



Citrus Imports from the Arab Republic of Egypt

A Review Under Existing Import Conditions for Citrus from Israel



April, 2002



Foreword

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GLOSSARY OF TERMS AND ABBREVIATIONS

AFFA	Agriculture, Fisheries and Forestry - Australia		
ALOP	appropriate level of protection		
AQIS	Australian Quarantine and Inspection Service		
Area	an officially defined country, part of a country or all or parts of several countries		
Biosecurity Australia	a major operating group within the Commonwealth Department of Agriculture, Fisheries and Forestry - Australia. Biosecurity Australia protects consumers and animal and plant health, and facilitates trade, by providing sound scientifically based and cost effective quarantine policy		
Control (of a pest)	suppression, containment or eradication of a pest population		
Endangered area	an area where ecological factors favour the establishment of a pest whose presence in the area will result in economically important loss		
Entry (of a pest)	movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled		
Entry potential	likelihood of the entry of a pest		
CAPQ	Central Adminstration for Plant Quarantine, Ministry of Agriculture and Land Reclamation		
Establishment	the perpetuation, for the foreseeable future, of a pest within an area after entry		
Establishment potential	likelihood of the establishment of a pest		
FAO	Food and Agriculture Organization of the United Nations		
Fresh	not dried, deep-frozen or otherwise conserved		
ICA	Interstate Certification Assurance		
ICON	AQIS Import Conditions database		
Introduction potential	likelihood of the introduction of a pest		
Introduction	entry of a pest resulting in its establishment		
IPPC	International Plant Protection Convention, as deposited in 1951 with FAO in Rome and as subsequently amended		
ISPM	International Standard on Phytosanitary Measures		
National Plant Protection			
Organisation	official service established by a government to discharge the functions specified by the IPPC		

Non-quarantine pest ______ pest that is not a quarantine pest for an area

Official______established, authorised or performed by a National Plant Protection Organization

Official control

(of a regulated pest)______the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests

Pathway______any means that allows the entry or spread of a pest

PBPM_____Plant Biosecurity Policy Memorandum

Pest_____any species, strain or biotype of plant, animal, or pathogenic agent, injurious to plants or plant products

Pest categorisation______the process for determining whether a pest has or has not the characteristics of a quarantine pest or those of a regulated non-quarantine pest

Pest free area _______an area in which a specific pest does not occur as demonstrated by scientific evidence and in which, where appropriate, this condition is being officially maintained

- Pest risk analysis ______ the process of evaluating biological or other scientific evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it
- Pest risk assessment ______ determination of whether a pest is a quarantine pest and evaluation of its introduction potential

Pest risk assessment

- (for quarantine pests) evaluation of the probability of the introduction and spread of a pest and of the associated potential economic consequences
- Pest risk management the decision-making process of reducing the risk of introduction of a quarantine pest

Pest risk management

- (for quarantine pests)______evaluation and selection of options to reduce the risk of introduction and spread of a pest
- Phytosanitary measure______any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests
- Phytosanitary regulation______official rule to prevent the introduction and/or spread of quarantine pests, by regulating the production, movement or existence of commodities or other articles,

or the normal activity of persons, and by establishing schemes for phytosanitary certification

Quarantine pest ______a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled

Regulated non-

- quarantine pest <u>a non-quarantine pest</u> whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing contracting party
- Spread______expansion of the geographical distribution of a pest within an area
- Spread potential likelihood of the spread of a pest
- SPS_____Sanitary and Phytosanitary
- SPS Agreement _____ WTO Agreement on the Application of Sanitary and Phytosanitary Measures
- WTO_____World Trade Organization

EXECUTIVE SUMMARY

Biosecurity Australia has reviewed the importation of fresh citrus fruit from Egypt under the existing policy for the importation of fresh citrus fruit from Israel. This was possible because of the similar profile for quarantine pests on fresh citrus fruit shared by Egypt and Israel.

This Review includes the following sections:

- Introductory information giving the background to the citrus industries in Egypt and Australia as well as the current quarantine requirements for the importation of citrus from various countries,
- Comparison of the citrus pests in Egypt and Israel,
- A discussion of the quarantine pests of concern for fresh citrus fruit from Egypt, and
- The proposed phytosanitary conditions for the importation of citrus fruit from Egypt.

This Review has identified 97 pests associated with citrus in both Egypt and Israel, however only 13 of these were considered to be both associated with fresh citrus fruit from Egypt and of quarantine concern.

The quarantine pests associated with fresh citrus fruit imported from the Arab Republic of Egypt are either the same as those associated with fresh citrus fruit imported from Israel or are of very low risk. Therefore this Review recommends that fresh citrus fruit be permitted entry into Australia from the Arab Republic of Egypt under the same conditions as are currently in place for fresh citrus fruit imported from Israel.

In summary the conditions proposed for importation are:

- Permitted varieties from Egypt: Seeded Baladi orange (*Citrus sinensis*) Seedless Baladi orange (*Citrus sinensis*) Washington Navel (*Citrus sinensis*) Abu-surra orange (*Citrus sinensis*) Valencia orange (*Citrus sinensis*) Egyptian lime (*Citrus aurantifolia*) Sweet lime (*Citrus latifolia*).
- Citrus will be subject to pre and post-harvest treatment and handling management systems that limit the development and spread of pests of quarantine concern to Australia.
- Citrus will be subject to either preshipment or intransit cold disinfestation for Mediterranean fruit fly.
- Citrus will be subject to both pre-export and on arrival inspection.

1. SCOPE

Australia currently permits the importation of fresh citrus from New Zealand, Israel, Spain and the United States. Importation is permitted under the general conditions for all fresh fruit and vegetables. As well as this, a program of field management and a cold disinfestation treatment are both required for Israel and Spain and a combination of field management and area freedom from economically significant fruit flies are required for the United States. These conditions are detailed in Section 3.3.

This Review considers the quarantine risks that may be associated with the importation into Australia of fresh citrus fruit for consumption from the Arab Republic of Egypt. The Review also considers and evaluates measures and procedures to manage these risks to an acceptably low level, which is consistent with Australia's appropriate level of protection (ALOP).

The implementation of any acceptable protocol will be made through the laws and regulations as well as the agricultural policies of both contracting parties. The citrus fruit covered by this Review are, as requested by Egypt, Seeded Baladi orange (*Citrus sinensis*), Seedless Baladi orange (*Citrus sinensis*), Washington Navel (*Citrus sinensis*), Abu-surra orange (*Citrus sinensis*), Valencia orange (*Citrus sinensis*), Egyptian lime (*Citrus aurantifolia*), and Sweet lime (*Citrus latifolia*). In this Review, citrus fruit is defined as a mature fruit of *Citrus spp*.

In completing this Review the pest list of citrus from Israel is compared with the pest list of citrus from Egypt. Biosecurity Australia (BA) acknowledges the assistance of the Central Administration for Plant Quarantine (CAPQ), Ministry of Agriculture and Land Reclamation and the Australian Citrus Growers Association for assistance in providing information and for their comments on the pest lists.

2. BACKGROUND

Egypt currently has three commodities, mangoes, citrus and okra, on the Plant Biosecurity Import Access Proposal list.

In 1996, AQIS (Australian Quarantine and Inspection Service) received access proposals from the Egyptian Government for the importation of citrus and okra into Australia. In 1999, the Egyptian Government requested access for mangoes. However, the main area of interest has been in the importation of citrus, with AQIS receiving several requests from Australian importers.

The Egyptian Government communicated with BA on 5 October 2000 that citrus is their highest priority and provided pest and disease information. Following the visit of the Egyptian Delegation to Australia in December 2000, BA placed this access request on their high priority work program. Several importers also provided AQIS with information on pests and diseases of citrus in Egypt. BA requested additional information from the Egyptian Plant Quarantine Authority as outlined in Annex 3 of *The AQIS Import Risk Analysis Process Handbook*. Industry and pest information was received as a result of this request.

In June 2001, BA developed an extended pest list for Egyptian citrus. After seeking clarification from Egypt on the validity of the extended pest list, BA sent this list to

Ms Judith Damiani, Chief Executive Officer of the Australian Citrus Growers Inc. on 16 June 2001 to be passed on to Mr Andrew Green and Dr Pat Barkley for their comments. Dr Barkley responded with her concerns regarding *Phoma tracheiphila* (Petri) Kantachveli & Gikachvili (mal secco) and *Alternaria alternata* pv. *citri* (*A. citri*). These matters are addressed in Sections 4.1 and 5.3 respectively.

2.1 The Citrus Industry in Australia

Citrus is one of the largest horticultural industries in Australia, supplying both domestic and export markets with an estimated gross value of production of \$392 million and exports of \$138 million in 1996–97. Australia is the fourth largest citrus producing country in the Southern Hemisphere after Brazil, Argentina and South Africa. However, Australia is a relatively small producer on a global scale, ranking only 16th in the world with about 1% of global citrus production.

The species of citrus grown commercially in Australia are:

C. latifolia (Yu. Tanaka) Tanaka (Persian or Tahitian lime), *C. limon* (L.) Burman f. (lemon), *C. maxima* (Burm.) Merrill. (pummelo), *C. medica* L. (citron), *C. reticulata* Blanco (mandarin, tangerine), *C. sinensis* (L.) Osbeck (sweet orange), *C. × paradisi* Macfad. (grapefruit), *Citrus × tangelo* J.W. Ingram & H.E. Moore (*Citrus reticulata × C. paradisi*) (tangelo), *Citrus aurantifolia* (Christman.) Swingle (lime). Various *Fortunella* spp. (kumquats) and *Citrus hystrix* DC. (kaffir lime) are being grown on a small scale, the latter in the Northern Territory and North Queensland. There are also indigenous Australian citrus relatives from the genus *Microcitrus* and *Eremocitrus* that are harvested for the bush food industry.

Citrus fruit are grown commercially in all states except Tasmania. Most of Australia's citrus production (43%) comes from New South Wales. South Australia follows with approximately 33%, Victoria 13%, Queensland 9% and Western Australia and Northern Territory 2%. New South Wales has the most citrus trees and the highest level of production in Australia.

The main growing areas are along the Murray River in South Australia, Victoria and New South Wales; the Riverina region of New South Wales; the Central Coast Region of New South Wales; and the Central Burnett region of Queensland, around the districts of Gayndah and Mundubbera. Other pockets of citrus production are in the Central West of New South Wales around Narromine and Bourke and in Western Australia.

There are about 3,000 citrus growers, cultivating 32,000 ha of land in Australia. The largest numbers of growers are in the Riverland region of South Australia. Of the nearly 1,000 citrus holdings in South Australia, 83% are 10 ha or less. In Australia, most citrus farms are mixed fruit-growing operations and are relatively small.

The farmgate value of citrus production was \$291.9m in 1996–1997, \$27m above that of the previous year. Broken down by product, this farmgate value of production comprised \$191.7m for oranges, \$66.9m for mandarins, \$25.3m for lemon/limes and \$8.0m for other citrus. There were 7.3 million orange trees, 165,500 grapefruit trees, 32.9 million lemon/lime trees and 1.8 million mandarin trees in the year to March 1997.

Total Australian citrus production over the last 5 years has been gradually increasing from 513,000 tonnes in 1988–89 to 650,000 tonnes in 1999–00. This primarily refelcts increases in production of navel oranges and mandarins. By contrast, grapefruit, lemons and limes have decreased in overall production. Over the past 10 years fresh fruit exports have recorded a three-fold increase in volumes with a five-fold increase in fob values. In 1988–89, just 5% of national citrus production was exported; ten years later this had risen to 23% (Anon., 2001). However, export volumes have stabilised during the last 4 years. Citrus production is projected to increase by approximately 150,000 tonnes by 2010, mainly in navel oranges and mandarins.

2.2 The Citrus Industry in Egypt

Citrus is a major export product of Egypt. The total cultivated area for citrus fruit is about 222,302 ha and total production is estimated at 2,149,349 ton/year. The average volume of citrus exported to various countries during 1997–2000 ranged from 205,800 to 210,500 tons.

The main varieties of citrus grown in Egypt are Seeded Baladi Orange, Seedless Baladi Orange, Valencia Orange, Blood Orange, Navel Orange, Jaffa Orange, Youssuf Soleiman Orange, Sweet Orange (Succart or Sukhary), Khalily Orange, Sour Orange, Egyptian Lemon, Grapefruit Ducan and limes. There are also small areas of other citrus such as grapefruit.

2.2.1. Citrus Production Areas in Egypt

Citrus is grown along the banks of the River Nile in four areas: Delta, New lands (Sharkia, Ismailia and Behara), Upper Egypt and Middle Egypt (Table 1).

Delta	New lands (Sharkia, Ismailia, and Behara)	Middle Egypt	Upper Egypt
Washington Navel	Washington Navel	Baladi (with seeds)	Baladi (seedless/with seeds), Youssuf
Limes, Baladi(seeds)	Baladi (with seeds)	Youssuf, Limes	Limes, Grapefruit
Valencia, Youssuf	Youssuf mandarin	Grapefruit	Lemon
Sweet Orange	Grape fruit	Valencia	
Lemon	Valencia, Lemon	Lemon	

Export production areas are in 12 governorates, namely Ismaillia, Sharkia, Gharbia, El-Behara, El-Monufia, El-Kalubia, El-Nubaria, Gaiza, El-Faium, Ben Suef, El-Minya and Asyot (Figure 1).





Orange production accounts for about 70% of total citrus production in Egypt. Approximately 80% of Egypt's total orange production is produced by large farms (6.6–66 ha) and 20% by small farms (0.6–6.6 ha). Three principal varieties of oranges are produced in Egypt: Navel, Valencia and Baladi. There are two kinds of Navel oranges, an early maturing variety and a late maturing variety. The early Navel oranges are mostly consumed domestically, whereas the late Navels are mainly exported. Valencia is a late maturing variety with high quality juice. The Baladi is principally used for juice.

All export citrus orchards are subject to strict supervision by the Central Administration of Plant Quarantine, the Plant Protection Research Institute, the Plant Pathology Research Institute and the Horticulture Research Institute to ensure that necessary management requirements have been implemented and maintained.

2.2.2. Harvesting Periods for Egyptian Citrus

Estimated harvest periods for the various citrus types are shown in Table 2. The orange harvest lasts four to five months, beginning in October. Sweet lime and lemon are grown nationwide and are available all year.

Region	Harvesting times for each variety					
	Baladi, Sweet orange	Valencia	Navel	Grapefruit		
Delta	Jan – Feb	Mar	Nov – Dec	Nov – Dec		
New lands	Nov – Dec	Feb	Nov – Dec	Feb – Mar		
Middle Egypt	Dec – Jan	Feb – Mar	Dec	Feb – Mar		
Upper Egypt	Late Oct – Nov	Feb		Nov – Feb		

 Table 2
 Citrus Harvesting Periods

2.2.3. Exports of Citrus from Egypt

Egypt currently exports citrus fruit to the European Union and the Gulf States. A small export quota of 8,000 MT per season limits Egyptian orange exports to the European Union under the free trade agreement. Egypt is negotiating to increase its orange export quota to 300,000 MT per season under the Egyptian-European Union partnership agreement. Total Egyptian orange exports in 1999–2000 was estimated at 208,000 MT compared to 215,000 MT in 1998–99.

Egypt has about 24 private-sector orange exporters. About 20 are small to medium in size and about four are large. However, three major companies control approximately 78% of the export market. There is one public sector company in the Egyptian orange sector and it controls about 20% of the export market.

Tangerine (mandarin) exports are handled by private sector companies. The total tangerine exports in 1999–2000 were estimated at 10,000 MT of which 3,758 MT were exported to Saudi Arabia, the major export market for Egyptian tangerines.

Total Egyptian export of citrus fruit, other than oranges and tangerines in 1999–2000 increased to 17,000 MT from 16,000 MT in 1998–99.

2.3 Current Australian Quarantine Protocols for Citrus Imports

All countries are required to comply with the "General requirements for all fruit and vegetables" detailed below.

- 1. A permit approved by the States is required.
- 2. A phytosanitary certificate must accompany each consignment.
- 3. A Quarantine Entry form should be lodged for produce from sea and airfreight by an importer or their agent for clearance of the consignment by AQIS.
- 4. Shipments must be free of soil and other debris and packed in clean new packages.
- 5. All consignments (other than those pre-cleared in the country of origin under an arrangement approved by AQIS) are subject to inspection on arrival and any treatment necessary before release.
- 6. Inspection must occur at the first port of call. No land bridging of consignments will be permitted unless the goods have cleared quarantine.
- 7. All consignments treated prior to export must have a commercial treatment certificate or a valid endorsement on the phytosanitary certificate or as otherwise stated in the specific conditions.
- 8. Open (door ajar) dry boxes that are used to ship produce that requires airing during transport are acceptable provided the containers are secured by replacing or closing the door prior to movement from the wharf to the site of inspection. Alternative security can be provided by security meshing, screening or covering with a heavy plastic sheet or tarping over the open containers.
- 9. Timber packing, pallets or dunnage in Full Container Load (FCL) containers will be subjected to inspection and treatment on arrival, unless certified as having been treated by an approved method.

2.3.1. Israel

Australia has an Arrangement with Israel which specifies that citrus fruit imported from Israel must undergo a cold disinfestation treatment for Mediterranean Fruit Fly (*Ceratitis capitata*). This is permitted to be undertaken preshipment, intransit or on arrival in the event of a treatment failure. Pre-treatment requirements and treatment are detailed in Section 5.2.

All citrus imported from Israel must come from areas which are free of Mal Secco infection.

Phytosanitary certificates must be endorsed with the following additional declaration:

1. The area in which the fruit was grown was free of Mal Secco.

2.3.2. New Zealand

The general conditions are the only requirements for citrus imported from New Zealand.

2.3.3. Spain

In accordance with the Specific Commodity Understanding (SCU) between Australia and Spain, all *Citrus* spp. imported from Spain must undergo a cold disinfestation treatment for Mediterranean fruit fly (*Ceratitis capitata*). The cold treatment is permitted to be undertaken preshipment or intransit. In the event of a treatment failure completion of the treatment is permitted on arrival. This treatment is detailed in Section 5.2.

Phytosanitary certificates must be endorsed with the following three additional declarations:

- 1. All fruit in the consignment is grown in mainland Spain,
- 2. The consignment was produced and inspected in accordance with the requirements of the SCU, and
- 3. That cold disinfestation treatment has been initiated.

2.3.4. United States of America

Importation of citrus is only permitted from Arizona, California and Texas.

Phytosanitary certificates must be endorsed with the following additional declarations:

- 1. The fruit in this consignment was sourced and packed in [*name of state*] which is free of all economically significant fruit flies, **or**
- 2. The fruit in this consignment was sourced and packed in [*name of county*] which is an area free of all economically significant fruit flies, **or**
- 3. The fruit in this consignment was sourced and packed in [*name of county*] which is an area located in excess of:
 - 80 kilometres from any fruit fly other than Mediterranean fruit *Ceratitis capitata* declared areas, and
 - . 15 kilometres from any Mediterranean fruit fly declared areas, or
- 4. The fruit has been stored for 14 days at $0^{\circ}C \pm 0.5^{\circ}C$.

3. CONSIDERATIONS

3.1 Comparison of citrus pests of Egypt and Israel

A pest list for citrus from Egypt and Israel was developed and is detailed in Appendix 1. Table 3 summarises the differences in pest categories between the two countries. The majority of the pests that were identified as being associated with fresh citrus fruit from Egypt were also found in Israel. Of the total 149 pests, 97 are common to both countries, 40 are found only in Egypt, and 20 are found only in Israel. Of the 149 pests, 82 are also found in Australia. Of the 97 arthropod species, 56 are found in both countries, 35 are found only in Egypt, 7 are found only in Israel, and 44 have also been reported in Australia. Of the 36 fungi, 28 are found in both countries with 3 found only in Egypt, 6 only in Israel and 30 are also found in Australia. Only one bacterium is known to occur on citrus in Egypt and Israel. This bacterium is not present in Australia and is not associated with the pathway for fresh citrus fruit from Egypt. Of the 3 viruses known to occur on citrus in Egypt and Israel, all 3 species also occur in Australia. The remaining virus is not associated with the pathway for fresh citrus fruit from Egypt. Of the 5 viroids known to occur on citrus in Egypt and Israel, 3 also occur in Australia. The remaining 2 viroids are not associated with the pathway for fresh citrus fruit from Egypt.

	Total potential citrus pests for Egypt & Israel	Citrus pests common to Egypt & Israel	Associated with citrus only in Egypt	Associated with citrus only in Israel	Present in Australia
Arthropods	97	56	35	7	44
Fungi	36	28	3	6	30
Nematodes	7	1	2	4	3
Bacteria	1	1	0	0	0
Viruses	3	2	0	1	2
Viroids	5	3	0	2	3
Total	149	91	40	20	82

 Table 3
 Summary of Potential Citrus Pests in Egypt and Israel

Of the 97 arthropod pests, 42 are on the fruit pathway and 32 of these have been recorded in Australia leaving 10 pests not reported in Australia (Table 4). These 10 pests together with the Mediterranean fruit fly (*Ceratitis capitata*), which is present in Australia but under official control in some states and the black parlatoria scale (*Parlatoria ziziphi*) which has been eradicated from the Northern Territory, take the total number of arthropod pests of quarantine concern to 12. These 12 arthropod species of quarantine concern are listed in Table 5. Of the fungi, 23 are on the fruit pathway and 22 of these are present in Australia. The remaining fungus, *Phoma tracheiphila*, that causes citrus Mal Secco disease in Israel is not known to occur in Egypt and therefore is not on the fruit pathway on citrus from Egypt. However, another fungus *Alternaria alternata* pv. *citri* (*A. citri*), although present in Australia, is of quarantine concern because different pathotypes of the fungus have been reported to occur. None of the nematodes, bacteria, viruses or viroids are on the fruit pathway and therefore all these pests are deemed not to be of any quarantine risk. Thus only 13 pests are considered to be of quarantine risk on fresh citrus fruit from Egypt.

 Table 4
 Potential Quarantine Pests on the Citrus Fruit Pathway

	Number of potential pests	Found only in Egypt	Found only in Israel	Found in Australia	Number of pests of quarantine concern
Arthropods	42	8	0	32	10+2
Fungi	23	1	1	22	1
Nematodes	0	0	0	0	0
Bacteria	0	0	0	0	0
Viruses	0	0	0	0	0
Viroids	0	0	0	0	0

	Total Pests	65	9	1	54	13
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Scientific Name	Common Name
Aleurothrixus floccosus (Maskell, 1895)	Woolly whitefly
Aphis fabae Scopoli, 1763	Black bean aphid
Ceratitis capitata (Wiedemann, 1829)	Mediterranean fruit fly
Cryptoblabes gnidiella Millière, 1867	Honeydew moth
Euzopherodes vapidella (Mannerheim,	Fruit piercing moth
1857)	
Parabemisia myricae Kuwana, 1927	Japanese bayberry whitefly
Parlatoria ziziphi (Lucas, 1853)	Black parlatoria scale
Phyllocoptruta citri Soliman & Abou-	Eriophyid rust mite
Awad, 1978	
Prays citri Millière, 1864	Citrus flower moth
Stathmopoda auriferella (Walker)	Apple heliodinid
Tarsonemus bilobatus Suski, 1965	Tarsonemid mite
Tuckerella nilotica Zaher & Rasmy,	Ornate false spider mite
1969	

 Table 5
 Arthropod Pests of Citrus in Egypt of Quarantine Concern

No specific references were found concerning gastropods (snails and slugs) as pests associated with fresh citrus fruit in Egypt or Israel. However, some species are known to be present in citrus orchards in Egypt and may be harvested as an incidental contaminant or may appear as a hitchhiker on cartons, pallets or containers. Therefore the risk of snails accompanying consignments of fresh citrus fruit are also considered in this review.

BA recommends that for the quarantine pests that are found in both Egypt and Israel the same or equivalent phytosanitary control measures should be applied. The risks of introducing the more important quarantine pests, and associated mitigation measures to reduce the risk, are discussed in the next section.

4. QUARANTINE PESTS OF CONCERN FOR FRESH CITRUS FRUIT EXPORTS FROM EGYPT

4.1 Internal Feeding Pests

Ceratitis capitata (Wiedemann) Mediterranean Fruit Fly

Mediterranean fruit fly (*Ceratitis capitata*) has been recorded in the citrus production areas of Egypt.

Within Australia, distribution of Mediterranean fruit fly is now limited to Western Australia and is mainly restricted to the horticultural and urban areas in the southwest of the state. The largest populations of the insect occur in the Perth metropolitan area and in towns in the southwest of the state (De Lima pers. comm, 1999; Woods, 1997). In all of the towns and areas south of Manjimup, Mediterranean fruit fly can be found in summer only for short periods. It is not found in orchards during the cooler months. The Ord River Irrigation area in northern Western Australia is free of this insect. All other states of Australia are free of Mediterranean fruit fly. Occasional, small, isolated outbreaks occur in the city of Adelaide in South Australia and in the Northern Territory. These originate from infested fruit brought into South Australia by people travelling. They are quickly detected through extensive fruit fly surveillance networks, and the outbreaks are successfully contained and rapidly eradicated.

Mediterranean fruit fly is a serious economic pest of citrus and other fruit. Fruit damage results from puncturing of the rind during egg laying and larvae feeding on the fruit pulp (Smith *et al.*, 1997). Management systems are in place in Egyptian citrus orchards to control this pest. These are detailed in Section 5.1. Further details about Mediterranean fruit fly can be found in the data sheet in Appendix 3.

BA considers that the current management systems in Egyptian citrus orchards in combination with the proposed mandatory cold disinfestation treatment, will provide adequate protection against the introduction of this pest.

4.2 Surface Feeding Pests

All arthropods detailed in Table 4 other than *Ceratitis capitata* are surface feeding pests and are considered to have a low risk of entry on citrus fruit imported from Egypt. These include whiteflies, fruit piercing moths, scales and mites as listed in Table 4 and detailed in the datasheets in Appendix 3.

This low risk of entry is due to post-harvest treatments normally carried out for citrus fruit, such as washing, brushing and waxing, as well as the packing house quality control procedures. These measures are detailed in Section 5.1. Further risk reduction is achieved by regulation of orchards and packing houses by CAPQ, pre-export inspections and the on-arrival inspection carried out by AQIS.

4.3 Fungal Pests

Alternaria alternata pv. citri (A. citri)

This fungus has been reported to cause the following problems on various citrus species viz. *Alternaria* rot; *Alternaria* rot of citrus; black rot of citrus fruit; brown leaf spot; brown spot of citrus; core rot of citrus; internal dry rot; navel end rot; stalk end rot; stem end rot. Citrus fruit has been coming into Australia from Israel, Spain, New Zealand and the USA (California, Texas and Arizona), which have these disorders, without any quarantine restriction for this pathogen. Elsewhere there are no known quarantine restrictions for *Alternaria alternata* pv. *citri* (*A. citri*) on citrus because of its widespread distribution and airborne transmission (CAB International, 2000). Egyptian authorities have reported that the *Alternaria* fungus is not economically significant in Egypt; hence no program has been adopted for controlling the disease in the field. This may be related to the low annual rainfall in Egypt of 62 mL per year that falls mainly on the coastal areas; in citrus growing governorates, rainfall is very rare. Australian citrus fruit are currently being exported to Taiwan, Japan, India, Vietnam, New Zealand and the USA without any quarantine restrictions for this pathogen despite its presence in Australia.

Industry is concerned about the introduction of additional pathotypes (or species) of *Alternaria* that could .jeopardise economic citrus production in some areas. The citrus industry plant pathology consultant felt that the host range in Australia is much

narrower than in Israel, based on the paper by Solel and Kimchi (1997), "Susceptibility and resistance of citrus genotypes of *Alternaria altern*ata pv. *citri*. *Journal of Phytopathology* 145(8–9), 389–391". The consultant further stated that susceptible varieties such as Emperor mandarin and Minneola tangelo are not being grown because the disease is difficult to control.

This concern resulted from the publication on the taxonomic revision of some of the Alternaria pathogens of citrus by Simmonds (1999) (Mycotaxon 70, 263–323). Simmonds identified several new species within the group identified as Alternaria alternata pv. citri or Alternaria citri. Simmonds identified the brown spot pathogen of tangelo in Israel, Turkey and South Africa as A. turkisafria. Less common newly described species of Alternaria on tangelo in Israel were A. interrupta and A. dumosa. Further, in the paper by Peever, Ibáñez and Timmer (2001), "Worldwide population structure of Alternaria sp. causing brown spot of tangerines and tangerine hybrids" (Abstract in *Phytopathology*), they analysed RAPD allele frequencies and found highly significant differentiation between samples of isolates from USA, Australia, Turkey, South Africa and Israel and large differences in pathogenicity. They concluded that the brown spot pathogen consists of several genetically and pathogenically distinct, non-recombining asexual lineages worldwide. In a recent study in Florida, Su et al. (2001) tested the isolates of the morphological species of Simmons (1999) using DNA molecular data. Several genomic regions of the pathogen including the 5' end of the beta-tubulin gene and mitochondrial large subunit were sequenced and compared to saprophytic isolates of A. alternata, A. solani and other known Alternaria species. Their data indicate that all of the citrus isolates belong to one phylogenetic species.

The risk of introduction of new strains of the pathogen from Egypt into Australia is low in view of routine post-harvest control measures being carried out in Egypt. Also citrus fruit has been coming into Australia for several years from Israel, Spain, and Texas, California and Arizona in the USA where the pathogen is widespread, without any interception of the disease or new strains of the fungus.

The current post-harvest practices carried out by the export sheds in Egypt such as the use of sodium carbonate solution, SOPP (sodium orthophenyl phenate), imazalil, or copper sulphate post-harvest treatments will help to reduce the risks of introducing the pathogen from Egypt. Strains of *A. alternaria* from a range of crops have been reported to be effectively controlled by sodium bicarbonate solution (Aharoni *et al.*, 1997), imazalil (Prusky and Ben-Ariel, 1981), wax emulsion and imazalil (Aharoni *et al.*, 1992), SOPP (Spotts *et al.*, 1994) and wax and SOPP (Daradhiyar, 1980). Cupric hydroxide gave the best control of *A. citri* on tangelo, reducing the number of lesions on infected fruit by 75 and 57% for the high (10 or 11) and low (5 or 6) spray frequencies, respectively, compared with untreated fruits (Olson *et al.*, 1992). Other effective fungicides were metiram, folpet, Bordeaux mixture and copper oxychloride (Kumar and Grover, 1964; Chand *et al.*, 1967; Pathak, 1980; Solel *et al.*, 1997).

Based on the possibility that there could be variability in the strains of the fungus, BA has deemed this pathogen to be of quarantine concern. To help alleviate industry concerns, it should be noted that pre and post-harvest fungicidal treatment effective against the *Alternaria* rot pathogen are already in place in Egyptian citrus orchards and packing sheds, and will reduce the risk of introducing new pathotypes. This information

is detailed in Section 5.1 and further information on the fungus is found in the datasheet in Appendix 3.

4.4 Gastropods

An analysis of the pest lists for Egypt and Israel has found that five terrestrial snails have been reported in association with citrus orchards in Egypt. Of the five species, *Xeropicta vestalis*, has not been reported to occur in Australia (see Table 6).

Scientific Name	Common Name	on Name Present in Egypt		Present in Australia	
<i>Cochlicella acuta</i> (Muller)	Pointed snail	Yes		Yes	
<i>Eobania vermiculata</i> (Muller)	Chocolate-band snail	Yes	Yes	Yes	
Rumina decollata (Linnaeus)	Decollate snail	Yes	Yes	Yes	
Theba pisana (Muller)	Mediterranean snail	Yes	Yes	Yes	
Xeropicta (Helicella) vestalis (Pfeiffer)	Desert snail	Yes		No	

 Table 6
 Snails Associated with Citrus Orchards

An extended list of land snails reported in Egypt and Israel is found in Appendix 2. Although there are no snails in this list which are pests associated with fresh citrus fruit, the possibility of snails as incidental contaminants applies to all exporting countries, including Australia.

BA considers that present phytosanitary management procedures including on arrival inspection are sufficient to detect any snails as hitchhikers on packaging or as incidental contaminants. Should exotic snails be intercepted during an on arrival inspection the consignment involved must be re-exported or destroyed or fumigated at the rate of 128g/m³ for 24 hours at 21°C.

5. PROPOSED PHYTOSANITARY CONDITIONS FOR THE IMPORTATION OF CITRUS FROM EGYPT

BA proposes the following procedures to address the risks posed by the quarantine pests identified. It is a condition of entry that CAPQ immediately advise BA and AQIS of any outbreak or change of status of the following pests in the citrus production governorates of Egypt:

- All economically significant species of Tephritid fruit flies, and
- Economically significant pathogens, such as *Xanthomonas campestris* pv. *citri* (pathogen of citrus bacterial canker) and *Phoma tracheiphila* (pathogen of Mal Secco disease).

