. (1988) A taxonomic analysis of the armored scale tribe Odonaspidini of the world (Homoptera: Coccoidea: Diaspididae), *United States Department of Agriculture, Washington, D.C., USA Technical Bulletin*, No. 1723, 1–142.
- CABI (1957a) *Howardia biclavis* (Comst.). Distribution Maps of Pests, Series A, Agricultural Map no. 80, 2 pp.
- CABI (1957b) *Orthezia insignis* Browne. Distribution Maps of Pests, Series A, Agricultural Map no. 73, 2 pp.
- CABI (1960) *Dysmicoccus boninsis* (Kuw.). Distribution Maps of Pests, Series A, Agricultural Map no. 116, 2 pp.
- CABI (1962) *Unaspis citri* (Comst.). Distribution Maps of Pests, Series A, Agricultural Map no. 149, 2 pp.
- CABI (1966a) *Aspidiella hartii* (Ckll.). Distribution Maps of Pests, Series A, Agricultural Map no. 217, 2 pp.
- CABI (1966b) *Aspidiotus destructor* (Sign.). Distribution Maps of Pests, Series A, Agricultural Map no. 218, 2 pp.
- CABI (1966c) *Ferrisia virgata* (Ckll.). Distribution Maps of Pests, Series A, Agricultural Map no. 219, 2 pp.
- CABI (1967) *Ischnaspis longirostris* (Sign.). Distribution Maps of Pests, Series A, Agricultural Map no. 235, 2 pp.
- CABI (1969) *Chrysomphalus dictyospermi* (Morg.). Distribution Maps of Pests, Series A, Agricultural Map no. 3 (revised), 2 pp.
- CABI (1971) *Icerya purchasi* (Mask.). Distribution Maps of Pests, Series A, Agricultural Map no. 51 (rev.), 3 pp.
- CABI (1972a) *Coccus hesperidum* (L.). Distribution Maps of Pests, Series A, Agricultural Map no. 92 (rev.), 2 pp.
- CABI (1972b) *Coccus viridis* (Green). Distribution Maps of Pests, Series A, Agricultural Map no. 305, 2 pp.
- CABI (1973a) *Saissetia oleae* (Ol.). Distribution Maps of Pests, Series A, Agricultural Map no. 24 (rev.), 2 pp.
- CABI (1973b) *Saissetia coffeae* (Wlk.). Distribution Maps of Pests, Series A, Agricultural Map no. 318, 2 pp.
- CABI (1976) *Hemiberlesia lataniae* (Sign.). Distribution Maps of Pests, Series A, Agricultural Map no. 360, 2 pp.
- CABI (1977) *Saccharicoccus sacchari* (Ckll.). Distribution Maps of Pests, Series A, Agricultural Map no. 102 (rev.), 2 pp.
- CABI (1981a) *Pseudaonidia trilobitiformis* (Green). Distribution Maps of Pests, Series A, Agricultural Map no. 418, 2 pp.
- CABI (1981b) *Selenaspis articulatus* (Morg.). Distribution Maps of Pests, Series A, Agricultural Map no. 419, 2 pp.
- CABI (1982) *Lepidosaphes beckii* (Newmn.). Distribution Maps of Pests, Series A, Agricultural Map no. 49 (rev.), 3 pp.
- CABI (1984) *Asterolecanium pustulans* (Cockerell). Distribution Maps of Pests, Series A, Agricultural Map no. 460, 3 pp.
- CABI (1988) *Chrysomphalus aonidum* (Linnaeus). Distribution Maps of Pests, Series A, Agricultural Map no. 4 (rev.), 3 pp.
- CABI (1990) *Phenacoccus parvus* Morrison. Distribution Maps of Pests, Series A, Agricultural Map no. 518, 2 pp.
- CABI (1996a) *Aonidiella aurantii* (Maskell). Distribution Maps of Pests, Series A, Agricultural Map no. 2 (rev.), 5 pp.
- CABI (1996b) *Pseudaulacaspis pentagona* (Targ. Tozz.). Distribution Maps of Pests, Series A, Agricultural Map no. 58 (2nd rev.), 5 pp.
