Changes to Compendia distribution data: the distribution tables, maps and references in datasheets have been restructured to handle the data better for updating and align with a geographic standard. Further details are available on the About page.

PRA Tool for plant commodity and pest-initiated Pest Risk Analysis. Available as an addition to the CPC.

Horizon Scanning Tool for prioritizing invasive species threats.

Next: Mealybug species (Hemiptera: Coccomorpha: Pseudococcidae) on soursop... >>
Return to Search Results

Datasheet

Ferrisia virgata (striped mealybug)

Index

Summary

Last modified
20 November 2019

Datasheet Type(s)
Pest
Natural Enemy
Vector of Plant Pest

Preferred Scientific Name
Ferrisia virgata

Preferred Common Name
striped mealybug

Taxonomic Tree
Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda

More information

Subphylum: Uniramia
Class: Insecta

Host Plants and Other Plants Affected

Abelmoschus esculentus (okra)
Acalypha (Copperleaf)
Albizia lebbeck (Indian siris)
Anacardium occidentale (cashew nut)
Ananas comosus (pineapple)

More...

More information

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Pictures

Top of page

Picture	Title	Caption	Copyright
	Adult F. virgata on rambutan	Adult females oval, greyish-yellow, 4-4.5 mm long, with two longitudinal, submedian, interrupted dark stripes on the dorsum showing through the waxy secretion. The dorsum also bears numerous straight, glassy threads of wax.	Crown Copyright
	Adult	Adult female with ovisac.	©Georg Goergen/IITA Insect Museum, Cotonou, Benin

Identity

Top of page

Preferred Scientific Name

Ferrisia virgata (Cockerell, 1893)

Preferred Common Name

striped mealybug

Other Scientific Names

Dactylopius ceriferus Newstead, 1894
Dactylopius magnolicida King, 1902
Dactylopius segregatus Cockerell, 1893
Dactylopius setosus Hempel, 1900
Dactylopius talini Green, 1896
Dactylopius virgatus Cockerell, 1893
Dactylopius virgatus farinosus Cockerell, 1893
Dactylopius virgatus humilis Cockerell, 1893
Dactylopius virgatus madagascariensis Newstead, 1908
Ferrisia neovirgata Khalid and Shafee, 1988
Ferrisia virgata (Cockerell) Fullaway, 1923
Ferrisiana setosus (Hempel) Ali, 1970
Ferrisiana virgata (Cockerell) Takahashi, 1929
Heliococcus malvastrus McDaniel, 1962
Pseudoccus virgatus farinosus (Cockerell) Cockerell, 1902
Pseudococcus bicaudatus Keuchenius, 1915
Pseudococcus magnolicida (King) Cockerell, 1902
Pseudococcus marchali Vayssière, 1912
Pseudococcus segregatus (Cockerell) Fernald, 1903
Pseudococcus virgatus (Cockerell) Kircaldy, 1902
Pseudococcus virgatus humilis (Cockerell) Fernald, 1903
Pseudococcus virgatus madagascariensis (Newstead) Lindinger, 1913

International Common Names

English: guava mealybug; spotted mealybug; tailed coffee mealybug; tailed mealybug; white-tailed mealybug
Spanish: cochinilla embandada
French: cochenille rayée

Local Common Names

Egypt: white mealybug
Germany: weisse Lamtoro-laus
Netherlands: lamtoroluis; witte lamtoro-luis
Philippines: grey mealybug
South Africa: gestreepte witluis

EPPO code

FERRVI (Ferrisia virgata)
PSECVI (Pseudococcus virgatus)

Taxonomic Tree

Top of page

Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Subphylum: Uniramia
Class: Insecta
Order: Hemiptera
Suborder: Sternorrhyncha
Unknown: Coccoidea
Family: Pseudococcidae
Genus: Ferrisia
Species: Ferrisia virgata

Notes on Taxonomy and Nomenclature

Top of page

The genus *Ferrisia* was described to accommodate *F. virgata*, a widespread tropical species. In 1929, Takahashi claimed (erroneously) that the name *Ferrisia* was a homonym, and replaced it with *Ferrisiana*; however, the name *Ferrisia* has since been recognized as valid.

It has long been known that specimens normally identified as *Ferrisia virgata* were either biparental or parthenogenetic (Williams, 1996). Nur (1977), using electrophoretic techniques, indicated that there was one uniparental species and at least two biparental species, while Miller and Kostarab (1979) mentioned seven species. The type species of *F. virgata* is biparental and Williams (1985) illustrated the uniparental form, showing morphological differences between the two forms. The uniparental form was later described as *F. consobrina* (Williams and Watson, 1988) and subsequently synonymized under *F. malvastra* by Williams (1996). Descriptions and illustrations of *F. virgata* prior to 1980 often contain a combination of the features of *F. virgata* and *F. malvastra*.

Furthermore, Kaydan and Gullan (2012) revised the genus *Ferrisia* and recognized 18 species, eight of them new to science.

Early records of *F. virgata* from all parts of its distribution therefore need to be verified due to confusion with *F. malvastra* (Ben-Dov, 1994) and the new species described by Kaydan and Gullan (2012).

Description

Top of page

In life, adult females are oval, up to 5 mm long, greyish-yellow, with two longitudinal, submedian, interrupted dark stripes on the dorsum showing through the waxy secretion -- hence the common name 'striped mealybug'. The dorsum also bears numerous straight, glassy threads of wax up to 4.0-4.5 mm long. Several members of the genus *Ferrisia* have this appearance in life, so authoritative identification requires expert study of stained, slide-mounted adult females using the key in Kaydan and Gullan (2012), or nucleotide sequence data.