5.1 Orchard Control Program

CAPQ will be required to ensure that citrus fruit is sourced from commercial orchards that are registered for export to Australia. Growers will undertake orchard pest control

programs to ensure that quarantine pests for Australia are adequately managed. CAPQ has to provide information on the management program undertaken for citrus throughout the growing season, from dormancy to post-harvest.

General survey programs for quarantine pests are to be conducted regularly. These may consist of surveying orchards, sampling, measurement and assessment of percentage infestation/infection. In instances where chemicals are applied and the maximum residue limits (MRLs) of such chemicals are significantly higher than the MRLs approved by the Australia New Zealand Food Authority (ANZFA), growers would also be required to ensure that adequate records of spray programs are kept and that these are made available to CAPQ auditors upon request.

In common with all other imported foods, citrus would be subject to the Imported Food Inspection Program operated by AQIS. Subject to risk categorisation by ANZFA, random samples of imported fruit may be taken for residue analysis with appropriate action taken if relevant MRLs are exceeded.

5.1.1. Mediterranean Fruit Fly Control

Citrus orchards in Egypt are normally planted as separate stands in mixed orchards with other horticultural crops that serve as alternative hosts for pests known to attack citrus trees, particularly Mediterranean fruit fly. The management strategies detailed below are intended to reduce infestation levels of Mediterranean fruit fly on a national level. CAPQ will coordinate the monitoring of the orchard trapping program, which can involve other government organisations including: Plant Protection Research Institute, Horticulture Research Institute and Central Administration of Extension.

A network of Jackson traps (pheromone and food attractants e.g. Trimedlure, Buminal) are to be distributed in the different fields to monitor the distribution of the pest throughout the year. These traps are to be hung on all Mediterranean fruit fly hosts in all governorates all year round. Traps should be baited weekly with the sex attractant "Trimedlure", inspected, and male catches counted. The sticky inserts should be replaced regularly and the average of the catch per trap per day "CTD" calculated.

"Hot spots" of pest distribution are to be determined using the trapping data and fruit infestation readings. Treatment of the infested areas with partial spray (trunk and main branches) should be carried out using one of the following mixtures:

100 mL Malathion + 200 mL attractant (Polycore Trimedlure) + 19.7 litre of water

100 mL Libacid + 200 mL attractant (Buminal) + 19.7 litre of water.

The mixtures are to be use alternately or together every 10–15 days. In addition, for large trees lethal bags saturated with one of the mixtures are to be used. These traps are to be positioned at the border of the orchard in a zigzag pattern as follows:

Х		Х		Х		Х		Х
	Х		Х		Х		Х	

Both partial spray and lethal bags are to be used until the pest disappears from the orchard which may be estimated from trap catches and fruit samples.

The infested fallen fruits are to be collected and buried at a depth of at least 50 cm.

A random sample of 100 fruits is to be collected weekly in all governorates, examined and the percentage of larvae and infestation in fruits estimated. The maintenance of traps and examination of infested fruit must continue until harvesting.

5.1.2. Other pests

Trees must be sprayed for external surface feeding pests (of quarantine concern) with mineral oils at the rate of 1% to help reduce infestation levels.

Sulphur compounds such as copper sulphate should be used to control *Alternaria* immediately after fruit formation at monthly intervals in May, June and July.

5.1.3. Registration

Sheds packing citrus fruit for export to Australia will be required to obtain fruit from CAPQ registered orchards and will themselves be registered with CAPQ to facilitate trace-back of exported fruit. Packing shed records of growers supplying fruit for export to Australia must be maintained and made available to CAPQ auditors upon request.

5.1.4. Packing sheds

Packing sheds must maintain a hygiene program. All grading equipment must be sanitised effectively by steam cleaning or disinfection with chlorinated water.

CAPQ will coordinate the receipt of the fruit at the gate of the packing shed and check documentation which includes: licence, transportation, production area, governorate and location, producer name, orchard name, variety and date.

5.1.5. Washing/ Post-harvest treatment

To control *Alternaria alternata*, fruits should be washed in warm water for 4–5 minutes using 1.25% sodium carbonate solution or 0.1% copper sulphate or 2% potassium permanganate or SOPP. Alternatively, TBZ (Thiabendazole) or Water-wax containing 22% of 2250 ppm TBZ + 2500 ppm Imazalil + 2500 ppm Guazatin can also be used.

Post-harvest treatments routinely used by packing sheds, should continue to reduce the incidence of quarantine pests on fruit. These may include 8% borax solution at 48°C for five minutes, **or** a mixture of 42% Borax and 2% Boric acid in warm water.

Washed, treated and waxed fruit must be sorted, graded and inspected by quality control officers before being packed into cartons made from Kraft paper or fibre-board material.

5.1.6. Packaging

• Packaging material may be made of fibre-board which can be manufactured either from recycled material or virgin Kraft paper. Only clean, new cartons will be allowed.

The packaging must be clearly marked with individual grower consignment numbers and packer or distributor identification to enable trace-back in the event if necessary.

The following information should be printed on each package.

- Product of Egypt,
- Name of the exporting company (the trademark)
- Variety
- Item (consignment) number
- Lot number
- Production date
- Export destination.

5.2 Cold Disinfestation

Cold disinfestation will be done preshipment or intransit. In the event of a treatment failure, treatment may be completed on arrival. Exporters may nominate any one of the treatment schedules in Table 7.

Fruit pulp temperature °C	Exposure period (consecutive days)			
0.00 C or below	10			
0.55 C or below	11			
1.11 C or below	12			
1.66 C or below	14			
2.22 C or below	16			

5.2.1. Preshipment Treatment

If a consignment is to receive preshipment cold treatment, CAPQ will ensure compliance with the following conditions.

- 1. Cold room facilities:
- (i) Preshipment treatment will only be permitted in cold room facilities approved by CAPQ.
- (ii) CAPQ is responsible for ensuring that cold room facilities used by exporters are of a suitable standard and have refrigeration equipment capable of achieving and holding the fruit at the required temperature.
- (iii) CAPQ will keep a register of cold treatment facilities approved for preshipment treatment of citrus to Australia. This register will include documentation covering:
 - (a) location and construction plans of all facilities, including owner/operator contact details,

- (b) dimensions of the facilities and room capacity,
- (c) type of insulation used in walls, ceilings and floors,
- (d) make, model, type and capacity of the refrigeration condenser and evaporator/air circulation, and
- (e) the temperature range of the equipment, defrost cycle control and specifications and details of any integrated temperature recording equipment.
- (iv) CAPQ will forward to AQIS (before the start of each citrus season) names and addresses of currently registered cold disinfestation treatment establishments.
- 2. Recorder types:
- (i) CAPQ is to ensure that the combination of temperature probes and temperature recorders are:
 - (a) suitable for the purpose. They should meet the standards required by the USDA. Sensors should be accurate to $\pm 0.15^{\circ}$ C in the range of -3.0° C to $+3.0^{\circ}$ C.
 - (b) able to accommodate the required number of probes,
 - (c) capable of recording and storing data for the period of the treatment and then until the information can be examined by a CAPQ officer,
 - (d) capable of recording all temperature sensors at least hourly to the same degree of accuracy as is required of the sensors, and
 - (e) capable of producing printouts which identify each sensor, time and the temperature, as well as the identification number of the storage facility.
- 3. Calibration of temperature:
- (i) Calibration must be conducted using a slurry of crushed ice and distilled water, using a certified thermometer approved by CAPQ.
 - (a) Any sensor which records more than $\pm 0.6^{\circ}$ C from 0°C must be replaced by one that meets this criterion.
 - (b) When the treatment has been completed CAPQ will check the calibration of the fruit sensors using the method referred to in Section 3 (i).
- 4. Placement of temperature sensors under CAPQ's supervision:
- (i) Palletised fruit must be loaded into cold rooms under CAPQ's supervision and may be pre-cooled at the exporters discretion.
- (ii) As a minimum, two probes (at the inlet and the outlet points of air circulation) to measure room temperature and minimum of four probes for fruit flesh temperature are required with one placed:
 - (a) one at the centre of the stack in the centre of the cold room,

- (b) one at the corner of the top stack in the centre of the cold room,
- (c) one at the centre of the stack near the outlet of cold air, and
- (d) one at the corner of the top stack near the outlet of cold air.
- (iii) Placement of sensors and connection to a logger must be under the direction and supervision of an officer authorised by CAPQ.
- (iv) Logger records may commence at any time, however the treatment time will be deemed to have begun only after all probes have attained the nominated treatment temperature.
- (v) Where only the minimum number of probes have been used, and in the event that any probe fails to record a temperature for a period of more than four consecutive hours, the treatment will be declared void and must be started again.
- 5. Progressive review of treatments:

If the record of treatment indicates that the treatment parameters have been met then CAPQ may authorise cessation of the treatment and if the sensors pass calibration as specified in Section 3 then the treatment will be considered to have been successfully completed.

Sensors should be calibrated before the fruit is moved from the treatment room.

- 6. Confirmation of treatment
- (i) After the nominated treatment period has elapsed, probes are to be recalibrated using the procedures in Section 3. Records must be kept for AQIS audit.
- (ii) If any probe show a higher calibration reading at the completion of the treatment than at the initial calibration setting, the recordings from the probe(s) will be adjusted accordingly. If this adjustment reveals that the nominated treatment schedule was not met, the treatment will be deemed to have failed. There is the option of re-treating this fruit at the discretion of CAPQ and the exporter.
- (iii) Printouts of temperature records are to be accompanied by suitable data summaries that indicate that the required cold treatment of the product has been achieved.
- (iv) CAPQ must endorse these records and summaries before confirming that the treatment has been successful. These are to be available for AQIS audit when required.
- (v) If the required cold treatment of the product has not been achieved, the logger may be reconnected and the treatment continued provided, that:
 - (a) CAPQ confirms the maintenance of the required conditions as per 5 (iii), or
 - (b) the elapsed time since treatment cessation and recommencement is less than 24 hours.

In both cases, data will continue to be collected from the time the logger is reconnected.

- 7. Loading into containers:
- (i) Containers must be inspected by CAPQ before loading, to ensure pest freedom and that any vents are covered to prevent the entry of pests.
- (ii) Fruit should be loaded within an insect proof building or using an insect-proof enclosure between the cool room entrance and the container.
- 8. Sealing of containers:
- (i) A numbered seal must be placed by an authorised officer of CAPQ on the loaded container door and the seal number noted on the phytosanitary certificate.
- (ii) The seal must only be removed by the AQIS officer at the port of arrival in Australia.
- (iii) Taping of the inners to the outers (of the telescopic cartons) of all top layer packages is required to prevent the outers lifting as a result of vibration, and blocking the airflow in the headspace.
- 9. Storage of fruit if not immediately loaded:
- (i) Treated fruit not intended for immediate loading may be stored for subsequent shipment provided security conditions are maintained by CAPQ:
 - (a) if fruit is stored in the treatment room, the room's doors must be sealed,
 - (b) if fruit is to be transferred to another room for storage, it must be transferred in a secure manner approved by CAPQ and the room must contain no other fruit, and
 - (c) subsequent container loading must be performed under CAPQ supervision in accordance with 7.

5.2.2. Intransit Treatment

If a consignment is to receive intransit cold treatment, CAPQ will ensure compliance with the following conditions.

- 1. Container type:
- (i) Containers must be self refrigerated (integral) shipping containers. In principle, CAPQ is responsible for ensuring that containers used by exporters are of a suitable type, and have refrigerator equipment capable of achieving and holding the required temperatures.
- 2. Recorder types:
- (i) CAPQ must ensure that the combination of temperature probes and temperature recorders are:

- (a) suitable for the purpose and meet the standards required by the USDA. Sensors should be accurate to $\pm 0.15^{\circ}$ C in the range of -3.0° C to $+3.0^{\circ}$ C.
- (b) able to accommodate the required number of probes,
- (c) capable of recording and storing data for the period of the treatment and then until the information can be examined by an AQIS officer,
- (d) capable of recording all temperature sensors at least hourly to the same degree of accuracy as is required of the sensors, and
- (e) capable of producing printouts which identify each sensor, time and the temperature, as well as the identification number of the recorder and the container.
- 3. Calibration of temperature recorder and sensors under CAPQ's supervision:
- (i) Calibration must be conducted using a slurry of crushed ice and distilled water, using a certified thermometer approved by CAPQ.
- (ii) Any sensor which records more than plus or minus 0.6°C from 0°C must be replaced by one that meets this criterion.
- (iii) A "Record of calibration of fruit sensors" (Appendix 4) must be prepared for each container and signed and stamped by a CAPQ officer. The original must be attached to the phytosanitary certificate which accompanies the consignment.
- (iv) On arrival AQIS will check the calibration of the fruit sensors using the method referred to in Section 3 (i).
- 4. Placement of temperature sensors under CAPQ's supervision:
- (i) Packed fruit must be loaded into shipping containers under CAPQ's supervision. Containers should be packed in a manner which ensures that there is equal airflow under and around all pallets and loose stacked cartons.
- (ii) Records of temperature are required from at least three locations.
- (iii) At least three sensors are necessary for each container.
- (iv) Two fruit pulp sensors must be placed approximately 1.5 metres from the end of the load for 12 metre containers and approximately 1 metre from the end of the load for 6 metre containers.
- (v) One fruit sensor must be placed in a centre carton and one in a carton at a side wall, both at half the height of the stack/pallet.
- (vi) Sensors must be placed under the direction and supervision of an officer authorised by CAPQ.
- (vii) On completion of treatments, printouts of all temperature sensors must be made available to the AQIS officer at the port of arrival for final clearance of the container by AQIS Canberra Office.
- 5. Sealing of containers:

- (i) A numbered seal must be placed on the loaded container door by an CAPQ authorised officer and the seal number noted on the phytosanitary certificate.
- (ii) The seal must only be removed by an AQIS officer at the port of arrival in Australia.
- (iii) Taping of the inners to the outers (of the telescopic cartons) of all top layer packages is required to prevent the outers lifting as a result of vibration, and blocking the airflow in the headspace. If this requirement is not adhered to AQIS may reject the consignment on opening the container.
- 6. Temperature records
- (i) The in-transit arrangement is for the cold disinfestation treatment to be completed during the voyage between Egypt and the first port of call in Australia. The Shipping Company will download the computer records of the disinfestation treatment and forward them to AQIS Canberra Office.
- (ii) AQIS Canberra Office will verify that the treatment records meet Australian disinfestation requirements and advise the State to which the consignment/s are arriving that, subject to calibration of the sensors, the treatment is complete.
- **Note:** Some sea voyages may allow the cold disinfestation treatment to be completed by the time the vessel arrives at a port en-route to Australia. It is permissible for treatment records to be downloaded en-route and sent to Canberra for verification. It is however a requirement that the treatment is not deemed to have been effected until AQIS have completed the re-calibration of the temperature sensor probes. It is therefore a commercial decision whether the fruit should be "conditioned" (i.e. gradually raising the carriage temperature) prior to arrival in Australia.

5.3 Phytosanitary Certification

A phytosanitary certificate issued by CAPQ must accompany every consignment of fresh citrus fruit from Egypt and must bear the following additional declaration:

"The consignment was produced and inspected in accordance with the Agreement on plant quarantine between CAPQ and AQIS."

If the consignment received preshipment cold disinfestation for Mediterranean fruit fly, the cold treatment facility, treatment temperature and period (number of consecutive days) must be inserted in the appropriate sections of the phytosanitary certificate.

Both the seal and container numbers must be recorded on the phytosanitary certificate (see Section 5).

If the consignment is subject to intransit cold disinfestation for Mediterranean fruit fly then the phytosanitary certificate must also bear the following additional declaration:

"CAPQ has supervised the calibration and the placement of fruit sensors into the fruit within the container/s in accordance with the requirements of the Agreement and that cold disinfestation treatment has been initiated."

5.4 On Arrival Inspection

On arrival of shipments, the importer will make available to an AQIS officer the original phytosanitary certificate. If temperature records have not already been made available to the AQIS Canberra Office they mst be provided to that office on arrival.

If treatment has not been completed the importer will have the option of repeating the nominated schedule after discharge. AQIS will deem a cold treatment to have failed if it has not completed the temperature requirements in transit and then having been placed on power within an AQIS registered establishment the fruit pulp temperatures have not completed 16 days at below 2.2°C within 23 days. Where a container is deemed to have failed a temperature treatment on land the importer will be given the option to re-export or the fruit will be destroyed in an AQIS approved manner.

Phytosanitary certificates issued by CAPQ will be examined to determine that the conditions have been met.

When temperature sensor calibration has been verified, using the procedure outlined in Section 3, the AQIS officer will endorse the phytosanitary certificate and attachment by signing and stamping both.

For containers that have been confirmed as cold treated, the fruit can then be inspected for quarantine pests. If Australia's requirements have not been satisfied necessary action will be taken.

Pests or diseases intercepted in on arrival inspection will be referred to an AQIS approved entomologist or plant pathologist, as appropriate, for identification, under quarantine security.

If live quarantine pests are detected during on-arrival inspection the consignment involved must be treated, re-exported or destroyed.

5.5 Summary of the Conditions for Citrus Importation from Egypt

• The following citrus varieties would be permitted from Egypt:

Seeded Baladi orange (*Citrus sinensis*) Seedless Baladi orange (*Citrus sinensis*) Washington Navel (*Citrus sinensis*) Abu-surra orange (*Citrus sinensis*) Valencia orange (*Citrus sinensis*) Egyptian lime (*Citrus aurantifolia*) Sweet lime (*Citrus latifolia*).

- Citrus would be subject to pre and post-harvest treatment and handling management systems that limit the development and spread of pests of quarantine concern to Australia.
- Citrus would be subject to either preshipment or intransit cold disinfestation for Mediterranean fruit fly.
- Citrus will be subject to both pre-export and on arrival inspection.

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APPENDIX 1: PESTS OF CITRUS IN EGYPT AND ISRAEL

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Arthropods								
Acaudaleyrodes rachipora (Singh) Syn. = [Acaudaleyrodes citri Priesner & Hosny; Aleurotrachilus citri Priesner & Hosny]	Babul whitefly; citrus whitefly	Hemiptera: Aleyrodidae	Yes – Gerling, 1972	Yes – CAB International, 2000; Helal <i>et</i> <i>al.</i> , 2000; Mansour <i>et al.</i> , 1976	No – Martin, 1999	Quarantine pest	No – leaf (Sundararaj & Murugesan, 1996)	
Aceria sheldoni (Ewing, 1937) Syn = [Eriophyes sheldoni Ewing]	Citrus bud mite	Acarina: Eriophyidae	Yes – Sternlicht, 1971	Yes – Attiah <i>et</i> <i>al.</i> , 1973b	Yes – widespread; NSW, QLD, SA, TAS, VIC, WA (CAB International, 2000; Smith <i>et</i> <i>al.</i> , 1997); NT (Anon., 2001a; CAB International, 2000); TAS (CAB International, 2000)	Non-quarantine pest	Yes – flower, fruit, leaf, twig (Smith <i>et</i> <i>al.</i> , 1997); leaf (Sternlicht, 1971)	
Agistemus exsertus Gonzalez-Rodriguez	Predatory mite	Acarina: Stigmaeidae	No	Yes – Rizk <i>et</i> <i>al.</i> , 1978–1979; Zaher <i>et al.</i> , 1971	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Rizk <i>et al.</i> , 1978– 1979)	
Aleurothrixus floccosus (Maskell, 1895) Syn. = [Aleurothrixus horridus (Hempel) Quaintance & Baker, 1914; Aleurodes floccosa Maskell, 1895; Aleurodes howardi Quaintance, 1907; Aleurothrixus howardi (Quaintance); Aleyrodes horridus Hempel, 1899]	Wooly whitefly; citrus whitefly	Hemiptera: Aleyrodidae	Yes – Argov, 1994; CAB International, 2000	Yes – Vulic & Beltran, 1977	No – Martin, 1999	Quarantine pest	Yes – eggs laid on fruit; leaf (CAB International, 2000; Jeppson, 1989)	Yes
Aleurotuberculatus jasmini Takahashi	Whitefly	Hemiptera: Aleyrodidae	No	Yes – Amin <i>et</i> <i>al.</i> , 1997	No – Martin, 1999	Non-quarantine pest	No – leaf, twig (Amin <i>et al.</i> , 1997)	
Amblyseius aegyptocitri Kandeel & El- Halawany, 1986	Predatory mite	Acarina: Phytoseiidae	No	Yes – Kandeel & El-Halawany,	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Kandeel & El-	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
				1986			Halawany, 1986)	
Amblyseius swirskii Athias-Henriot	Predatory mite	Acarina: Phytoseiidae	Yes – Ragusa & Swirski, 1977	Yes – Kandeel & Nassar, 1986	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Kandeel & Nassar, 1986)	
Amitermes desertorum (Desneux)	Desert subterranean termite	Isoptera: Termitidae	No	Yes – El- Hemaesy, 1976	No	Quarantine pest	No – living wood (El-Hemaesy, 1976)	
Anthaxia congregata Klug	Jewel beetle	Coleoptera: Buprestidae	No	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – woody trunk, branches (Hashem & El-Halawany, 1996)	
Aonidiella aurantii (Maskell, 1895) Syn. = [Aonidia aurantii (Maskell); Aonidiella citri (Comstock); Aspidiotus aurantii (Maskell); Aspidiotus citri Comstock; Aspidiotus coccineus Gennadius; Aonidiella gennadi McKenzie; Chrysomphalus aurantii (Maskell); Chrysomphalus citri (Comstock)	Red scale; orange scale; Californian red scale	Hemiptera: Diaspididae	Yes – Peleg, 1986; Yarom <i>et</i> <i>al.</i> , 1988	Yes – Rawhy <i>et</i> <i>al.</i> , 1973, 1980	Yes – NT, NSW, QLD, SA, VIC, WA (Smith <i>et al.</i> , 1997); TAS (CAB International, 2000)	Non-quarantine pest	Yes – whole plant (Hollander, 2001; Smith <i>et al.</i> , 1997)	
Aonidiella orientalis (Newstead, 1894)	Oriental scale	Hemiptera: Diaspididae	Yes – Wysoki, 1997	Yes – Hashem & El-Halawany, 1996	Yes – CIE, 1978	Non-quarantine pest	Yes – whole plant (CAB International, 2000)	
Apate monachus Fabricius, 1775 Syn. = [Apate monacha Fabricius, 1801; Apate carmelita Fabricius, 1801; Apate francisca Fabricius, 1801; Apate gibba Fabricius, 1798; Apate mendica Olivier, 1790; Apate monachus var. rufiventis Lucas, 1843; Apate semicostata Thomson, 1857; Apate senii Stefani, 1911]	Black borer; date palm bostrichid; twig borer	Coleoptera: Bostrichidae	Yes – Jeppson, 1989	Yes – Jeppson, 1989 Restricted distribution in Egypt (Lesne, 1938)	No – CAB International, 2000	Quarantine pest	No – bark, stem, trunk, woody branches (Halperin & Damoiseau, 1980; Jeppson, 1989)	
Aphis craccivora Koch, 1854Syn. =[Aphis atronitens Cockerell, 1903; Aphisbeccarii del Guercio, 1917; Aphiscistiella Theobald, 1923; Aphis citricoladel Guercio, 1917; Aphis dolichiMontrouzier, 1861; Aphis hordei del	Cowpea aphid	Hemiptera: Aphididae	Yes – CIE, 1983a	Yes – CIE, 1983a; Ismail <i>et</i> <i>al.</i> , 1986	Yes – NSW, NT, QLD, SA, TAS, VIC, WA (CIE, 1983a)	Non-quarantine pest	Yes – leaf, whole plant (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for	Present on the importation	Management options
	nume(b)		isiuci	Leipt	11usti unu	Australia	pathway (Egypt)	required
Guercio, 1913; Aphis kyberi Hottes,							F	
1930; Aphis laburni Theobald; Aphis								
leguminosae Theobald, 1915; Aphis loti								
Kaltenbach, 1862; Aphis medicaginis								
auct. nec Koch, 1854; Aphis mimosae								
Ferrari, 1872; Aphis oxalina Theobald,								
1925; Aphis papilionacearum van der								
Goot, 1918; Aphis robiniae Macchiati,								
1885; Doralida loti (Kaltenbach);								
Doralina craccivora (Koch); Doralina								
medicagnis (Koch); Doralina salsolae								
Börner, 1940; Dorsalis laburni								
(Kaltenbach); Doralis meliloti Börner,								
1939; Doralis robiniae (Macchiati);								
Pergandeida loti (Kaltenbach);								
Pergandeida medicaginis auct. nec.								
Koch, 1854; Pergandeida robiniae								
(Macchiati)]	DI 11 1'1	TT	N OF 1062	X7 T 11	N. CAD		X 7 . Cl	\$7
Aphis fabae Scopoli, 1763	Black bean aphid;	Hemiptera:	Yes – CIE, 1963	Yes – Ismail et	No – CAB	Quarantine pest	Yes – inflorescence,	Yes
Sup -	DIACK HY	Apilialdae		<i>al.</i> , 1980	international,		(CAP International	
Syll. = [Aphia abiataria Walker, 1852; Aphia					2000		(CAB International, 2000)	
Aprils abletaria walkel, 1852, Aprils							2000)	
Walker 1849: Aphis adducta Walker								
1849: Anhis advena Walker 1849: Anhis								
anarines Fabricius 1775: Anhis anarinis								
Blanchard, 1940: <i>Aphis apii</i> Theobald.								
1925: Aphis apocyni Koch. 1854: Aphis								
<i>atriplicis</i> Fabricius, 1775 nec Linnaeus,								
1758; Aphis brevisiphona Theobald,								
1913; Aphis chaerophylii Koch, 1854;								
Aphis cardui var. naumburgensis								
Franssen, 1927; Aphis castanea Koch,								
1872; Aphis chaerophylii Koch, 1854;								
Anuraphis cynariella Theobald, 1924;								
Aphis erecta del Guercio, 1911; Aphis								
cirsina Ferrari, 1872; Aphis dahliae								
Mosley, 1841; Aphis fabae Blanchard,								
1840; <i>Aphis hortensis</i> Fabricius, 1781;								
Aphis indistincta Walker, 1849; Aphis								
inducta Walker, 1849; Aphis insularis								
Blanchard, 1923; <i>Aphis nerii</i> Kaltenbach,								
1843 nec Boyer de Fonscolombe, 1841;								

