EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE POUR LA PROTECTION DES PLANTES

23- 28587 (23-28467, 23-28207)

Report of a Pest Risk Analysis for

Crisicoccus pini (Hemiptera: Pseudococcidae)

Courtesy: Vai – SFR Bologna (IT) – EPPO Global Database (EPPO Code: DACLPI)

This summary is based on
an Italian Express PRA (Bugiani & Finelli, 2018),
a British PRA (Lloyd, 2019),
an EFSA pest categorisation (EFSA, 2021) and
a Swedish risk assessment (Boberg & Björklund, 2022).

The pest categorisation prepared by EFSA covers the European Union. The three other PRAs focus on individual countries (Italy; UK, including Northern Ireland; Sweden), however, in these documents, data is often provided for wider areas, e.g. the whole European Union. Probability of entry, establishment, spread, and potential impact, with associated uncertainties, have been based on the above listed PRAs and adapted by the EPPO Secretariat and the Panel on Phytosanitary Measures (hereafter the Panel) for the EPPO region.

Pest:	*Crisicoccus pini*
PRA area:	EPPO region
Assessors:	IT Express PRA: Riccardo Bugiani, Franco Finelli EFSA pest categorization: EFSA Panel on Plant Health for the EU GB PRA: Simon Lloyd SE risk assessment: Johanna Boberg, Niklas Björklund With subsequent discussions in the Panel on Phytosanitary Measures.
Date:	IT Express PRA: 2018; GB PRA: 2019; EFSA pest categorization: 2021; SE risk assessment: 2022. The PRA report was reviewed on 2023-03 by the EPPO Panel on Phytosanitary Measures. EPPO Working Party on Phytosanitary Regulations and Council agreed that *Crisicoccus pini* should be added to the EPPO A2 List of pests recommended for regulation as quarantine pests in 2023.

Cite this document as:
EPPO (2023) Report of a pest risk analysis for *Crisicoccus pini*. EPPO, Paris. Available at https://gd.eppo.int/taxon/DACLPI/documents

Based on this PRA report, measures for plants for planting of *Pinus* spp. (except seeds, tissue culture and pollen) are recommended.

STAGE 1: INITIATION

Reason for doing PRA: *Crisicoccus pini* is a pest of Pinaceae originating from Asia, which was reported in the Emilia-Romagna region (Italy) for the first time in 2015. An IT PRA was reviewed by the Panel on Phytosanitary Measures in 2018 which considered that no specific recommendation for regulation should be made (pathway closed, inconsistency of information on economic impact). In 2019-01, *C. pini* was added to the EPPO Alert List to raise awareness. In 2021-10, an EFSA pest categorization on this pest was published, mentioning significant impact to *Pinus densiflora* (Japanese red pine) and *P. thunbergii* (black pine) in China, in addition to the damage noted on *P. pinaster* (maritime pine) and *P. pinea* (stone pine) in Italy. A rapid PRA was performed in 2019 by the United Kingdom; as well as a risk assessment for Sweden in 2022. Based on these new information, the Panel decided that a PRA report should be prepared.

Taxonomic position of pest: Insecta, Hemiptera, Sternorrhyncha, Pseudococcidae, *Crisicoccus*, *Crisicoccus pini*.
Other scientific names: *Dactylopius pini*, *Pseudococcus pini.*

STAGE 2: PEST RISK ASSESSMENT

PROBABILITY OF INTRODUCTION

Entry

Geographical distribution:
(Source: EPPO Global Database last consulted 2023-02-21, details on distribution are available in Global Database)

AMERICA:
USA (California, District of Columbia, Hawaii).

ASIA:
China; Japan; Korea Democratic People's Republic; Korea, Republic; Taiwan.

EUROPE:
Italy; Monaco; Russia (Far East).

Major host plants or habitats:
(Source: EPPO Global Database last consulted 2023-02-21, references on host status are available in Global Database)

Pest of Pinaceae. Recorded host species are:
Abies sp., *Keteleeria* sp., *Larix* sp., *Pinus coulteri, Pinus densiflora, Pinus halepensis, Pinus koraiensis, Pinus massoniana, Pinus nigra, Pinus parviflora, Pinus pinaster, Pinus pinea, Pinus radiata, Pinus tabuliformis, Pinus thunbergii.*
The significance of *Abies, Larix* and *Keteleeria* as hosts is unclear (cited only in Chen *et al.*, 2005, not citing the source of the records). *Pinus sylvestris* has not been recorded as a host and thus the susceptibility is not known. However, the pest has extended its host range to new *Pinus* species after its arrival in Italy, e.g., to *P. pinea* (Boselli & Pellizzari, 2016).
EFSA (2021) reports that *it has been intercepted at a US port-of-entry on* Taxus *sp. (Taxaceae) imported from Japan (Miller et al., 2014), but the significance of this record is unknown and there is some likelihood that there was cross contamination in transit. All of the confirmed hosts belong to the Pinaceae family.* This host is not considered further in this PRA report.