Slide-mounted adult female *Ferrisia* species are easy to recognise by the presence of only one pair of cerarii, situated on the anal lobes, and the presence of enlarged tubular ducts, each with the orifice surrounded by a flat, circular, sclerotized area associated with one or more short setae. Kaydan and Gullan (2012) provided a thorough revision of the genus *Ferrisia* and a morphological key to world species, including detailed morphological description, illustration and discussion of *F. virgata*. *F. virgata* is very difficult to separate from some of the other species, particularly *F. dasylirii*. It has both anterior and posterior pairs of ostioles; ventral oral-collar tubular ducts of at least 2 sizes; smaller ducts present singly or in segmental clusters on body margin, only on last 2–3 abdominal segments; minute discoidal pores in sclerotised area of enlarged dorsal tubular ducts and larger ventral oral-collar tubular ducts rarely if ever touching rim of duct opening (or only very rarely on ventral ducts); discoidal pores associated with sclerotised area around orifices of dorsal enlarged tubular ducts on anterior abdomen normally not touching outer margin of sclerotised area and very rarely projecting from that margin; dorsal enlarged tubular ducts numbering 69-101; abdominal segment VI with 11-28 multilocular disc pores, usually with more than 15 in a double row; each anal lobe cerarius with 3 (occasionally 2) enlarged conical setae; and hind coxa with translucent pores (Kaydan and Gullan, 2012).

The adult male has long antennae, six well developed legs, one pair of simple wings, no mouthparts, and a pair of long white wax filaments at the posterior end. The morphology of *Ferrisia* males has not been studied in detail so the species cannot be identified using male morphology.

Summary of Invasiveness

Top of page

Ferrisia virgata is a highly polyphagous mealybug. It reproduces quite rapidly in tropical conditions, but it tolerates subtropical and to some extent temperate conditions too. It has been reported on host-plants belonging to over 203 genera in 77 families, and can damage many crops, particularly tropical fruit, nut and spice crops and field crops like soybean and tomato. It is known to transmit plant badnavirus diseases of cocoa and black pepper. It is of Neotropical origin and spread around the world in only about 10 years after being first described from Jamaica. Its polyphagy has facilitated its spread by human transport of infested plants, and it is now established in all the subtropical and tropical zoogeographic regions. Its small size and cryptic habits make it difficult to detect and identify at plant quarantine inspection. The increase in international trade in fresh plant material in recent years is likely to facilitate its continued spread.

Distribution

Top of page

The genus *Ferrisia* is apparently of New World origin (Williams, 1996). *F. virgata* is by far the most widespread species in the genus (Kaydan and Gullan, 2012). Its area of origin is not known; it was described from Jamaica but it was a pest there at the time, so it may have been an introduction from elsewhere (Kaydan and Gullan, 2012). According to the literature, it has spread to all zoogeographical regions, mainly in the tropics, but often extends well into the temperate regions -- see Commonwealth Institute of Entomology (1966) and García et al. (2016). It is likely that the most northern populations are found only in greenhouses. Early records of *F. virgata* from all parts of its distribution need to be verified due to confusion with *F. malvastra* (Ben-Dov, 1994) and the new species described by Kaydan and Gullan (2012).

Distribution Table

Top of page

The distribution in this summary table is based on all the information available. When several references are cited, they may give conflicting information on the status. Further details may be available for individual references in the Distribution Table Details section which can be selected by going to Generate Report.