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Aphis papaveris Fabricius, 1781; Aphis phlomoidea del Guercio, 1911; Aphis polyanthis Passerini, 1863 nec J.F. Gmelin, 1790; Aphis rumicis auctt. prior to 1930 nec Linnaeus; Aphis silybi Passerini, 1861; Aphis sinensis del Guercio, 1900; Aphis thlaspeos Schrank, 1801; Aphis translata Walker, 1849; Aphis tuberosae Boyer de Fonscolombe, 1841; Aphis valerianina del Guercio, 1911; Aphis watsoni Theobald, 1929; Doralis fabae Scopoli, 1763; Doralis papaveris Fabricius, 1781; Myzus roseum Macchiati, 1881; Myzus rubrum del Guercio, 1900]			V CIE 1069	V CIE	V NGW	N		
Aphis gossypii Glover, 1877 Syn. = [Aphis bauhiniae Theobold, 1918; Aphis circezandis Fitch, 1870; Aphis citri Ashmead of Essig, 1909; Aphis cucumeris Forbes, 1883; Aphis citrulli Ashmead, 1882; Aphis cucurbiti Buckton, 1879; Aphis lilicola Williams, 1911; Aphis minuta Wilson, 1911; Aphis monardae Oestlund, 1887; Aphis parvus Theobald, 1915; Aphis tectonae van der Goot, 1917; Cerosipha gossypii (Glover, 1877); Toxoptera leonuri Takahashi, 1921; Doralina frangulae (Kaltenbach)]	Cotton aphid; melon aphid	Hemiptera: Aphididae	Yes – CIE, 1968	Yes – CIE, 1968; El-Nagar <i>et al.</i> , 1984– 1985; Shaaban <i>et al.</i> , 1975	Yes – NSW, NT, QLD, SA, TAS, VIC, WA (Smith <i>et al.</i> , 1997)	Non-quarantine pest	Yes – flower, fruit (Smith <i>et al.</i> , 1997)	
Aphis spiraecola Patch, 1914Syn. =[Anuraphis erratica del Guercio, 1917;Aphis bidentis Theobold, 1929; Aphiscitricola Van der Goot, 1912; Aphiscroomiae Shinzi, 1922; Aphis deutziaeShinji, 1922; Aphis malvoides Van derGoot, 1917; Aphis mitsubae Shinji, 1922;Aphis nigricavda Van der Goot, 1917;Aphis pirifoliae Shinji, 1922; Aphispseudopomi Bertels, 1973; Aphispseudopomi Blanchard, 1939; Aphis	Green citrus aphid; spiraea aphid	Hemiptera: Aphididae	Yes – Rosen, 1980	Yes – Attia & El-Kady, 1986; El-Kady & Attia, 1986	Yes – NSW, QLD (Smith <i>et al.</i> , 1997); SA, TAS, VIC (CAB International, 2000; CIE, 1969)	Non-quarantine pest	Yes – flower, fruit, vegetative parts (Smith <i>et al.</i> , 1997)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
virburnicolens Swain, 1919]								
Aphis nerii Boyer de Fonscolombe Syn. = [Aphis asclepiadis; Aphis lutesceus Monell]	Oleander aphid; sweet pepper aphid	Hemiptera: Aphididae	Yes – Blumberg & Swirski, 1974	Yes – Hashem & El-Halawany, 1996; Ismail <i>et</i> <i>al.</i> , 1986	Yes – Carver, 1984; Naumann, 1993	Non-quarantine pest	No – leaf, twig (El- Kady <i>et al.</i> , 1980– 1981)	
Aspidiotus nerii Bouché Syn. = [Aspidiotus aloes Signoret; Aspidiotus capparis Signoret; Aspidiotus erica (Boisduval); Aspidiotus hedera (Vallot) auct.; Aspidiotus hederae Signoret, 1869; Aspidiotus limonii Signoret; Aspidiotus genistae Westwood; Aspidiotus olea Colvee; Chermes aloes Boisduval]	Aucuba scale; ivy scale; oleander scale; white scale	Hemiptera: Diaspididae	Yes – CIE, 1970a	Yes – Hashem & El-Halawany, 1996	Yes – CIE, 1970a	Non-quarantine pest	Yes – whole plant (CAB International, 2000)	
Brevipalpus californicus (Banks, 1904) Syn. = [Brevipalpus australis Baker, 1949; Brevipalpus browningi Baker, 1949; Brevipalpus confusis Baker, 1949; Brevipalpus woglumi McGregor, 1949; Hystripalpus californicus Mitrofanov & Strunkova, 1979; Tenuipalpus australis Tucker, 1926; Tenuipalpus californicus Banks, 1904; Tenuipalpus vitis Womersley, 1940]	Bunch mite; citrus flat mite; red flat mite; scarlet tea mite; silver mite	Acarina: Tenuipalpidae	Yes – CAB International, 2000; Yousef, 1967	Yes – Attiah <i>et</i> <i>al.</i> , 1973a	Yes – NSW, NT, QLD, SA, northern coastal VIC, WA (Smith <i>et al.</i> , 1997)	Non-quarantine pest	Yes – flower, fruit, vegetative growing stages (CAB International, 2000; Smith <i>et al.</i> , 1997)	
Brevipalpus obovatus Donnadieu, 1875 Syn. = [Brevipalpus bioculatus; Brevipalpus inornatus (Banks); Tenuipalpus bioculatus; Tenuipalpus inornatus; Tenuipalpus obovatus; Tenuipalpus pseudocuneatus]	Privet mite; scarlet mite	Acarina: Tenuipalpidae	Yes – CIE, 1988a	Yes – CIE, 1988a; Wahab <i>et al.</i> , 1974	Yes – QLD, SA (CAB International, 2000; CIE, 1988a)	Non-quarantine pest	No – leaf, stem (Jeppson <i>et al.</i> , 1975)	
Brevipalpus phoenicis (Geijskes, 1939) Syn. = [Brevipalpus macbridei Baker, 1949; Brevipalpus papayensis Baker, 1949;	False spider mite; passion vine mite; red crevice mite; scarlet mite; red and black flat	Acarina: Tenuipalpidae	Yes – Swirski & Dorzia, 1969	Yes – CIE, 1970b; Zaher <i>et</i> <i>al.</i> , 1971	Yes – CAB International, 2000; CIE, 1970b	Non-quarantine pest	Yes – flower, fruit, stem and vegetative growing stages (Jeppson <i>et al.</i> , 1989)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Brevipalpus pseudocuneatus Baker, 1949; Brevipalpus yothersi Baker, 1949; Tenuipalpus phoenicis Geijskes, 1939]	mite							-
Cardiastethus nazarenus Reuter	Predatory mite	Hemiptera: Anthocoridae	Yes – CAB International, 2000; Pericart <i>et</i> <i>al.</i> , 1989	Yes – Tawfik <i>et al.</i> , 1976	No	Non-quarantine pest	No – predatory mite (Tawfik <i>et al.</i> , 1976)	
Ceratitis capitata (Wiedemann, 1829) Syn. = [Ceratitis citriperda Macleay, 1829; Ceratitis hispanica De Brême; Pardalaspis asparagi Bezzi; Tephritis capitata Wiedemann, 1824]	Mediterranean fruit fly; Medfly	Diptera: Tephritidae	Yes – Harpaz, 1979	Yes – El- Miniawi & Ezzat, 1970 Restricted distribution in Egypt (CAB International, 2000)	Yes – under official control Present in south-west and west coast of WA as far north as Broome and detected in SA. NSW – absent, QLD – absent, SA – restricted, VIC – absent, WA – restricted (CAB International, 2000; Smith <i>et</i> <i>al.</i> , 1997)	Quarantine pest	Yes – fruit (Smith <i>et al.</i> , 1997)	Yes
Ceroplastes floridensis Comstock, 1881 Syn. = [Cerostegia floridensis (Comstock) De Lotto, 1969; Paracerostegia floridensis (Comstock) Tang, 1991]	Florida wax scale; soft scale	Hemiptera: Coccidae	Yes – Ben-Dov, 1976; Bodenheimer, 1930; Szivos <i>et</i> <i>al.</i> , 1985	Yes – Ben-Dov, 1993; Bodenheimer, 1931; CIE, 1982; Hall, 1924; Rawhy <i>et</i> <i>al.</i> , 1973	Yes – NSW (CIE, 1982); QLD (Ben-Dov, 1993; Smith <i>et</i> <i>al.</i> , 1997)	Non-quarantine pest	Yes – whole plant (CAB International, 2000; Smith <i>et al.</i> , 1997)	
Ceroplastes rusci (Linnaeus, 1758) Syn. = [Calypticus hydatis (Costa); Calypticus radiatus Costa, 1829; Calypticus testudineus Costa, 1829; Ceroplastes denudatus Cockerell, 1893; Ceroplastes nerii Newstead, 1897; Ceroplastes tenuitectus Green, 1907; Chermes caricae (Barnard); Coccus artemisiae Rossi, 1794; Coccus caricae Bernard;	Fig wax scale; fig scale	Hemiptera: Coccidae	Yes – Szivos et al., 1985	Yes – Ben-Dov, 1993; IIE, 1993; Pellizzari & Camporese, 1994	Yes – restricted, recently recorded in the NT (Anon., 2001b)	Non-quarantine pest	Yes – whole plant (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Coccus caricae Fabricius, 1794; Coccus hydatis Costa, 1829; Coccus rusci Linnaeus, 1758; Columnea caricae (Fabricius); Columnea testudinata Targioni Tozzetti, 1868; Columnea testudiniformis; Lecanium artemisiae (Rossi); Lecanium radiatum (Costa); Lecanium rusci (Linnaeus); Lecanium testudineum (Costa)]								
Cheletogenes ornatus (Canestrini & Fanzago, 1876) Syn. = [Asterolecanium pustulans; Brevipalpus californicus in Egypt; Cenopalpus pulcher; Parlatoria oleae in Egypt; Pinnaspis aspidistrae; Pinnaspis strachani; Pseudaulacaspis cockerelli]	Predatory mite	Acarina: Cheyletidae	Yes – Avidov, 1970; CAB International, 2000	Yes – Rizk <i>et</i> al., 1978–1979	Yes – Halliday, 1998	Non-quarantine pest	No – predatory mite (Rizk <i>et al.</i> , 1978– 1979)	
Chlorophorus variusi (Muller, 1766)	Wasp beetle	Coleoptera: Cerambycidae	No	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – woody trunk, branches (Hashem & El-Halawany, 1996)	
Chloropulvinaria floccifera (Westwood) Syn. = [Pulvinaria floccifera Westwood]	Camellia cottony scale; camellia scale; pulvinaria cushion scale; tea scale	Hemiptera: Coccidae	No	Yes – El- Minshawy & Moursi, 1976	Yes – NSW, SA, VIC (Anon., 2001d)	Non-quarantine pest	No – pest of citrus (Smith <i>et al.</i> , 1997); but listed as a pest on guava in Egypt (El-Minshawy & Moursi, 1976)	
Chrysobothris dorsata (Fabricius, 1787)	Jewel beetle	Coleoptera: Buprestidae	No	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – woody trunk, branches (Hashem & El-Halawany, 1996)	
Chrysomphalus aonidum (Linnaeus, 1758) Syn. = [Aonidiella ficorum Ashmead; Aspidiotus (Chrysomphalus) aonidum (Linnaeus); Aspidiotus (Chrysomphalus) ficus (Ashmead); Aspidiotus aonidum (Linnaeus); Aspidiotus ficorum Ashmead Aspidiotus ficus (Ashmead); Chrysomphalus ficus Ashmead, 1880;	Circular black scale; circular purple scale; circular scale; citrus black scale; Egyptian black scale; Florida red scale; purple scale; red spotted scale	Hemiptera: Diaspididae	Yes – Szivos <i>et</i> al., 1985	Yes – CAB International, 1999; CIE, 1988b; Rawhy <i>et al.</i> , 1973	Yes – NSW, QLD (Smith <i>et</i> <i>al.</i> , 1997); NT (CIE, 1988b); TAS (Anon., 2001a); Not present in VIC, WA (CAB International, 2000; Smith <i>et</i> <i>al.</i> , 1997)	Non-quarantine pest	Yes – fruit, leaf, stem (CAB International, 2000; Smith <i>et al.</i> , 1997)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Coccus aonidum Linnaeus, 1758]						Tustiunu	patiway (Egypt)	requireu
Coccus capparidis Linnaeus	Capparis soft scale; thorn scale	Hemiptera: Coccidae	Yes – Ben-Dov, 1979, 1980	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – leaf (Anon., 1974)	
Coccus hesperidum Linnaeus, 1758 Syn. = [Calypticus hesperidum (Linnaeus); Calypticus laevis Costa, 1829; Chermes lauri Boisduval, 1867; Coccus (Lecanium) hesperidum Linnaeus; Coccus (Lecanium) minimus Newstead; Coccus angustatus (Signoret); Coccus flaveolus (Cockerell); Coccus hesperidum alienus (Douglas); Coccus hesperidum lauri (Boisduval); Coccus hesperidum pacificus (Kuwana); Coccus hesperidum pacificus (Kuwana); Coccus jungi Chen, 1936; Coccus maculatus (Signoret); Coccus mauritiensis (Mamet); Coccus minimus (Newstead); Coccus minimus pinicola (Maskell); Coccus nanus (Cockerell); Coccus patellaeformis Curtis, 1843; Coccus signiferus (Green); Coccus terminaliae (Cockerell); Coccus ventralis (Ehrhorn); Eulecanium assimile amaryllidis (Cockerell); Kermes aurantj Alfonso, 1875; Lecanium (Calymnatus) hesperidum pacificum Kuwana, 1902; Lecanium (Coccus) hesperidum Linnaeus; Lecanium (Coccus) hesperidum Linnaeus; Lecanium alienum Douglas, 1886; Lecanium angustatus Signoret, 1873; Lecanium angustatus Signoret, 1873; Lecanium assimile amaryllidis Cockerell (nomen nudum); Lecanium assimile amaryllis Cockerell, 1894; Lecanium ceratoniae Gennadius, 1895; Lecanium depressum simulans Douglas (nomen nudum); Lecanium flaveolum Cockerell, 1897; Lecanium hesperidum alienum Douglas;	Brown soft scale; common shield scale; soft brown scale	Hemiptera: Coccidae	Yes – Rosen, 1974	Yes – CIE, 1972	Yes – NSW, QLD, SA, WA (Ben-Dov, 1993); NT, TAS (CIE, 1972); VIC (Smith <i>et</i> <i>al.</i> , 1997)	Non-quarantine pest	No – leaf, stem (CAB International, 2000; Smith <i>et al.</i> , 1997)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Lecanium hesperidum lauri (Boisduval); Lecanium hesperidum minimum Newstead; Lecanium lauri (Boisduval); Lecanium maculatum Signoret, 1873; Lecanium mauritiense Mamet, 1936; Lecanium minimum Newstead, 1892; Lecanium minimum pinicola Maskell, 1897; Lecanium nanum Cockerell, 1896; Lecanium punctuliferum Green, 1904; Lecanium signiferum Green, 1904; Lecanium terminaliae Cockerell, 1893; Lecanium ventrale Ehrhorn, 1898; Saissetia punctulifera (Green)]								
Coccus longulus (Douglas)	Long brown scale	Hemiptera: Coccidae	Yes – Ben-Dov, 1979	Yes – Hashem & El-Halawany, 1996	Yes – Naumann, 1993	Non-quarantine	No – leaf, stem, green twigs (Copeland & Ibrahim, 1985)	
Contarinia citri Barnes	Citrus blossom midge	Diptera: Cecidomyiidae	Yes – Gerson & Neubauer, 1976	No	No	Quarantine pest	No – citrus blossom (Gerson & Neubauer, 1976)	
Cryptoblabes gnidiella Millière, 1867	Christmas berry webworm; citrus pyralid; fruit- piercing moth; honeydew moth; rind-boring orange moth	Lepidoptera: Pyralidae	Yes – Jeppson, 1989	Yes – Swailem & Ismail, 1972	No – Nielsen <i>et</i> <i>al.</i> , 1996	Quarantine pest	Yes – flowering stage, fruiting stage; eggs are laid on the fruit, vegetative stage (Jeppson, 1989)	Yes
Cunaxa capreolus (Berlese)	Predatory mite	Acarina: Cunaxidae	No	Yes – Muma <i>et</i> <i>al.</i> , 1975	No – Halliday, 1998	Non-quarantine pest	No – predatory mite, preys on <i>Eutetranychus</i> <i>orientalis</i> (a mite pest of citrus) (Muma <i>et al.</i> , 1975)	
Dialeurodes citri (Ashmead, 1885) Syn. = [Aleyrodes (Dialeurodes) citri (Riley & Howard); Aleyrodes aurantii (Maskell); Aleyrodes citri Ashmead, 1885; Aleyrodes citri Riley & Howard, 1893; Aleyrodes eugeniae var. aurantii Maskell, 1895; Aleyrodes kushinasii Sasaki, 1908; Dialeurodes citri	Citrus whitefly	Hemiptera: Aleyrodidae	Yes – Argov, 1988; Rosen, 1980	Yes – Nada, 1988–1989	No – Martin, 1999	Quarantine pest	No – eggs are laid on the leaf (CAB International, 2000); leaf, shoot (Fasulo & Brooks, 1997b; Uygun <i>et al.</i> , 1990)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation	Management options
(Ashmead); <i>Dialeurodes citri</i> (Ashmead) var. <i>hederae</i> Takahashi, 1936; <i>Dialeurodes citri</i> (Ashmead) var. <i>kinyana</i> Takahashi, 1935; <i>Dialeurodes</i> <i>tuberculatus</i> Takahashi, 1932]						Australia	paniway (Egypt)	requireu
Enneadesmus forficula Frm.	Powder post beetle	Coleopterra: Bostrichidae		Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – woody trunk, branches (Helal & El-Sebay, 1984– 1985)	
Enneadesmus obstusedentatus Lesne	Powder post beetle	Coleopterra: Bostrichidae		Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – woody trunk, branches (Helal & El-Sebay, 1984– 1985)	
<i>Eriophyes aegyptiacus</i> Soliman & Abou- Awad, 1978	Eriophyiid mite	Acarina: Eriophyidae	No	Yes – Soliman & Abou-Awad, 1978	No – Halliday, 1998	Non-quarantine pest	No – tree litter (Soliman & Abou- Awad, 1978)	
Euseius gossipi (El Badry) Syn. = [Amblyseius gossipi El Badry]	Predatory mite	Acarina: Phytoseiidae	No	Yes – Kandeel & Nassar, 1986	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Kandeel & Nassar, 1986)	
Euseius scutalis (Athias-Henriot) Syn. = [Amblyseius scutalis Athias-Henriot]	Predatory mite	Acarina: Phytoseiidae	No	Yes – Helal <i>et</i> <i>al.</i> , 1995	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Helal <i>et al.</i> , 1995)	
Eutetranychus orientalis (Klein, 1936) Syn. = [Anychus orientalis; Anychus ricini; Eutetranychus monodi Andre; Eutetranychus sudanicus Elbadry; Eutetranychus anneckei Meyer]	Citrus brown mite; oriental red mite; oriental spider mite	Acarina: Tetranychidae	Yes – Szivos et al., 1985	Yes – Abdelhafez & Hanna, 1975; Attiah <i>et al.</i> , 1973b; Atwa <i>et al.</i> , 1987; CAB International, 2000	Yes – restricted distribution – NSW, QLD (CAB International, 2000; Smith <i>et</i> <i>al.</i> , 1997)	Non-quarantine pest	Yes – fruit, vegetative parts, post-harvest (Anon., 2001a; CAB International, 2000; Smith <i>et al.</i> , 1997)	
Euzopherodes vapidella (Mannerheim, 1857) Syn. = [Ephestia vapidella Mannerheim]	Citrus stub moth; fruit piercing moth;	Lepidoptera: Pyralidae	Yes – Jeppson, 1989	Yes – CAB International, 2000	No – Nielsen <i>et</i> <i>al.</i> , 1996	Quarantine pest	Yes – fruit piercing (CAB International, 2000; Jeppson, 1989)	Yes
Ferrisia virgata Cockerell	Striped mealybug; spotted mealybug; long- tailed mealybug; white- tailed mealybug	Hemiptera: Pseudococcidae	No – CAB International, 2000	Yes – Hashem & El-Halawany, 1996	Yes – Ben-Dov, 1994	Non-quarantine pest	Yes – fruit, leaf, stem (CAB International, 2000)	
Heliothrips haemorrhoidalis (Bouché,	Black tea thrips;	Thysanoptera:	Yes – CIE,	Yes – CIE, 1961	Yes –	Non-quarantine	Yes – fruit, leaf,	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
1833) Syn. = [Dinurothrips rufiventris Girault, 1929; Heliothrips adonium Haliday; Heliothrips ceylonicus; Heliothrips haemorrhoidalis var. abdominalis Reuter; Heliothrips haemorrhoidalis var. ceylonicus Schmutz; Heliothrips haemorrhoidalis; Heliothrips haemorrhoidalis var. andustior Priesner; Heliothrips semiaureus Girault, 1928; Thrips haemorrhoidalis Bouché, 1833]	glasshouse thrips; greenhouse thrips	Thripidae	1961; Jeppson, 1989		widespread; ACT, NSW, QLD, SA, VIC, WA (Mound, 1996); NSW, WA (Smith <i>et</i> <i>al.</i> , 1997); TAS (CIE, 1961)	pest	twig (CAB International, 2000; Jeppson, 1989; Smith <i>et al.</i> , 1997)	
Hemiberlesia latania Signoret	Lantania scale; palm scale	Hemiptera: Diaspididae	Yes – Wysoki, 1997	Yes – Hashem & El-Halawany, 1996	Yes – CIE, 1976; Mitchell & Ironside, 1982	Non-quarantine pest	Yes – fruit, leaf, stem (CAB International, 2000)	
Hypothenemus eruditus Westwood, 1836 Syn. = [Cryphalus minutus Schedl, 1978; Cryphalus striatopunctatus Lea, 1910; Cryphalus striatopunctatus Lea, 1910; Cryphalus tantillus Lea, 1910; Cryphalus tectonae Stebbing, 1903; Hypothenemus argentinensis Schedl, 1939; Hypothenemus asaroriensis Beeson, 1940; Hypothenemus cylindricus Schedl, 1939; Hypothenemus cylindricus Schedl, 1939; Hypothenemus cylindripennis Schedl, 1957; Hypothenemus mauiensis Schedl, 1951; Hypothenemus minutulus Schedl, 1951; Hypothenemus parcius Schedl, 1951; Hypothenemus parcius Schedl, 1951; Hypothenemus pusillus Eggers, 1927; Hypothenemus tuberculosus Hagedorn, 1912; Hypothenemus vianai Schedl, 1958; Stephanoderes nanulus Schedl, 1952] Lagrage accomptioned (2000)	Shot-hole wood borer	Coleoptera: Scolytidae	No Vog Mandal fr	Yes – Hashem & El-Halawany, 1996	No Vac NSW	Quarantine pest	No – woody trunk and branches (Hashem & El- Halawany, 1996)	
Icerya aegyptiaca (Douglas, 1890)	Breadfruit mealybug; Egyptian	Hemiptera: Margarodidae	Yes – Mendel & Blumberg, 1991	Yes – CIE, 1966	Yes – NSW, NT, QLD (CIE, 1966; Smith <i>et</i>	Non-quarantine pest	No – leaf, stem, whole plant (Anon., 2001a; CAB	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Icerya purchasi Maskell Syn. = [Pericerya purchasi (Maskell)]	Australian bug; cottony cushion scale; fluted scale	Hemiptera: Margarodidae	Yes – Mendel & Blumberg, 1991	Yes – CAB International, 2000; El- Saadany & Goma, 1974	<i>al.</i> , 1997) Yes – restricted distribution – NSW, QLD, SA, VIC (Smith <i>et al.</i> , 1997); TAS (CIE, 1971); WA Carnarvon to Esperance (Anon., 2001a)	Non-quarantine pest	Yes – flower, fruit, vegetative stage (CAB International, 2000; Smith <i>et al.</i> , 1997)	
Icerya seychellarum (Westwood, 1855)	Seychelles scale	Hemiptera: Margarodidae	No	Yes – CAB International, 2000	Yes – NSW, NT, QLD (CAB International, 2000); suspected as native to Australia – (Smith <i>et al.</i> , 1997)	Non-quarantine pest	Yes – leaf, stem, whole plant (Anon., 2001a ; CAB International, 2000)	
Kiritshenkella sacchari (Green) Syn. = [Ripersia cellulosa; Ripersia sacchari (Green)]	Mealybug	Hemiptera: Pseudococcidae	Yes – Ben-Dov, 1985	No	No – Ben-Dov, 1994	Quarantine pest	No – not in Egypt. Leaf sheaths, stem, root (CAB International, 2000)	
Lasioseius athiasae Nawar & Nasr, 1991	Ascid mite (predatory mite)	Acarina: Ascidae	No	Yes – Nawar & Nasr, 1991	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Nawar & Nasr, 1991)	
Lasioseius bispinosus Evans	Ascid mite (predatory mite)	Acarina: Ascidae	No	Yes – Nasr & Abou-Awad, 1987	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Nasr & Abou- Awad, 1987)	
Lepidosaphes beckii (Newman, 1869) Syn. = [Aspidiotus citricola Packard, 1869; Coccus anguinis (Newman); Coccus anguinis Boisduval, 1870; Coccus beckii Newman, 1869; Coccus neckii Newman, 1869; Cornuaspis beckii (Newman); Lepidosaphes citricola (Packard); Lepidosaphes flava Souza da Camara, 1906; Lepidosaphes pinifolii Balachowsky, 1954; Lepidosaphes	Citrus mussel scale; mussel scale; purple scale	Hemiptera: Diaspididae	Yes – CIE, 1964a; Jeppson, 1989	Yes – CIE, 1964a; Rawhy <i>et al.</i> , 1973, 1980	Yes – NSW, NT, QLD (CIE, 1964a; Smith <i>et</i> <i>al.</i> , 1997); SA, TAS, VIC, WA (Anon., 2001a; CAB International, 2000)	Non-quarantine pest	Yes – branch, fruit, leaf, twig (Jeppson, 1989; Smith <i>et al.</i> , 1997)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
pinnaeformis (Newstead); Lepidosaphes pinniformis Lindinger, 1910; Mytilaspis anguineus (Boisduval); Mytilaspis beckii (Newman); Mytilaspis citricola (Packard); Mytilaspis citricola v. Tasmaniae Maskell, 1897; Mytilaspis flavescens Targioni Tozzetti, 1876; Mytilaspis fulva Berlese, 1892; Mytilaspis fulva Berlese, 1892; Mytilaspis pinnaeformis Newstead, 1901; Mytilaspis Tasmaniae (Maskell); Mytilococcus beckii (Newman); Mytilococcus piniformis Lindinger, 1936]								- oquinou
Maconellicoccus hirsutus (Green) Syn. = [Maconellicoccus pasaniae (Borchsenius); Maconellicoccus perforatus (DeLotto); Paracoccus pasaniae Borchsenius, 1962; Phenacoccus glomeratus Green, 1922; Phenacoccus hirsutus Green, 1908; Phenacoccus quaternus Green, 1912; Pseudococcus hibisci Hall, 1922; Spilococcus perforatus DeLotto, 1954]	Hibiscus mealybug	Hemiptera: Pseudococcidae	No	Yes – CAB International, 2000	Yes – NT, QLD, WA (Ben-Dov, 1994; CAB International, 2000; Williams, 1985); SA (Anon., 2001a)	Non-quarantine pest	Yes – flower, fruit, leaf, stem (CAB International, 2000)	
Macrotoma palmata Fabricius	Wood borer	Coleoptera: Cerambycidae	No	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – woody branches, trunk parts (Hashem & El-Halawany, 1996)	
Mycetaspis personata (Comstock) Syn. = [Aonidiella personata; Aspidiotus personatus Comstock; Chrysomphalus personatus Comstock	Masked scale	Hemiptera: Diaspididae	No	Yes – CAB International, 2000; El- Minshawy & Osman, 1974; Salama & Saleh, 1971	No – Anon., 2001a	Quarantine pest	No – leaf (Salama & Saleh, 1971)	
Myelois (Ectomyelois) ceratoniae (Zeller) Syn. = [Ectomyelois ceratoniae Zeller; Ectomyelois phoenicis (Durrant); Myelois ceratoniae Zeller; Myelois phoenicis Durrant; Spectrobates ceratoniae Zeller]	Carob moth; locust bean moth	Lepidoptera: Pyralidae	Yes – CAB International, 2000	Yes – Hashem & El-Halawany, 1996	Yes – Nielsen <i>et</i> al., 1996	Non-quarantine pest	Yes – fruit (Hashem & El-Halawany, 1996)	

Scientific name	Common	Order/Family	Present in	Present in	Present in	Quarantine	Present on the	Management
	name(s)		Israel	Egypt	Australia	status for	importation	options
Myzus persicae (Sulzer, 1776) Syn. = [Aphis convolvuli Kaltenbach, 1843; Aphis cynoglossi Walker, 1848; Aphis derelicta Walker, 1849; Aphis dianthi Schrank, 1801; Aphis dubia Curtis, 1842; Aphis egressa Walker, 1849; Aphis malvae Mosl., 1841; Aphis persicae Sulzer, 1776; Aphis persiciphila; Aphis persola Walker, 1848; Aphis rapae Curtis, 1842; Aphis redundans Walker, 1849 sec. Laing, 1925; Aphis suffragans Walker, 1848; Aphis tuberoscellae; Aphis vastator; Aphis vulgaris Kyber, 1815 (sec. Walker); Aulacorthum convolvuli; Myzodes persicae (Sulzer); Myzodes tabaci Mordvilko, 1914; Myzoides pericae; Myzus dianthi (Schrank); Myzus malvae Oestl., 1866 (sec. Theob.); Myzus pergandier Sanders, 1901 sec. Patch; Nectarosiphon persicae (Sulzer); Phorodon persicae (Sulzer); Phorodon persicae (Sulzer); Rhopalosiphum teate Theobald, 1913; Rhopalosiphum lactucellum Theobald, 1915; Rhopalosiphum lactucellum; Rhopalosiphum persicae; Rhopalosiphum	name(s) Green peach aphid; peach curl aphid	Hemiptera: Aphididae	Israel Yes – CIE, 1979	Egypt Yes – CIE, 1979; Ismail <i>et</i> <i>al.</i> , 1986	Australia Yes – NSW, NT, QLD, SA, TAS, VIC, WA (CIE, 1979)	status for Australia Non-quarantine pest	importation pathway (Egypt) Yes – inflorescence, leaf, stem, growing points, whole plant (CAB International, 2000)	options required
solani Theobald, 1912 non Kalt, 1843; Rhopalosiphum tuberosellae Theobald, 1922; Siphonophora achyrantes Mon., 1879; Siphonophora nasturtii Koch, 1855]								
Neoaliturus haematoceps Mulsant & Reyl. Syn. = [Circulifer haematoceps]	Leafhopper	Hemiptera: Cicadellidae	Yes – Klein & Raccah, 1991	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – vegetative plant parts (CAB International, 2000; Klein & Raccah, 1991)	
Neoaliturus tenellus (Baker) Syn. = [Circulifer tenellus]	Beet leafhopper	Hemiptera: Cicadellidae	Yes – CAB International, 2000	Yes – Hashem & El-Halawany, 1996	No – CAB International, 2000	Quarantine pest (vector of citrus stubborn disease and curly top	No – vegetative plant parts (Oldfield <i>et al.</i> , 1976)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
						disease of beet)		
Nenteria hypotrichus El-Borolossy & El- Banhawy	Predatory mite	Acarina: Uropodidae	No	Yes – El- Banhawy <i>et al.</i> , 1997	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (El-Banhawy <i>et al.</i> , 1997)	
Nezara viridula (Linnaeus, 1758) Syn. = [Cimex smaragdulus Fabricius; Cimex torquatus Fabricius; Cimex viridulus Linnaeus]	Green shield bug; green stink (vegetable) bug; green vegetable bug; southern green stink bug; tomato and bean bug	Hemiptera: Pentatomidae	Yes – CAB International, 2000	Yes – Attiah <i>et</i> <i>al.</i> , 1974; CABI/EPPO, 1998	Yes – NSW, NT, QLD, SA, TAS, VIC, WA (CABI/EPPO, 1998; Clarke, 1992)	Non-quarantine pest	Yes – fruit, leaf, stem, growing points (Anon., 2001a; CAB International, 2000)	
Nipaecoccus viridis (Newstead, 1894) Syn. = [Dactylopius perniciosus Newstead & Wilcocks, 1910; Dactylopius vastator Maskell, 1895; Dactylopius viridis Newstead, 1894; Nipaecoccus vastator (Maskell); Pseudococcus albizziae (Maskell); Pseudococcus filamentosus var. corymbatus Green, 1922; Pseudococcus perniciosus (Newstead & Wilcocks); Pseudococcus solitarius Brain, 1915; Pseudococcus vastator (Maskell); Pseudococcus vastator (Maskell); Pseudococcus viridis (Newstead); Trionymus sericeus James, 1936]	Coffee mealybug; cotton mealybug; globular mealybug; karoo thorn mealybug; lebbeck mealybug; spherical mealybug	Hemiptera: Pseudococcidae	Yes – Bar- Zakay <i>et al.</i> , 1988; Ben-Dov, 1985, 1987	Yes – CIE, 1983b; Hashem & El-Halawany, 1996	Yes – NT (CIE, 1983b; QLD (Ben-Dov, 1994; Smith <i>et</i> <i>al.</i> , 1997; Williams, 1985)	Non-quarantine pest	Yes – flower, fruit, leaf, shoot, twig (Jeppson, 1989; Smith <i>et al.</i> , 1997); flower, fruit, leaf (CAB International, 2000)	
Oribatula sp.	Beetle mite (predatory mite)	Acarina: Oribatulidae	No	Yes – Hashem <i>et al.</i> , 1987	Yes – genus is present in Australia (Halliday, 1998)	Non-quarantine pest	No – predatory mite (Hashem <i>et al.</i> , 1987)	
Papilio machaon sphyrus Hübner	Butterfly; common swallowtail; old world swallowtail	Lepidoptera: Papilionidae	Yes – Jeppson, 1989	Yes – Larsen, 1990	No – Nielsen <i>et al.</i> , 1996	Quarantine pest	No – leaf (CAB International, 2000; Jeppson, 1989)	
Parabemisia myricae (Kuwana, 1927) Syn. = [Bermisia myricae Kuwana, 1927]	Japanese bayberry whitefly	Hemiptera: Aleyrodidae	Yes – Swirski <i>et</i> al., 1988	Yes – IIE, 1992; Nada, 1988– 1989	No – Martin, 1999	Quarantine pest	Yes – fruit, leaf (CAB International, 2000; Jeppson, 1989; Uygun <i>et al.</i> , 1990)	Yes
Parlatoria cinerea Hadden	Armoured scale	Hemiptera: Diaspididae	Yes – Gerson, 1977; Jeppson,	No	No – Not listed in Smith <i>et al.</i> ,	Quarantine pest	No – not in Egypt. Branch, fruit, leaf	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
			1989		1997		(CAB International, 2000; Jeppson, 1989)	
Parlatoria crotonis Douglas, 1887	Croton scale	Hemiptera: Diaspididae		Yes – Potential pest on citrus (Hashem & El- Halawany, 1996)	No	Quarantine pest	No – citrus is not listed or published as a host (CAB International, 2000); Not a single published paper reports it attacking citrus	
Parlatoria oleae (Colvee)	Olive scale	Hemiptera: Diaspididae	Yes – on olive (Gerson, 1977; Rosen, 1978)	Yes – Potential pest on citrus (Hashem & El- Halawany, 1996)	No – CAB International, 2000	Quarantine pest	No – citrus is not listed or published as a host (CAB International, 2000); Not a single published paper reports it attacking citrus	
Parlatoria pergandii Comstock, 1881 Syn. = [Paralatoria proctus v. pergandei (Cockerell); Parlatoria pergandei (Cockerell); Parlatoria sinensis Maskell, 1897; Syngenaspis pergandei (Cockerell)]	Chaff scale	Hemiptera: Diaspididae	Yes – Gerson, 1977; Jeppson, 1989	Yes – CIE, 1964b	Yes – QLD (CIE, 1964b; Smith <i>et al.</i> , 1997)	Non-quarantine pest	Yes – fruit, leaf, branches, whole plant (CAB International, 2000; Neubauer, 1980; Smith <i>et al.</i> , 1997)	
Parlatoria ziziphi (Lucas, 1853) Syn. = [Coccus ziziphus Lucas, 1853; Parlatoria lucasii Targioni; Parlatoria zizyphus]	Black parlatoria scale; black scale; ebony scale; leaf black scale	Hemiptera: Diaspididae	Yes – Jeppson, 1989	Yes – CAB International, 2000; CIE, 1964c; Salama <i>et al.</i> , 1985	Yes – NT (CIE, 1964c), but was eradicated a few years ago (AQIS, 1993)	Quarantine pest	Yes – branch, fruit, leaf (Fasulo & Brooks, 1997a; Jeppson, 1989)	Yes
Paropta paradoxa HSchaeff.	Solitary carpenter worm	Lepidoptera: Cossidae	No	Yes – Hashem & El-Halawany, 1996	No – Nielsen <i>et al.</i> , 1996	Quarantine pest	No – branch, stem (Mesbah <i>et al.</i> , 1993)	
Penthimia bella (Stål)	Citrus leafhopper	Hemiptera: Cicadellidae	Yes – Raccha & Bar-Joseph, 1975	No	No – Day & Fletcher, 1994	Quarantine pest	No – not in Egypt. Fruit, leaf (Jeppson, 1989)	
Phyllocnistis citrella Stainton, 1856 Syn. = [Lithocolletis citricola; Phyllocnistis citricola Shiraki]	Citrus leafminer	Lepidoptera: Gracillariidae	Yes – restricted distribution (Argov & Rossler, 1998; CAB	Yes – CAB International, 2000	Yes – NSW, NT, QLD, SA, VIC, WA (Anon., 2001a; CAB	Non-quarantine pest	Yes – fruit mining is very remote; leaf, twig (Jeppson, 1989; Smith <i>et al.</i> , 1997)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
			International, 2000)		International, 2000; Smith <i>et</i> <i>al.</i> , 1997)			
<i>Phyllocoptruta citri</i> Soliman & Abou- Awad, 1978	Eriophyid rust mite	Acarina: Eriophyidae	No	Yes – Soliman & Abou-Awad, 1979	No – Halliday, 1998	Quarantine pest	Yes – fruit, leaf (Soliman & Abou- Awad, 1979)	Yes
Phyllocoptruta oleivora (Ashmead) Syn. = [Eriophyes oleivorus; Phyllocoptes oleivorus; Typhlodromus oleivorus]	Citrus rust mite; Maori mite; predatory mite	Acarina: Eriophyidae	Yes – Szivos et al., 1985	Yes – Attiah <i>et</i> <i>al.</i> , 1973b; CAB International, 2000	Yes – NSW, QLD, SA, VIC (CIE, 1970c; Smith <i>et al.</i> , 1997)	Non-quarantine pest	Yes – lays eggs on fruit; leaf, twig, (Anon., 2001a; CAB International, 2000; Smith <i>et al.</i> , 1997)	
Phytoseius plumifer (Canestrini & Fanzago)	Predatory mite	Acarina: Phytoseiidae	Yes – Wysoki, 1974	Yes – Rasmy & El-Banhawy, 1974	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Rasmy & El- Banhawy, 1974)	
Planococcus citri (Risso, 1813) Syn. = [Coccus citri (Risso); Coccus tuliporum Bouché; Dactylopius brevispinus Targioni Tozzetti; Dactylopius citri (Boisduval); Dactylopius destructor Comstock; Dorthesia citri (Risso); Lecanium phyllococcus Ashmead; Phenacoccus spiniferus Hempel; Planococcus citricus Ezzat & McConnell; Planococcus cubanensis Ezzat & McConnell; Planococcus cucurbitae Ezzat & McConnell; Pseudococcus brevispinus (Targioni Tozzetti); Pseudococcus citri (Risso); Pseudococcus citri var. phenacocciformis Brain; Pseudococcus citricoleorum Marchal]	Citrus mealybug; common mealybug; dompolan mealybug; grape mealybug	Hemiptera: Pseudococcidae	Yes – Jeppson, 1989; Szivos <i>et</i> <i>al.</i> , 1985	Yes – CAB International, 2000; Helal <i>et</i> <i>al.</i> , 2000	Yes – NSW, NT, QLD, SA, VIC (Smith <i>et</i> <i>al.</i> , 1997); WA south of Carnarvon (Anon., 2001a); SA, TAS, VIC (CAB International, 2000)	Non-quarantine pest	Yes – bark, fruit, leaf, twig (Jeppson, 1989); branch, flower, fruit, leaf, trunk, twig (Nestel <i>et al.</i> , 1995; Smith <i>et al.</i> , 1997)	
Prays citri Millière, 1864 Syn. = [Acrolepia citri (Millière); Prays citri (Millière, 1873); Prays nephelomima Meyrick, 1907]	Citrus blossom moth; citrus flower moth; citrus young fruit borer	Lepidoptera: Yponomeutidae	Yes – Peleg, 1986	Yes – CAB International, 2000; El- Dessouki <i>et al.</i> , 1988–1989; Ibrahim & Shahateh, 1984	No – Common, 1990; Nielsen <i>et</i> <i>al.</i> , 1996	Quarantine pest	Yes – fruit, inflorescence (CAB International, 2000)	Yes
Pseudocastalia dopressa G.	Jewel beetle	Coleoptera: Buprestidae	No	Yes – Hashem & El-Halawany,	No	Quarantine pest	No – woody branches (Hashem	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
				1996			& El-Halawany, 1996)	
Pseudococcus comstocki (Kuwana, 1902) Syn. = [Dactylopius comstocki Kuwana, 1902; Pseudococcus comstocki (Kuwana)]	Comstock mealybug; Japanese mealybug	Hemiptera: Pseudococcidae	Yes – Jeppson, 1989	No	No – Ben-Dov, 1994; Smith <i>et</i> <i>al.</i> , 1997	Quarantine pest	No – not in Egypt. Post-harvest, fruit, leaf, stem (CAB International, 2000)	
Pseudococcus cryptus Hempel, 1918 Syn. = [Pseudococcus citriculus Green, 1922]	Citriculus mealybug; cryptic mealybug	Hemiptera: Pseudococcidae	Yes – Jeppson, 1989; Rosen, 1974	No	No – Ben-Dov, 1994; Smith <i>et</i> <i>al.</i> , 1997	Quarantine pest	No – not in Egypt. Roots, aerial parts and post-harvest (CAB International, 2000)	
Pterochloroides persicae (Cholodkovsky) Syn. = [Pterochlorus persicae Cholodkovsky]	Peach black aphid	Hemiptera: Aphididae	Yes – Ciampolini & Martelli, 1977– 1978	Yes – Ciampolini & Martelli, 1977– 1978; Hashem & El-Halawany, 1996	No – CAB International, 2000	Quarantine pest	No – branch, stem (CAB International, 2000)	
Saissetia oleae (Olivier, 1791) Syn. = [Bermardia oleae (Bernard); Chermes oleae (Bernard); Coccus oleae Olivier, 1791; Coccus palmae Haworth, 1812; Coccus testudo Curtis, 1843; Lecanium oleae (Bernard); Lecanium oleae testudo (Curtis); Lecanium palmae (Haworth); Lecanium testudo (Curtis); Neobernardia oleae (Bernard); Parasaissetia oleae (Bernard); Saissetia obae (Bernard)]	Black scale; black shield scale; brown olive scale; citrus black scale; Mediterranean black scale; olive scale; olive soft scale	Hemiptera: Coccidae	Yes – Yarom <i>et</i> <i>al.</i> , 1988	Yes – Ben-Dov, 1993; CIE, 1973	Yes – NSW, QLD, SA, VIC, WA (Smith <i>et</i> <i>al.</i> , 1997); NT, TAS (CAB International, 2000; CIE, 1973)	Non-quarantine pest	Yes – fruit, leaf, twig (Smith <i>et al.</i> , 1997)	
Saniosulus nudus Summers	Predatory mite (Zaher & Gomaa, 1979)	Acarina: Eupalopsellidae	Yes – Rakha & McCoy, 1985	Yes – Rakha & McCoy, 1985	No – Halliday, 1998	Non-quarantine pest	No – predatory mite (Rakha & McCoy, 1985)	
Scolytus amygdali Guer.	Almond bark beetle; shot-hole bark borer	Coleoptera: Scolytidae	Yes – Mendel & Gurevitz, 1985	Yes – Hashem & El-Halawany, 1996	No	Quarantine pest	No – bark, wood (Mendel & Gurevitz, 1985)	
Siteroptes sp.	Mite	Acarina: Siteropteridae	No	Yes – Abo- Korah, 1980– 1981	Yes – genus is present in Australia (Halliday, 1998)	Non-quarantine pest	No – soil (Abo- Korah, 1980–1981)	
Stathmopoda auriferella (Walker) Syn. =	Apple heliodinid	Lepidoptera: Oecophoridae	No	Yes – Badr <i>et</i> <i>al.</i> , 1986	No – Nielsen <i>et</i> <i>al.</i> , 1996	Quarantine pest	Yes – fruit (Badr <i>et</i> <i>al.</i> , 1986; Park <i>et</i> <i>al.</i> , 1994)	Yes

