EPPO Datasheet: *Unaspis citri*

Last updated: 2023-12-01

IDENTITY

[more photos...]

Preferred name: *Unaspis citri*
Authority: (Comstock)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Hemiptera: Sternorrhyncha: Diaspididae
Other scientific names: *Chionaspis citri* Comstock, *Dinaspis annae* Malenotti, *Dinaspis veitchi* Green & Laing, *Prontaspis citri* (Comstock)
Common names: citrus snow scale, orange chionaspis, white louse scale
[view more common names online...]
EPPO Categorization: A1 list
[view more categorizations online...]
EU Categorization: A1 Quarantine pest (Annex II A)
EPPO Code: UNASCI

Notes on taxonomy and nomenclature

Data about *Unaspis citri* preceding Ferris (1937) may refer to a misidentification with *Unaspis euonymi* or other species not separated from each other (e.g. *U. citri* misidentified as *U. euonymi* (Comstock, 1881) thriving on *Euonymus japonicus* and *E. latifolius*). Such data should be considered cautiously.

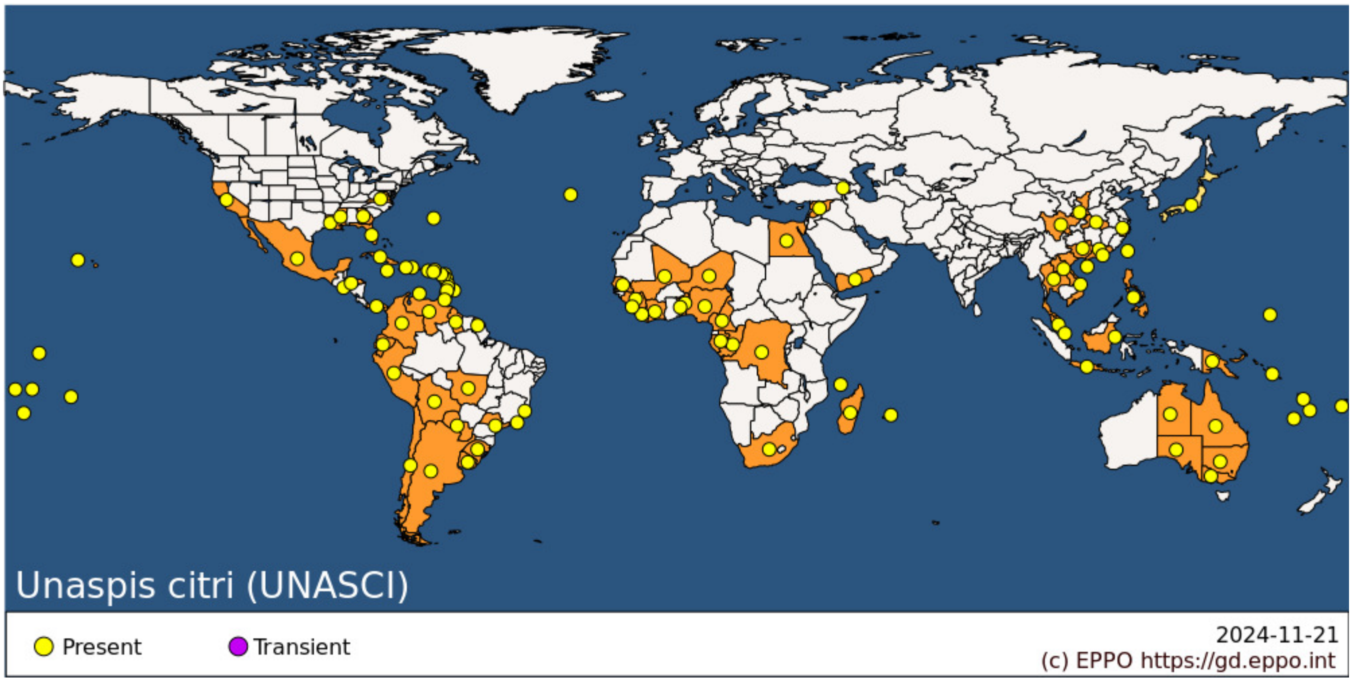
HOSTS

Unaspis citri is a polyphagous pest that infests plants belonging to 25 genera in 17 Families (Kondo & Watson, 2022). The insect has been recorded on *Citrus* or related genera, species, and hybrid cultivars. Some other fruit crops and ornamentals are also host plants.