- CABI (1997) *Parasaissetia nigra* (Nietner). Distribution Maps of Pests, Series A, Agricultural Map no. 573, 5 pp.
- CABI (1999) *Planococcus citri* (Risso). Distribution Maps of Pests, Series A, Agricultural Map no. 43 (2nd rev.), 8 pp.
- CABI (2000) *Phenacoccus madeirensis* Green. Distribution Maps of Pests, Map no. 607, 4 pp.
- CABI (2004) *Maconellicoccus hirsutus* (Green). Distribution Maps of Plant Pests, Map no. 100. [revised]
- CABI (2005) *Nipaeoccus nipae* (Maskell). Distribution Maps of Plant Pests, Map no. 220. [revised]
- CABI (2010) *Ceroplastes floridensis* Comstock. Distribution Maps of Plant Pests, Map no. 440. [revised]
- Chong, J.H. (2009) First Report of the Pink Hibiscus Mealybug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae), in South Carolina, *Journal of Agricultural and Urban Entomology*, 26, 87–94.
- Cox, J.M. (1989) The mealybug genus *Planococcus* (Homoptera: Pseudococcidae), *Bulletin British Museum (Natural History). Entomology*, 58, 1–78.
- CROP PROTECTION COMPENDIUM (2014) Datasheets *Pinnaspis strachani* (lesser snow scale). CABI CPC. Available from: <http://www.cabi.org/cpc> (accessed 7 April 2014)
- EPPO (2009) PQR database. Paris, France: European and Mediterranean Plant Protection Organization. Available from:

- www.eppo.org (accessed 7 April 2014)
- Étienne, J. & Matile-Ferrero, D. (2008) *Crypticerya genistae* (Hempel), nouveau danger en Guadeloupe (Hemiptera, Coccoidea, Monophlebidae). *Entomologique d'Égypte*, 113, 517–520.
- Ferris, G.F. (1941) *Atlas of the scale insects of North America*. Series 3. Stanford University Press, Palo Alto, California, 115 pp.
- Gagné, R.J. (1994) *The Gall Midges of the Neotropical Region*. Cornell University Press, Ithaca, 352 pp.
- Graveson, R. (2012) *Plants of Saint Lucia*. A Pictorial Flora of Wild and Cultivated Vascular Plants. Available from: <http://www.saintlucianplants.com/> (accessed 1 September 2013)
- Hamon, A.B. & Williams, M.L. (1984) The soft scale insects of Florida Homoptera: Coccoidea: Coccidae. *Arthropods of Florida and neighboring land areas. Florida Department of Agriculture & Consumer Services, Division of Plant Industry*, 11, 1–194.
- Harris, K.M. (1997) Cecidomyiidae and other Diptera. In Ben-Dov, Y. & Hodgson, C. (Eds.), *Soft Scale Insects - their Biology, Natural Enemies and Control (7B)*. Elsevier Science BV, pp. 61–68.
- Hodgson, C.J. (1994) *The scale insect family Coccidae: an identification manual to genera*. CAB International, Wallingford, Oxon, UK, 639 pp.
- Hodges, G.S. & Hodgson, C.J. (2010) *Phalacrooccus howertoni*, a new genus and species of soft scale (Hemiptera: Coccidae) from Florida. *Florida Entomologist*, 93 (1), 8–23.  
<http://dx.doi.org/10.1653/024.093.0102>
- INVASIVE SPECIES COMPENDIUM (2013) ISC CABI. Available from: <http://www.cabi.org/isc/> (accessed 1 September 2013)
- In Pierre, L. (2008) *Mitigating the Threat of Invasive Alien Species in the Insular Caribbean (Saint Lucia)*. Report to CABI, 56 pp.
- Kairo, M.T.K., Pollard, G.V., Peterkin, D.D. & Lopez, V.F. (2000) Biological control of the hibiscus mealybug, *Maconellicoccus hirsutus* Green (Hemiptera: Pseudococcidae) in the Caribbean, *Integrated Pest Management Reviews*, 5, 241–254.