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
[Stathmopoda adulatrix Meyrick]								1.1
Tarsonemus bilobatus Suski, 1965 Syn. = [Lupotarsonemus bilobatus (Suski)]	Tarsonemid mite	Acarina: Tarsonemidae	No	Yes – Abo- Korah, 1980– 1981	No – Halliday, 1998	Quarantine pest	Yes – Possible phytophagous pest, litter (Abo-Korah, 1980–1981)	Yes
<i>Tetraleurodes neemani</i> (Bink-Moenen & Gerling, 1990)	Whitefly	Homoptera: Aleyrodidae	Yes – Bink- Moenen & Gerling, 1990	No	No	Quarantine pest	No – not reported in Egypt	
Tetranychus neocaledonicus (Marc Andre, 1933) Syn. = [Eotetranychus neocaledonicus; Tetranychus cucurbitae; Tetranychus equatorius]	Vegetable spider mite	Acarina: Tetranychidae	No	Yes – Soliman et al., 1973	Yes – CAB International, 2000; Halliday, 1998); NSW, QLD (Davis, 1968); NSW (Gutierrez & Schicha, 1983); NT (Anon., 2001a)	Non-quarantine pest	No – leaf (Jeppson et al., 1975)	
Tetranychus urticae Koch, 1836 Syn. = [Eotetranychus scabrisetus; Epitetranychus althaeae; Epitetranychus bimaculatus; Epitetranychus telarius; Paratetranychus althaeae von Hanstein; Tetranychus althaeae von Hanstein; Tetranychus bimaculatus Harvey; Tetranychus fragariae; Tetranychus manihotis; Tetranychus russeolus; Tetranychus scabrisetus Tetranychus telarius]	glasshouse red spider mite; green house red spider mite; hop red spider mite; two- spotted spider mite	Acarina: Tetranychidae	Yes – Anon., 1981	Yes – Atwa <i>et</i> <i>al.</i> , 1987	Yes – Halliday, 1998; NSW, QLD, SA, TAS, VIC, WA (IIE, 1999)	Non-quarantine pest	No – leaf (CAB International, 2000; Halliday, 1998)	
Trialeurodes vaporariorum Westwood, 1856 Syn. = [Aleurochiton vaporariorum; Aleurodes papillifer Maskell; Aleurodes vaporariorum; Aleyrodes sonchi Kotinsky; Aleyrodes vaporariorum Westwood 1856; Asterochiton vaporariorum Westwood; Dialeurodes vaporariorum; Trialeurodes mossopi; Trialeurodes natalensis; Trialeurodes	Glasshouse whitefly; greenhouse whitefly	Hemiptera: Aleyrodidae	Yes – Berlinger, 1980	Yes – Nada, 1988–1989	Yes – ACT, NSW, NT, QLD, SA, TAS, VIC, WA (Martin, 1999)	Non-quarantine pest	No – inflorescence, leaf, pod, whole plant (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
sonchi Kotinsky]								-
Tuckerella nilotica Zaher & Rasmy, 1969	Ornate false spider mite; peacock mite; tuckerellid mite	Acarina: Tuckerellidae	No	Yes – Hashem & El-Halawany, 1996; Zaher & Rasmy, 1969	No – Halliday, 1998	Quarantine pest	Yes – buds and fruit of citrus (Rasmy & Abou-Awad, 1984)	Yes
Tydeus californicus (Banks) Syn. = [Orthotydeus californicus; Tetranychoides californicus]	Mite	Acarina: Tydeidae	No	Yes – CAB International, 2000; Rizk <i>et</i> <i>al.</i> , 1978–1979	Yes – Halliday, 1998; Smith <i>et</i> <i>al.</i> , 1997	Non-quarantine pest	Yes – fruit, leaf (Smith <i>et al.</i> , 1997)	
<i>Typhlodromus tetramedius</i> Zaher & Shehata, 1970	Predatory mite	Acarina: Phytoseiidae	No	Yes – Zaher & Shehata, 1970	No – Halliday, 1998	Non-quarantine pest	No – predatory mite	
Nematodes								
<i>Belondira brevibulba</i> Ferris, Ferris & Goseco	Nematode	Nematoda: Belondiridae	No	Yes – Ferris et al., 1983	No	Quarantine pest	No – soil (Ferris <i>et al.</i> , 1983)	
Paratylenchoides israelensis Ruski	Nematode	Tylenchida: Paratylenchidae	Yes – Raski, 1973	No	No	Quarantine pest	No – root, soil (Raski, 1973)	
Thiernchulus sp.	Nematode	Tylenchida: Paratylenchidae	No	Yes – Anon., 2000	No	Quarantine pest	No – root	
Tylenchulus semipenetrans Cobb, 1913	Citrus nematode; citrus root nematode; root nematode; slow decline nematode	Tylenchida: Tylenchulidae	Yes – CAB International, 2000; Cohn & Mordechai, 1973	Yes – Abdul- Magid, 1980; Badra & Shafiee, 1979; CAB International, 2000	Yes – CAB International, 2000); NSW (Anderson, 1965); NT Anon., 2001c); QLD (Colbran, 1955); SA, VIC, WA (Meagher, 1969)	Non-quarantine pest	No – leaf, root (Cohn & Mordechai, 1973)	
Xiphinema brevicolle Lordello & Da Costa 1961	Dagger nematode	Dorylaimida: Longidoridae	Yes – Insera & Vovlas, 1977; Mor & Spiegel, 1998	No	Yes – NSW, VIC (Anon., 2001c; McLeod <i>et al.</i> , 1994)	Non-quarantine pest	No – root	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Xiphinema index Thorne & Allen	Dagger nematode	Dorylaimida: Longidoridae	Yes – Insera & Vovlas, 1977	No	Yes – (CAB International, 2000); VIC (McLeod <i>et al.</i> , 1994)	Non-quarantine pest	No – root	
Xiphinema israeliae Luc et al.	Dagger nematode	Dorylaimida: Longidoridae	Yes – Luc <i>et al.</i> , 1982	No	No	Quarantine pest	No – root	
Bacteria								
Spiroplasma citri Saglio et al., 1973	Citrus stubborn disease; little leaf of citrus	Mycoplasmatales: Mycoplasmatacea e	Yes – CAB International, 2000; Klein, 1989; Yarom <i>et</i> <i>al.</i> , 1988	Yes – Fudl- Allah & Nour- Eldin, 1979; Nour-Eldin, 1959	No – CAB International, 2000	Quarantine pest	No – plant materials, transmitted by leafhopper vectors (CAB International, 2000)	
Fungi								
Alternaria alternata (Fr:Fr.) Keissl. Syn. = [Alternaria alternata f.sp. fragariae Dingley; Alternaria alternata f.sp. lycopersici. Grogan et al.; Alternaria fasciculata (Cooke & Ellis) Jones & Grout; Alternaria tenuis Nees; Macrosporium fasciculatum Cooke & Ellis; Macrosporium maydis (Cooke & Ellis)]	Alternaria leaf spot; brown spot	Mitosporic fungi Dothideales: Pleosporaceae	Yes – Solel, 1991	Yes – CAB International, 2000	Yes – NSW, QLD (Anon., 2001c); NT (unconfirmed) (CAB International, 2000); WA (Shivas, 1989)	Non-quarantine pest	Yes – fruit, leaf (Anon., 2001c)	
<i>Alternaria citri</i> Ellis & N. Pierce in N. Pierce	Black rot; fruit drop; navel end rot; stalk end rot	Mitosporic fungi Dothideales: Pleosporaceae	Yes – Ellis, 1971; Schiffman <i>et al.</i> , 1983; Solel <i>et</i> <i>al.</i> , 1997	Yes – Ellis, 1971; El-Zayat <i>et al.</i> , 1983; Tarabeih <i>et al.</i> , 1977	Yes – NSW, QLD (CAB International, 2000); NSW, QLD, SA, VIC, WA (Anon., 2001c); NT (Pitkethley, 1998); WA (Shivas, 1989)	Non-quarantine pest (post-harvest)	Yes – flowering, fruiting and post- harvest stages; fruit, leaf (Anon., 2001c); fruit (Schiffman <i>et</i> <i>al.</i> , 1983)	
Aspergillus niger Van Tiegh Syn. = [Aspergillus ficuum (Reichardt) Thom & Church; Aspergillus phoenicis (Corda) Thom; Sterigmatocystis niger Tiegh]	Black mould	Mitosporic fungi Eurotiales: Trichocomaceae	Yes – Grinstein et al., 1992	Yes – Moharram <i>et</i> <i>al.</i> , 1989	Yes – Nair, 1985; NT, VIC (Anon., 2001c)	Non-quarantine pest	Yes – flowering, vegetative and fruiting stage; post- harvest stage; seedling stage (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Aspergillus flavus Link Syn. = [Aspergillus fasciculatum Batista & H. Maia; Aspergillus flavus f. magnasporus (Sakag. & G. Yamada) Nehira; Aspergillus flavus var. wehmeri (Costantin & Lucet) Blochwitz; Aspergillus humus E.V. Abbott; Aspergillus luteus (Tiegh.) C.W. Dodge; Aspergillus parasiticus Speare; Aspergillus wehmeri Costantin & Lucet]	Aspergillus rot	Mitosporic fungi Eurotiales: Trichocomaceae	Yes – cosmopolitan (CAB International, 2000)	Yes – cosmopolitan (CAB International, 2000)	Yes – cosmopolitan (CAB International, 2000)	Non-quarantine pest (post-harvest fruit rot)	Yes – flowering, vegetative and fruiting stage; post- harvest stage; seedling stage (CAB International, 2000)	
Aspergillus ochraceus Wilhelm		Mitosporic fungi Eurotiales: Trichocomaceae	Yes – Paster, <i>et al.</i> , 1979	Yes – CAB International, 2000; Moubasher, 1972	Yes	Non-quarantine pest (post-harvest)	Yes	
Botryodiplodia theobromae Pat. [anamorph] Syn. = [Botrydiplodia ananassae (Sacc.) Petr.; Botrydiplodia elasticae Petch; Botrydiplodia gossypii Ellis & Barthol.; Botrydiplodia tubericola (Ellis & Everh.) Petr.; Botryosphaeria rhodina (Cooke) Arx (teleomorph); Chaetodiplodia grisea Petch; Diplodia ananassae Sacc.; Diplodia cacaoicola Henn; Diplodia gossypina Cooke; Diplodia natalensis Pole Evans; Diplodia tubericola (Ellis & Everh.) Taubenh.; Lasidiplodia tubericola Ellis & Everh.; Lasiodiplodia theobromae (Pat.) Griffiths & Maubl. (anamorph); Lasiodiplodia triflorae B.B. Higgins; Macrophomina vestita Prillinger & Delacr.; Physalospora rhodina Berk. & M.A. Curtis (teleomorph)]	Diplodia pod rot (brown pod rot)	Mitosporic fungi Dothideales: Botryosphaeriacea e	Yes – CMI, 1985a	Yes – Anon., 2000; CMI, 1985a	Yes – CMI, 1985a; NSW (Anon., 1995); NT (Pitkethley, 1998); SA (Cook & Dube, 1989); WA (Shivas, 1989)	Non-quarantine pest (post-harvest)	Yes – flowering, vegetative, fruiting and post-harvest stages (CAB International, 2000)	
Capnodium citricolum McAlpine Syn. = [Limacinula citricola (McAlpine) Speg.]	Sooty mould	Capnodiales: Capnodiaceae	Yes – Grasso & Polizzi, 1988	Yes – Anon., 2000	Yes – Anon., 2001b; CAB International, 2000; Smith <i>et</i>	Non-quarantine pest	Yes – fruit, leaf, twigs (Smith <i>et al.</i> , 1997)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for	Present on the importation	Management options
						Australia	pathway (Egypt)	required
					al., 1997; NSW (Anon., 1995); SA (Cook & Dube, 1989); VIC (Chambers, 1980); WA (Shivas, 1989)			
Chaetothyrium citri Arn. Fisher	Citrus sooty mould	Dothideales: Chaetothyriaceae	No	Yes – Anon., 2000	No	Non-quarantine pest (post-harvest)	Yes – fruit, leaf (Jlin <i>et al.</i> , 1988)	
Colletotrichum gloeosporioides (Penz.) Penz. & Sacc. Syn. = [Glomerella cingulata (Stone) Spaulding & Schenk (teleomorph)]	Anthracnose strain	Mitosporic fungi Phyllachorales: Phyllachoraceae	Yes – Oren & Solel, 1978	Yes – Wahid, 1999	Yes – NSW (Anon., 1995); QLD (Simmonds, 1966); SA (Cook & Dube, 1989); VIC (Chambers, 1980); WA (Shivas, 1989)	Non-quarantine pest (post-harvest)	Yes – fruit (CAB International, 2000; Oren & Solel, 1978)	
Corticium rolfsii Curzi [teleomorph] Syn. = [Athelia rolfsii (Curzi) C.C. Tu & Kimbr [teleomorph]; Botryobasidium rolfsii (Saccardo) Venkat.; Corticium centrifugum [Lev'.) Bresad.; Hypochnus centrifugus (Lev'.)Tul.; Pellicularia rolfsii (Curzi) E. West (teleomorph); Sclerotium rolfsii Sacc. (teleomorph); Sclerotium rolfsii var. rolfsii Saccardo]	Collar rot; sclerotium rot; damping-off	Stereales: Corticiaceae	Yes – IMI, 1992	Yes – Abdel- Hak <i>et al.</i> , 1973; Anon., 2000	Yes – NSW, NT, QLD, SA, TAS, VIC, WA (IMI, 1992)	Non-quarantine pest	Yes – fruit, inflorescence, leaf, root, seed, vegetative parts, whole plant (CAB International, 2000)	
Debaryomyces hansenii (Zopf) Lodder & Kreger-van Rij	Sour rot	Saccharomycetale s: Saccharomycetace ae	Yes – Chalutz & Wilson, 1990	Yes – Moawad <i>et al.</i> , 1986	Yes – NSW (Praphailong & Fleet, 1997)	Non-quarantine pest	Yes – fruit	
Dematophora necatrix Hartig Syn. = [Rosellinia necatrix Prill (teleomorph)]	White root rot; Dematophora root rot	Xylariales: Xylariaceae	Yes – Sztejnberg & Madar, 1980	No	Yes – TAS (CAB International, 2000); WA (Shivas, 1989)	Non-quarantine pest	No – root (Sztejnberg & Madar, 1980)	
Diaporthe citri F.A. Wolf [teleomorph] Syn. =	Gummosis melanose of citrus; Phomopsis	Diaporthales: Valsaceae	Yes – CAB International, 2000; Grasso &	Yes – Anon., 2000; CAB International,	Yes – cosmopolitan (CAB	Non-quarantine pest	Yes – fruit, leaf, stem (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
[<i>Phomopsis citri</i> H.S. Fawcett (anamorph); <i>Phomopsis californica</i> H.S. Fawcett; <i>Phomopsis caribaea</i> W.T. Horne; <i>Phomopsis cytosporella</i> Penz & Sacc.)]	stem-end rot; stem-end rot of citrus		Polizzi, 1988	2000	International, 2000); NSW, NT, QLD, SA, VIC (CAB International, 2000)			
Gibberella fujikuroi (Sawada) S. Ito [teleomorph] Syn. = [Fusarium moniliforme Sheldon (anamorph); Gibberella moniliforme (teleomorph); Lisea fujikuroi Sawada]	Stem end rot	Hypocreales: Hypocreaceae	Yes – Joffe & Schiffmann, 1972; Joffe <i>et</i> <i>al.</i> , 1973	Yes – Abdel- Hak <i>et al.</i> , 1973	Yes – restricted distribution – NSW, QLD, SA, VIC, WA (IMI, 1990); NT (Heaton & Morschel, 1965)	Non-quarantine pest	Yes – fruit (Joffe & Schiffmann, 1972); fruit, leaf, root, stem, whole plant (CAB International, 2000)	
Fusarium oxysporum Schlechtendahl Syn. = [Fusarium oxysporum var. orthocerus]	Stem end rot	Hypocreales: Hypocreaceae	Yes – Joffe & Schiffmann, 1972; Joffe <i>et</i> <i>al.</i> , 1973	Yes – CAB International, 2000	Yes – NSW, QLD (Moore <i>et</i> <i>al.</i> , 1993); NT (Pitkethley, 1998); SA (Cook & Dube, 1989); VIC (Chambers, 1980); WA (Shivas, 1989)	Non-quarantine pest	Yes – fruit (Joffe & Schiffmann, 1972)	
Geotrichum candidum var. citri-aurantii (Ferraris) Sacc. & Sydow [anamorph] Syn. = [Oospora citri-aurantii (Ferraris) Sacc. & Sydow]	Fruit rot; oospora rot; sour rot	Saccharomycetale s: Dipodascaceae	Yes – CAB International, 2000; Chalutz & Wilson, 1990; Hershenhorn <i>et</i> <i>al.</i> , 1992	Yes – Tarabeih et al., 1977	Yes – NSW (Anon., 1979); NT, SA (Hall, 1973); QLD (Anning, 1973); VIC (Anon., 1973); WA (Shivas, 1989)	Non-quarantine pest	Yes – fruit (Anon., 2000)	
Hendersonula toruloidea Nattrass	Gummosis disease	Mitosporic fungi	Yes – Achilea & Sztejnberg, 1975	No	No	Quarantine pest	No – branch, trunk (Achilea & Sztejnberg, 1975)	
Macrophomina phaseolina (Tassi.) Goida'nich Syn. = [Botrydiplodia phaseoli (Maubl.) Thirum; Dothioriella cajani Syd., P. Syd. & E.J. Butl.; Macrophoma cajani Syd., P. Syd. & E.J. Butl.; Macrophoma corchori Sawada; Macrophoma phaseoli	Fruit rot	Mitosporic fungi	Yes – CMI, 1985b; Lisker <i>et</i> <i>al.</i> , 1994; Minz & Gutter, 1949	Yes – Anon., 2000	Yes – NSW, QLD, SA, TAS, WA (CMI, 1985b); VIC (Trimboli & Burgess, 1985)	Non-quarantine pest	Yes – flower, fruit, vegetative stage, post-harvest (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Maubl.; Macrophoma phaseolina Tassi; Macrophoma sesami Sawada; Macrophomina phaseoli (Maubl.) S.F. Ashby; Macrophomina philippines Petr.; Rhizoctonia bataticola (Taubenh.) E.J. Butler (anamorph); Rhizoctonia lamellifera Small; Sclerotium bataticola Taubenh.)]								
Nectria haematococca (Wollenw.) Gerlach [teleomorph] Syn. = [Fusarium solani (Martius) Saccardo (anamorph); Fusarium solani var. martii (Appel & Wollenw. Wollenw.); Fusarium solani var. striatum (Sherbakov Wollenw.)]	Stem end rot	Hypocreales: Hypocreaceae	Yes – Joffe & Schiffmann, 1972	Yes – Minessy et al., 1974	Yes – cosmopolitan (CAB International, 2000)	Non-quarantine pest	Yes – fruit, root (Joffe & Schiffmann, 1972)	
Penicillium digitatum (Pers. ex Fr.) Sacc. Syn. = [Monilia digitata Pers.: Fr.; Penicillium olivaceum var. norvegicum Sopp; Penicillium digitatoides Peyronel; Penicillium lanosogrisellum Biourge; Penicillium olivaceum var. italicum Sopp; Penicillium olivaceum var. olivaceum; Penicillium olivaceum Wehmer]	Fruit decay; green mould (Carne, 1925b)	Mitosporic fungi	Yes – Gutter, 1975	Yes – Isshak <i>et</i> al., 1974	Yes – NSW (Rippon & Wild, 1974); QLD (Muirhead, 1974); SA (CAB International, 2000; Cook & Dube, 1989); VIC (Chambers, 1980); WA (Shivas, 1989)	Non-quarantine pest	Yes – fruit, post- harvest (Gutter, 1975)	
Penicillium italicum Wehmer Syn. = [Penicillium digitatum var. latum S. Abe: Penicillium japonicum G. Sm.; Penicillium ventruosum Westling]	Blue mould (Carne, 1925b); blue rot; fruit decay	Mitosporic fungi	Yes – Gutter, 1975	Yes – Isshak <i>et</i> <i>al.</i> , 1974	Yes – NSW (Rippon & Wild, 1974); QLD (Muirhead, 1974); SA (CAB International, 2000; Cook & Dube, 1989; Tugwell, 1974); VIC (Chambers, 1980); WA	Non-quarantine pest	Yes – fruit, post- harvest (Gutter, 1975)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Pestalotiopsis versicolor (Speg.) Steyart 1949 [anamorph]	Citrus leaf spot	Mitosporic fungi	No	Yes – Anon., 2000	(Shivas, 1989) No – some Pestalotiopsis sp. associated with leaf spot is present in NSW (Anon., 1995, 2001c); QLD (Simmonds, 1966)	Non-quarantine pest	No – leaf (Anon., 1995, 2001c)	
Phoma tracheiphila (Petri) Kantachveli & Gikachvili Syn. = [Bakerophoma tracheiphila (Petri) Cif.; Deuterophoma tracheiphila Petri]	Citrus mal secco; mal secco disease; wilt of citrus	Mitosporic fungi	Yes – Anon., 1974; CAB International, 2000; Solel, 1976	No	No – CAB International, 2000	Quarantine pest	No – not reported in Egypt. Leaf, stem (CAB International, 2000)	
Phytophthora sp.	Gummosis; root rot	Pythiales: Pythiaceae	Yes – CAB International, 2000	Yes – Minessy et al., 1974	Yes – NSW – P. solani (Anon., 1995); NSW, NT – P. nicotianae (Anon., 1995; Pitkethley, 1998); SA – P. hibernalis (Cook & Dube, 1989); WA – P. citricola (Shivas, 1989)	Non-quarantine pest	No – root (Anon., 2001c)	
Phytophthora citrophthora (R.H. Sm. & E. Sm.) Leonian	Brown rot of citrus; foot rot of citrus	Pythiales: Pythiaceae	Yes – CAB International, 2000	Yes – Anon., 2000; CAB International, 2000	Yes – NSW, QLD, SA, VIC, TAS, WA (CAB International, 2000); NSW (Anon., 1995); QLD (Simmonds, 1966); SA (Cook & Dube, 1989); TAS (Samson & Walker, 1982);	Non-quarantine pest	Yes – fruit, post- harvest; vegetative growing stage (Anon., 2001c; CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for	Present on the importation	Management options
						Australia	pathway (Egypt)	required
					VIC (Chambers, 1980); WA (Shivas, 1989)			
Phytophthora hibernalis Carne	Brown rot; leaf blight	Pythiales: Pythiaceae	Yes – Oren & Solel, 1978	No	Yes – NSW (Anon., 1995); SA (Cook & Dube, 1989); VIC (Chambers, 1980); WA (Shivas, 1989)	Non-quarantine pest	Yes – fruit, leaf (Anon., 2001c)	
Phytophthora nicotianae Breda de Haan var. parasitica (Breda de Haan) Tucker Syn. = [Phytophthora allii Sawada; Phytophthora formosana Sawada; Phytophthora imperfecta var. nicotianae (Breda de Haan) Sarej.; Phytophthora lycopersici Sawada; Phytophthora manoana Sideris; Phytophthora melongenae Sawada; Phytophthora nicotianae var. parasitica (Dastur) G.M. Waterh.; Phytophthora parasitica Dastur; Phytophthora parasitica var. nicotianae (Breda de Haan) Tucker; Phytophthora parasitica var. piperina Dastur; Phytophthora parasitica var. rhei G.H. Godfrey; Phytophthora ricini Sawada; Phytophthora tabaci Sawada; Phytophthora terrestris Shreb]	Shoot rot; stem blight	Pythiales: Pythiaceae	Yes – Oren & Solel, 1978	Yes – Satour <i>et</i> <i>al.</i> , 1991	Yes – NSW (Anon., 1995); NT (Pitkethley, 1998); QLD (Simmonds, 1966); SA (Cook & Dube, 1989)	Non-quarantine pest	No – Anon., 2001c	
Pythium aphanidermatum (Edson) Fitzp.	Black leg of seedlings; collar rot; damping-off of seedlings; damping-off; stem rot of seedlings; water rot	Pythiales: Pythiaceae	Yes – CAB International, 2000; CMI, 1978	Yes – CAB International, 2000; CMI, 1978	Yes – CAB International, 2000; NSW, NT, QLD, SA (CMI, 1978); WA (Shivas, 1989)	Non-quarantine pest	No – seedling, vegetative; pre- emergence (Anon., 2001c; CAB International, 2000)	
Pythium irregulare Buisman Syn. = [Pythium dactyliferum Drechs. In Rands; Pythium fabae Cheney; Pythium polymorphon Sideris]	Gummosis; root rot	Pythiales: Pythiaceae	Yes – CAB International, 2000; CMI, 1986	Yes – CAB International, 2000; CMI, 1986	Yes – NSW, QLD, SA, TAS, VIC, WA (CMI, 1986); NSW, QLD, SA, VIC, WA (CAB	Non-quarantine pest	No – root (CAB International, 2000)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
					International, 2000); SA (Cook & Dube, 1989); WA (Anon., 2001c; Shivas, 1989)			
Pythium oligandrum Drechsler	Root rot	Pythiales: Pythiaceae	Yes – Ali, 1985; CAB International, 2000	Yes – Abdelzaher <i>et</i> <i>al.</i> , 1997	Yes – CAB International, 2000; QLD (Simmonds, 1966); WA (Shivas, 1989)	Non-quarantine pest	No – used as a biological fungicide in glasshouses, outdoor vegetables, cereals and non- food tree crops (Anon., 2001c)	
Pythium ostracodes Drechs.	Gummosis; root rot	Pythiales: Pythiaceae	No	Yes – Minessy et al., 1974	No	Quarantine pest	No – root (Minessy et al., 1974)	
Pythium rostratum E.J. Butler Syn. = [Pythium diameson Sideris]	Root rot	Pythiales: Pythiaceae	Yes – Ali, 1985	No	Yes – SA (Anon., 2001c; Cook & Dube, 1989)	Non-quarantine pest	No – citrus soil, root (Ali, 1985)	
Pythium ultimum (Trow)	Root rot	Pythiales: Pythiaceae	Yes – Ali, 1985	Yes – Abdelzaher <i>et</i> <i>al.</i> , 1997; Shatla <i>et al.</i> , 1974	Yes – NSW (CAB International, 2000); SA (Cook & Dube, 1989); WA (Shivas, 1989)	Non-quarantine pest	No – citrus soil, root (Ali, 1985)	
Rhizoctonia solani [anamorph]Syn. =[Corticium areolatum (teleomorph);Corticium solani (Prillieux & Delacroix)Bourdot & Galzin (teleomorph);Corticium vagum Berk. & Curt.(teleomorph); Hypochnus aderholdiiKolosh. (teleomorph); Hypochnuscucumeris Frank (teleomorph);Hypochnus sasakii Shirai (teleomorph);Hypochnus solani Prillieux & Delacroix(teleomorph); Moniliopsis solani (Kuhn)R.T. Moore; Pellicularia filamentosa(Pat.) Rogers (teleomorph); Pelliculariafilamentosa f. sasakii (Pat.) Rogers(teleomorph); Rhizoctonia aderholdii	Damping-off; fruit rot; root rot	Stereales: Corticiaceae	Yes – CAB International, 2000	Yes – El- Azouni <i>et al.</i> , 1969	Yes – SA (Cook & Dube, 1989); QLD (Simmonds, 1966)	Non-quarantine pest	No – root (Anon., 2001c)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
Kolosch (anamorph); <i>Rhizoctonia</i> <i>microsclerotia</i> (anamorph); <i>Sclerotium</i> <i>irregulare</i> Miyake (anamorph); <i>Thanatephorus cucumeris</i> (Frank) Donk (teleomorph)]								
Sclerotinia sclerotiorum (Lib.) de Bary Syn. = [Peziza sclerotium Lib.; Sclerotinia libertiana Fuckel; Sclerotium varium Pers.; Whetzelinia sclerotiorum (Lib.) Korf & Dumont]	Base rot; calyx rot; cottony rot; fruit green rot; seedling stem blight; seedling stem rot; shoot blight; stem rot; twig blight; white mould	Leotiales: Sclerotiniaceae	Yes – CAB International, 2000; El- Goorani & Sommer, 1979	Yes – Anon., 2000; CAB International, 2000	Yes – NSW, SA, VIC, WA (Anon., 2001c); QLD (CAB International, 2000; Simmonds, 1966); TAS (CAB International, 2000)	Non-quarantine pest	Yes – fruit (El- Goorani & Sommer, 1979)	
Trichoderma viride Pers. ex S.F. Gray	Trichoderma rot	Hypocreales: Hypocreaceae	Yes – Gutter, 1963	Yes – El- Zawahry <i>et al.</i> , 2000	Yes – NSW (Anon., 1995); NT (Pitkethley, 1998); QLD (Simmonds, 1966); SA (Cook & Dube, 1989); VIC (Chambers, 1980); WA (Shivas, 1989)	Non-quarantine pest	Yes – fruit (Gutter, 1963); soil	
Viruses								
Citrus impietratura disease	Citrus impietratura virus; impietratura of citrus	Unassigned virus	Yes – Bar- Yossef <i>et al.</i> , 1970	No	No – CAB International, 2000	Quarantine pest	No – bark, leaf (Bar-Yossef <i>et al.</i> , 1970); budwood, seed (Oren & Golomb, 1988)	
Citrus psorosis complex	Psorosis; citrus ringspot virus; citrus scaly bark	Ilavirus: Bromoviridae	Yes – Bar- Joseph & Ben- Shalom, 1993	Yes – Anon., 2000	Yes – CAB International, 2000; NSW, QLD, SA, VIC, WA (Anon., 2001c)	Non-quarantine pest	No – bark (Anon., 2001c)	
Citrus tristeza <i>closterovirus</i> (CTV) Syn. = [Citrus decline virus; Citrus quick	Citrus tristeza; citrus tristeza disease; CTV- strain; grapefruit	Closteroviridae	Yes – Bar- Joseph <i>et al.</i> , 1972	Yes – CAB International, 2000; Nour- Eldin, 1959	Yes – CAB International, 2000; NSW, QLD, SA, VIC,	Non-quarantine pest	No – bark (Anon., 2001c; Bar-Joseph <i>et al.</i> , 1989)	