Last updated: 10 Jan 2020

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Africa							
Angola	Present					UK, CAB International (1966)	
Benin	Present					Germain et al. (2010)	
Cabo Verde	Present					Harten et al. (1990)	
Cameroon	Present					UK, CAB International (1966)	
Comoros	Present					Ben-Dov (1994); Matile-Ferrero (1978)	
Congo, Democratic Republic of the	Present, Widespread					Buyckx (1962)	
Congo, Republic of the	Present					UK, CAB International (1966); Ben-Dov (1994)	
Côte d'Ivoire	Present					UK, CAB International (1966); Ben-Dov (1994)	
Egypt	Present					Abd-Rabou (2001); UK, CAB International (1966); Adly et al. (2016)	
Ethiopia	Present					UK, CAB International (1966)	
Ghana	Present					UK, CAB International (1966); Ben-Dov (1994); Kaydan and Gullan (2012)	
Guinea	Present					Ben-Dov (1994)	
Guinea-Bissau	Present					Ben-Dov and Carvalho (2006)	
Kenya	Present					UK, CAB International (1966); Ben-Dov (1994); Kaydan and Gullan (2012)	
Madagascar	Present					UK, CAB International (1966); Ben-Dov (1994)	
Malawi	Present					UK, CAB International (1966)	
Mali	Present					Muniappan et al. (2012)	
Mauritius	Present					UK, CAB International (1966); Ben-Dov (1994)	
-Rodrigues	Present					Ben-Dov (1994)	
Mozambique	Present					UK, CAB International (1966)	
Nigeria	Present					UK, CAB International (1966)	
Réunion	Present					Germain et al. (2014)	
São Tomé and Príncipe	Present					UK, CAB International (1966)	
Senegal	Present					Muniappan et al. (2012); UK, CAB International (1966)	
Seychelles	Present					UK, CAB International (1966); Ben-Dov (1994)	
-Aldabra Islands	Present					Ben-Dov (1994)	
Sierra Leone	Present					UK, CAB International (1966)	
Somalia	Present					UK, CAB International (1966)	
South Africa	Present					UK, CAB International (1966); Ben-Dov (1994); Kaydan and Gullan (2012)	
Sudan	Present					UK, CAB International (1966); Ben-Dov (1994)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Tanzania	Present					UK, CAB International (1966); Bohlen (1973); Ben-Dov (1994)	
-Zanzibar Island	Present					Williams and Matile-Ferrero (2005)	
Togo	Present					UK, CAB International (1966)	
Tunisia	Present			2016	Invasive	CABI (Undated)	Khezama City; Original citation: Ben Halima et al. (2018)
Uganda	Present					UK, CAB International (1966); Ben-Dov (1994); Kaydan and Gullan (2012)	
Zambia	Present					Kaydan and Gullan (2012); UK, CAB International (1966)	
Zimbabwe	Present					UK, CAB International (1966)	
Asia							
Bangladesh	Present					UK, CAB International (1966); APPPC (1987); Williams (2004)	
British Indian Ocean Territory	Present					Ben-Dov (1994)	
Brunei	Present					Waterhouse (1993); Williams (2004)	
Cambodia	Present					UK, CAB International (1966); Waterhouse (1993); Ben-Dov (1994); Kaydan and Gullan (2012)	
China	Present					Kaydan and Gullan (2012)	
-Guangdong	Present					UK, CAB International (1966)	
-Hunan	Present					Hu et al. (1992)	
Cocos Islands	Present					Bellis et al. (2004); Williams (2004)	
Hong Kong	Present					UK, CAB International (1966)	
India	Present					Kaydan and Gullan (2012)	
-Andaman and Nicobar Islands	Present					Williams (2004)	
-Andhra Pradesh	Present					UK, CAB International (1966)	
-Assam	Present					Mustafee (1970)	
-Bihar	Present					UK, CAB International (1966); Williams (2004)	
-Goa	Present					Ali (1972)	
-Gujarat	Present					Williams (2004)	
-Karnataka	Present					Williams (2004); UK, CAB International (1966); Mangala et al. (2012)	
-Kerala	Present					Williams (2004); UK, CAB International (1966)	
-Madhya Pradesh	Present					Williams (2004); UK, CAB International (1966)	
-Maharashtra	Present					Williams (2004); UK, CAB International (1966)	
-Odisha	Present					Williams (2004); UK, CAB International (1966)	
-Punjab	Present					UK, CAB International (1966); Sharma (2011)	
-Rajasthan	Present					Williams (2004); UK, CAB International (1966)	
-Tamil Nadu	Present					Williams (2004); UK, CAB International (1966)	
-Tripura	Present					Williams (2004); UK, CAB International (1966)	
-Uttar Pradesh	Present					Williams (2004); UK, CAB International (1966)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-West Bengal	Present					Williams (2004); UK, CAB International (1966)	
Indonesia	Present					Waterhouse (1993)	
-Irian Jaya	Present					Williams and Watson (1988)	
-Java	Present					UK, CAB International (1966); Ben-Dov (1994); Williams (2004)	
-Lesser Sunda Islands	Present					Kaydan and Gullan (2012)	
-Sulawesi	Present					Williams (2004)	
-Sumatra	Present					UK, CAB International (1966)	
Iran	Present					Moghadam (2004)	
Israel	Present					Gerson (2016); Ben-Dov (1978)	
Japan	Present					Ben-Dov (1994); Kinjo et al. (1996)	
Laos	Present					Waterhouse (1993)	
Malaysia	Present					Kaydan and Gullan (2012); Waterhouse (1993)	
-Peninsular Malaysia	Present					UK, CAB International (1966)	
-Sabah	Present					Williams (2004); UK, CAB International (1966)	
-Sarawak	Present					Williams (2004); UK, CAB International (1966)	
Maldives	Present					Watson et al. (1995)	
Myanmar	Present					UK, CAB International (1966); Waterhouse (1993); Williams (2004)	
Pakistan	Present					Williams (2004); UK, CAB International (1966)	
Philippines	Present					UK, CAB International (1966); Waterhouse (1993); Lit and Calilung (1994); Kaydan and Gullan (2012)	
Saudi Arabia	Present					Ben-Dov (1994)	
Singapore	Present					Kaydan and Gullan (2012); Waterhouse (1993)	
Sri Lanka	Present					UK, CAB International (1966); Ben-Dov (1994); Williams (2004)	
Taiwan	Present					UK, CAB International (1966); Ben-Dov (1994); Wong et al. (1999)	
Thailand	Present					UK, CAB International (1966); APPPC (1987); Waterhouse (1993); Ben-Dov (1994); Kaydan and Gullan (2012)	