- Kondo, T. & Gullan, P.J. (2007) Taxonomic review of the lac insect genus *Paratachardina* Balachowsky (Hemiptera: Coccoidea: Kerriidae), with a revised key to genera of Kerriidae and description of two new species. *Zootaxa*, 1617, 1–41.
- Kozár, F. (2004) *Ortheziidae of the World*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, Hungary, 525 pp.
- Kozár, F. & Konczné Benedicty, Z. (2007) *Rhizoecinae of the world*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, 617 pp.
- Laurence, G.A. (1991) The scale insects of Trinidad and Tobago. *Journal of the Agricultural Society (Trinidad)*, 1, 19–23, 26–29, 32–36.
- Malumphy, C. (2002) *Parasaissetia nigra*. Diagnostic protocols for regulated pests. *OEPP/EPPO Bulletin*, 32, 293–298.
- Malumphy, C. (2012) An annotated checklist of scale insects (Hemiptera: Coccoidea) of Saint Lucia. *Entomologist's Monthly Magazine*, 148, 207–216.
- Malumphy, C., Hamilton, M.A., Manco, B.N., Green, P.W.C., Sanchez, M.D., Corcoran, M. & Salamanca, E. (2012) *Toumeyella parvicornis* (Hemiptera: Coccidae), causing severe decline of *Pinus caribaea* var. *bahamensis* in the Turks and Caicos Islands. *Florida Entomologist*, 95, 113–119.  
<http://dx.doi.org/10.1653/024.095.0118>
- Matile-Ferrero, D. & Étienne, J. (2006) Cochenilles des Antilles françaises et de quelques autres îles Caraïbes (Hemiptera, Coccoidea). *Revue Française d'Entomologie*, 28, 161–190.
- Etienne, J. & Matile-Ferrero, D. (2008) *Crypticerya genistae* (Hempel), nouveau danger en Guadeloupe (Hemiptera, Coccoidea, Monophlebidae). *Bulletin de la Société Entomologique d'Égypte*, 113 (4), 517–520.
- Merrill, G.B. (1953) A revision of the scale insects of Florida. *Bulletin of the Florida State Plant Board*, 1, 1–143.
- Miller, D.R. & Davidson, J.A. (2005) *Armored scale insect pests of trees and shrubs. (Hemiptera: Diaspididae)*. Cornell University Press, Ithaca, 442 pp.
- Miller, G.L. & Miller, D.R. (2003) Invasive soft scales (Hemiptera: Coccidae) and their threat to US Agriculture. *Proceedings of the Entomological Society of Washington*, 105, 832–846.
- Miller, D.R., Williams, D.J. & Hamon, A.B. (1999) Notes on a new mealybug (Hemiptera: Coccoidea: Pseudococcidae) pest in Florida and the Caribbean: the papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink. *Insecta Mundi*, 13, 178–181.
- Morrison, H. (1939) Taxonomy of some scale insects of the genus *Parlatoria* encountered in plant quarantine inspection work. *United States Department of Agriculture, Miscellaneous Publications*, 344, 1–34.
- Nakahara, S. (1983) List of the Coccoidea species (Homoptera) of the United States Virgin Islands. *United States Department of Agriculture, Plant Protection and Quarantine, APHIS*, 8142, 1–21.
- Pellizzari, G. & Dalla Montá, L. (1997) 1945-1995: Fifty years of incidental insect pest introductions to Italy. *Acta Phytopathologica et Entomologica Hungarica*, 32, 171–183.
- Roltsch, W.J., Meyerdirk, D.E., Warkentin, R., Andress, E.R. & Carrera, K. (2006) Classical biological control of the pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green), in southern California. *Biological Control*, 37, 155–166.  
<http://dx.doi.org/10.1016/j.biocontrol.2006.01.006>

- ScaleNet (2014) ScaleNet: A Database of Scale insects of the World. Available from: <http://www.sel.barc.usda.gov/scalenet/scalenet.htm>. (accessed 7 April 2014)
- Schotman, C.Y.L. (1989) *Plant pests of quarantine importance to the Caribbean*. RLAC-PROVEG, No. 21, 80 pp.