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia	Quarantine status for Australia	Present on the importation pathway (Egypt)	Management options required
decline virus; grapevine A virus; citrus seedling yellow virus; grapefruit stem pitting virus; grapefruit stunt bush virus; line die-back virus; Ellendale mandarin decline virus]	stem pitting; bud- union decline of citrus; kassaku dwarf virus; line dieback disease; mal secco; pummelo yellow dwarf; quick decline of citrus; sweet orange stem pitting				WA (Anon., 2001c); NT (CAB International, 2000)			
Viroids								
Citrus bent leaf viroid (CBLVd)		Apscaviroid	Yes – Ashulin et al., 1991	No	No	Quarantine pest	No – plant parts	
Citrus cachexia viroid Syn. = [Citrus cachexia viroid; citrus xyloporosis 'viroid']	Citrus cachexia; citrus little leaf; xyloporosis of citrus	Hostuviroid	Yes – CAB International, 2000	Yes – Anon., 2000; CAB International, 2000; Knorr, 1961; Nour- Eldin, 1959	Yes – NSW (Anon., 2001c)	Non-quarantine pest	No – plant parts (Anon., 2001c)	
Citrus exocortis viroid	Citrus scaly butt; citrus exocortis	Pospiviroidae	Yes – CAB International, 2000; Gafny <i>et</i> <i>al.</i> , 1995	Yes – Anon., 2000; Bové, 1995; CAB International, 2000	Yes – CAB International, 2000); NSW, QLD, SA, VIC (Anon., 2001c); NT (CAB International, 2000)	Non-quarantine pest	No – Anon., 2001c. Affects trees on <i>Poncirus trifoliata</i> root stock only	
Citrus viroid IV (CVd IV)	Citrus gummy bark viroid – for both CVd-Ib and CVd-IV (Onelge, 1996)	Cocadviroid	Yes – Puchta <i>et</i> <i>al.</i> , 1991	Yes – El- Dougdoug <i>et</i> <i>al.</i> , 1997; Nour- Eldin, 1959	No	Quarantine pest	No – bark, leaf, scion (El-Dougdoug <i>et al.</i> , 1997)	
Hop stunt viroid (HSVd)		Hostuviroid	Yes – Puchta <i>et</i> <i>al.</i> , 1989	No	Yes – Gillings et al., 1988	Non-quarantine pest	No – plant parts	

Acronyms:

ACT – Australian Capital Territory; NSW – New South Wales; NT – Northern Territory; QLD – Queensland; SA – South Australia; TAS – Tasmania; VIC – Victoria; WA – Western Australia

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APPENDIX 2: GASTROPODS (SNAILS) REPORTED IN EGYPT AND ISRAEL

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia
Acicula parcel ineata palaestinensis	Desert snail	Stylommatophora:	Yes – Forcart,		
(Forcart, 1981)	Descrit and 1	Aciculidae	1981		
1804)	Desert shall	Stylommatophora: Enidae	res - Nevo et al., 1982		
Calaxis gracilis (Forcart, 1981)	Desert snail	Stylommatophora:	Yes – Forcart,		
		Ferussaciidae	1981		
Caracollina lenticula (Michaud, 1831)	Desert snail	Stylommatophora: Hygromidae	Yes – Heller, 1984		
<i>Cecilioides genezarethensis</i> (Forcart, 1981)	Desert snail	Stylommatophora: Ferussaciidae	Yes – Forcart, 1981		
<i>Cernuella (Microxeromagna) arrouxi</i> (Bourguignat, 1863)	Desert snail	Stylommatophora: Helicidae	Yes – Mienis, 1987b		
Cochlicella acuta (Muller, 1774)	Pointed snail; small conical snail	Stylommatophora: Helicidae		Yes – citrus orchards (Nakla <i>et al.</i> , 1997)	Yes – Baker, 1986; Smith, 1992
<i>Ena (Turanena) hermonensis (</i> Forcart, 1981)	Desert snail	Stylommatophora: Enidae	Yes – Forcart, 1981		No
Eobania vermiculata (Muller, 1774)	Chocolate-band snail	Stylommatophora: Helicidae	Yes – Mienis, 1979	Yes – citrus orchards (Nakla <i>et al.</i> , 1997)	Yes – Smith, 1992
<i>Eremina desertorum</i> (Forkal, 1775)	Desert snail	Stylommatophora: Helicidae	Yes – Heller, 1984	Yes – El- Kassas <i>et al.</i> , 1993	No
Eremina ehrenbergi (Roth, 1839)	Land snail	Stylommatophora: Helicidae		Yes – Essawy, 1993	No
Euchondrus (Jaminia) albulus Mousson	Land snail	Stylommatophora: Enidae	Yes – Zaady <i>et</i> <i>al.</i> , 1996		No
Euchondrus desertorum (Rochanaburananda, 1881) Granot, 1986	Land snail	Stylommatophora: Enidae	Yes – Granot, 1986		No
Euchondrus (Jaminia) saulcyi (Bourguignat, 1852)	Land snail	Stylommatophora: Enidae	Yes – Mienis, 1981		No
Euchondrus haasi (Forcart, 1981)	Land snail	Stylommatophora: Enidae	Yes – Forcart, 1981		No
<i>Euchondrus pseudovularis</i> (Forcart, 1981)	Land snail	Stylommatophora: Enidae	Yes – Forcart, 1981		No
Euchondrus ramoensis (Granot, 1988)	Land snail	Stylommatophora: Enidae	Yes – Forcart, 1981; Granot, 1986		No
Euchondrus (Jaminia) saulcyi (Bourguignat, 1852)	Land snail	Stylommatophora: Enidae	Yes – Mienis, 1981		No
Euchondrus septemdentatus (Roth, 1839)	Land snail	Stylommatophora: Enidae	Yes – Mienis, 1994		No
Euchondrus sulcidens	Land snail	Stylommatophora: Enidae	Yes – Mienis, 1987b		No
Granopupa granum (Draparnaud, 1801)	Land snail	Stylommatophora: Chrondrinidae	Yes – Heller, 1984		No
Helix aspersa (Muller 1774)	Brown garden snail; common	Stylommatophora: Helicidae		Yes – Zidan <i>et al.</i> , 1997	Yes – Smith, 1992
Syn. = [Cryptomphalus asperus]	garden snail				
Helix (Pelasga) engaddensis (Bourguignat, 1852)	Land snail	Stylommatophora: Helicidae	Yes –Mienis, 1988		No
Helix (Helix) lucorum (Linnaeus, 1758)		Stylommatophora: Helicidae	Yes – Mienis, 1979		No
Jaminia ovularis (Olivier, 1801) Syn. = [Euchondrus ovularis]	Desert snail	Stylommatophora: Enidae	Yes – Heller & Tchernov, 1978; Mienis, 1980		No

Scientific name	Common name(s)	Order/Family	Present in Israel	Present in Egypt	Present in Australia
Levantina spiriplana hierosolyma (Mousson, 1854)	Land snail	Stylommatophora: Helicidae	Yes – Heller, 1984; Mienis, 1987a		No
Macrochlamys indica	Land snail	Stylommatophora: Helicarionidae		Yes – El-Alfy et al., 1994	No
Metafruticicola berytensis hermonensis (Ferussac, 1821) Forcart, 1981	Land snail	Stylommatophora: Helicidae	Yes – Forcart, 1981		No
Monacha arbustorum	Land snail	Stylommatophora: Helicidae		Yes – Tolba, 1997	No
Monacha bari (Forcart, 1981)	Land snail	Stylommatophora: Helicidae	Yes – Forcart, 1981		No
Monacha cantiana (Montagu, 1803)	Kentish garden snail	Stylommatophora: Helicidae		Yes – Heiba & Mahran, 1999	No
Monacha haifaensis (Pallary, 1939)	Land snail	Stylommatophora: Helicidae	Yes – Arad, 1990; Mienis, 1987b, 1988		No
Monacha obstructa (Ferussac, 1821)	Land snail	Stylommatophora: Helicidae	Yes – Mienis, 1988	Yes – Wanas et al., 1995	No
Monacha syriacea (Ehrenberg, 1831)	Desert snail	Stylommatophora: Helicidae	Yes – Heller & Tchernov, 1978		No
Pupoides coenopictus (Hutton, 1834)	Land snail	Stylommatophora: Pupillidae	Yes – Heller, 1984		No
Rumina decollata (Linnaeus, 1758) Syn. = [Bulimus decollatus Draparaud, 1805 (Germain, 1930); Helix decollata Linnaeus, 1758 (Germain, 1930); Orbitina incomparabilis (Germain, 1930); Orbitina truncatella (Germain, 1930)]	Decollate snail	Stylommatophora: Subulinidae	Yes – Mienis, 1979; Singer & Mienis, 1993	Yes – citrus orchards (Nakla <i>et al.,</i> 1995)	No – CAB International, 2000
Sphincterochila boissieri (Charpentier)	Desert snail	Stylommatophora: Sphincterochilidae	Yes – Yom- Tov, 1989		No
Sphincterochila cariosa (Olivier, 1804)	Desert snail	Stylommatophora: Sphincterochilidae	Yes – Koekkoek, 1990		
Sphincterochila prophetarum (Bourguignat, 1852)	Desert snail	Stylommatophora: Sphincterochilidae	Yes – Nevo <i>et</i> <i>al.</i> , 1982		
Sphincterochila zonata	Desert snail	Stylommatophora: Sphincterochilidae	Yes – Shachak et al., 1981		No
Theba pisana (Muller, 1774)	Italian white snail; Mediterranean snail	Stylommatophora: Helicidae	Yes – Arad, 1990; Mienis, 1987b, 1988	Yes – citrus orchards (Nakla <i>et al.</i> , 1997)	Yes – Baker, 1986; Smith, 1992
Trochoidea picardi (Hass)	Desert snail	Stylommatophora: Helicidae	Yes – Bar, 1978		No
Trochoidea (Xerocrassa) davidiana davidiana (Bourguignat)	Desert snail	Stylommatophora: Helicidae	Yes – Mienis, 1994		No
Trochoidea (Xerocrassa) erkelii helleri (Forcart)	Desert snail	Stylommatophora: Helicidae	Yes – Nevo <i>et</i> <i>al.</i> , 1981		No
Trochoidea (Xerocrassa) simulata (Ehrenberg, 1831)	Land snail	Stylommatophora: Helicidae	Yes – Arad, 1990		No
Trochoidea (Xerocrassa) seetzenii (Pfeiffer, 1847)	Land snail	Stylommatophora: Helicidae	Yes – Mienis, 1987a; Zaady <i>et</i> <i>al.</i> , 1996		No
Trochoidea (Xerocrassa) siniaca (Martens)	Desert snail	Stylommatophora: Helicidae	Yes – Forcart 1978		No
Trochoidea (Xerocrassa) syrensis lederi (Pfeiffer, 1856)	Desert snail	Stylommatophora: Helicidae	Yes – Mienis, 1979		No
Xerophila icmalea	Semi-desert snail	Stylommatophora: Helicidae	Yes – El-Kassas et al., 1993		No
<i>Xeropicta (Helicella) vestalis</i> (Pfeiffer, 1841)	Desert snail	Stylommatophora: Helicidae		Yes – citrus orchards (Nakla <i>et al.</i> , 1997)	No

Scientific name	Common	Order/Family	Present in	Present in	Present in
	name(s)		Israel	Egypt	Australia
Xeropicta ilanae (Forcart, 1981)	Desert snail	Stylommatophora:	Yes – Forcart,		No
		Helicidae	1981		
Xeropicta vestalis joppensis (Schmidt,	Desert snail	Stylommatophora:	Yes – Arad,		No
1885)		Helicidae	1990; Mienis,		
			1987b, 1988		
Zebrina eburnea (Pfeiffer)	Desert snail	Stylommophora:	Yes – Mienis,		No
		Enidae	1979		
Zebrina fasciolata fasciolata (Olivier,	Desert snail	Stylommophora:	Yes – Mienis,		No
1801)		Enidae	1979		

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APPENDIX 3: DATASHEETS FOR PESTS OF CITRUS IN EGYPT

Arthropoda

Species: Aleurothrixus floccosus (Maskell, 1895) [Hemiptera: Aleyrodidae]

Synonym(s) and changes in combination(s): *Aleurodes floccosa* Maskell, 1895; *Aleyrodes horridus* Hempel, 1899; *Aleyrodes howardi* Quaintance, 1907; *Aleurothrixus horridus* (Hempel) Quaintance & Baker, 1914; *Aleurothrixus howardi* (Quaintance).

Common name(s): Citrus whitefly; flocculent whitefly; woolly whitefly; wooly whitefly.

Host(s): *Aleurothrixus floccosus* is a polyphagous whitefly species with a wide host range covering over 50 species of plants in 43 genera and 32 families (Nakahara, 1983). However in the Mediterranean region where the whitefly was introduced, it infests almost exclusively species of the genus *Citrus* (CAB International, 2000).

Anacardium sp. (cashew) (Costa Lima, 1968); Annona reticulata (cherimoya) (CAB International, 2000; Costa Lima, 1936); *Baccharis genistelloides* (groundsel tree) (CAB International, 2000; Quaintance and Baker, 1916); Bougainvillea sp. (CAB International, 2000; Costa Lima, 1968); Bursonima crassifolia (nanche) (Rose and DeBach, 1994); *Calophyllum* sp. (Rose and DeBach, 1994); *Citrus* × *nobilis* (tangor) (Cohic, 1968); Citrus paradisi (grapefruit) (Clausen, 1978); Citrus aurantium (sour orange) (Mound and Halsey, 1978); Citrus decumana (Mound and Halsey, 1978); Citrus sinensis (sweet orange) (Mound and Halsey, 1978); Citrus spp. (CAB International, 2000; Salinas et al., 1996); Coccoloba uvifera (sea-grape) (CAB International, 2000; Rose and DeBach, 1994); Coffea arabica (arabica coffee) (CAB International, 2000; Mound and Halsey, 1978); *Diospyros kaki* (Japanese persimmon) (Biezanko and Freitas, 1939; CAB International, 2000); *Ehretia anacua* (pinquinca) (Rose and DeBach, 1994); Eugenia axillaris (white stopper) (Rose and DeBach, 1994); Eugenia pimenta (Rose and DeBach, 1994); Eugenia uniflora (Surinam cherry) (CAB International, 2000; Vieira, 1950); Ficus spp. (fig) (Malumphy, 1995); Fortunella sp. (kumquat) (Rose and DeBach, 1994); Gloriosa superba (climbing lily, glory lily) (CAB International, 2000; Cohic, 1968); Guaiacum officinale (lignum vitae) (CAB International, 2000; Maskell, 1895); Licania tomentosa (Costa Lima, 1968); Malpighia glabra (Barbados cherry) (Rose and DeBach, 1994); Mangifera indica (mango) (CAB International, 2000; Costa Lima, 1936); Manilkara zapota (sapodilla) (Salinas et al., 1996); Monstera deliciosa (ceriman) (Vieira, 1950); Musa × paradisiaca (banana) (CABI/EPPO, 1997); Parquetia nigrescens (milkweed, silk weed) (Cohic, 1968); Persea americana (avocado) (Vieira, 1950); Persea borbonia (red bay) (Rose and DeBach, 1994); Phoradendron sp. (mistletoe) (CAB International, 2000; Costa Lima, 1968); Plumeria rubra (frangipani) (Rose and DeBach, 1994); Plumeria sp. (frangipani) (CAB International, 2000; Rose and DeBach, 1994); Pouteria caimito (caimito) (Costa Lima, 1968); Psidium cattleianum (cherry guava) (Rose and DeBach, 1994); Psidium guajava (guava) (Bondar, 1923; Salinas et al., 1996; Vieira, 1950); Schinus molle (California pepper tree) (Rose and DeBach, 1994); Sida rhombifolia (arrowleaf sida) (Biezanko and Freitas, 1939); Solanum melongena (aubergine, eggplant) (Mound and Halsey, 1978; Salinas et al., 1996); Solanum nigrum (black nightshade) (Onillon, 1969); Spondias dulcis (goldenapple) (Rose and DeBach, 1994); Spondias mombin (hog-plum, yellow mombin)

(Mound and Halsey, 1978); *Spondias purpurea* (purple mombin, Spanish plum) (Salinas *et al.*, 1996); *Syncarpia glomulifera* (turpentine tree) (Dozier, 1932); *Triplaris weigeltiana* (Rose and DeBach, 1994).

Part(s) of plant affected: Fruit (Vulic and Beltran, 1977); inflorescence (CAB International, 2000); leaf (Salinas *et al.*, 1996; Vulic and Beltran, 1977); stem (CAB International, 2000).

Distribution: Algeria (Berkani and Dridi, 1992; CABI/EPPO, 1997); Angola (CABI/EPPO, 1997); Argentina (CABI/EPPO, 1997); Bahamas (CABI/EPPO, 1997); Barbados (CABI/EPPO, 1997); Belize (CABI/EPPO, 1997); Benin (CABI/EPPO, 1997); Brazil (CABI/EPPO, 1997); Chile (CABI/EPPO, 1997); Colombia (CABI/EPPO, 1997); Congo (CABI/EPPO, 1997); Costa Rica (CABI/EPPO, 1997); Cuba (CABI/EPPO, 1997); Dominica (CABI/EPPO, 1997); Dominican Republic (CABI/EPPO, 1997); Ecuador (Galapagos Islands) (CABI/EPPO, 1997); Egypt (CABI/EPPO, 1997; Vulic and Beltran, 1977); El Salvador (CABI/EPPO, 1997); France (CABI/EPPO, 1997); French Polynesia (Tahiti) (CABI/EPPO, 1997); Gambia (Bink-Moenen, 1983; CABI/EPPO, 1997); Guadeloupe (CABI/EPPO, 1997); Guyana (CABI/EPPO, 1997); Haiti (CABI/EPPO, 1997); India (CABI/EPPO, 1997); Israel (Argov, 1994; CABI/EPPO, 1997); Italy (CABI/EPPO, 1997; Genduso and Liotta, 1980; Onillon and Abbassi, 1973); Jamaica (CABI/EPPO, 1997); Kenya (Bink-Moenen, 1983: CABI/EPPO, 1997); Malta (Mifsud, 1997); Mauritius (Bink-Moenen, 1983; CABI/EPPO, 1997); Mexico (CABI/EPPO, 1997); Morocco (Abbassi, 1975; Abbassi and Onillon, 1973; CABI/EPPO, 1997); Niger (Bink-Moenen, 1983); Nigeria (CABI/EPPO, 1997); Panama (CABI/EPPO, 1997); Paraguay (CABI/EPPO, 1997); Peru (CABI/EPPO, 1997); Philippines (CABI/EPPO, 1997; Salinas et al., 1996); Portugal (Magalhaes, 1980) (Madeira (CABI/EPPO, 1997)); Puerto Rico (CABI/EPPO, 1997); Puerto Rico (CABI/EPPO, 1997); Réunion (CABI/EPPO, 1997; Russell and Etienne, 1985); Saint Helena (CABI/EPPO, 1997); Saint Kitts and Nevis (CABI/EPPO, 1997); São Tome and Principe (CABI/EPPO, 1997; Piedade-Guerreiro, 1984); Singapore (CABI/EPPO, 1997); Spain (Canary Islands) (CABI/EPPO, 1997); Suriname (CABI/EPPO, 1997); Tanzania, United Republic of (CABI/EPPO, 1997); Togo (CABI/EPPO, 1997); Trinidad and Tobago (CABI/EPPO, 1997); Tunisia (CABI/EPPO, 1997: Chermiti et al., 1993): United Kingdom (CABI/EPPO, 1997: Malumphy, 1995); Unites States (California, Florida, Hawaii, Texas) (CABI/EPPO, 1997); United States Virgin Islands (CABI/EPPO, 1997); Venezuela (CABI/EPPO, 1997); Zaire (CABI/EPPO, 1997); Zambia (CABI/EPPO, 1997).

Biology: Adults are 0.7–1.2 mm in length, have a light yellow body and powdery white wings. The wings are folded flat leaving a V-shaped slit and with little overlap. Emerging adults are yellowish white in colour and seldom fly (Fasulo and Brooks, 1997). Adults of *A. floccosus* are very sluggish and once disturbed, they seldom take to wings or fly only short distances (Salinas *et al.*, 1996). Adult dispersal can be greatly accelerated by wind, vehicles and humans (Salinas *et al.*, 1996). The woolly whitefly derives its name from the numerous white waxy, wool-like filaments that develop from the third and fourth nymphal instars.

Reproduction is sexual. Paulson and Beardsley (1986) and Salinas *et al.* (1996) both observed that oviposition occurred within one day after adult emergence. The female inserts her mouthparts into the leaf underside and then rotates while depositing eggs (CAB International, 2000; Salinas *et al.*, 1996). The eggs are deposited on the underside of mature leaves and inserted into leaf tissues (Salinas *et al.*, 1996). Vulic

and Beltran (1997) studied this whitefly on citrus in Spain and found that it oviposited on the fruit. Eggs are laid either singly, in small groups, a circle, partial circle, or in concentric rings (overlapping circles) with the female in the centre (Fasulo and Brooks, 1997). This varies considerably, especially under adult high density conditions when eggs tend to be scattered randomly (Rose and DeBach, 1994). Females lay an average of 42–178 eggs with egg hatchability ranging from 92–100% in laboratory conditions (Salinas *et al.*, 1996). Eggs are bean-shaped or curved, without reticulations, and are attached by a short stalk (Rose and DeBach, 1994). Newly laid eggs are opaque or whitish in colour, but soon turn dark brown to black, and are partially covered with white waxy secretions from adults.

There are four nymphal instar stages. The length ranges from 0.2–0.94 mm over the four larval instar stages (Salinas *et al.*, 1996). First instar nymphs are light green or yellow in colour, and the rest are brown. As the nymph grows, it secretes a white, waxy and powdery substance which covers the body. In general, nymphs are active only during the first instar (or crawler) stage, becoming sessile for the remaining nymphal instars (van Lenteren and Noldus, 1990). Newly hatched nymphs are mobile for about 20 minutes but will settle along a vein on the underside of a leaf (Salinas *et al.*, 1996). Pupae are usually covered by white wax threads which are very conspicuous on heavily infested leaves. With wax threads removed, pupal cases vary in colour from yellowish-brown to black. Parasitised nymphs are black.

Adults and larvae damage the host plant by sucking sap and excreting honeydew onto the fruit and leaves, leading to sooty mould growth that interferes with photosynthesis (Salinas *et al.*, 1996). Adult longevity ranges from 1–18 days for males and 1–25 days for females (Salinas *et al.*, 1996). The total development period from egg to adult emergence ranges from 23–31 days, depending on the temperature (Salinas *et al.*, 1996). At constant temperatures of 17°C, 22°C, 27°C and 30°C it was shown that development from egg stage to adult stage took 80 days, 45 days, 30 days and 28 days, respectively (CAB International, 2000). At higher temperatures mortality of eggs and nymphs are very high and at lower temperatures development is slower. There are 4–6 generations per year, with hibernation of the various nymphal stages during the winter (CAB International, 2000). The number of generations per year is very dependent on ambient climatic parameters.

In Mediterranean environments, this species has an almost continuous development, showing many generations per year (CAB International, 2000). The life cycle slows down during the warmest and the coldest periods of the year, and consequently the population of the insect is represented by all stages. The highest densities of the insect are observed in autumn and spring.

Entry potential: Low, as pre-harvest control measures routinely carried out in citrus orchards and post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing, and waxing will reduce the risk of introduction of this pest.

Establishment potential: High, as the pest has high reproductive rate and lives in similar environmental conditions to those found in Australia. This species has a wide host range covering over 50 species of plants in 43 genera and 32 families.

Spread potential: Low to moderate, weak flier and sluggish in behaviour; seldom takes flight when disturbed or flies only short distances. First instars

(crawlers) are able to disperse within the host plant. Dispersal is primarily by wind, vehicles and humans.

Economic importance: High, as the woolly whitefly is a pest of commercial crops and has a wide host range. It is capable of causing severe crop damage as heavy infestations may cause rapid tree deterioration and crop failure.

Quarantine status: Quarantine.

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Vieira, R. (1950). In: Fruitas da Madeira. Ano X, No. 1, 9–13.

Vulic, M. and Beltran, J.L. (1977). The whitefly Aleurothrixus floccosus, a serious pest of citrus crops. Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz 84(4), 202–214. **Species:** *Aphis fabae* Scopoli, 1763 [Hemiptera: Aphididae]

Synonym(s) and changes in combination(s): Anuraphis cynariella Theobald, 1924; Aphis abietaria Walker, 1852; Aphis acanthi Schrank, 1801; Aphis addita Walker, 1849; Aphis adducta Walker, 1849; Aphis advena Walker, 1849; Aphis aparines Fabricius, 1775; Aphis aparinis Blanchard, 1840; Aphis apii Theobald, 1925; Aphis apocyni Koch, 1854; Aphis atriplicis Fabricius, 1775 nec Linnaeus, 1758; Aphis bazzii Blanchard, 1923; Aphis brevisiphona Theobald, 1913; Aphis cardui var. naumburgensis Franssen, 1927; Aphis castanea Koch, 1872; Aphis chaerophylii Koch, 1854; Aphis cirsina Ferrari, 1872; Aphis citricola van der Goot 1912; Aphis compositae Theobald, 1915; Aphis dahliae Mosley, 1841; Aphis dusmeti Gomez Menor, 1950 (part.); Aphis erecta del Guercio, 1911; Aphis eryngii Blanchard, 1923; Aphis euonymi Börner; Aphis euonymi auctt. prior to 1950 nec Fabricius, 1775; Aphis fabae Blanchard, 1840; Aphis fumariae Blanchard, 1840; Aphis hortensis Fabricius, 1781; Aphis indistincta Walker, 1849; Aphis inducta Walker, 1849; Aphis insularis, Blanchard, 1923; Aphis ligustici Fabricius, 1779; Aphis neoreticulata Theobald, 1927; Aphis nerii Kaltenbach, 1843 nec Boyer de Fonscolombe, 1841; Aphis papaveris Fabricius, 1781; Aphis philadelphi Börner, 1921; Aphis phlomoidea del Guercio, 1911; Aphis polyanthis Passerini, 1863 nec J.F. Gmelin, 1790; Aphis reticulata Theobald, 1922 nec Wilson, 1915; Aphis rumicis auctt. prior to 1930 nec Linnaeus; Aphis serratulae Schrank, 1801: Aphis silvbi Passerini, 1861: Aphis solanella Theobald, 1914; Aphis silybi Passerini, 1861; Aphis sinensis del Guercio, 1900; Aphis solanophilus Blanchard, 1923; Aphis thlaspeos Schrank, 1801; Aphis translata Walker, 1849; Aphis tuberosae Boyer de Fonscolombe, 1841; Aphis valerianina del Guercio, 1911; Aphis watsoni Theobald, 1929; Doralis fabae Scopoli, 1763; Doralis papaveris Fabricius, 1781; Myzus roseum Macchiati, 1881; Myzus rubra Macchiati, 1884; Myzus rubrum del Guercio, 1900.

Common name(s): Bean aphid; beat leaf aphid; black bean aphid; blackfly.

Host(s): This aphid is one of the most polyphagous species which feeds on more than 200 plants (CAB International, 2000). The primary host is usually *Euonymus europaeus* (spindle tree). *Aphis fabae* is highly polyphagous on secondary hosts, which include many crop plants. In temperate regions its main host crops are *Vicia faba* (broad bean) and *Beta vulgaris* (beetroot), while at high altitudes in the tropics its main host is *Phaseolus vulgaris* (kidney bean). *A. fabae* sensu stricto is replaced in hotter regions by *A. fabae solanella*, which has a more restricted host range and feeds on plants of lower economic importance, although these include *Solanum* spp. (Blackman and Eastop, 1984; Müller, 1984).

Allium spp. (garlic, leek, onion), Amaranthus retroflexus (redroot), Apium graveolens (celery), Arctium lappa (great burdock), Berberis vulgaris (European barberry), Beta vulgaris (beetroot), Brassica spp. (cabbage, kale), Cajanus cajan (pigeon pea), Capsicum annuum (chilli pepper), Capsicum spp. (bell pepper, capsicum), Carduus spp. (thistle), Chenopodium album (fat hen), Chromolaena odorata (archangel, bitterbush), Cirsium arvense (Canadian thistle), Cirsium spp. (thistle), Citrus deliciosa (Mediterranean mandarin), Citrus sinensis (navel orange), Crataegus phaenopyrum (Washington hawthorn), Cucumis melo (melon), Cucumis sativus (cucumber), Cucurbita maxima (giant pumpkin), Cynara scolymus (artichoke), Euonymus europaeus (spindle tree), Euonymus japonicus (Japanese spindle tree), Glycine max (soy bean), Gossypium sp. (cotton), Helianthus annuus (sunflower), Helichrysum spp. (everlasting), Hosta spp. (lily), Lactuca sativa (lettuce), Lonicera spp. (honeysuckle), Lupinus angustifolius (blue lupine), Lupinus luteus (yellow lupine), Lupinus spp. (lupine), Lycopersicon esculentum (tomato), Momordica spp., Nerium oleander (oleander), Nicotiana tabacum (tobacco), Papaver somniferum (opium poppy), Pastinaca sativa (parsnip), Phaseolus coccineus (scarlet runner bean), Phaseolus spp. (bean), Phaseolus vulgaris (kidney bean), Philadelphus coronarius (sweet mock orange), Pisum sativum (garden pea), Rheum officinale (Chinese rhubarb), Rosa spp. (rose), Sambucus spp. (elder, elderberry), Sinapis alba (white mustard), Solanum nigrum (black nightshade), Solanum tuberosum (potato), Triticum aestivum (wheat), Tulipa gesneriana (tulip), Urtica spp. (nettle), Viburnum opulus (guelder rose), Viburnum spp. (arrow-wood), Vicia faba (broad bean), Vicia spp. (vetch), Vigna unguiculata (cowpea), Vitis vinifera (grapevine), Zea mays (maize) (CAB International, 2000).

Part(s) of plant affected: Growing points, inflorescence, leaf, whole plant (CAB International, 2000).