United Arab Emirates	Present					UK, CAB International (1966)	
Vietnam	Present					Williams (2004); Ben-Dov (1994)	
Yemen	Present					UK, CAB International (1966)	
Europe							
France	Present					Foldi (2000)	
North America							
Antigua and Barbuda	Present					CABI (Undated)	Barbuda; Original citation: Williams and Granara de Willink (1992)
Bahamas	Present					Ben-Dov (1994); CABI (Undated)	
Barbados	Present					UK, CAB International (1966); Ben-Dov (1994)	
Belize	Present					Ben-Dov (1994)	
Bermuda	Present					UK, CAB International (1966); Hodgson and Hilburn (1990); Ben-Dov (1994)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Cayman Islands	Present					Ben-Dov (1994); CABI (Undated)	
Costa Rica	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	
Cuba	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	
Dominica	Present					Ben-Dov (1994); CABI (Undated)	
Guadeloupe	Present					CABI (Undated)	Original citation: Matile-Ferrero and Étienne (2006)
Guatemala	Present					Ben-Dov (1994)	
Haiti	Present					Perez-Gelabert (2008); UK, CAB International (1966)	
Honduras	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	
Jamaica	Present					UK, CAB International (1966); Ben-Dov (1994); Kaydan and Gullan (2012)	
Martinique	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	
Mexico	Present					UK, CAB International (1966); Rosen (1981); Ben-Dov (1994); Kaydan and Gullan (2012); Villatoro-Moreno et al. (2016)	
Nicaragua	Present					UK, CAB International (1966); Ben-Dov (1994)	
Panama	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	
Puerto Rico	Present					UK, CAB International (1966); Ben-Dov (1994)	
Saint Kitts and Nevis	Present					CABI (Undated); Ben-Dov (1994)	In both Saint Kitts and Nevis; Original citation: Williams and Granara de Willink (1992)
Trinidad and Tobago	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	On both islands: Trinidad and Tobago
U.S. Virgin Islands	Present					Ben-Dov (1994); Beatty (1944); CABI (Undated)	
United States	Present					CABI (Undated a)	Present based on regional distribution.
-Alabama	Present					UK, CAB International (1966)	
-California	Present					UK, CAB International (1966); Ben-Dov (1994)	
-District of Columbia	Present					Kosztarab (1996)	
-Florida	Present					UK, CAB International (1966); Ben-Dov (1994)	
-Hawaii	Present					UK, CAB International (1966)	
-Louisiana	Present					UK, CAB International (1966); Ben-Dov (1994); Kaydan and Gullan (2012)	
-Maryland	Present					Kosztarab (1996)	
-Massachusetts	Present					Kosztarab (1996)	
-Mississippi	Present					UK, CAB International (1966)	
-New Jersey	Present					Kosztarab (1996)	
-New Mexico	Present					UK, CAB International (1966); Ben-Dov (1994)	
-New York	Present					Ben-Dov (1994)	
-Ohio	Present					Kosztarab (1996)	
-Pennsylvania	Present					Kosztarab (1996)	
-Texas	Present					UK, CAB International (1966); Ben-Dov (1994)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Virginia	Present					Kosztarab (1996)	
Oceania							
Australia	Present					Kaydan and Gullan (2012)	
-Northern Territory	Present					UK, CAB International (1966); Williams (1985); Ben-Dov (1994)	
-Queensland	Present					UK, CAB International (1966); Williams (1985); Ben-Dov (1994)	
Christmas Island	Present					Bellis et al. (2004)	
Cook Islands	Present					Ben-Dov (1994); Williams and Watson (1988)	
Federated States of Micronesia	Present					BEARDSLEY jr. (1966)	Pohnpei, Truk Islands and Yap
Fiji	Present					UK, CAB International (1966); Williams and Watson (1988); Ben-Dov (1994)	
French Polynesia	Present					Ben-Dov (1994); Kaydan and Gullan (2012)	
Kiribati	Present					UK, CAB International (1966); Williams and Watson (1988); Ben-Dov (1994)	
Marshall Islands	Present					UK, CAB International (1966); Ben-Dov (1994)	
New Caledonia	Present					UK, CAB International (1966); Ben-Dov (1994)	
Northern Mariana Islands	Present					Ben-Dov (1994); BEARDSLEY jr. (1966)	
Palau	Present					Ben-Dov (1994); BEARDSLEY jr. (1966)	
Papua New Guinea	Present					UK, CAB International (1966); Ben-Dov (1994); Gavrilov-Zimin (2013)	
Samoa	Present					Ben-Dov (1994); Williams and Watson (1988)	
Solomon Islands	Present					Ben-Dov (1994); Williams and Watson (1988)	
Tonga	Present					UK, CAB International (1966); Williams and Watson (1988); Ben-Dov (1994)	
Tuvalu	Present					Ben-Dov (1994); Williams and Watson (1988)	
United States Minor Outlying Islands							
-Wake Island	Present					Ben-Dov (1994)	
Vanuatu	Present					UK, CAB International (1966); Williams and Watson (1988); Ben-Dov (1994)	
Wallis and Futuna	Present					UK, CAB International (1966)	
South America							
Argentina	Present					UK, CAB International (1966); Ben-Dov (1994); Trjapitzin and Trjapitzin (1999); CABI (Undated);	
Bolivia	Present					Ben-Dov (1994); CABI (Undated)	
Brazil	Present					Kaydan and Gullan (2012); Ben-Dov (1994)	
-Amazonas	Present					Foldi and Kozár (2005)	
-Espirito Santo	Present					Culik et al. (2009)	
-Paraiba	Present					UK, CAB International (1966)	
-Rio de Janeiro	Present					UK, CAB International (1966)	
-Rio Grande do Norte	Present					UK, CAB International (1966)	
-Sao Paulo	Present					UK, CAB International (1966)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Colombia	Present					UK, CAB International (1966); Ben-Dov (1994); Kondo (2008)	
Ecuador	Present					Ben-Dov (1994)	
-Galapagos Islands	Present					Lincango et al. (2010); CABI (Undated)	
Guyana	Present					UK, CAB International (1966); Ben-Dov (1994)	
Paraguay	Present					Ben-Dov (1994)	
Peru	Present					Ben-Dov (1994)	
Suriname	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	
Venezuela	Present					UK, CAB International (1966); Ben-Dov (1994); CABI (Undated)	

