EPPO Datasheet: *Aleurocanthus spiniferus*

Last updated: 2020-09-15

IDENTITY

Preferred name: *Aleurocanthus spiniferus*
Authority: (Quaintance)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Hemiptera: Sternorrhyncha: Aleyrodidae
Other scientific names: *Aleurocanthus cheni* Young, *Aleurocanthus citricolus* (Newstead), *Aleurocanthus rosae* Singh, *Aleurodes citricola* Newstead, *Aleurodes spinifera* Quaintance
Common names: citrus mealywing, citrus spiny whitefly, orange spiny whitefly, spiny blackfly
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EPPO Categorization: A2 list
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EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II B)
EPPO Code: ALECSN



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Notes on taxonomy and nomenclature

Aleurocanthus spiniferus grouped two different taxa for several years, until the description of *Aleurocanthus camelliae* Kanmiya & Kasai in Kanmiya *et al*. (2011) was published. Thus, previous records of *A. spiniferus* may include records of *A. camelliae*, especially for populations infesting tea (*Camellia sinensis*).

HOSTS

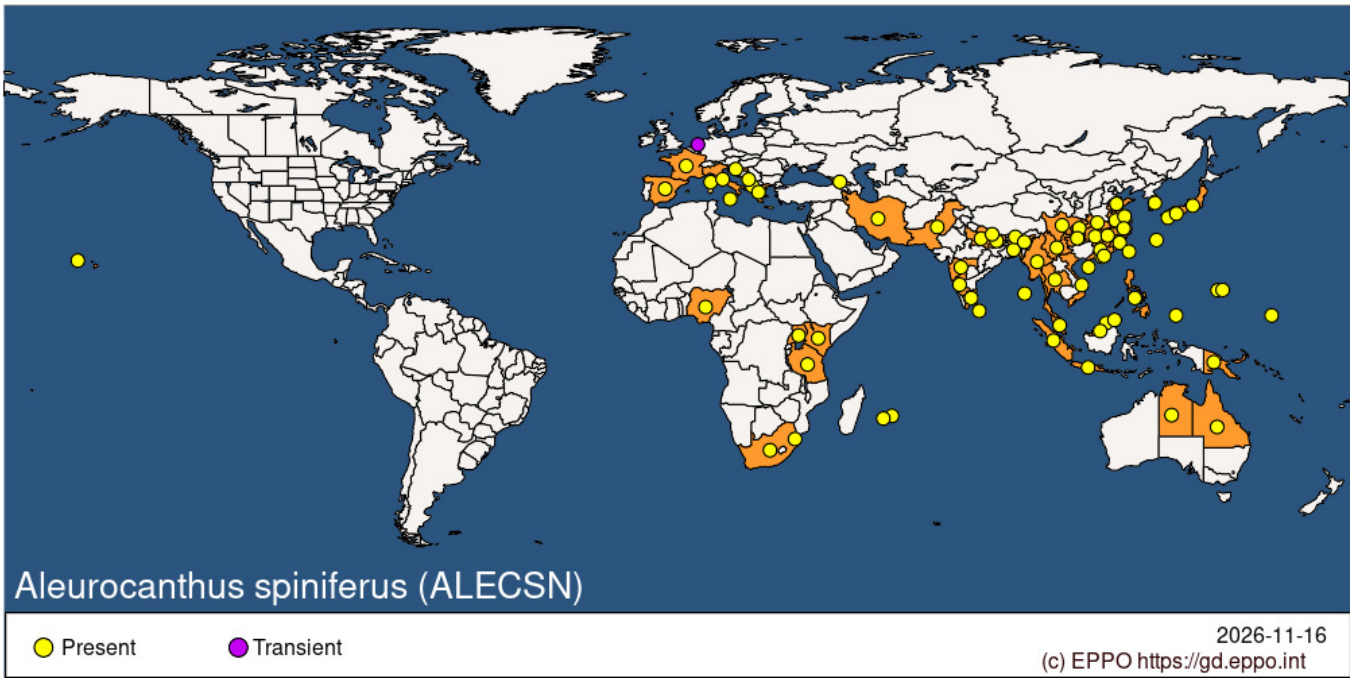
Citrus spp. are the main hosts of economic importance but *A. spiniferus* has been recorded on other crops, for example grapes (*Vitis vinifera*), guavas (*Psidium guajava*), pears (*Pyrus* spp.), persimmons (*Diospyros kaki*) and roses (*Rosa* spp.). *A. spiniferus* occurs throughout much of the Asian range of *A. woglumi* and possibly shares many of its hosts.

The potential host range in the EPPO region would be essentially citrus, with some possibility of establishment on other woody plantation crops growing in the southern part of the region in climatic conditions suitable for the pest.