Distribution: *A. fabae* and its subspecies are widespread in temperate regions of the Northern Hemisphere. It is predominantly a crop pest in temperate and Mediterranean climates, but also occurs in the Middle East, India and in some countries in South America and Africa (CIE, 1963). It is uncommon in most tropical regions and is presently absent from Australasia. Records of *A. rumicis* on hosts other than *Rumex*, from earlier in the 20th Century, are assumed to be *A. fabae* in distribution maps (CIE, 1963).

Afghanistan (CIE, 1963); Argentina (CIE, 1963); Austria (CIE, 1963); Belgium (CIE, 1963); Bermuda (CAB International, 2000); Brazil (Bahia (CIE, 1963), Ceara (Bezerra et al., 1995), Rio Grande do Sul (CIE, 1963), Rio de Janeiro (CIE, 1963), São Paulo (CIE, 1963)); Bulgaria (CIE, 1963); Burundi (Autrique et al., 1989); Cameroon (CIE, 1963); Canada (CIE, 1963); Chile (CAB International, 2000); China (Hebei (CIE, 1963), Hong Kong (CAB International, 2000), Jiangsu (CIE, 1963), Shanxi (Zheng and Tang, 1989), Zhejiang (CIE, 1963)); Congo (CIE, 1963); Côte d'Ivoire (CAB International, 2000); Croatia (Igrc, 1990); Czech Republic (Konecny, 1995); Cyprus (CIE, 1963); Denmark (CIE, 1963; Hansen, 1995); Egypt (CIE, 1963); Ethiopia (CAB International, 2000); Finland (CIE, 1963); France (CIE, 1963; Robert and le Gallic, 1991); Georgia (Republic) (Giorgadze et al., 1988); Greece (CIE, 1963; Lykouressis and Tsitsipis, 1987); Hungary (CIE, 1963; Kuroli and Nemeth, 1987); India (Arunachal Pradesh (Ghosh, 1975), Assam (Ghosh, 1975), Himachal Pradesh (Bhardwaj et al., 1993; Ghosh, 1975), Kerala (Lyla et al., 1987), Manipur (Ghosh, 1975), Meghalaya (Ghosh, 1975), Sikkim (Ghosh, 1975), Tripura (Das, 1988), Uttar Pradesh (Ghosh, 1975; Mohd et al., 1996), West Bengal (CIE, 1963; Ghosh, 1975)); Iran, Islamic Republic of (CIE, 1963); Iraq (CIE, 1963; El-Jassani and El-Adel, 1991); Ireland (CIE, 1963); Israel (CIE, 1963); Italy (CIE, 1963); Japan (Hokkaido, Honshu, Kyushu, Shikoku (CIE, 1963)); Jordan (CIE, 1963); Kenya (CIE, 1963); Korea, Republic of (CAB International, 2000); Latvia (Damroze, 1989); Lebanon (CAB International, 2000); Libya (CIE, 1963); Malawi (Mchowa et al., 1994); Malta (CAB International, 2000); Netherlands (CIE, 1963); Mexico (Pinto and Cardenas Alonso, 1990); Morocco (CIE, 1963); Niger (CAB International, 2000); Nepal (CIE, 1963); Pakistan (CIE, 1963); Nigeria (CIE, 1963); Norway (CIE, 1963); Peru (CAB International, 2000); Philippines (CIE, 1963); Poland (Chikh-Khami, 1995; CIE, 1963); Portugal (CIE, 1963); Puerto Rico (CIE, 1963); Romania (CIE, 1963; Ioan et

al., 1987); Russian Federation (CIE, 1963); South Africa (CIE, 1963); Sudan (CIE, 1963); Spain (CIE, 1963; Duenas and Ovilo, 1990); Sri Lanka (CIE, 1963); Sweden (CIE, 1963); Switzerland (CIE, 1963); Syrian Arab Republic (Weigand, 1990); Taiwan, Province of China (CIE, 1963); Tanzania, United Republic of (CIE, 1963; Mohamed and Teri, 1989); Turkey (CAB International, 2000); Uganda (CAB International, 2000); Ukraine (Fedorenko, 1992); United Kingdom (Channel Islands (CIE, 1963; Leather, 1992)); Uruguay (CAB International, 2000); United States (Alabama (CIE, 1963), Alaska (CIE, 1963), California (CIE, 1963; Kirk et al., 1991), Colorado (CIE, 1963), Connecticut (CIE, 1963), Delaware (CIE, 1963), Florida (CIE, 1963; Stoetzel, 1990), Georgia (CIE, 1963), Hawaii (CIE, 1963), Idaho (CIE, 1963), Maryland (CIE, 1963), Michigan (CIE, 1963), Nebraska (CIE, 1963), Nevada (CIE, 1963), New Jersey (CIE, 1963), New York (CIE, 1963; Tingey and Lamont, 1988), North Carolina (CAB International, 2000), Ohio (CAB International, 2000), Oregon (CIE, 1963), Pennsylvania (CIE, 1963), South Carolina (CIE, 1963), Texas (CIE, 1963), Utah (CIE, 1963), Virginia (CIE, 1963), Washington (CIE, 1963), Wisconsin (CIE, 1963), Wyoming (CAB International, 2000)); Yugoslavia (CIE, 1963); Zimbabwe (CIE, 1963).

Biology: The biology of this insect on citrus has not been reported.

The complex life cycle of this species, involving both primary and secondary host plants, is illustrated in Blackman and Eastop (1984). *A. fabae* has a heteroecious and holocyclic lifecycle in much of Europe, alternating between its primary host, spindle (*Euonymus europaeus*), where it overwinters as an egg stage, and a wide range of secondary host plants i.e. *Philadelphus coronarius* and *Viburnum opulus*. Several generations follow one another on *Euonymus* before alate migrate to secondary host plants (CAB International, 2000).

In Northern Europe, winter eggs are laid on *E. europaeus* between October and December. Eggs hatch in spring (from late February to April) into nymphs, which go through four instars to become fundatrices that are large parthenogenetically reproducing adult apterous females. About three generations occur on spindle (*Euonymus europaeus*), until alates (spring migrants) are produced in summer between mid-May and early June. The spring migrants colonize a wide range of secondary hosts, including field beans, sugarbeet and numerous wild host plants, on which apterous females are produced which reproduce parthenogenetically. Rapid rates of population growth occur, resulting in dense colonies until mid June. One female may produce up to 100 young, at a rate of 10 per day. The young appear as matt black aphids and as they get older white wax markings develop. After mid June population decline progressively due to the action of parasites and predators. Alates are produced on secondary hosts throughout the summer (summer migrants), partly in response to overcrowding, and these continuously colonize fresh herbaceous secondary host plants (Cammell, 1981).

Around September (advent of autumn), shorter day lengths, modified by temperature (Nunes *et al.*, 1996), initiate physiological and behavioural changes, resulting in the production of gynoparae (autumn migrants) and males. Gynoparae undertake obligatory migratory flights to relocate the primary host spindle (Nottingham and Hardie, 1989). Once on spindle they produce the apterous oviparae or sexual females. Several weeks after the gynoparae start appearing, the sexual males are produced on the secondary host plants. They independently locate the spindle (*E. europaeus*), and find the oviparae using sex pheromone cues. Soon after mating (fertilisation) in

October, the oviparae lay their eggs in bark crevices on the stem or on the winter buds of the spindle trees. Each oviparae lays around four to six yellow-green eggs, which darken with time to a shiny black. The embryos need to go through a cold spell and enter diapause before they hatch (CAB International, 2000).

The eggs laid on spindle are the most important means by which *A. fabae* overwinters in Northern Europe, but in Southern Europe aphids may reproduce parthenogenetically on secondary hosts throughout the year (Cammell, 1981). In the tropics the aphid, which is most likely to be the subspecies *A. fabae solanella*, does not overwinter as an egg stage. It is anholocyclic, breeding parthenogenetically throughout the year, with alate forms being produced in response to overcrowding. *A. fabae* s. str. thrives best at temperatures around 14–15°C (CAB International, 2000).

Hurej and van der Werf (1993) artificially infested sugarbeet leaves with colonies of *A. fabae* to assess direct feeding damage. They started colonies on 3–4 leaf-stage plants in the glasshouse and recorded peak aphid numbers of 3000 individuals/plant, and reductions of leaf area by 64% at the 14 leaf-stage. Direct feeding damage by *A. fabae* causes loss of sap and injury to plant tissues (CAB International, 2000). Direct feeding damage by *A. fabae* is of more significant in bean crops, including *Vicia faba*, than virus transmission. Aphids cause severe crop losses in beans by forming dense aggregations on actively growing parts of young plants. Small populations may be relatively harmless, but large numbers of aphids stunt plants, reduce seed formation, and may eventually cause premature mortality. Young growth is preferred, and young plants are particularly vulnerable in terms of stunted growth and early death, although populations on older plants may cause crop loss by decreasing flower and pod production. Honeydew is also produced on the plant which promotes the development of sooty mould.

Entry potential: Low, as the pest is primarily present on plant stems and leaf material. However, the post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing, waxing and removal of trash will substantially reduce the risk associated with the entry of this pest.

Establishment potential: High, as this species has a wide host range and females can reproduce parthenogenetically.

Spread potential: High, since winged adults occur.

Economic importance: High, as this species is an economic pest of beans worldwide. Direct damage is caused by loss of sap and injury to plant tissues due to feeding, and indirectly through virus spread.

Yield loss on beans is primarily due to fewer pods per plant and fewer and smaller seeds per pod. Damage may also reduce seed viability and food value (CAB International, 2000). In field experiments in Iraq, yield losses in broad beans due to *A*. *fabae* revealed up to 64% loss in seed dry weight compared with controls (Mohammad and Abdulla, 1988).

A. fabae can transmit over 30 plant pathogenic viruses, including non-persistent viruses of beans and peas (bean common mosaic potyvirus and bean yellow mosaic potyvirus), beets, chilli peppers, crucifers (cabbage black ring spot virus, turnip mosaic potyvirus and cauliflower mosaic caulimovirus), cucurbits, *Dahlia* (Dahlia mosaic caulimovirus), potato, tomato, tulip, lucerne and *Iris*. It transmits the persistent

beet yellow net luteovirus and potato leaf roll luteovirus. It is an economic pest of sugarbeet and seed potatoes in part due to its ability to transmit viruses (CAB International, 2000).

Quarantine status: Quarantine.

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Species: *Ceratitis capitata* (Wiedemann, 1829) [Diptera: Tephritidae]

Synonym(s) and changes in combination(s): *Tephritis capitata* Wiedemann, 1824; *Ceratitis citriperda* Macleay, 1829; *Ceratitis hispanica* De Brême; *Pardalaspis asparagi* Bezzi.

Common name(s): Medfly; Mediterranean fruit fly.

Host(s): Fruit fly species are frequently recorded from unusual hosts. In many cases these records are from overripe or damaged fruit, or that are already infested by other species. Hence, a record from a particular fruit does not necessarily mean that it is a normal host for that fly species. In a few cases fruit maturation stage is also important. For example, *Dirioxa pornia* infests a wide range of fruit that normally (if not invariably) is in a ripe, overripe or damaged state. In the case of bananas, species such as *Bactrocera tryoni* infest only ripening fruit, whilst *B. musae* and *B. papayae* infest them at a greener stage.

Medfly is a highly polyphagous species and its pattern of host relationships from region to region appears to relate largely to what fruits are available (CAB International, 2000). In Hawaii, USA, 60 out of 196 fruit species examined over the years 1945–85 were at least once found as hosts of this pest; the two most important hosts were *Coffea arabica* and *Solanum pseudocapsicum* (Liquido *et al.*, 1990). In the EPPO region, important hosts include apple, avocados, citrus, figs, kiwi fruits, mangoes, medlars, pears and prunus species (CABI/EPPO, 1997).

Ceratitis capitata attacks a very wide range of deciduous and subtropical fruits, with over 200 hosts recorded (Smith et al., 1997). Other additional hosts include: Actinidia deliciosa (kiwi fruit), Anacardium occidentale (cashew), Ananas comosus (pineapple), Annona cherimola (cherimoya), Annona reticulata (bullock's heart), Antidesma dallachvana (Herbert River-cherry, Queensland-cherry), Arbutus unedo (Irish strawberry), Artocarpus altilis (breadfruit), Averrhoa carambola (carambola), Capsicum annuum (bell pepper), Capsicum frutescens (chilli), Carica papaya (pawpaw), Carissa edulis (carandas plum), Carissa macrocarpa (Natal plum). Casimiroa edulis (white sapote), Chrysophyllum cainito (caimito), Citrus aurantifolia (lime), Citrus aurantium (sour orange), Citrus deliciosa (Mediterranean mandarin), Citrus limetta (sweet lime), Citrus limon (lemon), Citrus limonia (mandarin lime), Citrus madurensis (calamondin), Citrus maxima (pummelo), Citrus medica (citron), Citrus nobilis (tangor), Citrus paradisi (grapefruit), Citrus reticulata (mandarin), Citrus reticulata × C. paradisi (tangelo), Citrus sinensis (navel orange), Coffea arabica (arabica coffee), Coffea liberica (liberica coffee), Cotoneaster sp., Cucumis sativus (cucumber), Cydonia oblonga (quince), Cyphomandra betacea (tamarillo), Diospyros kaki (persimmon), Dovyalis caffra (kei apple), Eriobotrya japonica (loquat), Eugenia brasiliensis (Brazil cherry, grumichama), Eugenia uniflora (Surinam cherry), Feijoa sellowiana (feijoa), Ficus carica (fig), Ficus spp. (fig), Fortunella japonica (round kumquat), Fortunella spp. (kumquat), Garcinia livingstonei (African mangosteen), Garcinia mangostana (mangosteen), Harpephyllum caffrum (Kaffir plum), Juglans regia (walnut), Litchi chinensis (lychee), Lycopersicon esculentum (tomato), Macadamia tetraphylla (rough-shell Queensland nut), Malpighia glabra (acerola), Malus domestica (apple), Malus sylvestris (crabapple), Malus spp. (apple), Mangifera indica (mango), Manilkara zapota (sapodilla), Mespilus germanica (medlar), Mimusops elengi (Spanish cherry), Monstera deliciosa (Mexican breadfruit), Morus nigra (black mulberry), Muntingia

calabura (Jamaica cherry), Musa × paradisiaca (banana, plantain), Myrciaria cauliflora (jaboticaba), Olea europaea (olive), Opuntia sp. (prickly pear), Opuntia ficus-indica (Indian fig prickly pear), Passiflora edulis (purple passionfruit), Pereskia aculeata (Barbados gooseberry), Persea americana (avocado), Phoenix dactylifera (date-palm), Physalis peruviana (Cape gooseberry), Pouteria sapota (mammee sapote), Pouteria viridis (sapodella), Prunus armeniaca (apricot), Prunus domestica (plum), Prunus ilicifolia (chaparral tree), Prunus persica (peach), Prunus persica var. nucipersica (nectarine), Prunus spp. (stonefruit), Psidium cattleianum (cherry guava), Psidium guajava (guava), Psidium littorale (strawberry guava), Punica granatum (pomegranate), Pyrus communis (pear), Rosa spp. (rose), Rubus loganobaccus (loganberry), Rubus ursinus var. loganbaccus (boysenberry), Rubus spp. (raspberry), Santalum album (Indian sandalwood), Santalum freycinetianum, Solanum incanum (bitter apple), Solanum melongena (eggplant), Solanum muricatum (pepino), Solanum nigrum (black nightshade), Solanum pseudocapsicum (Jerusalem cherry), Spondias cytherea (Hog's plum), Spondias purpurea (purple mombin, Spanish plum), Syzygium cumini (black plum), Syzygium jambos (rose apple), Syzygium malaccense (malayapple), Syzygium samarangense (water apple), Terminalia catappa (water almond), Theobroma cacao (cocoa), Thevetia peruviana (yellow oleander), Vitis vinifera (grape) (CAB International, 2000).

Part(s) of plant affected: Fruit (Smith *et al.*, 1997).

Distribution: Albania, Algeria, Angola, Argentina, Australia (New South Wales, Queensland, Victoria – absent, not established, found only in the distant past (pre 1931); South Australia – present, few occurrences; Western Australia – (restricted distribution)), Benin, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cameroon, Cape Verde, Colombia, Congo, Democratic Republic, Congo, Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Ecuador, Egypt, El Salvador, Ethiopia, France, Gabon, Ghana, Greece, Guatemala, Honduras, Guinea, Israel, Italy, Jamaica, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Malawi, Mali, Malta, Mauritius, Mexico, Morocco, Mozambique, Netherlands Antilles, Nicaragua, Niger, Nigeria, Panama, Paraguay, Peru, Portugal, Réunion, Russian Federation, Saint Helena, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Slovenia, South Africa, Spain, Sudan, Syrian Arab Republic, Tanzania, United Republic of, Togo, Tunisia, Turkey, Uganda, Uruguay, United States, Venezuela, Yemen, Yugoslavia, Zimbabwe (CAB International, 2000).

Biology: Adults are 4–5 mm in length with pale-green eyes, mottled wings and a yellow body marked with white, brown, blue and black. Adults take 2–3 days to become sexually mature at 25°C (Krainacker *et al.*, 1987). Medflies attack fruit that are beginning to colour (Smith *et al.*, 1997). Peak adult emergence takes place in the early morning. Adult females must feed on protein (e.g. bacteria growing on fruit and plant surfaces, and on sugars in honeydew or nectar), for several days before they can mature and lay their eggs (Smith *et al.*, 1997). Mating takes place on host plants with ripening fruit. Adult survival for up to a year has been observed in the laboratory but probably does not exceed two to three months in the field (Fletcher, 1989). Generally, adults live up to 2 months (CABI/EPPO, 1997; Christenson and Foote, 1960), although adult females can live for up to 6 months (Smith *et al.*, 1997). This species has a relatively long reproductive phase (Fletcher, 1989).

Medfly development time is dependent upon environmental factors, with temperature being a key factor for all life stages. In general, the higher the temperature, the faster

the development time and *vice versa*. In cool regions, Medflies may overwinter as pupae or adults though in warmer regions it is reproductively active throughout the year.

The developmental rate of Medfly reaches an upper limit at temperatures between 30 and 33°C and then decreases at temperatures above 35° C (Shoukry and Hafez, 1979). Shoukry and Hafez (1979) also found that in the laboratory, low humidity detrimentally affected Medfly egg and larval stages. However, low humidity and high temperature rarely occur in the field. On average, under Australian conditions, development from egg to adult will take 28 to 34 days in the summer and 60 to 115 days in the winter (De Lima and Woods, 1996). Medfly activity is possible over winter when daily maximum temperatures exceed 12°C and they can survive the winter in both adult and immature stages (De Lima, 1998). In Australia, adults overwinter in citrus trees (Smith *et al.*, 1997). Numbers fall in winter, and start increasing in spring. Populations are highest in late summer and early autumn (Smith *et al.*, 1997).

Females lay 1–14 eggs per fruit, depending on its size (McDonald and McInnis, 1985), and can produce 300–1000 eggs throughout their life (Fletcher, 1989). Eggs are white, 1 mm in length and deposited in batches of 2–30 beneath the skin in the albedo (rind) of ripening fruit (Smith *et al.*, 1997). The eggs hatch within 2–4 days (up to 16–18 days in cool weather) (CABI/EPPO, 1997). Larvae (or maggots) are cream-coloured with a pointed head and squarish rear end. They hatch from the eggs and tunnel into the fruit pulp. Heavy mortality of eggs and young larvae, particularly in immature fruit, is caused by oil released from oil cells in the rind ruptured during egg laying (Smith *et al.*, 1997). In thicker skinned varieties, larval death follows the formation of gum in and around the egg-laying site (Smith *et al.*, 1997). The larvae feed for 6–11 days at 13–28°C (CABI/EPPO, 1997). Mature (third instar) larvae are 6.5–9 mm in length, and leave the fruit to pupate in the top 50 mm of soil (Smith *et al.*, 1997). Pupation takes place in the soil under the host plant and adults emerge after 6–11 days (at 24–26°C; longer in cool conditions) (CABI/EPPO, 1997).

In Australia, most damage in citrus occurs during late summer and early autumn, especially to early maturing varieties (Smith *et al.*, 1997). This coincides with the end of the season for deciduous fruits. Mature deciduous fruits are a good breeding place for fruit flies, which, at the end of the season when there are no more fruit, then migrate onto ripening citrus fruit (Smith *et al.*, 1997). Fruit damage results from puncturing of the rind during egg laying and larvae feeding on the fruit pulp (Smith *et al.*, 1997). In addition, organisms such as green mould (*Penicillium digitatum*) enter the fruit through the punctures, and rots develop (Cayol *et al.*, 1994; Smith *et al.*, 1997). The life cycle takes 4–17 weeks, depending on the temperature (Smith *et al.*, 1997). There are 4–5 generations per year, with the number of generations determined by temperature (Fletcher, 1989; Smith *et al.*, 1997). In tropical and subtropical regions there may be as many as 12–13 generations a year.

Between October 1979 and September 1981, Hashem *et al.* (1987) studied the population fluctuations of *C. capitata* in the north of Egypt. Two population peaks occurred, the first in October–November, mainly on *Citrus*, and the second in May–June on apricot and some early varieties of peaches. Infestation levels averaged 74% on apricots, 49.5% on grapefruits, 42.5% on sour oranges, 36.5% on guavas, 24% on peaches, 16% on mandarins, 13.3% on baladi oranges, 8.5% on navel oranges, 8.6% on mangoes and 7.5% on valencia oranges.

Entry potential: High, as eggs and larvae are likely to be in harvested fruit.

Establishment potential: High, this species has a wide host range, high reproductive rate and a relatively long reproductive phase. Given the broad host range of this insect, it has a high probability of establishment in Eastern Australia if it enters undetected. However, this pest has already established and currently under control in some parts of Western Australia.

Spread potential: High, this pest is an internal feeder and would spread quickly and easily without detection. Adult flight and the transport of infested fruits are the major means of movement and dispersal to uninfested areas (CABI/EPPO, 1997). There is evidence that *C. capitata* can fly at least 20 km (Fletcher, 1989). Long distance flights of adults, particularly over water have been recorded and when fruit is unavailable in an area, both immature and mature flies will rapidly disperse (Fletcher, 1989). However, when hosts are available and other conditions are favourable the movements of the majority of adults seem to be restricted to a few hundred metres per week (Wong *et al.*, 1982).

Economic importance: High, as this insect is an important pest and has spread to almost all continents to become the single most important pest species in the family. This pest is highly polyphagous and causes damage to a wide variety of unrelated fruit crops. In Mediterranean countries, it is particularly damaging to citrus and peach (CABI/EPPO, 1997).

Quarantine status: Medfly is considered as a serious pest of citrus and other fruits in Egypt because of its ideal climate, the presence of continuously available susceptible hosts, and ineffective natural enemies. Flies insert their eggs into the citrus fruits and the larvae mine within, resulting in unmarketable fruit or its premature abscission.

The distribution of Medfly is now limited to Western Australia and is mainly restricted to the horticultural and urban areas in the southwest of the state. The largest populations of the insect occur in the Perth metropolitan area and in towns in the southwest of the state (De Lima pers. comm, 1999; Woods, 1997). In all of the towns and areas south of Manjimup, Medfly can be found in summer only for short periods. However, it is not found in orchards during the cooler months. The Ord River Irrigation area in northern Western Australia is free of this insect.

All other states of Australia are free of Medfly. Occasional, isolated, small outbreaks sometimes occur in the city of Adelaide in South Australia and the Northern Territory due to the introduction of infested fruit by humans, but they are quickly detected through extensive fruit fly surveillance networks, and the outbreaks are successfully contained and rapidly eradicated.

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Overview. *Proceedings from the National Mediterranean fruit fly Workshop*, *Perth.* pp. 5–10.
Species: *Cryptoblabes gnidiella* (Millière, 1867) [Lepidoptera: Pyralidae]

Synonym(s) and changes in combination(s): *Albinia casazzar* Briosi; *Albinia gnidiella* Millière; *Albinia wockiana*; *Cryptoblabes aliena* Swezey; *Ephestia gnidiella* (Millière).

Common name(s): Christmas berry webworm; honeydew moth; rind-boring orange moth; sorghum earhead worm.

Host(s): *Cryptoblabes gnidiella* is polyphagous and able to use almost any plant, but it is most often encountered on commercial crops.

Allium sativum (garlic) (Swailem and Ismail, 1972); Annona muricata (soursop) (CAB International, 2000); Azolla anabaena (azolla) (Sasmal and Kelshreshtha, 1978); Azolla pinnata (ferny azolla) (Takara, 1981); Citrus spp. (Ascher et al., 1983; Carter, 1984; Swailem and Ismail, 1972); Citrus limon (lemon) (Sternlicht, 1979); Citrus sinensis (sweet orange) (Silva and Mexia, 1999); Coffea spp. (coffee) (CAB International, 2000); Eleusine corana (ragi) (Singh and Singh, 1997); Eriobotrya japonica (loquat) (Ascher et al., 1983); Ficus carica (fig) (CAB International, 2000: Carter, 1984); Gossypium hirsutum (cotton) (Swailem and Ismail, 1972); Macadamia ternifolia (smooth shell macadamia nut) (macadamia) (Wysoki, 1986); Malus domestica (apple) (Carter, 1984); Mangifera indica (mango) (Hashem et al., 1997); Mespilus germanica (medlar) (CAB International, 2000; Carter, 1984); Morus alba (mulberry) (CAB International, 2000); Musa sp. (banana) (Jager and Daneel, 1999); Myrica faya (fayatree, firetree) (Duffy and Gardner, 1994); Oryza sativa (rice) (Sasmal and Kulshreshtha, 1984); Panicum miliacem (millet panic) (Singh and Singh, 1997); Paspalum dilatatum (paspalum) (Yehuda et al., 1991/1992); Pennisetum glaucum (pearl millet) (Kishore, 1991); Pennisetum typhoideus (pearl millet) (Kishore, 1991; Singh and Singh, 1997); Persea americana (avocado) (Ascher et al., 1983; Swirski et al., 1980); Phaseolus sp. (bean) (CAB International, 2000); Prunus domestica (plum, prune) (Carter, 1984); Prunus persica (peach) (Carter, 1984); Punica granatum (pomegranate) (Ascher et al., 1983; Carter, 1984); Ricinus communis (castor bean) (Singh and Singh, 1997); Saccharum officinarum (sugarcane) (CAB International, 2000); Schinus terebinthifolius (Brazilian pepper tree) (CAB International, 2000); Solanum melongena (eggplant) (Swailem and Ismail, 1972); Sorghum vulgare (sorghum) (Swailem and Ismail, 1972; Singh and Singh, 1995); Swietinia macrophylla (mahogany) (Akanbi, 1973); Tarchardia lacca (Yunus and Ho, 1980); Vaccinium sp. (blueberry) (Molina, 1998); Vitis vinifera (grapevine) (Ascher et al., 1983; Carter, 1984; Hashem et al., 1997); Zea mays (maize) (Swailem and Ismail, 1972).

Part(s) of plant affected: Flower, fruit, grain, leaf (CAB International, 2000).

Distribution: *C. gnidiella* is a cosmopolitan species in warm climates, unable to survive winters in cooler temperate areas into which it may be imported with produce. Records from the Netherlands, Scandinavian countries (Denmark, Finland, Norway and Sweden) and United Kingdom are of imported material (Karsholt, 1996). This species is native to the Mediterranean region but has been introduced to Malaysia, New Zealand, Hawaii and parts of tropical and subtropical America (Carter, 1984).

Austria (Karsholt, 1996); Bermuda (CAB International, 2000); Egypt (Swailem and Ismail, 1972); France (Karsholt, 1996); Greece (Karsholt, 1996); India (Singh and

Singh, 1995) (Karnataka (Gubbaiah, 1984), Maharashtra (Zhang, 1994), Orissa (Satapathy and Singh, 1987), Uttar Pradesh (Zhang, 1994)); Israel (Yehuda *et al.*, 1991/1992); Italy (Karsholt, 1996); Lebanon (CAB International, 2000); Liberia (CAB International, 2000); Malaysia (Yunus and Ho, 1980); Malta (Karsholt, 1996); Portugal (Karsholt, 1996); New Zealand (Zhang, 1994); Nigeria (Akanbi, 1973); Pakistan (CAB International, 2000); Sierra Leone (CAB International, 2000); South Africa (Kruger, 1998); Spain (Karsholt, 1996) (Canary Islands (CAB International, 2000)); Thailand (Takara, 1981); Turkey (Karsholt, 1996); Uruguay (CAB International, 2000); United States (Hawaii (Zimmerman, 1958)).

Biology: The species is described in detail by Zimmerman (1958) (as *C. aliena*), Carter (1984) and Goater (1986). Adults are dark-grey in colour. The wing expanse of males and females are 13.95 and 14.86 mm, respectively, whereas the body lengths are 7.33 and 7.62 mm, respectively (Singh and Singh, 1995). Adults have a greyish brown forewing, suffused with white and with scattered reddish brown scales; the hindwing is shining white in colour and the abdomen is shining greyish white (Carter, 1984).

C. gnidiella lays about 100 eggs on the fruit or on foliage and these hatch in 4–7 days (Carter, 1984). Singh and Singh (1995) observed that eggs were creamy-white in colour and measured 0.45×0.32 mm, with an incubation period of 3.79 days. There were 5 larval instars. Fully-grown larva were cylindrical in shape, brown in colour and measured 11.91×1.99 mm; the duration of the larval period was 13.32 days. The duration of the pre-pupal stage was 1.62 days. The pupa was dark brown in colour and measured 7.03×1.92 mm; the duration of the pupal period was 8.36 days. The period from egg to adult was 27.63 days. The sex ratio (male:female) was 1:0.89. The longevity of females was greater (3.94 days) than that of males (2.55 days).

Larvae mainly attack the fruit, but also feed on the foliage, bark and twigs (Liotta and Mineo, 1964). Larvae of *C. gnidiella* are often found in association with infestations by other pests. e.g. on citrus with the mealybug *Planococcus citri* and on grapes following attack by the European vine moth, *Lobesia botrana* (Carter, 1984). Pupation takes place on the food plant or on the ground. The moth is attracted to honeydew created by mealybugs (Swirski *et al.*, 1980; Zimmerman, 1958). There are three or four generations a year in southern Europe and up to five in North Africa (Carter, 1984).

In Israel, Yehuda *et al.* (1991/1992) found that *C. gnidiella* overwintered in avocado orchards on fresh or dry fruits remaining on the trees or on leaves infested with *Protopulvinaria pyriformis*, on the weed *Paspalum dilatatum* and on various other plants. Adult moths were caught in pheromone traps in March–April (5%), June–September (75%) and October–December (20%). More were trapped in young orchards than in mature orchards or in adjacent crops. Five generations were observed in the field. Overwintering moths emerged during March and April and produced a first generation that did not cause any damage to the crop. The fifth generation, flying in October to November, established the overwintering population.

The reproductive behaviour of *C. gnidiella* was also studied in the laboratory (Wysoki *et al.*, 1993). The sex ratio was 1.1:1, males to females, in both laboratory and field stocks in Israel. Most of the females that mated did so during the first night after emergence; males began mating on the following night. Mating occurred 1–2 hours before dawn and lasted on average for 100 minutes. Both sexes mated only once a

night. Most females mated only once in their lifetime, a few mated 2–4 times, whereas males mated up to 6 times. Insects that lived longer also mated more times. When the sex ratio was altered from 3:1 to 1:3, males to females, the percentage of females that mated in one night dropped from 90 to 65, whereas the number of matings/male rose from 0.32 to 2.25. When fresh one-day-old females were provided daily at a ratio of 3 per male, the males averaged 1.4 matings/lifetime versus 2.6 with 2- to 3-day-old females. A delay in mating did not affect the percentages of males and females that mated; highest percentages were obtained with 2- to 4-day-old males and females, but a delay in mating resulted in egg fertility dropping from 91% to 73%. The pre-oviposition period lasted a full day after mating, and then most of the eggs were laid during the first night. Average fecundity was 105 eggs/female (Wysoki *et al.*, 1993).

In Egypt, Swailem and Ismail (1972) found that on maize plants at 25°C and 62% R.H., there was a pre-oviposition period of 2–3 days and females laid 6–87 eggs each. The eggs were laid singly or in groups of up to three on both surfaces of maize leaves, inside the sheaths, on the husks and silks and on the developing grains. The egg stage lasted about 3 days. At an average temperature of 27°C and an average relative humidity of 60% R.H., the larval, prepupal and pupal stages averaged 12–14, 1 and 5–7 days, respectively, and at 25°C and 62% R.H. the larval and pupal stages lasted 14–16 and 8–10 days. Two species of braconids, one of which was of the genus *Phanerotoma*, were reared from the pupae. *Scolothrips sexmaculatus, Orius* spp. and a phytoseiid mite were observed preying on the eggs and early-instar larvae in the field during the summer and autumn.