History of Introduction and Spread

Top of page

F. virgata was first described from Jamaica (Cockerell, 1893). Within a short period, it had been described from India (by Newstead, 1894), Sri Lanka (by Green, 1896), Madagascar (by Newstead, 1908), West Africa (by Vayssière, 1912) and Indonesia (Java) (by Keuchenius, 1915). Although its morphological affinities indicate that it is of New World origin, in Jamaica it was infesting many plant species in a manner characteristic of a new introduction (Liebhold and Tobin, 2008), so its locality of origin is not known exactly (Kaydan and Gullan, 2012). The speed with which it spread around the world is typical of newly invading insect species (Liebhold and Tobin, 2008). Transport of infested plant material is presumed to have been the main mode of spread.

Risk of Introduction

Top of page

All life stages may be carried on consignments of fresh plant material and fruit. *F. virgata* is often injurious to crop and ornamental plants especially when it is introduced to new geographical areas without its natural enemies (Williams, 1996).

Habitat List

Top of page

Category	Sub-Category	Habitat	Presence	Status
Terrestrial	Terrestrial – Managed	Cultivated / agricultural land	Principal habitat	Harmful (pest or invasive)
		Cultivated / agricultural land	Principal habitat	Natural
		Protected agriculture (e.g. glasshouse production)	Secondary/tolerated habitat	Harmful (pest or invasive)
		Managed forests, plantations and orchards	Principal habitat	Harmful (pest or invasive)
		Managed forests, plantations and orchards	Principal habitat	Natural
		Disturbed areas	Secondary/tolerated habitat	Harmful (pest or invasive)
		Disturbed areas	Secondary/tolerated habitat	Natural
		Rail / roadsides	Secondary/tolerated habitat	Harmful (pest or invasive)
		Rail / roadsides	Secondary/tolerated habitat	Natural
		Urban / peri-urban areas	Principal habitat	Harmful (pest or invasive)
		Urban / peri-urban areas	Principal habitat	Natural
	Terrestrial - Natural / Semi-natural	Natural forests	Secondary/tolerated habitat	Harmful (pest or invasive)
		Natural forests	Secondary/tolerated habitat	Natural
		Riverbanks	Secondary/tolerated habitat	Harmful (pest or invasive)
		Riverbanks	Secondary/tolerated habitat	Natural
Littoral		Coastal areas	Secondary/tolerated habitat	Harmful (pest or invasive)
		Coastal areas	Secondary/tolerated habitat	Natural
		Coastal dunes	Secondary/tolerated habitat	Harmful (pest or invasive)
		Coastal dunes	Secondary/tolerated habitat	Natural
		Mangroves	Secondary/tolerated habitat	Harmful (pest or invasive)
		Mangroves	Secondary/tolerated habitat	Natural
Freshwater		Irrigation channels	Secondary/tolerated habitat	Harmful (pest or invasive)
		Irrigation channels	Secondary/tolerated habitat	Natural

Hosts/Species Affected

Top of page

F. virgata is one of the most highly polyphagous mealybugs known, attacking plant species belonging to some 203 genera in 77 families (García et al., 2016). Many of the host species belong to the Fabaceae and Euphorbiaceae. Among the hosts of economic importance are avocado, banana, betel vine, black pepper, cassava, cashew, cauliflower, citrus, cocoa, coffee, cotton, custard apple, aunergine, grapevine, guava, jute, lantana, *Leucaena*, litchi, mango, oil palm, pigeon pea, pineapple, soyabean and tomato. *Acalypha* species are apparently a favoured host-plant in many places (Kaydan and Gullan, 2012).

Host Plants and Other Plants Affected

Top of page

Plant name	Family	Context
Abelmoschus esculentus (okra)	Malvaceae	Main
Acalypha (Copperleaf)	Euphorbiaceae	Main
Albizia lebbeck (Indian siris)	Fabaceae	Main
Anacardium occidentale (cashew nut)	Anacardiaceae	Main
Ananas comosus (pineapple)	Bromeliaceae	Main
Annona	Annonaceae	Main
Annona reticulata (bullock's heart)	Annonaceae	Other
Annona squamosa (sugar apple)	Annonaceae	Unknown
Arachis hypogaea (groundnut)	Fabaceae	Other
Brassica oleracea (cabbages, cauliflowers)	Brassicaceae	Unknown
Cajanus cajan (pigeon pea)	Fabaceae	Main
Carica papaya (pawpaw)	Caricaceae	Main
Citrus	Rutaceae	Main
Coccoloba uvifera (sea grape)	Polygonaceae	Main
Cocos nucifera (coconut)	Arecaceae	Main
Codiaeum variegatum (garden croton)	Euphorbiaceae	Main
Coffea (coffee)	Rubiaceae	Main
Colocasia esculenta (taro)	Araceae	Main
Corchorus (jutes)	Tiliaceae	Main
Cucurbita maxima (giant pumpkin)	Cucurbitaceae	Main
Cucurbita pepo (marrow)	Cucurbitaceae	Main
Dioscorea esculenta (Asiatic yam)	Dioscoreaceae	Unknown
Dracaena	Agavaceae	Main
Elaeis guineensis (African oil palm)	Arecaceae	Main
Ficus	Moraceae	Main
Glycine max (soyabean)	Fabaceae	Unknown
Gossypium (cotton)	Malvaceae	Main
Hevea brasiliensis (rubber)	Euphorbiaceae	Unknown
Hibiscus (rosemallows)	Malvaceae	Other
Ipomoea batatas (sweet potato)	Convolvulaceae	Main
Lantana camara (lantana)	Verbenaceae	Other
Leucaena leucocephala (leucaena)	Fabaceae	Main
Litchi chinensis (lichi)	Sapindaceae	Main
Malpighia glabra (acerola)	Malpighiaceae	Other
Mangifera indica (mango)	Anacardiaceae	Main
Manihot esculenta (cassava)	Euphorbiaceae	Main
Manilkara	Sapotaceae	Main
Musa (banana)	Musaceae	Main
Nephelium lappaceum (rambutan)	Sapindaceae	Other
Nicotiana tabacum (tobacco)	Solanaceae	Main
Persea americana (avocado)	Lauraceae	Other
Phaseolus (beans)	Fabaceae	Main
Phoenix dactylifera (date-palm)	Arecaceae	Main