Host list: *Acacia oshanesii*, *Acacia sp.*, *Ananas comosus*, *Annona muricata*, *Citrus maxima*, *Citrus x aurantiifolia*, *Citrus x aurantium var. deliciosa*, *Citrus x aurantium var. sinensis*, *Citrus x aurantium*, *Citrus x latifolia*, *Citrus x limon*, *Cocos nucifera*, *Glycosmis parviflora*, *Hibiscus sp.*, *Inga sp.*, *Mangifera indica*, *Murraya paniculata*, *Musa x paradisiaca*, *Nephelium lappaceum*, *Osmanthus sp.*, *Persea americana*, *Pittosporum sp.*, *Psidium guajava*, *Tillandsia usneoides*

GEOGRAPHICAL DISTRIBUTION

Unaspis citri originated in the Indomalayan realm, and subsequently spread to other Citrus-growing tropical and subtropical regions worldwide. The scale insect prefers humid tropical habitats. It is not known to establish in semi-arid areas with a dry season, and is less often found in temperate regions. *U. citri* is not present in Algeria, Greece, Italy, and Spain: the citrus snow scale reports in these countries are old and unconfirmed literature records. Some interceptions on traded plant material have been reported from Uzbekistan and Turkey (Europhyt, 2012) but no further pest reports exist for these countries. Presence in Russia and other countries in the former USSR is considered uncertain.



EPPO Region: Armenia, Portugal (Azores)
Africa: Benin, Cameroon, Comoros, Congo, Congo, Democratic republic of the, Cote d'Ivoire, Egypt, Gabon, Guinea, Liberia, Madagascar, Mali, Mauritius, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo
Asia: China (Guangdong, Guangxi, Hainan, Hubei, Shaanxi, Sichuan, Xianggang (Hong Kong), Zhejiang), Indonesia (Java, Kalimantan), Japan, Laos, Malaysia (West), Philippines, Singapore, Syria, Taiwan, Thailand, Vietnam, Yemen
North America: Mexico, United States of America (California, Florida, Georgia, Hawaii, Louisiana, Mississippi, Virginia)
Central America and Caribbean: Antigua and Barbuda, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, Panama, Puerto Rico, Saint Lucia, St Kitts-Nevis, St Vincent and the Grenadines, Trinidad and Tobago, Virgin Islands (British), Virgin Islands (US)
South America: Argentina, Bolivia, Brazil (Espirito Santo, Mato Grosso, Rio de Janeiro, Rio Grande do Sul, Sao Paulo), Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Uruguay, Venezuela
Oceania: Australia (New South Wales, Northern Territory, Queensland, South Australia, Victoria), Cook Islands, Fiji, Kiribati, Micronesia, New Caledonia, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu, Wallis and Futuna Islands

BIOLOGY

Unaspis citri reproduces sexually, with several overlapping generations yearly. Eggs hatch all year round in Australia, with a peak in autumn. A female can produce up to 169 eggs (over a maximum period of 146 days) with an average number of about 80 per female (Hely *et al*., 1982). However, given the dispersive behaviour and the small size of the first instar (crawlers), it may be difficult to distinguish the last borne crawlers of one brood in the same cohort with the first of the next so miscounting may occur.

Arias-Reverón & Browning (1995) suggest the optimal temperature for development ranges between 25°C and 38°C, with a minimum threshold at 12°C. One brood in the warm season needs eight weeks to complete its development (Miller and Davidson, 2005), resulting in a calculated maximum of 6 broods per year, in the most favourable habitats. In the areas where the pest has been described, a mean of 4-5 broods per year has been reported (Brooks *et al*., 1977 in Davidson & Miller, 1990).