Which pathway(s) is the pest likely to be introduced on:

Review of the pathways for entry into the EPPO region:
C. pini has already been introduced in the EPPO region (Italy and Monaco). Although it is not known on which pathway the pest was introduced, it is likely that it was with plants for planting.
The pathways for entry from countries where *C. pini* into EPPO countries are discussed in this PRA.

- Plants for planting of *Pinus*, *Abies*, *Larix*, *Keteleeria* (except seeds, tissue culture and pollen)

All stages of *C. pini* can be present on plants for planting. Nymphs can be found feeding at the base of the needles but when migrating they can also be found on branches, or on the lower part of the trunk where they overwinter (EFSA, 2021).
Early infestation of *C. pini* are difficult to detect if only a small number of nymphs are present. Later stages of infestation, with large numbers of larvae/adults would be conspicuous, with the white waxy build ups and egg sacs will be easier to detect (Lloyd, 2019); however, it is likely that the infested plant will be discarded before export.
The pest will be able to survive on its host during transport or storage and arrive to suitable habitat with this pathway.
Several EPPO countries (e.g., EU countries, the UK) prohibit the import of *Abies, Larix* and *Pinus* plants for planting (except fruits and seeds) from countries where *C. pini* is present (although this may not cover Monaco). However, dwarfed (bonsai) *Pinus* plants for planting can be imported in the EU countries under a derogation system (from Japan, Commission Implementing Decision (EU) 2020/1217) and from the Republic of Korea (Commission Decision 2002/499/EC), with specific requirements related to *C. pini* from Japan only.
Import of *Pinus* and Coniferae plants for planting is not prohibited in the EAEU (EPPO, 2022).
Import of *Keteleeria* plants for planting is not prohibited in the EU.
In EPPO countries plants for planting are imported with a Phytosanitary Certificate (PC) consequently the import of *Keteleeria* plants for planting is regulated.

In all PRAs reviewed, plants for planting of host plants are considered to be the main pathway for entry of the pest. It is however noted that import of* Abies, Larix *and* Pinus *plants for planting is prohibited in many EPPO countries (e.g., EU). However, movement of plants for planting is not restricted between EU countries.

- Cut branches of host plants (including Christmas trees)

Conifer branches are commonly used in floristry and in the production of Christmas decorations and this are seasonal imports. As nymphs can be found feeding at the base of the needles, cut branches from infested hosts may carry the mealybug (EFSA, 2021).
As for plants for planting, EU countries prohibit the import of cut branches of *Abies, Larix* and *Pinus* from outside third countries. For *Keteleeria* cut branches EU countries require a Phytosanitary Certificate.
Import of *Pinus* and Coniferae cut branches is not prohibited in the EAEU (EPPO, 2022).
The pathway is closed, at least for some EPPO members.
Given the low mobility of the pest, transfer to a host plant from cut branches is unlikely to happen.
Cut branches of host plants is considered to be an unlikely pathway for entry of the pest in the region (and this is a closed pathway in many of EPPO member countries).

- Conifer nuts and cones of host plants

Cones are also commonly used in floristry and in the production of Christmas decorations, however, it is unclear if *C. pini* could be associated with the import of pinecones (EFSA, 2021). Conifer nuts are high value commodities intended for consumption; there is also no information on the association of the pest with cone nuts.

Conifer nuts and cones are considered to be an unlikely pathway for entry of the pest.

- Wood of host plants, with bark

C. pini may be found on the bark of living trees as nymphs overwinter on bark (EFSA, 2021 citing others). There is a trade of conifer wood from countries where the pest is present. However, the likelihood that wood with bark is a pathway is low in many EPPO countries due existing pre-export treatments (fumigation and heat treatment), including drying, are likely to be very effective in killing the mealybugs (EFSA, 2021).
Wood with bark is considered to be an unlikely pathway for entry of the pest.

- Bark of host plants

C. pini feeds on the needles but may be associated with bark, e.g., during overwintering as nymphs. In EU countries, isolated bark of Pinales originating in third countries (not incl. Monaco) should be treated (fumigation or heat treatment) ((EU) 2019/2071, Annex VII, 82). The treatments are assumed to eliminate *C. pini* efficiently (EFSA, 2021). In addition, *C. pini* is very unlikely to develop on isolated bark (EFSA, 2021).
Bark is considered to be an unlikely pathway for entry of the pest.