Host list: *Ailanthus altissima, Akebia longeracemosa, Akebia quinata, Akebia trifoliata, Alnus formosana, Annona muricata, Annona reticulata, Annona squamosa, Annona x atemoya, Aphananthe philippinensis, Arbutus unedo, Barringtonia acutangula, Bauhinia championii, Boehmeria virgata var. densiglomerata, Boehmeria zollingeriana var. blinii, Casearia aculeata, Ceratonia siliqua, Cinnamomum camphora, Citrus medica, Citrus reticulata, Citrus x aurantium var. sinensis, Citrus x aurantium, Citrus x limon, Clematis vitalba, Cocos nucifera, Cupaniopsis anacardioides, Cydonia sp., Diospyros kaki, Diospyros maritima, Entada phaseoloides, Eriobotrya japonica, Erycibe henryi, Eurya japonica, Fatsia sp., Ficus carica, Ficus racemosa, Ficus sp., Ficus sur, Flindersia sp., Fortunella, Ganophyllum falcatum, Gardenia jasminoides, Gossypium sp., Hedera helix, Hibiscus cannabinus, Hibiscus rosa-sinensis, Hibiscus tiliaceus, Laurus nobilis, Liquidambar formosana, Macaranga tanarius, Machilus zuihoensis, Maesa perlarius, Malus sp., Malva sp., Manihot esculenta, Maranthes corymbosa, Meliosma rigida, Mespilus germanica, Morus alba, Murraya koenigii, Mussaenda pubescens, Myrica rubra, Parthenocissus tricuspidata, Persea americana, Phoebe formosana, Photinia x fraseri, Piper kadsura, Pistacia vera, Plumeria rubra , Prunus armeniaca, Prunus avium, Prunus cerasus, Prunus domestica, Prunus persica, Prunus serotina, Psidium guajava, Punica granatum, Pyracantha coccinea, Pyrus communis, Pyrus pyraster, Pyrus pyrifolia, Rhododendron latoucheae, Rollinia mucosa, Rosa banksiae, Rosa chinensis, Rosa indica, Rosa x damascena, Rosa, Salix sp., Schefflera sp., Scolopia oldhamii, Senna siamea, Sloanea dasycarpa, Streblus sp., Synedrella nodiflora, Syzygium samarangense, Toona ciliata, Triadica sebifera, Urena lobata, Vigna unguiculata subsp. sesquipedalis, Vitis vinifera, Wisteria sinensis, Xylosma congesta, Zanthoxylum nitidum*

GEOGRAPHICAL DISTRIBUTION

Aleurocanthus spiniferus originated in tropical Asia and has spread widely into the Indian Ocean, Africa and the Pacific. Its range overlaps that of *A. woglumi* in many regions, but it has not been introduced into the American continent. In the EPPO region, it has been recorded in Southeast Europe where populations remain low. It was first recorded in Italy in 2008 (Porcelli, 2008) in the area of Supersano (Puglia region). Since then, it has also been found on *Citrus* spp. in the Campania, Lazio and Basilicata regions in Italy (EPPO, 2017/19). It has been found in Croatia (first record 2012) (Šimala *et al.*, 2015) with a severe outbreak reported in Split Dalmatia County in 2019 (EPPO, 2020). *A. spiniferus* was first recorded in Greece (Corfu) in 2016 (Kapantaidaki *et al.*, 2019). It has also been recorded from Montenegro (first record 2013: Radonji? *et al.*, 2014) and Albania (first report 2020: Nugnes *et al.*, 2020).



EPPO Region: Albania, Croatia, France (mainland, Corse), Georgia, Greece (mainland), Italy (mainland, Sicilia), Montenegro, Netherlands, Spain (mainland)
Africa: Eswatini, Kenya, Mauritius, Nigeria, Reunion, South Africa, Tanzania, United Republic of, Uganda
Asia: Bangladesh, Bhutan, Brunei Darussalam, China (Anhui, Aomen (Macau), Chongqing, Fujian, Guangdong, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Sichuan, Xianggang (Hong Kong), Yunnan, Zhejiang), India (Andaman and Nicobar Islands, Assam, Bihar, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh), Indonesia (Java, Sumatra), Iran, Islamic Republic of, Japan (Honshu, Kyushu, Ryukyu Archipelago, Shikoku), Korea, Republic of, Malaysia (Sabah, Sarawak, West), Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam
North America: United States of America (Hawaii)
Oceania: Australia (Northern Territory, Queensland), Guam, Micronesia, Federated States of, Northern Mariana Islands, Palau, Papua New Guinea