Crawlers disperse (Smith *et al*., 1997) soon after hatching. The crawlers exhibit positive phototactic behaviour, in particular if there is leaf fall above them, which leads to a mass upward movement towards the twigs on the top of the tree. Further, passive spreading may occur via machinery and equipment. Crawlers can passively disperse for about 1 m by wind and animals (Kondo & Watson, 2022). Infested plants and plant parts allow passive dispersion opportunities. The sessile scales can be moved with the trade of nursery stock and fruits of infested host plants (Hely *et al*., 1982).

Unaspis citri prefers to infest trunks and main branches; and infestations on leaves or fruits are occasional. The scale moves to twigs in the case of heavy infestations.

Laboratory studies of the population dynamics of *U. citri* showed *U. citri* thrives on orange (*Citrus sinensis*) and on lemon (*Citrus limon*). The longevity of female scales on orange was approximately 13 weeks compared to 17 weeks on lemons (Fernández & García, 1988).

DETECTION AND IDENTIFICATION

Symptoms

Infestations of *U. citri* usually occur on the trunk and main limbs of trees under ten years old. Heavy infestations spread to the twigs, leaves, and fruit resulting in dieback of twigs and weakening and eventual killing of branches; yellow spotting on the undersides of leaves which drop prematurely, and scales accumulation at the petiole-fruit insertion. Heavily infested bark becomes dark, dull, and tight and splits. Weakened limbs and twigs become infected with fungi and may be attacked by wood-boring insects.

Morphology

The adult female scales are mussel or oyster-shell shaped, brown or brown-black with a lighter coloured margin, moderately convex and often have a distinct longitudinal dorsal ridge. The exuviae are anterior and brownish-yellow. The scales attain a length of about 2-2.5 mm. The male pupal cases are waxy, white, felted, elongated, and slender, with three dorsal longitudinal ridges. The exuviae are anterior and brownish-yellow. Identification requires attention, to avoid confusion between *U. citri, U. yanonensis* or *Lepidosaphes* sp. on citrus and related host species (EPPO, 2004 - under revision; 2020).

Formal identification involves a detailed microscopic examination of teneral adult females by a taxonomist who has shown competency in morphological identification of the species. *U. citri* should be carefully distinguished from *U. yanonensis,* which occurs throughout South-East Asia, Australia, and France. Adult females of *U. citri* have relatively few (about 70) pygidial dorsal macroducts, do not have marked divisions among the thoracic segments and have subjacent median lobes. Adult females of *U. yanonensis* have numerous (about 125) pygidial dorsal macroducts and usually have marked divisions between the thoracic segments and distinct median lobes. Ferris (1937), Balachowsky (1954), Williams & Watson (1988) and Watson (2015) provide detailed morphological descriptions and keys. *Unaspis citri* can be differentiated from *Unaspis lansivora* thanks to the numerous perivulvar glands of the latter. A simplified key to diaspid scales on citrus in the EPPO region, pictures, as well as elements of comparison with other similar species are available in Standard PM 7/38 (EPPO, 2004 - under revision). Wilkey (1990), PM 7/38 (EPPO, 2004 – under revision), or Porcelli (2019) describe a suitable slide-mounting method.

Detection and inspection methods

Direct plant scrutiny allows the detection of the scales. However, the small size, dark colour (especially on bark), and sessile nature of the female scales make it difficult to detect them unless present in large numbers. Moreover, the female scales can be confused with the common *Lepidosaphes* spp. or easily overlooked as dirt particles on citrus fruit. Males aggregate in conspicuous, striking, white patches on the trunk or main limbs; hence the common name of ‘citrus snow scale’.

Scales on twigs, leaves, and fruits are easier to detect, but the pest usually only infests these if its population has grown considerably. Scales are persistent on the infested plants, and estimating the actual population may be difficult. This may be done by collecting bark slabs from the trunk and observing these with a stereoscope. Operators can check the vitality of scales by rubbing the bark hosting the scale to with their hand to crush them. If the insects stain the operator’s skin then this shows the insects were alive. Ishaaya & Swirski (1990) suggest an Iodine test to determine whether scales are dead or alive.