A study of *C. gnidiella* population dynamics on sweet orange groves (*Citrus sinensis*), the importance of damage caused by *C. gnidiella*, and the interspecific association between *C. gnidiella* and the citrus mealybug, *Planococcus citri* were studied in four groves in the Alagarve, Portugal (Silva and Mexia, 1999). The percentage of the total *C. gnidiella* males captured in each grove showed a similar pattern and the greater percentage of males were trapped during the June–September period (except for the grove Fazenda Grande). It was possible to identify three or four distinct peaks. The results suggested a positive significant association (P = 0.05) between *C. gnidiella* and *P. citri*, supporting the hypothesis of several authors that a *P. citri* infestation is necessary for attack by *C. gnidiella* in the case of citrus. Even in the case of low *C. gnidiella* larval infestation it can cause serious damage by fruit drop and, consequently, a high reduction of sweet orange production, mainly in Navel cultivars.

In India, Singh and Singh (1995) reported that this pyralid causes serious damage on hybrid sorghum. Activity in the field in Uttar Pradesh, India, began from the end of March, when females emerged, mated and oviposited. Females of C. *gnidiella* lay their eggs singly on the spikelets and grains of the sorghum earheads following preoviposition periods of 20–28 hours (Taley *et al.*, 1974). The egg, larval and pupal stages and adult male and female life span last about 4, 12–12, 12, 4–5, and 14–15 days, respectively. Singh and Singh (1995) reported that the larvae fed on the lemma of newly-opened flowers, and milky and hard grains. The pre-oviposition and oviposition period was 21.32 and 53.27 hours, respectively. The number of eggs laid by a single female was 27.88. The pest was active from the end of March to November and overwintered in the pupal stage with the onset of cold weather. There were 9 generations each year.

Entry potential: Low to moderate, as eggs are laid on fruit and leaves and larvae attack the fruit. The honeydew moth on the fruit as the consignment is expected to be free of plant trash, soil and other organic debris. Post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing and waxing will reduce the risk of its introduction.

Establishment potential: Moderate to high. *C. gnidiella* is a polyphagous pest of numerous crops including fruit and vegetables. It is a cosmopolitan species in warm climates, unable to survive winters in cooler temperate areas into which it may be imported with produce.

Spread potential: High, as the adults can fly, has a wide host range and high fecundity.

Economic importance: High, as *C. gnidiella* is a polyphagous pest of numerous crops and is recorded as a secondary pest in citrus groves often associated with the attacks of other species such as mealy bugs and their honeydew in Portugal (Silva and Mexia, 1999).

In Egypt, *C. gnidiella* is considered a serious polyphagous pest in fruit orchard as well as in vegetables and field crops (Hashem *et al.*, 1997). C. *gnidiella* is a pest of avocadoes, citrus, grapes, loquats and pomegranates in the Mediterranean area (Balachowsky, 1972). It is most noted as an important pest of avocados in Israel, of *Azolla*, rice and sorghum in India, and sporadically of maize or other crops in any warm part of the world.

The losses caused by this pest are not quantified in the literature, although in Israel, combined losses of macadamia nuts as a result of *C. gnidiella*, *Ectomyelois ceratoniae* [*Apomyelois ceratoniae*] and the tortricid, *Cryptophlebia leucotreta* amounted to 30% (Wysoki, 1986). Singh and Singh (1995) reported that *C. gnidiella* causes serious damage on hybrid sorghum in India.

Apart from its pest status it is stated to have potential as a vector of *Botrytis cinerea* for the control of the weed *Myrica faya* in Hawaii (Duffy and Gardner, 1994).

Quarantine status: Quarantine.

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Species: Euzopherodes vapidella (Mannerheim, 1857) [Lepidoptera: Pyralidae]

Synonym(s) and changes in combination(s): *Ephestia vapidella* Mannerheim.

Common name(s): Stub moth; yam moth.

Host(s): *Citrus* spp. (Anonymous, 2000; Jeppson, 1989); *Dioscorea* spp. (yam) (Ashamo and Odeyemi, 2001); *Dioscorea alata* (greater yam) (Ashamo and Odeyemi, 2001); *Dioscorea cayenensis* (Lagos yam, yellow Guinea yam) (Ashamo and Odeyemi, 2001).

Distribution: Côte d'Ivoire (Sauphanor and Ratnadass, 1985); Egypt (Anonymous, 2000); France (Asselbergs, 1994); Israel (Jeppson, 1989); Nigeria (Ashamo and Odeyemi, 2001); West Africa (Anonymous, 1986).

Part(s) of plant affected: Fruit (Jeppson, 1989); tuber (Sauphanor and Ratnadass, 1985).

Biology: The biology of this insect on citrus has not been reported.

Euzopherodes vapidella preferentially attacks *Dioscorea alata*, generally during the first few days following harvest. Infestation may also start in the field on those parts of the tuber emerging from the mound (Anonymous, 2001b). It lays its eggs in existing wounds or holes dug by its larvae from a previous generation but can also penetrate the epidermis for this purpose (Anonymous, 2001a). The damage is visible from the "dust-like" excreta on the surface of the tuber. In West Africa, this species is controlled by using the chemical deltamethrin at 10 or pirimiphos-methyl at 25 g/100 L water (Anonymous, 1986).

The fecundity and development of *E. vapidella* on *D. alata* was investigated in the laboratory by Ashamo and Odeyemi (2001) at four different temperatures: 20, 24, 29 and 33°C. The mean fecundity per female at the above temperatures was 51.8 ± 3.5 , 102.4 ± 3.8 , 123.3 ± 4.4 and 124.4 ± 4.4 eggs respectively. Hatchability of eggs was highest at 29°C and lowest at 20°C. The mean developmental time at 20, 24, 29 and 33°C was 12.1 ± 0.6 , 6.2 ± 0.3 , 3.0 ± 0.0 and 2.7 ± 0.1 days for the egg, 23.6 ± 1.1 , 20.0 ± 0.9 , $15. \pm 0.7$ and 12.9 ± 0.4 days for the larval stages, 13.0 ± 0.03 , 8.9 ± 0.02 , 7.9 ± 0.02 , and 6.4 ± 0.03 days for the pupa and 48.7 ± 3.5 , 35.1 ± 2.3 , 26.3 ± 1.2 and 22.0 ± 1.0 days for the period from egg to adult emergence respectively. The developmental threshold for the egg stage was estimated as 16.8° C with thresholds of 8.0, 6.2 and 11.4° C for larvae, pupae and egg to adult emergence, respectively (Ashamo and Odeyemi (2001). Storage of yam tubers at low temperatures (but higher than 12° C to avoid damage to tubers) will significantly retard the development of *E. vapidella* and therefore help in their control. Adult males ranged from 0.50 to 0.65 cm in length and females from 0.70 to 0.90 cm.

Entry potential: Low, as the post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing and waxing will reduce the risk of introduction of this pest.

Establishment potential: Low, as it has a narrow host range i.e. yams and citrus. It is a significant pest on yams and a minor pest on citrus. It is mainly a pest in warmer climates.

Spread potential: Moderate, as the adults can fly but its host range is restricted and its prevalence is restricted to regions of warmer climates.

Economic importance: Moderate. *E. vapidella* is a pest of significance in stored yams. In recent years in the Ivory Coast insect attack on yams (*Dioscorea* spp.) stored fresh on the premises of the growers has increased considerably, sometimes leading to the destruction of half the crop after several months of storage (Sauphanor and Ratnadass, 1985). The damage was caused by the two main pests, the pyralid *E. vapidella* (which was formerly known only in Nigeria) and a tineid belonging to an unidentified genus, which develops on drier foods than the first species. The tineid appears on *D. alata* only after at least 3 months of storage and is the only one of the two species to attack *D. cayenensis* (Sauphanor and Ratnadass, 1985).

Quarantine status: Quarantine.

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Species: Parabemisia myricae (Kuwana, 1927) [Hemiptera: Aleyrodidae]

Synonym(s) and changes in combination(s): *Bemisia myricae* Kuwana, 1927.

Common name(s): Bayberry whitefly; Japanese bayberry whitefly.

Host(s): Acer spp. (maple) (Uygun et al., 1990); Betula spp. (birch) (CAB International, 2000); Camellia sinensis (tea) (Hamon et al., 1990; Mound and Halsey, 1978; Luo and Zhou, 1997); Carya illinoensis (pecan) (Uygun et al., 1990); Chiococca alba (snowberry) (Hamon et al., 1990); Cinnamomum camphora (camphor tree) (CAB International, 2000); Citrus spp. (Hamon et al., 1990; Mound and Halsey, 1978; Citrus limon (lemon) (Uygun et al., 1990); Uygun et al., 1990); Coffea sp. (coffee) (CAB International, 2000); Cucurbitaceae (cucurbits) (CAB International, 2000); Cydonia oblonga (quince) (Uygun et al., 1990); Diospyros kaki (persimmon) (CAB International, 2000; Mound and Halsey, 1978); Elaeocarpus serratus (Cevlon olive) (Mound and Halsey, 1978; Uygun et al., 1990); Eriobotrya japonica (loquat) (CAB International, 2000); Ficus sp. (fig) (Uygun et al., 1990); Ficus carica (fig) (CAB International, 2000; Mound and Halsey, 1978); Gardenia jasminoides (Cape jasmine) (CAB International, 2000); Hibiscus sp. (rosemallow) (CAB International, 2000); Lamium sp. (deadnettle) (Uygun et al., 1990); Laurus nobilis (bay, laurel) (Uygun et al., 1990); Lycopersicon esculentum (tomato) (CAB International, 2000; Uvgun et al., 1990); Machilus sp. (Mound and Halsev, 1978); Maclura pomifera (Osage orange) (Uygun et al., 1990); Maesa japonica (Mound and Halsey, 1978); Malva neglecta (mallow) (Uygun et al., 1990); Malus communis (batu apple) (Uygun et al., 1990); Mercurialis annua (annual mercury) (Uygun et al., 1990); Morella rubra (Chinese arbutus) (Hamon et al., 1990); Morus alba (white mulberry) (CAB International, 2000; Mound and Halsey, 1978); Morus sp. (mulberry) (Uygun et al., 1990); Murraya koenigii (curry leaf tree) (CAB International, 2000); Myristica fragrans (nutmeg) (CAB International, 2000); Myrtus communis (true myrtle) (Uygun et al., 1990); Parthenocissus quinquefolia (Virginia creeper) (Uygun et al., 1990); Persea americana (avocado) (CAB International, 2000; Uygun et al., 1990); Polygonum sp. (knotgrass) (Uygun et al., 1990); Prunus avium (cherry) (CAB International, 2000); Prunus domestica (plum) (CAB International, 2000); Prunus mume (Japanese apricot) (Mound and Halsey, 1978); Prunus persica (peach) (CAB International, 2000; Mound and Halsey, 1978); *Prunus salicina* (Japanese plum) (CAB International, 2000); Prunus triflora (Florentia L. Japanese variety) (Mound and Halsey, 1978); Psidium guajava (guava) (CAB International, 2000; Mound and Halsey, 1978); Punica granatum (granada, pomegranate) (Uygun et al., 1990); Pyrus communis (pear) (CAB International, 2000; Uygun et al., 1990); Quercus spp. (oak) (CAB International, 2000); *Quercus acutissima* (sawtooth oak) (Uygun et al., 1990); Ouercus serrata (konara oak) (Mound and Halsey, 1978); Rhododendron sp. (azalea, rhododendron) (CAB International, 2000; Mound and Halsey, 1978); Rosa sp. (rose) (Uygun et al., 1990); Rubus sp. (blackberry, raspberry) (Uygun et al., 1990); Salix babylonica (weeping willow) (Mound and Halsey, 1978); Salix gracilistyla (rose-gold pussy willow) (Mound and Halsey, 1978); Salix spp. (willow) (CAB International, 2000); Solanum nigrum (black nightshade, common nightshade) (Uygun et al., 1990); Sonchus sp. (sow thistle) (Uygun et al., 1990); Vitex sp. (CAB International, 2000); Vitis spp. (grape) (Uygun et al., 1990).

Part(s) of plant affected: Fruit, leaf, wood (Jeppson, 1989; Uygun et al., 1990).

Distribution: *Parabemisia myricae* is thought to be Asian in origin (Rose and Rosen, 1991). Takahashi (1952) recorded it from Malaya [now Malaysia] but this material has not been available for examination. Material from Sarawak (Malaysia) in the Natural History Museum (London, UK) collection is not listed in the distribution of *P. myricae* because its morphology differs slightly; the material may not be conspecific with *P. myricae*. The record from Hawaii mentioned in USDA (1978) is based on a single collection on coffee in Hawaii in the early 1900s and seven subsequent quarantine interceptions since 1954. No material or other reference to its presence there has been seen.

P. myricae has extended its geographical range dramatically in the past 30 years, particularly in the Mediterranean region. Specimens from India (held in the Natural History Museum, London) are from quarantine interceptions in 1994.

Algeria (Berkani and Dridi, 1992); China (Luo and Zhou, 1997) (Hong Kong (Hamon *et al.*, 1990)); Côte d'Ivoire (IIE, 1992); Croatia (Zanic *et al.*, 2000); Cyprus (CABI/EPPO, 1997); Egypt (IIE, 1992); Greece (Michalopoulos, 1989); Israel (Hamon *et al.*, 1990; IIE, 1992); Italy (Rapisarda, 1990); Japan (Hamon *et al.*, 1990; IIE, 1992); Mound and Halsey, 1978); Lebanon (Aslam, 1995); Malaysia (Mound and Halsey, 1978; Takahashi, 1952); Papua New Guinea (CABI/EPPO, 1997); Portugal (Franco *et al.*, 1996); Spain (Garcia-Segura, 1992; IIE, 1992); Taiwan, Province of China (Chou *et al.*, 1996; IIE, 1992); Tunisia (Chermiti *et al.*, 1993); Turkey (IIE, 1992); Ukraine (CAB International, 2000); United States (California (Hamon *et al.*, 1990; USDA, 1978), Florida (Hamon *et al.*, 1990), Hawaii (USDA, 1978)); Venezuela (Chavez and Alvaro-Chavez, 1985; Hamon *et al.*, 1990); Vietnam (Waterhouse, 1993).

Biology: Adults are 0.89–1.12 mm in length, moth-like and whitish-yellow in colour (Uygun *et al.*, 1990). Reproduction is by parthenogenesis (development from an unfertilised egg), with males occurring only exceptionally (Uygun *et al.*, 1990). Adults fly in the morning and evening, redistributing themselves within the crop and locating leaves suitable for feeding and oviposition (Meyerdirk and Moreno, 1984).

On citrus groves in Turkey, Uvgun et al. (1990) noted that at low population densities, oviposition occurs on very young, actively growing citrus foliage which have not yet completely unfolded. Fully expanded (mature) leaves may be chosen later, but old leaves are never chosen. At high population densities oviposition may also take place on young fruits and shoots (Uygun et al., 1990). Females live for up to 6 days at $25 \pm 1^{\circ}$ C and $60 \pm 5\%$ R.H. and produce an average of 70 eggs (Uygun *et* al., 1990). Eggs are 0.17–0.23 mm in length, are white when newly laid, but turn blackish during the course of development. Eggs are deposited either singly, in circles or half circles along leaf margins and on the veins. Nymphs are active only during the first instar (or crawler) stage, becoming sessile for the remaining nymphal (larval) instars. Length ranges from 0.25–0.65 mm over the 3 larval instar stages. Nymphs are surrounded by a waxy secretion. This species hibernates in the larval stage or in the puparium. During warm weather some adults may emerge and even oviposit in the winter. However, complete development from egg to adult never occurs during winter. The life cycle takes about 24 days at $60 \pm 5\%$ R.H. ($60 \pm 5\%$ R.H.). There are 7–8 generations per year. Whitefly occurrence is enhanced by high humidity. Developmental threshold temperature is 10.2°C and optimum development temperature is 25–26°C.

High population densities cause direct damage to plants by sucking nutrients from young leaves and excreting honeydew onto the fruit and leaves, leading to sooty mould growth that interferes with photosynthesis (Uygun *et al.*, 1990; Walker and Aitken, 1985). This direct and indirect feeding damage caused by *P. myricae* can result in defoliation of the trees (Rose *et al.*, 1981). Other types of feeding damage include discolouration and deformations in very young leaves. Heavy infestations can result in premature leaf drop, especially during periods of dry weather.

On citrus in California, adult females lay eggs selectively on new, small foliage, often referred to as feather growth (Jeppson, 1989). Eggs, each attached with a supporting pedicel are laid on both sides of the leaves. The eggs are white when newly laid, but turn blackish during the course of development (Walker and Aitken, 1985). On hatching, the nymphs (larvae) feed on the lower surface of the leaves. The larval stages have a clear, wax fringe around the body margin. Complete larval development can occur on green wood (Uygun *et al.*, 1990). Its life cycle requires 21 days for completion under variable day/night conditions at 21°C to 17.3°C and 65–100% R.H. (Rose *et al.*, 1981). Adults feed on leaves, but they also feed and lay eggs on fruit and green angular wood (Rose *et al.*, 1981).

Under field conditions in California, *P. myricae* strongly prefers to oviposit on young (actively growing) foliar terminals of lemon over middle terminals (meristematic growth ceased, leaves still soft and light green) and mature terminals (leaves hardened and dark green (Walker and Aitken, 1985). Within young terminals, newly laid eggs are concentrated on the apical 5–6 cm where leaves are youngest. When first instars (crawlers) of *P. myricae* were placed experimentally on young, middle and mature leaves, 49, 35 and 0%, respectively, successfully developed to the adult stage. Walker and Aitken (1993) recorded five generations per year in California and a development requirement of 265 day degrees C, with lower and upper thresholds of development of 12.8 and 30.6°C.

In Israel, larvae and adults are found on citrus and avocado trees throughout the winter (Swirski *et al.*, 1986). The oviposition rate of *P. myricae* in winter was low, and rose steeply in the spring. The density of larvae on the lower side of leaves was higher than on the upper side. Substantial numbers (45.4%) of larvae survived the winter on avocado trees. Emergence of adults increased at the end of February, reached a peak in early March, and ceased at the end of March or beginning of April.

In Turkey, the population development of *P. myricae* was studied on lemon, grapefruit, orange and mandarin in an 8-year-old orchard from January 1986 to July 1987 (Atay and Sekeroglu, 1987). Population densities of immatures remained low in 1986 until July and then increased to a peak in mid-September. Immature populations were also low early in 1987 but reached a peak in June–July. The population trends were similar on all food plants, but the number of aleyrodids per leaf was highest on lemon, followed in descending order by grapefruit, orange and mandarin. Larval mortality was high, with only 8–16% of the eggs laid reaching the pupal stage. Adults caught in yellow sticky traps in 1986 showed similar population trends to the larvae, remaining low in numbers early in the season and reaching a peak by September. In 1987, almost no adults were trapped until June, and a slight population increase was observed in July.

In laboratory studies conducted by Uygun *et al.* (1993) in Turkey, the developmental time from egg to adult was 79.7, 41.7, 24.4 and 22 days at 15, 20, 25 and 30°C,

respectively. At a fluctuating temperature of 25–35°C (12–12 hours), the developmental time was 24.2 days. With increasing relative humidity at 25°C constant temperature, the total developmental time decreased significantly from 26.7 days at 40% R.H. to 20.3 days at 90% R.H. The mortality rate was lowest at 25°C and highest at 30°C. In Cyprus up to nine generations occur per year (Orphanides, 1991).

In Turkey, Ulusoy *et al.* (1999) studied the effect of 6 citrus and 5 non-citrus host plants on the developmental period of immature stages of *P. myricae*. The developmental time on the citrus host plants from egg stage to adult was found to be 16.1, 16.1, 19.2, 20.0, 24.4 and 29.3 days on lemon, mandarin, grapefruit, sweet-orange, sour-orange, and trifoliate, respectively. The developmental time on the non-citrus host plants was 15.7, 20.4, 20.8, 23.8 and 26.4 days on grapevine, peach, rose, mulberry and pomegranate, respectively. The mortality rate during egg stage was lowest on lemon and rose and was highest on sweet-orange and peach. The total mortality rate of all immature stages was lowest on sour-orange and grapevine but highest on trifoliate (*Poncirus trifoliata*) and peach.

Entry potential: Low, as the post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing and waxing will reduce the risk associated with the entry of this pest.

Establishment potential: High, this species has a high reproductive rate, wide host range and can establish in warm and cool climate in the absence of natural enemies.

Spread potential: Medium, as whiteflies are not very effective flyers and have limited ability to direct their flight (Byrne *et al.*, 1990). There is no real evidence of long range migrations (greater than 100 km), although most movement of this type is probably human-assisted (Byrne *et al.*, 1990). First instars (crawlers) are able to disperse within the host plant. Most whiteflies are not inclined to leave the plants on which they originated, especially if conditions remain favourable (Gerling and Horowitz, 1984).

Economic significance: High, as *P. myricae* is considered to be one of the six most injurious whitefly pests (Onillon, 1990). Rose and Rosen (1991) describe it as very damaging to citrus in California. It was one of the most serious pests of citrus in Turkey until biological control was established (Sengonca *et al.*, 1993) and caused heavy damage to citrus in Israel until it was controlled biologically (Swirsky *et al.*, 1985). In Florida, *P. myricae* has been recorded damaging citrus seedlings when the natural balance was disturbed by the use of chemicals, eliminating the parasitoid but not the pest (Hamon *et al.*, 1990). In Algeria, it is regarded as a citrus pest (Berkani and Dridi, 1992). In Turkey *P. myricae* has been shown to be able to transmit the citrus chlorotic dwarf (CCD) (Korkmaz *et al.*, 1996). It was not possible to transmit the causal agent mechanically to citrus seedlings or herbaceous plants by leaf-inoculation or by knife cuts, simulating pruning. According to the results, vector transmission appeared to be the primary means of transmission of CCD. Feeding by *P. myricae* causes direct damage, and sooty moulds growing on honeydew deposits block light and air from the leaves, reducing photosynthesis and productivity.

Quarantine status: Quarantine. *P. myricae* is pest is on the EPPO A2 list (CABI/EPPO, 1997).

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Species: *Parlatoria ziziphi* (Lucas, 1853) [Hemiptera: Diaspididae]

Synonym(s) and changes in combination(s): *Coccus zizyphus* Lucas, 1853; *Parlatoria lucasii* Targioni; *Parlatoria ziziphus* (Lucas); *Parlatoria zizyphus* (Lucas).

Common name(s): Black parlatoria scale; black scale; citrus scale; ebony scale; leaf black scale; lime scale.

Host(s): *Campnosperma brevipetiolata* (Beardsley, 1966); *Citrus aurantifolia* (lime) (CAB International, 2000); *Citrus aurantium* (sour orange) (Beardsley, 1966; CAB International, 2000); *Citrus hystrix* (caffre lime, Mauritius papeda); (CAB International, 2000); *Citrus limon* (lemon) (CAB International, 2000); *Citrus nobilis* (tangor) (CAB International, 2000); *Citrus paradisi* (grapefruit) (CAB International, 2000); *Citrus reticulata* (mandarin) (CAB International, 2000); *Citrus sinensis* (navel orange) (CAB International, 2000); *Citrus spp.* (Beardsley, 1966; CAB International, 2000); *Cocos nucifera* (coconut) (Beardsley, 1966); *Mangifera indica* (mango) (Beardsley, 1966); *Murraya paniculata* (orange jessamine) (CAB International, 2000); *Nypa fruticans* (mangrove palm) (Beardsley, 1966); *Nypa sp.* (Beardsley, 1966); *Phoenix dactylifera* (date palm) (CAB International, 2000); *Psidium* sp. (guava) (Dekle, 1976); *Severinia buxifolia* (Chinese box-orange) (CAB International, 2000); *Ziziphus* sp. (jujube) (Dekle, 1976).

Part(s) of plant affected: Branch, fruit, leaf, stem (CAB International, 2000).

Distribution: Africa (CAB International, 2000); Algeria (CIE, 1964); Argentina (CIE, 1964); Australia (Northern Territory – eradicated (AQIS, 1993)); Bangladesh (CIE, 1964); Barbados (CAB International, 2000); Brazil (CAB International, 2000); Cambodia (Waterhouse, 1993); Cameroon (CIE, 1964); Central African Republic (CIE, 1964); China (CIE, 1964); Colombia (CAB International, 2000); Congo (CIE, 1964); Congo, Democratic Republic (CAB International, 2000); Côte d'Ivoire (CIE, 1964); Cuba (CIE, 1964); Cyprus (CIE, 1964); Dominica (restricted distribution) (CAB International, 2000); Dominican Republic (CAB International, 2000); Egypt (CIE, 1964); Eritrea (CIE, 1964); Ethiopia (CAB International, 2000); Federated States of Micronesia (CAB International, 2000); France (restricted distribution) (CIE, 1964); Gambia (CIE, 1964); Georgia (CAB International, 2000); Ghana (CIE, 1964); Greece (CIE, 1964); Guam (restricted distribution) (CAB International, 2000); Guatemala (CAB International, 2000); Guinea (CIE, 1964); Guyana (CIE, 1964); Haiti (CAB International, 2000); India (Tamil Nadu, West Bengal (CIE, 1964)); Indonesia (Irian Jaya, Java, Sumatra (CIE, 1964)); Iran, Islamic Republic of (CIE, 1964); Israel (CAB International, 2000); Italy (CIE, 1964); Jamaica (CIE, 1964); Japan (CIE, 1964); Korea, Democratic People's Republic of (CAB International, 2000); Korea, Republic of (CAB International, 2000); Laos (Waterhouse, 1993); Lebanon (CAB International, 2000); Liberia (CAB International, 2000); Libya (CIE, 1964); Malaysia (CIE, 1964); Mali (CIE, 1964); Malta (CIE, 1964); Mauritius (CIE, 1964): Middle East (CAB International, 2000): Morocco (CIE, 1964): Myanmar (CIE, 1964; Waterhouse, 1993); New Zealand (restricted distribution) (CAB International, 2000); Nigeria (CIE, 1964); Northern Mariana Islands (restricted distribution) (CAB International, 2000); Pakistan (CAB International, 2000); Panama (CAB International, 2000); Peru (CAB International, 2000); Philippines (CIE, 1964); Portugal (restricted distribution) (CAB International, 2000); Puerto Rico (CAB International, 2000); Russian Federation (CAB International, 2000); Saudi Arabia (restricted distribution) (CAB International, 2000); Senegal (CIE, 1964); Sierra Leone (CIE, 1964); Singapore (restricted distribution) (Waterhouse, 1993); South Africa (CIE, 1964); Spain (CIE, 1964) (Canary Islands (Carnero Hernandez and Perez Guerra, 1986)); Sri Lanka (CAB International, 2000); Syrian Arab Republic (restricted distribution) (CAB International, 2000); Thailand (CIE, 1964); Togo (CAB International, 2000); Trinidad and Tobago (CAB International, 2000); Tunisia (CIE, 1964); Turkey (CAB International, 2000); United States (CAB International, 2000); United States Virgin Islands (restricted distribution) (CAB International, 2000); Venezuela (restricted distribution) (CAB International, 2000); Vietnam (CIE, 1964; Waterhouse, 1993).

Biology: This pest infests the shoots, foliage and fruit. The depletion of plant sap leads to reduced host vigour and the foliage and fruit may be discoloured with yellow streaking and spotting. Heavy infestations cause chlorosis on foliage and stems, premature dropping of leaves, moderate to severe defoliation, dieback of twigs and branches, stunting and distortion of fruit, spots on fruit and fruit drop before it is mature. Severe infestations can drastically affect plant vigour and may even kill the plant (Fasulo and Brooks, 1997). Female armour is 1.25–2 mm in length, flat to slightly convex, while adult males are flat, elongated and about 1/3 the size of the female. Adult females are immobile, wingless and often have no legs. In contrast, males usually have one pair of wings, well-developed legs and lack mouthparts, as they do not feed. Males live for only a few hours while females live for some months. Reproduction is bisexual (production of fertilised eggs).

The adult female lays from 8 to 20 eggs (Fasulo and Brooks, 1997). Females feeding on fruit lay more eggs than those feeding on the branches or foliage, and the eggs hatch in 5–12 days and pass through nymphal stages lasting 23–35 days (Sweilem *et al.*, 1984). Nymphs are active only during the first instar (or crawler) stage and may travel some distance to a new plant; they become sessile for the remaining nymphal (larval) instars. The crawlers settle down and feed upon plant juices by inserting their piercing-sucking mouthparts into the host plant. Depending upon the region of the world, there are from three to seven generations per year and each generation may take 30–93 days to develop. In colder weather the time required is much longer (Fasulo and Brooks, 1997). All stages of development can be found throughout the year. Population density appeared to be significantly positively influenced by temperature and negatively influenced by relative humidity and rainfall, although the latter was not found to be significant (El Bolok *et al.*, 1984a). The highest population densities were usually observed in the lowest part of the tree (El Bolok *et al.*, 1984b).

Leaves are the preferred feeding site but fruit and branches are also attacked (Fasulo and Brooks, 1997). Generally, scales firmly attach to the fruit so that they cannot be removed, causing rejection in most fresh fruit markets. Most scales settle on the upper leaf surface; the lower surface only becomes infested at very high population densities (Fasulo and Brooks, 1997).

Entry potential: Low, as pre-harvest control measures routinely carried out in citrus orchards and post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing and waxing will reduce the risk associated with the entry of this pest. Also, packing house procedures and quality control procedures in-place will discard the infested fruits

Establishment potential: High, as this pest was established in the Northern Territory, Australia early this century but was eradicated during the citrus canker eradication.

Spread potential: High, adult males are capable of flight but are weak flyers, though dispersal may be subject to wind conditions. First instars (crawlers) are able to disperse by active wandering and by wind. Occasionally other agencies such as birds, insects, movement of plant material, and other animals, including humans, may serve as accidental carriers. The pest is probably of Asian origin but has spread to all zoogeographical regions. It is found mainly in the tropics, but also extends into temperate regions (CAB International, 2000).

Economic importance: Moderate to high. *P. ziziphi* is recorded as a pest of citrus but there are few details of the economic losses caused by this pest on citrus. It has been reported causing serious damage in East Java on varieties of *Citrus nobilis* where shoots and leaves were attacked (Kalshoven, 1981). This pest has long been considered as a major pest while in some countries it is not considered as a serious pest.

Quarantine status: Quarantine.

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Species: *Phyllocoptruta citri* Soliman & Abou-Awad, 1978 [Acarina: Eriophyidae]

Synonym(s) and changes in combination(s): Not known.

Common name(s): Eriophyid rust mite.

Host(s): Citrus (Soliman and Abou-Awad, 1978).

Distribution: Egypt (Soliman and Abou-Awad, 1978).

Part(s) of plant affected: Fruit, leaf (Soliman and Abou-Awad, 1978).

Biology: *Phyllocoptruta citri* was found on citrus at Rashid, El-Behera, in Egypt, causing russeting of the fruit and leaves (Soliman and Abou-Awad, 1978). Both male and female mites were described and found to be very similar to the common citrus rust mite, *P. oleivora* (Ashmead). The only salient morphological difference was that *P. citri* has a longer genital seta $(33-46 \mu)$ that surpasses the first ventral seta.

Although nothing has been reported on the biology of *P. citri*, it is reasonable to assume that this new species may have biological and behavioural patterns similar to that of *P. oleivora* because morphologically they are very similar. *P. oleivora* lays eggs either singly or in groups in depressions in the fruit rind or in the leaf surface (Smith *et al.*, 1997). The egg hatches and gives rise to two nymphal stages before reaching adulthood. For *P. oleivora*, the complete cycle ranges from 7-10 days in summer, and lengthens to 14 days, or more, during winter (CAB International, 2000). Smith *et al.* (1997) has reported that the life cycle from egg to adult takes about 6 days at 30°C for P. *oleivora*. The adult female lives for 4–6 weeks and lays an average of 30 eggs (Smith *et al.*, 1997).

Entry potential: Low, as the post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing and waxing will reduce the risk of its introduction. Their presence can be detected by the silvering and russeting of fruits.

Establishment potential: Low to moderate, as the rust mite thus far has only been reported on citrus species. Warm and humid conditions favour the development of this *Phyllocoptruta* rust mite. Population dynamics in the field is closely related to nutrition of hosts, temperature, humidity, rainfall, and sunshine.

Spread potential: Low, as the host range is restricted only to citrus species and their dispersal is passive.

Economic importance: Moderate, as *P. citri* infests navel, Valencia and mandarin oranges in descending order of preference (Soliman and Abou-Awad, 1978). *P. oleivora* has been recognised as an important arthropod pest on citrus (Yothers and Mason, 1930), causing injury to the fruit, leaves, and young terminal shoots (McCoy *et al.*, 1976). *Phyllocoptruta* rust mites feed on the epidermal layer of cells on the rind of both immature and mature citrus fruit, resulting in early or late season fruit blemish referred to as russeting. Epidermal cells die, wound periderm develops, with both reduced fruit size and yield reduction occurring following early season injury (Albrigo and McCoy, 1974). One result of mite damage is small fruit, which not only appears substandard, but also deteriorates rapidly. Heavy populations of the mites cause bronzing of leaves and green twigs, and general loss of vitality of the whole tree

(CAB International, 2000). Water loss, reduced bonding force of the fruit, and increased fruit drop are greater on citrus rust mite-damaged fruit compared to clean fruit (Allen, 1978).