BIOLOGY

In tropical conditions all stages of *A. spiniferus* may be found throughout the year, but very limited breeding occurs during cold periods. In Asia, the stages that overwinter (eggs and early-instar larvae or pupa) vary with the region and the year. The biology of *A. spiniferus* is essentially similar to that of *A. woglumi* (EPPO/CABI, 1996). *A. spiniferus* has six developmental stages: the egg stage, four nymphal instars and the adult. All stages are found on the leaves. Eggs are laid in a spiral pattern on the underside of the leaf in batches of 12-22 (USDA, 1982; Byrne & Bellows, 1991). Eggs hatch in 4 to 15 days depending on environmental conditions. The first instar nymphs are active, brown to black, with a flattened body and six legs. Upon hatching, the 1st instar nymphs disperse by crawling

for a short time, staying mainly on abaxial leaf surface to avoid strong sunlight. They then insert their mouthparts into the leaves and begin sucking phloem sap. Following this, the nymphs moult, losing their legs in the process, and become minute, flattened, oval bodies which attach to the leaf by their mouthparts. Immature stages often form dense colonies of up to several hundred individuals on a single leaf. After two more moults, the adults emerge from the last instar (called puparium). In Croatia, egg development takes 12-15 days (11-22 in Japan), the development of the stages 1 to 3 takes 36-43 days and development of the last instar (puparium) takes 12-17 days (7-34 in Japan) (Gyeltshen *et al.,* 2017; Paladin So?e *et al.,* 2020). Both sexes are winged and feed by sucking phloem sap. Depending on climatic conditions (mild temperatures and high relative humidity being optimal), the life cycle generally takes 2-4 months but there can be four (Japan) to six (Guam) overlapping generations a year (Gyeltshen *et al*., 2017).

In the very similar species *A. woglumi*, development is favoured by temperatures of 20-34°C (optimum 25.6°C) and relative humidities of 70-80%. The species does not survive at temperatures below freezing and is not found in areas with temperatures of 43°C or over. The occurrence of *A. woglumi* and *A. spiniferus* on citrus in Kenya, at lower and higher altitudes respectively, suggests these species may differ in their ecological tolerances (CABI, 2018). It may also be noted that *A. spiniferus* occurs further north in Asia than *A. woglumi* (Jiangsu and Shandong provinces in China; Japan, Korean peninsula) (EFSA Plant Health Panel, 2018).

DETECTION AND IDENTIFICATION

Symptoms

Dense colonies of immature stages develop on leaf undersides, mainly on the lower parts of the trees; the adults fly actively when disturbed. Leaves and fruit have spots of sticky, transparent honeydew, which become covered in black sooty mould fungus. A heavy infestation gives trees an almost completely black appearance.

Morphology

Eggs

Elongate-oval to kidney-shaped, 0.2 mm long, laid in a very characteristic spiral pattern, attached to the underside of leaves by a short pedicel; yellowish at first, turning darker to brown and black as the embryo develops.

Nymph

1st instar: 6-legged, elongate, 0.315 x 0.153 mm, brown to black, with 2 long and several shorter, radiating spiny filaments.

2nd instar: no legs, ovate-convex, 0.4 x 0.3 mm, dark-brown to pale-black with yellow markings, with easily distinguished, radiating spiny filaments and a crenulated marginal edge.

3rd instar: more ovate, 0.66-0.525 mm, generally black with a rounded, greenish spot on the anterior part of the abdomen, spiny filaments obvious.

4th instar = ‘puparium’: ovate, shiny-black, females 1.08-1.28 mm long x 0.8-1 mm wide, males smaller 0.75-0.8 x 0.52-0.58 mm. Dorsal surface with many long, acute glandular spines; insect surrounded by a white fringe of waxy secretion. Exuviae of earlier instars often remain stacked up on median area of immature insect.

Authoritative identification of *Aleurocanthus* spp. involves detailed microscopic study of external puparial morphology by a specialist. *A. spiniferus* and *A. woglumi* can be confused with each other since they only differ from one another in subtle characteristics. They might also be confused with several similar species of *Aleurocanthus* that occur on citrus, including *A. citriperdus*, and *A. husaini* (Schrader *et al.*, 2018). Microscopic differences between puparia of *A. spiniferus*, *A. woglumi* and *A. camelliae* are given in Jansen & Porcelli (2018).

Adult

Females about 1.33-1.7 mm in length, males 0.96-1.33 mm long: at rest, the general appearance is metallic grey-blue, being the colour of the wings which cover most of the body; light markings on the wings appear to form a band across the middle of the red abdomen. The eyes are reddish-brown and the antennae and legs are white with pale-yellow markings.

Molecular identification

Two haplotypes of *A. spiniferus* from Italy, based on mtCOI partial gene, are described in Nugnes *et al*. (2020). Primers used to amplify a 682bp fragment of the same gene are given in Uesugi & Sato (2011) and PCR conditions in Uesugi *et al*. (2016). A slightly modified protocol has been used by Kapantaidaki *et al*. (2019).