PATHWAYS FOR MOVEMENT

Like other diaspidids, the primary dispersal stage is the first instar which wind and animals can naturally disperse. Once they choose a feeding site, the insect becomes sessile, and females will no longer move. Adult males can fly, and they will go searching for females. *U. citri* can move readily on consignments of plant material and fruits and have been often intercepted on imported citrus fruits (see also Biology).

PEST SIGNIFICANCE

Economic impact

Miller & Davidson (2005) gave a summary of *U. citri*'s pest status. *Unaspis citri* is one of the principal pests of *Citrus* spp. in many of the citrus-growing regions of the world, especially in the tropics. It prefers to settle on the bark so leaves and fruits are less infested. Injected saliva (Washington & Walker, 1990) is detrimental to the plant, and a low number of individuals can cause severe damage such as bark splitting and loss of limbs which may lead to plant death. *Unaspis citri* does not cause damage in temperate areas. This scale has significant economic importance in Argentina, Australia, China, Colombia, Mexico, tropical Central America, USA (Florida), and Venezuela requiring more than one control action per season. *Unaspis citri* is also an important pest requiring occasional control measures in Peru, Chile and Brazil. Interestingly, the scale's extensive spread in Florida began in 1963 after a significant number of plants died in citrus orchards due to freezing, when infested nursery stock was used for replanting. Data suggests that before 1960 less than 1% of Florida's citrus groves hosted this scale, but in 1972 50% of the citrus orchards in Florida were infested, and 25% of these required chemical treatments specifically for *U. citri* . High-volume plant protection product sprays worked for control (Simanton, 1976) as biocontrol could not manage the pest.

Control

Three primary control means may be used for the management of *U. citri* as standalone measures or combined in IPM strategies: chemical control with plant protection products, biological control, and tolerant hybrid.

In 1961 Hearn (1979a,b) USDA Orlando, crossed the citrus hybrids Robinson and Osceola [*Citrus reticulata* 'Blanco' X (C. *paradisi* × *C. reticulata*)] obtaining Sunburst: a type of tangerine that was released for commercial use in 1979 (Futch & Jackson, 2021). The trees are highly tolerant of the snow-scale, field resistant to *Alternaria* (scab) and moderately cold hardy. Sunburst is still the most widely grown early tangerine in Florida, on rootstocks of Carrizo citrange (× *Citroncirus* spp.) *Citrus sinensis* 'Washington' sweet orange × *Poncirus trifoliata***,** sour orange [*Citrus* × *aurantium* L. cultigen (*C. daoxianensis* × *C. maxima*)], Swingle citrumelo (× *Citroncirus* spp.), and Cleopatra mandarin (*Citrus reshni* Hort. ex Tan.) (Froelicher *et al*., 2010; Mourão Filho *et al*., 2009; POWO, 2023; UCR, 2023).

Sunburst is self-incompatible and can uses the pollen from Temple, Orlando, Nova, Minneola, Robinson or Fallglo to fructify. Sunburst is susceptible to leaf browning and stem blistering if strongly infested by Texas citrus mite, *Eutetranychus banksi* (McGregor) or *Phyllocoptruta oleivora* (Ashmead). From the year 2005, Sunburst has declined in popularity due to its high susceptibility to Huanglongbing (citrus greening).

Chemical control needs systemic formulations to counteract the armoured scale's protein-waxy shield and its sessile nature. *Unaspis citri*'s overlapping broods make it difficult to kill enough target insect to limit the damage. Conventional old and habitat-impacting active ingredients such as organophosphate (Fernandez & Rodriguez, 1988); carbamate (Castineiras & Obregon, 1986); chitin synthesis inhibitor (de Moraes et al., 1995) are no longer available in many EPPO countries (e.g. in the EU), as is also the case for insect growth regulators (Smith & Papacek 1990) and neonicotinoids (Alayon-Luaces *et al.*, 2018.). Many active ingredients and formulates are being abandoned because of their impact on ecosystems and human health. Mineral oils are still available and can be used in *Citrus* orchards, but are only effective on Diaspididae crawlers.