- Smith, R.M., Baker, R.H.A., Malumphy, C.P., Hockland, S., Hammon, R.P., Ostojá-Starzewski, J.C. & Collins, D.W. (2007) Recent non-native invertebrate plant pests establishments in Great Britain: origins, pathways, and trends. *Agricultural and Forest Entomology*, 9, 307–326.  
<http://dx.doi.org/10.1111/j.1461-9563.2007.00349.x>
- Stocks, I. (2013) Recent adventive scale insects (Hemiptera: Coccoidea) and whiteflies (Hemiptera: Aleyrodidae) in Florida and the Caribbean region. In: Peña, J.E. (Ed.), *Potential invasive pests of agricultural crops*. CABI International, Wallingford, UK, pp. 342–362.
- Stocks, I. (2014) *Poliaspoides formosana (Takahashi) (Hemiptera: Diaspididae), an adventive armored scale on bamboo in Florida, USA*. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, March 2014, Entomology Circular No. 429, 2 pp.
- Stumpf, C.F. & Lambdin, P.L. (2006) *Pit scales (Sternorrhyncha: Coccoidea) of North and South America*. Tennessee Agricultural Experiment Station, University of Tennessee Institute of Agriculture, Knoxville, Tennessee, 231 pp.
- Thomas, M.C. (2006) The exotic invasion of Florida. A report on arthropod immigration into the sunshine state. Available from: <http://www.freshfromflorida.com/Divisions-Offices/Plant-Industry/Science/The-Exotic-Invasion-of-Florida> (accessed 4 June 2014)
- Walker, A., Hoy, M. & Meyerdirk, D. (2003) Featured creatures. Common name: papaya mealybug. Scientific name: *Paracoccus marginatus* Williams and Granara de Willink (Insecta: Hemiptera: Pseudococcidae). University of Florida's Entomology and Nematology Department and the Florida Department of Agriculture and Consumer Services' Division of Plant Industry. Updated 2006. Available from: [http://entnemdept.ufl.edu/creatures/fruit/mealybugs/papaya\\_mealybug.htm](http://entnemdept.ufl.edu/creatures/fruit/mealybugs/papaya_mealybug.htm) (accessed 7 April 2014).
- Walters, E.A. (1926) *Control of Insect Pests*. Report, Agricultural Department, St. Lucia, 1926, pp 9–10.
- Watson, G.W. (2002) *Arthropods of Economic Importance: Diaspididae of the World*. (Series Title: World Biodiversity Database). ETI Information Services (Expert Center for Taxonomic Identification), Berkshire, UK.
- Williams, D.J. (1970) The mealy bugs (Homoptera: Coccoidea: Pseudococcidae) of sugarcane, rice and sorghum. *Bulletin of Entomological Research*, 60, 109–188.
- Williams, D.J. (1996) A brief account of the hibiscus mealybug *Maconellicoccus hirsutus* (Hemiptera: Pseudococcidae), a pest of agriculture and horticulture, with descriptions of two related species from southern Asia. *Bulletin of Entomological Research*, 86, 617–628.  
<http://dx.doi.org/10.1017/s0007485300039420>
- Williams, D.J. & Cox, J.M. (1984) Notes on the distribution of *Phenacoccus parvus* Morrison = *P. surinamensis* Green syn. n. (Hem., Pseudococcidae). *Entomologist's Monthly Magazine*, 120, 139–140.
- Williams, D.J. & Granara de Willink, M.C. (1992) *Mealybugs of Central and South America*. CAB International, London, England, 635 pp.
- Williams, D.J., Miller, D.R. & Rung, A. (2006) A systematic revision of the armored scale genus *Furcaspis* Lindinger (Diaspididae: Coccoidea: Hemiptera). *Contributions of the American Entomological Institute*, 34, 1–86.
- Woodruff, R.E., Beck, B.M., Skelley, P.E., Schotman, C.Y.L. & Thomas, M.C. (1998) *Checklist and Bibliography of the Insects of Grenada and the Grenadines*. Center for Systematic Entomology, Gainesville, FL, 286 pp.