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Data Sheets on Quarantine Pests

Aonidiella citrina

IDENTITY

Name: *Aonidiella citrina* (Coquillett)
Synonyms: *Aspidiotus citrinus* Coquillett
Chrysomphalus aurantii citrinus (Coquillett)
Taxonomic position: Insecta: Hemiptera: Homoptera: Diaspididae
Common names: Yellow scale (English)
Cochenille jaune (French)
Escama amarilla de los cítricos (Spanish)
Notes on taxonomy and nomenclature: The original description by Coquillett is inadequate and simply refers to 'the yellow scale' on orange (Nel, 1933). *A. citrina* is morphologically very similar to the Californian red scale, *Aonidiella aurantii* (Maskell), and was considered to be a variety until Nel (1933) raised it to specific level based on a comparative study of their ecology, biology and morphology.
Bayer computer code: AONDCI
EU Annex designation: II/A1

HOSTS

A. citrina is polyphagous attacking plant species belonging to more than 50 genera in 32 families. The main hosts of economic importance are *Citrus* spp., especially oranges (*C. sinensis*), but the insect is also recorded incidentally on a wide range of ornamentals and some fruit crops including *Acacia*, bananas (*Musa paradisiaca*), *Camellia* including tea (*C. sinensis*), *Clematis*, Cucurbitaceae, *Eucalyptus*, *Euonymus*, guavas (*Psidium guajava*), *Hedera helix*, *Jasminum*, *Ficus*, *Ligustrum*, *Magnolia*, mangoes (*Mangifera indica*), *Myrica*, olives (*Olea europea*), peaches (*Prunus persica*), poplars (*Populus*), *Rosa*, *Schefflera actinophylla*, *Strelitzia reginae*, *Viburnum* and *Yucca*.

The main potential hosts in the EPPO region are *Citrus* spp. growing in the southern part of the region, around the Mediterranean.

GEOGRAPHICAL DISTRIBUTION

A. citrina originated in Asia and has spread to various tropical and subtropical regions throughout the world. The precise distribution of *A. citrina* is uncertain due to difficulties in separating it from *A. aurantii*. *A. aurantii* is a common pest of citrus found throughout the Mediterranean region and all major citrus-growing areas of the world.
EPPO region: Italy (limited outbreak reported in 1994 in Calabria), Libya, Russia (only in extreme south - Krasnodar territory), Turkey.
Asia: Afghanistan, Azerbaijan, Bangladesh, China (Guangdong), Georgia, Hong Kong, India (Maharashtra), Indonesia (Irian Jaya), Iran, Japan (Honshu), Malaysia (Sabah, Sarawak), Pakistan, Philippines, Saudi Arabia, Taiwan, Thailand, Turkey, Yemen.

Africa: Benin, Cameroon, Congo, Côte d'Ivoire, Ethiopia, Gabon, Guinea, Libya, Madagascar, Mali (Vilardebo, 1974), Mauritius, Niger, Senegal, St. Helena. *A. citrina* has also been recorded on citrus fruit imported into the USA from South Africa (Anon., 1979) but has not been recorded in South Africa despite intensive research on citrus pests.
North America: Mexico, USA (California, Florida, Texas).
Central America and Caribbean: Trinidad and Tobago.
South America: Argentina, Chile.
Oceania: Australia (New South Wales, South Australia, Victoria). *A. citrina* has also been recorded from Fiji, Papua New Guinea, Samoa (CIE, 1975), but specimens originally identified as *A. citrina* from the South Pacific were all subsequently found to be *A. aurantii* (Williams & Watson, 1988).
EU: Present.
Distribution map: See CIE (1975, No. 349).

BIOLOGY

The biology of *A. citrina* has been described in great detail by Nel (1933) following studies on orange in California. The life cycle took an average of 65 days from active first instar to reproductive adult. It was sexually reproductive. Fecundity appeared to be higher on fruit than on the leaves and a single adult female produced 150 first instars on a lemon fruit. Most of the first instars settled to feed within 6 h of emerging but some were active for up to 24 h. Highest mortality occurred during the first instar. In California (USA), *A. citrina* appeared to prefer citrus growing in the more arid, warmer valleys and foothills of the interior, whereas *A. aurantii* prefers citrus in the coastal regions.

A. citrina has also been studied on satsuma and grapefruit in Izmir, Turkey (Onder, 1982) where it has three generations a year in May, July and September and overwinters mostly as a second instar. Its development threshold was 14.8°C with the thermal constant of 449 day degrees.

Adult females of *A. citrina* produce species-specific sex pheromones to attract the winged adult males (Moreno *et al.*, 1972a, 1972b). The pheromones ((E)-3, 9-dimethyl-6-isopropyl-5, 8-decadienyl acetate), isolated from airborne collections (Gieselmann *et al.*, 1979), have been found to differ in structure but exhibit identical chirality at C3 to the sex pheromones produced by *A. aurantii* (Roelofs *et al.*, 1982).