Biocontrol of *U. citri* offers several promising options. There is a potential arsenal of agents, which has not yet been fully explored, comprising predators: Coccinellidae, Diaspidid predators (Chazeau, 1979; Chazeau, 1984; Houston, 1991; Smith *et al.*, 1995; Coronado Blanco *et al.*, 2000; dos Santos Wolff *et al.*, 2004), Diptera (Coronado Blanco & Ruiz Cancino, 1999); Hymenoptera parasitoids (Annecke & Prinsloo, 1974; Browning, 1994; Ceballos, 1988; de Crouzel & Merluzzi, 1980; Fernandez Argudin, 1995; Fernando & Walter, 1997; Soares *et al.*, 1997; Stapley, 1976) e.g. using field cages facilitating the establishment of *Aphytis lingnanensis* in Florida (Brooks & Vitelli, 1976). Acari (Gerson, 1994a; Gerson, 1994b) and Entomopathogenic fungi are also interesting biocontrol agents for use against *U. citri* (Agudelo & Falcon, 1977; Dao *et al.*, 2015; dos Santos Wolff *et al.*, 2004; Prade *et al.*, 2005; Prade *et al.* 2007). Among the biocontrol options, Diptera, Acari and Fungi seem less available on the market than parasitoids and lady beetles. Again Miller & Davidson (2005) report that at first sight, introducing the Hong Kong variety of *A. lingnanensis* achieved significant success in managing *U. citri*. Nevertheless, today, snow scale populations are not appropriately controlled with biological control options (not at or below the subeconomic levels), and there is still work to do. In different countries, assessment of the positive impact of parasitoids is challenging since many strains of *A. lingnanensis*, which are morphologically identical were introduced (intentionally or unintentionally) in the citrus orchards. Currently, *Chilocorus circumdatus* Gyllenhal offers a reasonable level of biological control in Australia (Houston, 1991).

Finally, Hely *et al.* (1982) suggest that caterpillars of *Batrachedra* sp. (Lepidoptera: Batrachedridae) cause spectacular reductions in the number of scales. This is the only citation for a non-identified species of a lepidopteran predator on *U. citri*, which makes the validity of this questionable.

Phytosanitary risk

The main potential hosts in the EPPO region are *Citrus* spp., growing in the southern part of the region, around the Mediterranean. *Annona muricata* cultivation in Israel (Williams & Watson, 1988) and neighbouring countries may also be at risk.

Unaspis citri presents a certain threat to the citrus industry throughout the Mediterranean but is considered more tropical than *U. yanonensis*. Vilardebo (1974) noted that, in West Africa, *U. citri* prefers the humid tropical zone along the coast and does not occur where there is a dry season. Maelzer (1979) similarly noted that *U. citri* is confined to the non-irrigated humid coastal regions of Queensland and New South Wales in Australia and does not occur in the semi-arid irrigated citrus cultivation areas inland, where *Aonidiella aurantii* is abundant (a situation thus resembling the Mediterranean). *Unaspis citri* also has lesser tendency to infest fruits than *U. yanonensis*. Like *U. yanonensis*, *U. citri* may be subject to adequate control by biological methods alone.

Considering all these arguments, *U. citri* is at lesser risk of establishment and a lower magnitude of potential impact than *U. yanonensis* throughout the Mediterranean.

Nevertheless, it is considered as a significant pest to be excluded from the EPPO region.

PHYTOSANITARY MEASURES

Importation of *Citrus* plants is already prohibited or restricted in many EPPO countries because of other important pests e.g. in the EU. However, in these countries, *Citrus* plants for planting could still be imported through a post-entry quarantine procedure by bilateral agreement.

In countries in which importation of *Citrus* plants is not already prohibited, possible measures could include production of *Citrus* plants for planting (except seeds, tissue culture, pollen) in pest-free areas, pest-free place/site of production established according to EPPO Standard PM 5/8 *Guidelines on the phytosanitary measure 'Plants grown under physical isolation'*. As recommended by EPPO for *Chionaspis pinifoliae* (in the framework of a bilateral agreement), a systems approach, combining absence of the pest after inspection of the consignment, dipping the whole plant in horticultural oils (summer oils or botanical oils) or insecticidal soap, and storage and transportation in conditions preventing new infestation may be considered.

Citrus fruits may be subject to similar requirements.

Measures for additional host plants may need to be considered.

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