The EPPO Standard PM 7/7 *Aleurocanthus spiniferus* (EPPO, 2022) describes the characters to be used to distinguish species of interest within this taxonomically dif?cult genus.

Detection and inspection methods

Yellow sticky traps can be used to capture adults, mainly in the citrus orchards. However, since adults and immature stages are present on above ground plant parts, Aleyrodidae can be detected more efficiently by visual observation (presence of sooty mould on leaves and fruits) and plant sampling (spiral egg masses and the three last larval instar stages being sessile), especially targeting the black puparia surrounded by a fringe of white wax and the adults with metallic grey-blue wings with white markings.

Infested samples showing the presence of various stages or debris of the insects (e.g. adults, pre-imaginal whitefly stages, puparia or pupal cases) should be collected and placed in a labelled plastic bag together with a piece of slightly damp absorbent paper, kept in cool conditions and sent to a diagnostic laboratory as soon as possible (EPPO, 2018).

PATHWAYS FOR MOVEMENT

Adults of *Aleurocanthus* spp. are capable of limited down-wind flight but this is not a major means of long-range dispersal (Meyerdink *et al*., 1979). The whiteflies are most likely to be moved between countries on planting material of citrus or other host species, or possibly on fruits (CABI, 2018). Species of *Aleurocanthus* have been intercepted on the leaves of infested host plants moving in international trade (e.g. USDA, 1988).

PEST SIGNIFICANCE

Economic impact

Aleurocanthus spiniferus excretes copious amounts of sugary honeydew, which coats leaf and fruit surfaces. Sooty mould fungus develops on the honeydew, reducing respiration and photosynthesis and rendering plants and fruit unsightly and unsaleable (USDA, 1982). Badly affected foliage may drop and fruit set may be reduced (Radonji? *et al.*, 2014). Nitrogen levels in infested leaves are reduced and young leaf growth is damaged by heavy infestations. Eventual death of heavily infested plants owing to sap loss and development of sooty mould may occur (USDA, 1982). It is one of the most destructive Aleyrodids attacking citrus in tropical Asia (USDA, 1982; Kapantaidaki *et al* ., 2019). In Australia, *A. spiniferus* is occasionally a pest on *Annona* and *Citrus*, and also on several ornamental trees (Mifsud *et al*., 2010; Gillespie, 2012). In India, *A. spiniferus* can be a serious pest of roses (David & Subramaniam, 1976; Cioffi *et al.*, 2013).

Control

It has not been demonstrated that chemical control was effective on *A. spiniferus* but biological control, using hymenopteran parasites, has proved to be more economical and effective in several parts of the world (Lin *et al*.,

1975; Clausen, 1978). *Encarsia smithi* (Silvestri) has been used to control *A. spiniferus* in Japan, in Hawaii (Clausen, 1978; Cioffi *et al*., 2013), in Pohnpei, Federated States of Micronesia (Muniappan *et al*., 1992) and in Southern Africa (van den Berg & Greenland, 1997). The same parasitoid, together with *Amitus hesperidum* Silvestri, has also been used to successfully control *A. spiniferus* in Guam on citrus, but it was less successful on rose and grape (Clausen, 1978).

Phytosanitary risk

Aleurocanthus spiniferus presents a risk to citrus in Mediterranean countries. It has a well-documented history of spread to new continents from its south-east Asian origin. Due to its small size and the potential of it moving and spreading via planting material and fruit further and repeated introductions are likely. For example, genetic analysis of samples of *A. spiniferus* suggests that multiple introductions have occurred in Corfu (Kapantaidaki *et al*., 2019).

Based on its current distribution and the distribution of citrus species in the EPPO region, it is predicted that the limits of the potential distribution of *A. spiniferus* is the southern part, in particular the Mediterranean region. There is also a risk of establishment on other woody plantation crops growing in the southern part of the region in climatic conditions suitable for the pest.

Aleurocanthus spiniferus appears to be fairly well restricted by natural enemies in its native range, but is liable to cause damage if introduced into new areas.

PHYTOSANITARY MEASURES

Aleurocanthus spiniferus is on the EPPO A2 list and has recently been added to the EU Annex II B. The measures recommended by EPPO for *A. woglumi* would also be appropriate for *A. spiniferus* (EPPO/CABI, 1996). This would include that all host plants imported as planting material and as cut branches come from a nursery found to be free from the pest during the previous growing season. Additionally, plant material and cut branches of host plants shipped from countries where *A. spiniferus* occurs should be fumigated. Fresh fruit of host plants should be imported with a phytosanitary certificate.

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Datasheet history

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