DETECTION AND IDENTIFICATION

Symptoms

A. citrina usually attacks the leaves and fruit but rarely the bark (*A. aurantii* occurs on all aerial parts of the plant). Heavy infestations may result in leaf drop, dieback of apical twigs and discoloured, stunted and pitted fruits which fall prematurely or are unmarketable.

The small size, pale colour and sessile nature of *A. citrina* makes it difficult to detect unless present in large numbers. *A. citrina* can easily be confused with *A. aurantii*, which is one of the most commonly intercepted scale insects on imported citrus fruit.

Morphology

The adult female scales are circular, flat, yellow-brown and semi-translucent with the yellow body of the insect visible through the scale. The margin of the scale is parchment-like and the exuviae are positioned centrally. The scale attains a diameter of 1.75 mm. Male scales are similar in appearance to the females but are smaller and more oval. Adult female scales of *A. aurantii* are similar in appearance to *A. citrina* but differ in colour, being orange-red.

Authoritative identification requires detailed microscopic examination of teneral adult females by a scale insect specialist. *A. citrina* is one of a group of six morphologically similar species composed of: *A. aurantii*, *A. comperei* McKenzie, *A. eremocitri* McKenzie, *A. inornata* McKenzie and *A. taxus* Leonardi. It is closest in appearance to *A. aurantii* and should be distinguished from this species. Adult female *A. aurantii* usually have distinct prevulvar scleroses behind the apophyses which are absent in *A. citrina*. Morphological descriptions, illustrations and keys are provided by Ferris (1938), McKenzie (1937) and Quayle (1938) and, more recently, Longo *et al*. (1994).

MEANS OF MOVEMENT AND DISPERSAL

As in other diaspidids, the main dispersal stage is the first instar which may be naturally dispersed by wind and animals. Once a feeding site has been selected the insect becomes sessile and is not naturally dispersed. However, it is readily carried on consignments of plant material and fruits.

PEST SIGNIFICANCE

Economic impact

A. citrina is considered a damaging pest of citrus fruits in some citrus-growing regions. Fruits and leaves are attacked, but not usually branches or trunks. Heavily attacked fruits may lose their commercial value because of the unsightly pits and discoloration. Attacks on the leaves may lead to leaf fall and dieback of apical twigs. *A. citrina* was considered a major pest of citrus in the San Joaquin Valley, California in the 1950s but is now rare. It has also been recorded as a non-specific pest of tea in Georgia (Dzhashi, 1970).

Control

Chemical control (organophosphorus insecticides, oil, growth regulators) is possible but spray applications must be thorough to contact the scales on the undersides of lower and inner foliage. The waxy surfaces, sessile nature, intermittent feeding, overlapping generations and pesticide-resistant populations of the scale insects make chemical control difficult. Methods of controlling pesticide-resistant populations, including descaling machines, oil, growth regulators such as buprofezin and fenoxycarb are discussed by Carmean (1988). In Chile, 100% control was achieved with a liquid formulation of systemic omethoate applied undiluted with a brush to the trunk at a rate of 20 ml per tree (Zuniga, 1985). Parasites and predators appeared to be unaffected by the treatment.

Natural enemies are important, including Encarsia citrinus which gave over 60% parasitism of A. citrina in Turkey (Onder, 1982) and Aphytis chrysomphali and Comperiella bifasciata in Australia (Hely et al., 1982). Longo et al. (1994) note that the complex of natural enemies which controls A. aurantii in southern Italy (*Encarsia citrina*, *Aphytis melinus* and the introduced *Chilocorus nigritus*) is also effective against *A. citrina*.

The possible use of sex pheromones in integrated control programmes has been discussed by Tremblay & Rotundo (1975).

Phytosanitary risk

A. citrina is under consideration by EPPO as an A2 quarantine pest, but has not been declared to be a quarantine pest by any other regional plant protection organization. It is already present in the Mediterranean area (and adjoining areas of Asia and Africa) and has been for some 40 years. It occurs in Libya, and is apparently abundant in the Aegean region of Turkey. It has not until recently moved westwards to other citrus-growing areas. Its recent appearance in southern Italy shows that the insect does have the potential to spread, but Longo *et al*. (1994) do not consider it particularly threatening.

A. citrina is less damaging than *A. aurantii* but has a greater tendency to attack fruits. The two species are sympatric in parts of California where *A. aurantii* appears to be the superior competitor and is replacing *A. citrina* (DeBach, 1978). Since *A. aurantii* is already firmly established in the Mediterranean, *A. citrina* may not be able to compete with it, and thus only be able to establish in limited areas. Natural enemies of *A. citrina* are already present in the Mediterranean area.

In conclusion, *A. citrina* does present a certain threat to uninfested areas in the Mediterranean, but its importance as a quarantine pest remains debatable. It is not clear that its introduction into areas where *A. aurantii* already occurs would cause additional problems, and it seems already to have reached a stable status in the Mediterranean area without special measures having been taken.

PHYTOSANITARY MEASURES

Importation of *Citrus* plants for planting is already prohibited or restricted on account of more important pests. Fruits should be subject to requirements such as area freedom, place of production freedom or treatment.

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