Quarantine status: Quarantine.

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Species: *Prays citri* Millière, 1864 [Lepidoptera: Yponomeutidae]

Synonym(s) or changes in combination(s): *Acrolepia citri* (Millière); *Prays citri* (Millière, 1873); *Prays nephelomima* Meyrick, 1907.

Common name(s): Citrus blossom moth; citrus flower moth; citrus young fruit borer.

Host(s): *Citrus* is the only known primary host. *Citrus aurantifolia* (lime) (Ibrahim and Shahateh, 1984); *Citrus limon* (lemon) (Ibrahim and Shahateh, 1984); *Citrus paradisi* (grapefruit) (Ibrahim and Shahateh, 1984); *Citrus reticulata* (mandarin, tangerine) (Ibrahim and Shahateh, 1984); *Citrus sinensis* (orange) (Ibrahim and Shahateh, 1984). Other secondary hosts include *Casimiroa edulis* (white sapote) and *Ligustrum lucidum* (glossy privet) (Sinacori and Mineo, 1997).

Part(s) of plant affected: Flower, fruit, leaf (Ibrahim and Shahateh, 1984).

Distribution: According to Common (1990), *P. citri* has not been reported in Australia although seven *Prays* species are endemic in Australia.

Algeria (CIE, 1982); Cyprus (CIE, 1982; Gerini, 1997); Egypt (CIE, 1982; Ibrahim and Shahateh, 1984); Fiji (CAB International, 2000); France (Arambourg and Pralavorio, 1978; CIE, 1982); Greece (Katsoyannos, 1996); India (Carter, 1984); Israel (CIE, 1982; Sternlicht, 1979); Italy (CIE, 1982; Mineo, 1967); Japan (Carter, 1984; Horiike and Hirano, 1980); Lebanon (CIE, 1982); Libyan Arab Jamahiriya (CIE, 1982); Malaysia (Yunus and Ho, 1980); Malta (CIE, 1982); Mauritius (CIE, 1982); Morocco (CIE, 1982); New Zealand (CAB International, 2000); Pakistan (CAB International, 2000); Philippines (CAB International, 2000); Portugal (CIE, 1982; Mendonca *et al.*, 1997); Samoa (CAB International, 2000); Seychelles (CIE, 1982); South Africa (Annecke and Moran, 1982; CIE, 1982); Spain (Canary Islands (CIE, 1982; Moreno and Garijo, 1978)); Sri Lanka (CAB International, 2000); Syrian Arab Republic (CIE, 1982); Tunisia (CIE, 1982); Turkey (CIE, 1982; Soylu, 1979); Zimbabwe (CIE, 1982).

Biology: *Prays citri* infests citrus in Egypt especially in the northern region, attacking the leaves, flowers and developing fruits (Ibrahim and Shahateh, 1984). Lime (*Citrus aurantifolia*) was the species most susceptible to the pest, followed by lemon, sweet orange, mandarin and grapefruit in order of decreasing susceptibility. In the laboratory, this species had 15 overlapping generations from July 1978 to June 1979, each lasting 14–47 days according to the time of year (Ibrahim and Shahateh, 1984). The egg stage lasted 2–6 days, the larval stage 7.25 days, the pupal stage 3–10 days and the adult stage 2–18 days (with preoviposition, oviposition and post oviposition periods of 2–6, 4–11 and 1–4 days, respectively, in females). Females laid 39–334 eggs each (Ibrahim and Shahateh, 1984).

Field observations made by Mineo (1967) in Sicily on citrus (especially lemon), indicated that the females oviposit not only on the flower buds and the developing fruit but also on leaf shoots and larger fruits; the larvae develop successfully, however, only from eggs laid on buds or shoots. They are able to migrate to a certain extent but die if they encounter lignified tissue in the sepals or peduncle or pierce the juice or oil-bearing cells in the fruits. The larvae feed not only on reproductive organs, binding them together with silk threads, but also on young fruits. Pupation occurs among damaged flowers or leaves. Separate matings are necessary between each batch of viable eggs (Liotta and Mineo, 1963).

In 1978–79 in Sicily, using pheromone traps with capsules containing 160 mµ g of (Z)-7-tetradecenal, Mineo *et al.* (1980) found that males of *P. citri* were caught almost throughout the year, being rare only at the end of February or beginning of March. During August the highest catches were observed between mid-May and mid-July and between early October and early November. Weekly catches/trap varied greatly according to the location of the trap, from 33 to 1110. Fruit infestation rate was 10–40% in the autumn of 1978, but in 1979 it was 4–16%. Flower infestation was low until April but reached 100% in May and remained very high until the end of June, when the average number of eggs and larvae/flower varied from 6.2 to 7.8. Flower infestation began again in the second half of August and reached 100% in September, with the numbers of eggs and larvae averaging 10/flower. The relationship of male catches to the degree of infestation is largely influenced by cultural and climatic factors.

The phenology of the preimaginal stages of *P. citri* was studied in 3 lemon orchards in Sicily in 1986–88 (Mineo *et al.*, 1991). Eggs and larvae of this species were found all year round, although they were more abundant in the first 3 weeks of January, from the beginning of May to mid-July, and from the end of August until the end of December. The results indicated that control of *P. citri* should be affected only when necessary during periods of late flowering, i.e. in May–June or August–September. In Sicily, there are 11 generations a year (Jeppson, 1989).

In laboratory experiments in Israel with *P. citri* (Mill.), Sternlicht (1974) reported that females 1–16 hours old proved more attractive to males 2–6 days old than did female pupae 1–8 hours before emergence or female adults 1–4 days old. Attractiveness in the field was tested by means of sticky traps baited with female pupae or adult females. The females were attractive for up to 14 days in summer (19–30°C) and 27 days in winter (8–20°C). The greatest attractiveness was shown by females 1–7 days old during summer as compared with females 5–9 days old during winter.

Entry potential: Low, as larvae feed on developing (young) citrus fruit. Washing, brushing and waxing of citrus fruits would further reduce the risk of its introduction.

Establishment potential: Moderate, as ovipositing females are able to migrate to a certain extent but die if they encounter lignified tissue in the sepals or peduncle or pierce the juice or oil-bearing cells in the fruits. This moth has a high reproductive rate with more than 10 generations per year, but has a limited host range.

Spread potential: Moderate, as ovipositing females are able to migrate to a certain extent and adults can fly.

Economic importance: High, as *P. citri* is a serious pest of citrus in the Mediterranean area and eastern and South-east Asia. Sternlicht *et al.* (1990) showed that lemon trees without any control measures decline in fruit yield.

Quarantine status: Quarantine.

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Species: *Stathmopoda auriferella* (Walker) [Lepidoptera: Sesiidae]

Synonym(s) and changes in combination(s): *Stathmopoda adulatrix* Meyrick; *Stathmopoda theoris* Meyrick.

Common name(s): Apple heliodinid.

Host(s): Actinidia chinensis (kiwi fruit) (Park et al., 1994); Citrus sinensis (navel orange) (Badr et al., 1986; CAB International, 2000); Cocos nucifera (coconut) (Yunus and Ho, 1980); Coffea canephora (robusta coffee) (Yunus and Ho, 1980); Mangifera indica (mango) (Badr et al., 1986; CAB International, 2000); Malus domestica (apple) (MAFF, 1990); Prunus persica (peach) (AQIS, 1997); Vitis vinifera (grapevine) (AQIS, 1997).

Part(s) of plant affected: The larvae are known to damage flower buds, flowers and fruits of peach, nectarine and fruit of grape in Japan (AQIS, 1997).

Distribution: Cameroon (Zhang, 1994); Egypt (Badr *et al.*, 1986); India (Ramzan and Judge, 1994); Japan (AQIS, 1997); Korea, Republic of (Park *et al.*, 1994); Malaysia (Yunus and Ho, 1980); Nigeria (Zhang, 1994); Pakistan (Mahdihassan, 1981).

Biology: The biology of this insect on citrus has not been reported.

In 1991–93, a study was carried out to investigate insects associated with kiwi fruits and ecological characteristics of *Stathmopoda* in Chonnam province, Korea Republic (Park *et al.*, 1994). In this study, the body size of each stage of *S. auriferella* was measured and found to be: 0.12 mm for the egg, 9.8 mm for mature larva, 5.9 mm for pupae and 12.3 mm for an adult with opened wings. Adults occurred from late May to mid-July and mid-August to early September with two peaks in early to mid-June and late August. Change in age structure (% larva: % pupae) over time was 100:0 in early-July, 96.1:3.9 in mid-July, 64.9:35.1 in late July, 19.8:80.2 in early August, and 0:100 in mid-August. *S. auriferella* appears to have two generations a year.

In a study conducted on kiwi fruit in Korea, the proportion of damaged fruit was 4.6% in early July, >40% in mid-July, and then the damage surpassed the damage threshold (Park *et al.*, 1994). The rate of fruit damage was 45.9%, and non-significant among counties. The damaged parts of the kiwi fruits were mainly the fruit apex (70%) followed by the fruit stalk (11.1%) (Park *et al.*, 1994).

Entry potential: Low on citrus, as this pest usually infests kiwi fruit, stone fruit and apples. Post-harvest handling treatments such as washing in detergents, brushing and waxing in combination with inspection will reduce the risk of entry of this pest on citrus fruits.

Establishment potential: Moderate to high, as climate and hosts for the establishment of this pest is available in Australia.

Spread potential: High, as adults can fly.

Economic importance: High, as this pest is of economic significance and listed as a pest of apple and stone fruit by Japan (MAFF, 1990). This pest is exotic to Australia and is not present in Australia as claimed by Japan.

Quarantine status: Quarantine. The presence of this pest on the pathway of the Fuji apple fruit from Japan has been considered high (AQIS, 1997).

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Species: *Tarsonemus bilobatus* Suski, 1965 [Acari: Tarsonemidae]

Synonym(s) and changes in combination(s): Lupotarsonemus bilobatus (Suski).

Common name(s): Tarsonemid mite.

Host(s): Allium sativum (garlic, stored) (Na et al., 1998); Beta vulgaris ssp. vulgaris (fodder beet) (Abo-Korah et al., 1999); Brassica rapa ssp. pekinensis (Chinese cabbage) (Nakao, 1991); Capsicum annuum (capsicum) (Nemestothy, 1983); Citrullus lanatus (watermelons) (Nakao, 1991); Citrus spp. (Abo-Korah, 1980); Cucumis melo (melon) (Nakao, 1991); Cucumis sativus (cucumber) (Nakao, 1991; Nemestothy, 1983); Fragaria ananassa (strawberry) (Nemestothy, 1983); Glycine max (soybean) (Abo-Korah et al., 1999); Helianthus annuus (sunflowers) (Abo-Korah et al., 1999); Lycopersicon esculentum (tomato) (Nemestothy, 1983); Medicago sativa (lucerne) (Abo-Korah et al., 1999); Perilla frutescens (perilla) (Yanagida et al., 1996); Poa spp. (meadow grass) – associated with other mites causing white ear (Mitrofanov and Trepashko, 1976); Prunus persica (peach) (Wang et al., 1999); Solanum melongena (brinjal, eggplant) (Dhooria, 1996); Sorghum vulgare (sorghum) (Abo-Korah et al., 1999); Thuja occidentalis (eastern white cedar) (Cho et al., 1995); Trifolium alexandrinum (Egyptian clover) (Abo-Korah and Osman, 1978); Triticum aestivum (wheat) (Abo-Korah and Osman, 1978); Vicia faba (horse bean) (Abo-Korah and Osman, 1978); Zea mays (maize) (Abo-Korah, 1978).

Part(s) of plant affected: Bulb (garlic) (Na *et al.*, 1998); fruit (peach) (Wang *et al.*, 1999); inflorescence (Mitrofanov and Trepashko, 1976); leaf (Abo-Korah and Osman, 1978; Nakao, 1991; Nemestothy, 1983).

Distribution: China (Wang *et al.*, 1999); Costa Rica (Vargas and Ochoa, 1990); Egypt (Abo-Korah, 1980; Abo-Korah and Osman, 1978); Hungary (Nemestothy, 1983); India (Punjab (Dhooria, 1996)); Japan (Nakao, 1991; Yanagida *et al.*, 1996); Korea, Republic of (Cho *et al.*, 1995; Na *et al.*, 1998); Russia (Mitrofanov and Trepashko, 1976; Uzhevskaya, 1987).

Biology: Very little known about this species and its biology. As in other Tarsonemidae, the life stages of *Tarsonemus bilobatus* may include egg, larva, calyptostase nymph (the apoderm) and adult.

T. bilobatus is facultatively phytophagous and fungivorous. Species belonging to the *Tarsonemus* genus feed mainly on fungi associated with the leaves or fruits of plants rather than on the plants themselves (Kim *et al.*, 1998). Nevertheless, Lindquist (1978) reports that some species are possibly facultatively phytophagous and capable of causing distortive growth in their host plants. Karl (1965) observed, although inconclusively, that the damage caused to ivy leaves by the obligately phytophagous *Polyphagotarsonemus latus* Banks was intensified by the presence of *T. setifer* (now *T. parawaitei*). In Japan, *T. bilobatus* has been reported on melon, watermelon, cucumber and Chinese cabbage seedlings causing lustrous, discoloured and deformed leaves with irregular folding of the upper surface (Nakao, 1991). On the cucurbit seedlings, severe leaf damage was observed when *T. bilobatus* occurs together with the acarid mite, *Tyrophagus similis*.

T. bilobatus is commonly reported in the soil under field crops (Abo-Korah and Osman, 1978; Abo-Korah *et al.*, 1999) and under fruit crops (Abo-Korah, 1980) in Egypt. In Russia, it is reported as soil dwelling and to feed on soil fungi (Uzhevskaya,

1987). *T. bilobatus* is also a common media contaminant feeding on fungi in Costa Rica (Vargas and Ochoa, 1990), and is suspected to be a vector of plant diseases (Abo-Korah, 1980).

Entry potential: Low, as this mite has not been reported on citrus fruit in Egypt or elsewhere but could be important on glasshouse vegetables (Nemestothy, 1983; Yanagida *et al.*, 1996), where it can damage the foliage of vegetable seedlings. This mite would not be on the fruit as the consignment is expected to be free of plant trash, soil and other organic debris. Washing, brushing and waxing of citrus fruits would further reduce the risk of its introduction.

Establishment potential: Moderate, as this mite has a wide host range and usually confined to crops grown in the glasshouse due to its facultatively phytophagous and fungivorous feeding habit.

Spread potential: Low to moderate, as this mite spreads by the passive transportation of infested foliage of plants or infested soil.

Economic importance: Low, as no damage has been reported on the crops listed in Egypt except on maize (*Zea mays*) (Abo-Korah, 1978). *T. bilobatus* is suspected to be a vector of plant diseases (Abo-Korah, 1980).

Quarantine status: Quarantine.

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Species: Tuckerella nilotica (Zaher & Rasmy, 1969) [Acarina: Tuckerellidae]

Synonym(s) and changes in combination(s): Not known.

Common name(s): Ornate false spider mite; peacock mite; tuckerellid mite.

Host(s): This mite pest has been collected from orange trees in Egypt (Rasmy and Abou-Awad, 1984).

Part(s) of plant affected: This mite has been found on fruit and bud on oranges in Egypt (Rasmy and Abou-Awad, 1984). Species of *Tuckerella* are considered obligate plant parasites (Walter, 2001). Unlike most plant parasitic mites, Australian species of *Tuckerella* tend to be found on the stems of woody plants, usually in the cracks on small twigs, where they appear to feed on the cambium (Walter 2001b). Other species of *Tuckerella* have been reported on grasses (Ochoa, 1989).

Distribution: Egypt (Rasmy and Abou-Awad, 1984; Zaher and Rasmy, 1969).

Biology: Very little is known about this species and its biology. According to Rasmy and Abou-Awad (1984), the female of this mite species has an elongated, oval and red body. Dorsum with typical fan-shaped or palmate setae is characteristic of this mite family. Male is unknown. The larvae are delicate and similar to the female but dorso-lateral foliaceous setate on propodosoma and hysterosoma are more pointed. The protonymph has a dorso-lateral setae of similar shape to those in larva but last four palmate setae on dorsum are arranged as in female. This mite also has deutonymph and tritonymph stages in its life cycle.

Entry potential: Low, as the pre-harvest field control measures routinely carried out in citrus orchards and post-harvest handling treatments normally carried out for citrus fruits such as washing in detergents, brushing and waxing of citrus fruits would further reduce the risk of introduction of this pest.

Establishment potential: Low, as *T. nilotica* has thus far only been reported on citrus in Egypt.

Spread potential: Low to moderate, as the long plumose posterior setae can extend the length of the body which may help these mites to disperse on wind currents (Ochoa, 1989).

Economic importance: Moderate, as this mite species has been found on citrus in Egypt. This genus of mites tends to have a wide host range as they are obligate plant parasites (Walter, 2001a). This mite species has egg, larval, three nymphal and adult stages in its life cycle, but males are unknown. In view of this, it is highly likely that this mite species is capable of parthenogenetic reproduction. Also this species may mostly act as plant feeders on citrus.

Quarantine status: Quarantine.

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Fungi

Species: *Alternaria alternata* pv. *citri* (Fr.) Keissler (*Alternaria citri* Ellis and N. Pierce) [Mitosporic fungi: Hyphomycetes]

Synonym(s) and changes in combination(s): See Biology section below.

Common name(s): *Alternaria* rot; *Alternaria* rot of citrus; black rot of citrus fruit; brown leaf spot; brown spot of citrus; core rot of citrus; internal dry rot; navel end rot; stalk end rot; stem end rot.

Host(s): *Alternaria citri* is known to grow and cause disease especially on the fruits of lemons, oranges and other species of *Citrus*. Its host range includes:

Citrus aurantifolia (lime) (Solel and Kimchi, 1997); *Citrus jambhiri* (rough lemon) (CAB International, 2000); *Citrus junos* (yuzu) (CAB International, 2000); *Citrus limon* (lemon) (CAB International, 2000); *Citrus limonia* (lemandarin, Rangpur lime) (Solel and Kimchi, 1997); *Citrus madurensis* (calamondin) (Solel and Kimchi, 1997); *Citrus medica* (citron) (CAB International, 2000); *Citrus paradisi* (grapefruit) (Solel and Kimchi, 1997); *Citrus reticulata* (mandarin, tangerine) (CAB International, 2000; Farooqi *et al.*, 1995); *Citrus reticulata* × *C. paradisi* (Minneola tangelo) (Solel and Kimchi, 1997); *Citrus reticulata* × *C. sinensis* (Murcott tangor) (Hutton and Mayers, 1988); *Citrus sinensis* (navel orange) (CAB International, 2000).

Parts of plant affected: Fruit (pre- and post-harvest), leaf, twig (CAB International, 2000).

Distribution: Argentina (Ellis, 1971); Australia (New South Wales (Anonymous, 1995), Queensland (Pegg, 1966), South Australia (Cook and Dube, 1989), Victoria (Washington, 1980), Western Australia (Shivas, 1989)); Bhutan (CAB International, 2000); Bulgaria (Ellis, 1971); China (Ellis, 1971) (Hong Kong (CAB International, 2000)); Cuba (Ellis, 1971; Mercado-Sierra and Mena-Portales, 1992); Cyprus (Ellis, 1971); Egypt (Ellis, 1971); France (Ellis, 1971); Greece (Ellis, 1971); India (Ellis, 1971; Subramanian, 1972); Iran, Islamic Republic of (Ellis, 1971); Iraq (CAB International, 2000); Israel (Ellis, 1971; Solel et al., 1997); Italy (Ellis, 1971); Jamaica (Ellis, 1971); Japan (Ellis, 1971); Kenya (Ellis, 1971); Korea, Republic of (Hong et al., 1991; Nam et al., 1993; Young and Kim, 1996); Libya (Ellis, 1971); Malawi (Ellis, 1971); Malta (Ellis, 1971); Mexico (Palm and Civerolo, 1994); Morocco (El-Khamass et al., 1995; Ellis, 1971); Mozambique (Ellis, 1971); Myanmar (Ellis, 1971); Nepal (Ellis, 1971); New Zealand (CAB International, 2000); Nigeria (CAB International, 2000); Pakistan (Ellis, 1971; Farooqi et al., 1995); Paraguay (Ellis, 1971); Portugal (Ellis, 1971); Puerto Rico (Ellis, 1971); Russian Federation (Ellis, 1971); South Africa (Ellis, 1971; Schutte et al., 1994); Spain (Ellis, 1971); Sudan (Ellis, 1971); Tanzania, United Republic of (Ellis, 1971); Turkey (Ozcelik and Ozcelik, 1997); Uganda (Ellis, 1971); Uruguay (Ellis, 1971); United States (Farr et al., 1989) (Arizona (Olsen et al., 2000), California (Brown and Eckert, 1988), Florida (Scheffer, 1983)); Vietnam (Whittle, 1992); Zambia (Ellis, 1971); Zimbabwe (CAB International, 2000).

Biology: The taxonomy of *Alternaria* species causing various maladies on citrus species is still unclear despite the diseases being around more than a hundred years ago. *Alternaria* black rot on citrus was first recognised in 1892 in California by Pierce and the causal agent was named *A. citri* (Simmons, 1990). The pathogen for citrus

brown spot was also identified as *A. citri* (Kiely, 1964), although isolates causing black rot appeared to be morphologically similar to isolates causing brown spot, their pathogenic traits and toxin production distinguished them as distinct strains (Kiely, 1964). The pathogen for brown spot was subsequently placed in *A. alternata* (Fr:Fr) Keissler by Nishimura and Kohmoto (1983). The pathogen has also been referred to as *A. alternata* pv. *citri* (Solel and Kimchi, 1997). Bottalico and Logrieco (1998) classified *A. citri* into two pathotypes of *A. alternata*: *A. alternata* Rough lemon pathotype, the causal agent of brown leaf spots on young leaves of Rough le mon and Rangpur lime; and *A. alternata* Tangerine pathotype, causing leaf spots on the leaves of Dancy tangerine and Emperor mandarin. Bottalico and Logrieco (1998) classified toxigenic species of *Alternaria* into two groups i.e. conidia produced solitary or in chains. They included *A. citri* in the second group because it produces conidia in long chains (more than five). However in the initial classification proposed by Neergaard (1945), *A. citri* was included in section Brevicatenatae comprising all those species of *Alternaria* which had short chains of about three to five conidia.

Simmons (1999) strongly opposed the application of collective or catchall species concept for A. citri and A. alternaria by many workers including Bottalico and Logrieco (1998), Nishimura et al. (1978), Otani and Kohmoto (1992) and Scheffer (1992). Simmons (1999) based on controlled cultural conditions reclassified 35 isolates of Alternaria on citrus into various taxons including 10 new Alternaria species. The 135 isolates were from leafspot of rough lemon (Citrus jambhiri) and brown spot of tangerine (C. reticulata) and tangelo (C. paradisi \times C. reticulata) from citrus-growing regions of Colombia, Israel, Turkey, South Africa, and the USA (Florida) were studied under controlled culture conditions (Simmons, 1999). Seventyseven were assigned to 10 new species of Alternaria. None of the 135 pathologyrelated strains could be identified morphologically with either typical A. alternata or typical A. citri. The most abundant taxon from rough lemon (all Florida sources) is A. limoniasperae sp. nov. The most abundant taxon from brown spot in Florida and Colombia is A. tangelonis sp. nov. and from brown spot in Israel, Turkey, and South Africa is A. turkisafria sp. nov. A second major group of isolates from rough lemon (Florida) is A. citrimacularis sp. nov. Other morphologically unique isolates described as new species are A. citriarbusti (tangelo, Florida), A. toxicogenica (tangerine, Florida), A. colombiana (tangelo, Colombia), A. perangusta (tangelo, Turkey), A. interrupta (tangelo, Israel) and A. dumosa (tangelo, Israel) (Simmons, 1999).

In an earlier paper, Simmons (1990) provided morphological descriptions of several *Alternaria* spp. which have been isolated from various maladies on citrus species: *A. limicola* E. Simmons and M. Palmer (new species from key lime in Mexico); *A. citri* Ellis and Pierce; *A. alternata* (Nees:Fries) Keissler; *A. hesperidearum* (Pantanelli) E. Simmons (a new combination which also included isolates from *Citrus nobilis* in Australia from K. Pegg, 1962); *A. alternata* group species 1; *A. tenuissima* group species 2; and *A. pellucida* E. Simmons (new *Alternaria* species from Satsuma orange in Japan).

Peever *et al.* (1999) reported that the *Alternaria* sp. causing black rot of citrus may be closely related to the citrus brown spot pathogen. Their study indicted that citrus brown spot is caused by a diverse assemblage of fungi but did not at that time establish whether separate species of *Alternaria* were involved.

Peever *et al.* (2000) reported three genetically distinct groups of *Alternaria* spp. that cause foliar diseases of citrus. The first group is the "tangerine pathotype" that causes

diseases on tangerines, grapefruit and tangerine \times grapefruit and tangerine \times sweet orange hybrids and is economically the most important. The second group is the "rough lemon pathotype" – this does not generally cause disease on tangerines or tangerine hybrids. The third group is called "mancha foliar de los citricos" which affects Mexican key lime and is weakly pathogenic on other citrus species. This third group has now been reidentified as a new species, *A. limicola* (Palm and Civerolo, 1994).

In a subsequent study in Florida, Su *et al.* (2001) tested the 135 isolates of the morphological species of Simmons (1999) using molecular data. Several genomic regions of the pathogen including the 5' end of the beta-tubulin gene and mitochondrial large subunit were sequenced and compared to saprophytic isolates of *A. alternata*, *A. solani* and other known *Alternaria* species. These data indicate that all of the citrus isolates belong to **one phylogenetic species**.

In a recent paper by Peever *et al.* (2001a) "Worldwide population structure of *Alternaria* sp. causing brown spot of tangerines and tangerine hybrids" (Abstract in *Phytopathology*), RAPD allele frequencies were analysed and highly significant differentiation between samples of isolates from USA, Australia, Turkey, South Africa and Israel were found together with distinct differences in pathogenicity. They concluded that the brown spot pathogen consists of several genetically and pathogenically distinct, non-recombining asexual lineages worldwide.

Also recently, Peever *et al.* (2001b) reported on the phylogeography of *Alternaria alternata* on citrus. Isolates of *Alternaria alternata* on *Citrus* spp. in six countries sampled from brown spot lesions (putative pathogens), black rot lesions on fruit (putative saprophytes) and from healthy citrus leaves (putative endophytes) were studied using PCR amplification with ATC-specific primers (ATC = host specific toxin gene 1) and Southern blotting. Qualitative estimates of pathogenicity were obtained by spray-inoculation of detached leaves. The results indicate that most isolates from brown spot lesions were pathogenic on leaves and carried ATC sequences, but a number of saprophytic and endophytic isolates were non-pathogenic on leaves yet carried ATC sequences.

In Florida, Alternaria brown spot, caused by *Alternaria alternata* pv. *citri*, affects Minneola tangelos, Dancy tangerines, Murcotts, and less frequently Orlando tangelos, Novas, Lees, and Sunburst. In rare cases, it may also infect grapefruit. Where severe, the disease results in extensive fruit drop and must be controlled on processing and fresh market fruit.

Spores of *Alternaria* are airborne. Most spores are produced on recently fallen infected leaves on the grove floor or on lesions on the mature leaves on the tree. Many management practices are helpful in reducing the severity of Alternaria brown spot.

Studies carried in Israel (Solel and Kimchi, 1997), and in Japan (Kohmoto *et al.*, 1979) showed that isolates of. *A. alternaria* pv. *citri* varied in their level of pathogenicity on a wide range of citrus species and cultivars. A survey of citrus cultivars in Israel in orchards where *Alternaria* brown spot was common on Minneola tangelos (mandarin × grapefruit), revealed the occurrence of the disease as typical foliar and fruit lesions on Dancy and Ellendale (mandarins), Murcott tangor (mandarin × sweet orange), Nova and Idith (mandarin hybrids), Calamondin and Sunrise and Redblush (grapefruit) (Solel and Kimchi, 1997). Isolates of *A. alternata*

from each of these hosts were proven to be pathogenic to Minneola tangelo. The host range of *A. alternata* pv. *citri* from Israel was assayed by inoculating leaves of diverse citrus genotypes. Several mandarins and their hybrids (Dancy, Kara, King, Wilking, Satsuma, Minneola, Orlando, Mikhal, Idith, Nova, Page, Murcott), grapefruit (Marsh seedless), grapefruit × pummelo (Oroblanco), sweet orange (Shamouti, Valencia, Washington navel) Calamondin and Volkamer citrus were susceptible. Several mandarins and their hybrids (Clementine, Avana, Yafit, Ortanique), Cleopatra, 1 sweet orange cultivar (Newhall), pummelo (Chandler), lemon (Eureka), Rough lemon, Rangpur lime, sweet lime, citron, limequat, sour orange, Troyer citrange and Alemow were resistant (Solel and Kimchi, 1997). No citrus host range studies of the disease have been carried out in Egypt as the disease has been deemed to be of low economic significance (Anonymous, 2000).

A virulent race of *A. citri* first appeared in Australia (Pegg, 1966) and became locally destructive. This race, which was highly specialized to the Emperor mandarin, was similar in morphology to the earlier known, non-specialized form of *A. citri*. The only obvious difference was the ability of the new race to produce a highly toxic, host-selective factor (Pegg, 1966; Kohmoto *et al.*, 1979). The new disease was thought to have resulted from an ability, which may have been acquired by mutation, to produce toxin. The same, or a very similar, toxin-producing race also appeared in 1974 in Florida. This race affected Dancy tangerine, which is closely related to the Emperor mandarin. Scheffer (1983) suspected that the Florida and Australia races had similar origins. A third race of *A. citri*, which is specialised to cause diseases on rough lemons, has also been reported. This race also produces a host-specific toxin (Kohmoto *et al.*, 1979).

In Florida, Timmer *et al.* (1998) found conidial production of *A. alternata* was greatest on mature leaves of Minneola tangelo (*Citrus reticulata* \times *C. paradisi*) moistened and maintained at near 100% relative humidity (R.H.) for 24 hours. In contrast, leaves that had been soaked or maintained at moderate R.H. produced few conidia. In Florida field studies from 1994 to 1996, air sampling with a 7-day recording volumetric spore trap indicated that conidia were present throughout the year with periodic large peaks (Timmer *et al.*, 1998). Sufficient inoculum appears to be available to allow infection to occur throughout the year whenever susceptible host tissue and moisture are available.

In inoculation studies, Solel and Kimchi (1997) reported that susceptibility of the Minneola tangelo leaves to conidial penetration of *A. alternata* pv. *citri*, was negatively correlated with their age: mature leaves (approximately two months old) were very resistant to infection. Lesions developed faster when leaves were inoculated on the abaxial rather than the adaxial surface. There was no difference in disease severity on detached or intact leaves, or between leaves incubated in darkness or under natural light. Fruit were highly susceptible throughout the whole season (Solel and Kimchi, 1997).

Currently, there are no known quarantine restrictions for this disease because of its widespread distribution and airborne transmission (CAB International, 2000).

Entry potential: Low. Currently, citrus fruit has been coming into Australia from Israel, Spain and USA (California) which have this disease without any quarantine restriction for the disease. Citrus fruit has been coming into Australia from these areas for several years without any interception of the disease or new strains or
species of the causal agent(s). Likewise, Australian citrus fruit are currently being exported to Taiwan, Japan and the USA without any quarantine restrictions for the pathogen.

Establishment potential: Moderate, as the strains of *Alternaria* from citrus have only been reported to attack citrus species. There is wide variability between strains of the pathogen and citrus cultivars. Young leaves are more susceptible to infection than mature leaves. Disease can establish when susceptible citrus cultivars are available for infection under suitable conditions of high humidity. The virulent race of the pathogen which devastated Emperor mandarin in Queensland was thought to have resulted from an ability of the fungus, which may have been acquired by mutation, to produce toxin (Pegg, 1966).

Spread potential: Moderate to high spread potential as spores of *Alternaria* are airborne. Most spores are produced on recently fallen infected leaves on the ground or on lesions on the mature leaves on the tree. Many management practices are helpful in reducing the severity of Alternaria brown spot.

Economic importance: Moderate to high. The pathogen is responsible for various maladies in fruits and leaves of species and cultivars of *Citrus*, namely, black rot of oranges, fruit rot of lemons and tangerines, stem end rot of lemons and brown spot of rough lemon and Emperor mandarin. It has many pathotypes and the pathogenicity of many pathotypes are not known.

Quarantine status: Quarantine. The pathogen is present in Australia but some of the new pathotypes reported especially in Israel have not been reported to be in Australia nor reported in Egypt. Hence the pathogen is of quarantine concern to Australia.

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APPENDIX 4: RECORD OF CALIBRATION OF FRUIT SENSORS

RECORD OF CALIBRATION OF FRUIT SENSORS

SENSOR CALIBRATION (AT 32°F (0°C))

SENSOR	TEST		CORRECTION
NUMBER	1	2	FACTOR
1			
2			
3			

CAPQ OFFICER'S

SIGNATURE _____ SEAL _____