Plant name	Family	Context
Phyllanthus acidus (star gooseberry)	Euphorbiaceae	Other
Piper betle (betel pepper)	Piperaceae	Main
Piper nigrum (black pepper)	Piperaceae	Main
Pongamia pinnata (Indian beech)	Fabaceae	Other
Psidium guajava (guava)	Myrtaceae	Main
Punica granatum (pomegranate)	Punicaceae	Main
Saccharum officinarum (sugarcane)	Poaceae	Other
Solanum lycopersicum (tomato)	Solanaceae	Main
Solanum melongena (aubergine)	Solanaceae	Main
Solanum nigrum (black nightshade)	Solanaceae	Main
Theobroma cacao (cocoa)	Malvaceae	Main
Vigna unguiculata (cowpea)	Fabaceae	Main
Vitis vinifera (grapevine)	Vitaceae	Main
Zea mays (maize)	Poaceae	Other
Zingiber officinale (ginger)	Zingiberaceae	Main

Growth Stages

Top of page

Flowering stage, Fruiting stage, Post-harvest, Vegetative growing stage

Symptoms

Top of page

Infestations of *F. virgata* remain clustered around the terminal shoots, leaves and fruit, sucking plant sap which results in yellowing, withering and drying of plants and premature shedding of leaves and fruit. The mealybugs do not feed on phloem very often, so unlike many mealybug species they do not produce huge quantities of sugary honeydew. What honeydew is produced can foul foliage and fruit and serve as a medium for the growth of black sooty moulds. Sooty moulds and wax deposits can block light and air from the plant, sometimes reducing photosynthesis and hence plant vigour and crop yield.

List of Symptoms/Signs

Top of page

Sign	Life Stages	Type
Fruit / discoloration		
Fruit / external feeding		
Fruit / honeydew or sooty mould		
Growing point / dead heart		
Growing point / external feeding		
Leaves / abnormal colours		
Leaves / honeydew or sooty mould		
Leaves / wilting		
Stems / discoloration		
Stems / external feeding		
Stems / honeydew or sooty mould		

Species Vectored

Top of page

Cacao swollen shoot virus (cacao swollen shoot)

Biology and Ecology

Top of page

There are several papers on the biology of *F. virgata* but these need to be verified due to the confusion with *F. malvastra*, particularly in India where both species occur. *F. virgata* is biparental and *F. malvastra* is parthenogenetic.

Reproductive Biology

F. virgata reproduces sexually, with each female mating only once. At 30-35 ºC and 65% relative humidity (RH), a complete life cycle required about 6-7 weeks, and at 16.6 ºC, 13-14 weeks (Gerson, 2016). When reared at 16-29 ºC and 54-71% RH on sprouting potatoes, there were three (Ammar et al., 1979) to five overlapping generations per year (Nayar et al., 1976; Awadallah et al., 1979), with the population increasing with each successive generation in the field (Ammar et al., 1979). The same study found that the production of males was highest in crowded conditions. In the field in Egypt, the preferred oviposition sites were on the lower leaf surfaces and at the junction between stem and leaf petiole on *Acalypha macrophylla* (Awadallah et al., 1979). Eggs are laid in groups beneath the body on a pad of cottony wax filaments (Kaydan and Gullan, 2012) over a period of 20-29 days (Schmutterer, 1969). Each female is ovoviviparous and, in the laboratory, produces from 64 eggs (Awadallah et al., 1979) up to 737 eggs that hatch within 30 minutes of being laid (Ghose and Paul, 1972) or after 3-4 hours (Schmutterer, 1969). Female and male nymphs moulted 3 and 4 times, respectively, and the development period varied from 26-47 and 31-57 days, respectively (Ghose and Paul, 1972).

Longevity

Longevity of the adult female was 36-53 days, and that of the male 1-3 days (Ghose and Paul, 1972).

Activity patterns:

As with all mealybugs, only the short-lived males can fly.

In Egypt in the field, *F. virgata* overwintered (probably as adult females) in cracks and junctions of trunks and larger branches and on fallen leaves. In the laboratory, females migrated to the soil in winter (Ammar et al., 1979).

Nutrition

F. virgata feeds on the sap of a wide variety of host plants.

Environmental requirements:

F. virgata is found predominantly in the tropics, but its range does extend well into some temperate regions; it is found as far north as New York state in the USA (Ben-Dov., 1994).

A significant positive correlation was found (in Egypt) between population density and daily maximum and minimum temperatures, but not between population density and relative humidity (Ammar et al., 1979).

Notes on Natural Enemies

Top of page

Bartlett (1978) gave an account of the introduced parasitoids and predators used to control *F. virgata*. Noyes (2016) provides a list of known hymenopteran parasitoids of *F. virgata*.

Natural enemies

Top of page

Natural enemy	Type	Life stages	Specificity	References	Biological control in	Biological control on
Acerophagus texanus	Parasite				California	most flowering plants
Aenasius advena	Parasite	Adults/Nymphs			California; Hawaii	most flowering plants
Alloagrapta javana	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Alloagrapta obliqua	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Anagyrus brevicornis	Parasite	Adults/Nymphs				
Anagyrus qadrii	Parasite	Adults/Nymphs				
Anaysis alcocki	Parasite	Adults/Nymphs				
Anusioptera aureocincta	Parasite	Adults/Nymphs				
Azya luteipes	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Blepyrus insularis	Parasite	Nymphs				
Brumoides suturalis	Predator	Adults/Nymphs				
Cephaleta brunniventris	Parasite					
Cheilomenes sexmaculata	Predator	Adults/Nymphs				
Chrysopa flaveola	Predator	Adults/Nymphs				
Chrysopa orestes	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Chrysoperla carnea	Predator	Adults/Nymphs				
Coccinella septempunctata	Predator	Adults/Nymphs				
Coelinius	Parasite	Larvae				
Cryptolaemus montrouzieri	Predator	Adults/Eggs/Larvae/Nymphs/Pupae			Indonesia, India	coffee, guava
Eublemma costimacula	Predator	Adults/Nymphs				
Exochomus flaviventris	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Geocoris tricolor	Predator	Adults/Nymphs				
Gyranusoidea citrina	Parasite	Nymphs				
Hyperaspis notata	Predator	Adults/Nymphs				
Hyperaspis senegalensis hottentotta	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Mallada boninensis	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Myiopharus doryphorae	Parasite	Adults/Nymphs				
Neozygites fresenii	Pathogen	Adults/Nymphs				
Nephus regularis	Predator	Adults/Nymphs				
Ocyptamus argentinus	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Ocyptamus mentor	Predator	Adults/Nymphs				
Odontochrysa lacciperda	Predator	Adults/Nymphs				
Olla v-nigrum	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Patiyana coccorum	Parasite	Adults/Nymphs				
Pseudaphycus debachi	Parasite	Adults/Nymphs				
Scymnus apiciflavus	Predator	Adults/Nymphs				
Scymnus castaneus	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Scymnus coccivora	Predator	Adults/Eggs/Larvae/Nymphs/Pupae				
Scymnus roepkei	Predator	Adults/Nymphs				
Spalgis epeus	Predator	Adults/Nymphs				
Triommata coccidivora	Predator	Adults/Nymphs				

Means of Movement and Dispersal

Top of page

Natural Dispersal

As for most mealybugs, local dispersal of *F. virgata* is mainly by the crawling of the first instars. However, all the female developmental stages can walk, at least until eggs are laid (Kaydan and Gullan, 2012), and they will move to avoid unfavourable conditions. Additionally, wind may pick up and carry crawlers longer distances (Kaydan and Gullan, 2012).

Vector Transmission

In unfavourable conditions, attendant ants sometimes pick up mealybugs and carry them to new feeding sites (Missouri Botanical Garden, 2016). Sometimes mealybug crawlers walk onto the feet of birds perching on infested trees, and get carried to new plants.

Accidental Introduction

All life stages of *F. virgata* may be carried in shipments of fresh plant material and fruit (Kaydan and Gullan, 2012); as for other mealybug species, human transport of infested plants is a common way in which *F. virgata* gets transported over long distances, in-country or internationally, and presumably for short distances as well. This includes trade in nursery stock, sharing or trade of infested material by plant fanciers, import of unusual plants to botanical gardens and food plant material to zoos, and the considerable trade in planting material like ornamental bamboos and orchids, bought online and sent via mail or courier, sometimes with no customs declaration on the package.

Humans and farm machinery working in infested fields can accidentally carry crawlers to other sites.

Pathway Causes

Top of page

Cause	Notes	Long Distance	Local	References
Botanical gardens and zoos	Accidental introduction on plants	Yes		
Crop production	Accidental introduction on plants; transport on used farm machinery	Yes	Yes	
Cut flower trade	Accidental introduction on plants	Yes	Yes	
Hitchhiker	Accidental introduction on plants, and also on machinery, tools and workers	Yes	Yes	
Horticulture	Accidental introduction on plants, and also on machinery, tools and workers	Yes	Yes	
Landscape improvement	Accidental introduction on plants	Yes	Yes	
Nursery trade	Accidental introduction on plants, and also on machinery, tools and workers	Yes	Yes	
People sharing resources	Plant fanciers sharing plant material	Yes	Yes	
Self-propelled			Yes	

Pathway Vectors

Top of page

Vector	Notes	Long Distance	Local	References
Consumables	Accidental introduction on plant material	Yes		
Host and vector organisms	Accidental introduction on plant material	Yes	Yes	
Plants or parts of plants	Accidental introduction on plant material	Yes	Yes	
Wind			Yes	

Plant Trade

Top of page

Plant parts liable to carry the pest in trade/transport	Pest stages	Borne internally	Borne externally	Visibility of pest or symptoms
Flowers/Inflorescences/Cones/Calyx	adults; eggs; larvae; nymphs; pupae		Yes	Pest or symptoms usually visible to the naked eye
Fruits (inc. pods)	adults; eggs; larvae; nymphs; pupae		Yes	Pest or symptoms usually visible to the naked eye
Leaves	adults; eggs; larvae; nymphs; pupae		Yes	Pest or symptoms usually visible to the naked eye
Stems (above ground)/Shoots/Trunks/Branches	adults; eggs; larvae; nymphs; pupae		Yes	Pest or symptoms usually visible to the naked eye

Impact Summary

Top of page

Category	Impact
Economic/livelihood	Negative

Impact: Economic

Top of page

Pelley (1968) gave a general discussion of the pest status of *F. virgata* on coffee. Keuchenius (1915) and Ultee (1924) discussed it forming damaging mixed populations with Planococcus citri (Risso) on coffee in Java, Indonesia. Schmutterer (1969) stated it was a major pest of irrigated guava trees in the drier areas of the Sudan where it is common on many other crop, shade, ornamental and wild plants. In Tanzania it is a pest of cashew and in some parts of the world it is a pest of cotton (Williams, 1996). In India it has been widely reported as a pest of ornamental plants (Ghose and Paul, 1972) and a range of crops including coffee (Chacko and Bhat, 1976), custard apple (Mani and Krishnamoorthy, 1989), betel vine (Patil et al., 1987), black pepper (Sarma et al., 1987), pigeon pea (Gautam and Saxena, 1986) and milk tree (*Manilkara hexandra*), a rootstock for sapodilla (*Manilkara achras*) (Jhala et al., 1988). It is also recorded as a pest of kenaf (*Hibiscus cannabinus*) and mesta (*H. sabdariffa*) in Bangladesh (Jalil and Kabir, 1971), of *Leucaena leucocephala* in Taiwan (Chang and Sun, 1985), and of glasshouse ornamental plants in Egypt (Nada, 1986).

As well as direct damage caused by feeding, *F. virgata* is a known vector of *Cacao swollen shoot virus* (CSSV) in West Africa, cocoa Trinidad virus (CTV, Diego Martin valley isolate) in Trinidad (Thorold, 1975), and a badnavirus disease of black pepper in India (Bhat et al., 2003). Sooty mould fouling of ornamental plants and produce reduces their market value or can make them unmarketable.

Risk and Impact Factors

Top of page

Invasiveness

- Invasive in its native range
- Proved invasive outside its native range
- Has a broad native range
- Highly adaptable to different environments
- Tolerant of shade
- Capable of securing and ingesting a wide range of food
- Benefits from human association (i.e. it is a human commensal)
- Has high reproductive potential
- Gregarious

Impact outcomes

- Host damage
- Negatively impacts agriculture
- Negatively impacts livelihoods
- Reduced amenity values
- Negatively impacts animal/plant collections
- Damages animal/plant products

Impact mechanisms

- Pest and disease transmission
- Fouling
- Herbivory/grazing/browsing

Likelihood of entry/control

- Highly likely to be transported internationally accidentally
- Highly likely to be transported internationally illegally
- Difficult to identify/detect as a commodity contaminant
- Difficult to identify/detect in the field
- Difficult/costly to control

Detection and Inspection

Top of page

Heavy infestations are conspicuous because of the white waxy secretions, white masses of male tests (waxy filamentous cocoons) and sooty moulds growing on the excreted honeydew. Colonies often occur at the growing points, around the stem nodes, on the undersides of leaves and on the fruit.

Similarities to Other Species/Conditions

Top of page

F. virgata should be distinguished from *F. malvastra,* recorded from many parts of the world, and *F. dasylirii* in the neotropics (García et al., 2016), which may be more widespread than is presently known. These species are morphologically very similar and cannot be distinguished in the field by simple superficial features. Slide-mounted preparations are needed for examination. Other species closely related to *F. virgata* have been described in recent years from South America and should be separated using the key given by Kaydan and Gullan (2012). Kaydan and Gullan (2012) also provide detailed morphological descriptions, illustrations and discussion of *F. virgata*, *F. dasylirii* and *F. malvastra*; information from their description of *F. virgata* is provided in the 'Description' section of this datasheet.

Prevention and Control

Top of page

Due to the variable regulations around (de)registration of pesticides, your national list of registered pesticides or relevant authority should be consulted to determine which products are legally allowed for use in your country when considering chemical control. Pesticides should always be used in a lawful manner, consistent with the product's label.

Cultural Control and Sanitary Methods

At the beginning of a local outbreak, severely infested branches should be cut and burnt immediately (Schmutterer, 1969). Mealybugs can walk from one canopy to another when they are touching, so pruning can prevent spread of an infestation.

Biological Control

Noyes (2016) provides a list of known hymenopteran parasitoids of *F. virgata*. In Egypt, three species of Coccinellidae, two species of Neuroptera and three parasitoid wasp species (*Leptomastix* sp. and two species of Tetrastichus) were reported attacking *F. virgata* (Awadallah et al., 1979). In India, a coccinellid predator (*Scymnus* sp.) has been reported attacking *F. virgata*, controlling a population kept in culture (Ghose and Paul, 1972); also, the predatory caterpillar of *Spalgis epius* has been recorded feeding on the mealybugs (Chako and Bhat, 1976).

According to Zimmerman (1948), *F. virgata* was first recorded in the Hawaiian Islands in 1898 but was a widespread and common pest in the islands long before this. It is no longer common there as it has been controlled by the coccinellids *Cryptolaemus montrouzieri*, *Olla v-nigrum* and *Azya luteipes*, together with the syrphid *Alloagrapta obliqua*.

Pesticide-resistant populations of *F. virgata* were effectively controlled in guava orchards in India by the release of *C. montrouzieri*. The local natural enemies *Aenasius advena* (an encyrtid parasitoid) and *Scymnus coccivora* (a cocinellid predator) also helped control the mealybugs (Mani et al., 1990).

Bartlett (1978) gave an account of the introduced parasitoids and predators used to control *F. virgata*.

Chemical Control

Diazinon, malathion and dimethoate are effective in controlling *F. virgata*; however, these chemicals have to be sprayed repeatedly to achieve satisfactory control (Schmutterer, 1969). Prothiofos, either alone or with mineral oil, gave better control of *F. virgata* on guava in South Africa than did malathion, and resulted in negligible residues (Villiers and Stander, 1978).

In Florida, *F. virgata* on *Caladium* foliage was controlled by four sprays of permethrin at weekly intervals. Diflubenzuron reduced populations by about half. Permethrin provided the most effective control 21 days after dip treatments of tubers, and bendiocarb dip treatment was also very effective (Price, 1979).

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Top of page

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