- Other wood commodities

The likelihood that wood without bark and wood packaging material could provide a pathway of introduction is very low for the following reasons: pre-export treatments (fumigation and heat treatment), including drying, are likely to be very effective in killing the mealybugs (EFSA, 2021). The pest feeds on pine needles and is not associated with the heartwood and sapwood.
These commodities are not pathways.

- Other pathways (EFSA, 2021)

Seeds is not a viable pathway.

Natural spread: as a scale, natural spread is considered to happen only locally.
Stored products / dried plant parts: in the PRA on *Chionaspis pinifoliae*, this pathway was evaluated (EPPO, 2022). Pine needles may be used as mulch for gardens, or for phytotherapy. However, for such uses pine needles are generally dried and nymphs are not expected to survive. 'Preserved' or 'stabilized' cut branches bearing needles can be traded for decorative purposes (e.g., Christmas decoration). However, the pest is not expected to survive the preservation process when preservation fluids saturate the plant material.

Hitchhiking: First-instar nymphs may be carried by animals and on vehicles and are likely to be able to survive for approximately one day without feeding. However, there is not enough specific information about *C. pini* to accurately assess the likelihood of hitchhiking as a pathway of entry.

Overall, *C. pini* is able to enter the EPPO region, even though the risk is already reduced by the measures implemented in many EPPO countries. The likelihood of entry is low with a moderate uncertainty.

Establishment

Plants at risk in the PRA area:

C. pini is oligophagous on Pinaceae, including species used for forestry, ornamentals, and environmentally important native species. The main hosts are *Pinus* species, which are available throughout most of the EPPO region.

Maps for specific *Pinus* species are available at:
https://forest.jrc.ec.europa.eu/en/european-atlas/
An analysis of the distribution of some Pinus species is presented in the PRA

for EPPO Pest Risk Analysis for *Chionaspis pinifoliae* (EPPO, 2022).

P. pinaster (maritime pine):
Major crop, present in Italy in most of the regions along the coasts and in a hilly environment. The maritime pine range extends from the western Mediterranean basin to the European Atlantic coast: France, Spain, Portugal, Corsica, North Africa.

P. pinea (stone pine)
Major crop, species originating from the Mediterranean coasts whose range extends from the Crimea to Portugal and Algeria. *P. pinea* is also used for pine nut production.

Damage is already observed in Italy on *P. pinaster* and *P. pinea* (Bugiani & Finelli, 2018).

P. halepensis (Aleppo pine)
This species is mainly found in the Mediterranean region where it is widely distributed. It is mainly a coastal species. It is ecologically significant in southern France and Italy and the most important forest species in North Africa (Euforgen, 2021). The species is also important for afforestation programmes, because it improves water infiltration, prevents soil erosion on dry slopes and serves as windbreaks (Farjon & Filer, 2013; Euforgen, 2021).

P. nigra (European black pine)
This species has a wide but scattered distribution across Europe and Asia. It is mainly found in mountainous areas and is one of the most economically important native conifers in southern Europe (Euforgen, 2021), with extension into Turkey and some outlying populations in coastal North Africa (Algeria, Morocco), Ukraine and East Black Sea coast. It is used for wood, Christmas trees and as an ornamental. It is also effective for controlling soil erosion and landslides and hence widely used for reforestation (Farjon & Filer, 2013; Euforgen, 2021).

*P. radiata (*Monterey pine)
The species is widely planted in Southwest Europe and huge plantations can be found in the Basque Region in Spain.

The species listed above are also used as ornamental species.

Other listed hosts include several pine species that are mostly used in the EPPO region as ornamentals, e.g., *P. densiflora, P. koraiensis, P. massoniana, P. radiata, P. thunbergii*.
Abies and *Larix* are reported to be host genera in China and these are also major taxa of conifers throughout most of the EPPO region (e.g. *A. nordmanniana* is a major species cultivated as Christmas tree in central Europe). However, there is uncertainty regarding the importance of *Abies*, *Larix* and *Keteleeria* as hosts, and whether *P. sylvestris* (not listed as a host in literature), a dominant tree species in Northern areas of the EPPO region, is a suitable host.

Climatic similarity of present distribution with PRA area (or parts thereof):

The development threshold temperature for *C. pini* is about 13°C, the thermal constant is 456.7 Degree Days, and the optimum temperature for development is 25°C (Chen *et al.*, 2005). *C. pini* occurs mainly in subtropical and temperate regions in Asia (native range), established in North America and Italy (introduced range). In Russia, it occurs in the most southerly tip of the Primorye (Far East) Territory (Danzig & Gavrilov-Zimin, 2010), which experiences a humid continental climate (Dfb). Winters are cold and dry with daily mean temperatures between December and March below 0°C, and the average low temperature in January minus 13.9°C (EFSA, 2021).

EFSA (2021) concludes that *C. pini* has a potential to establish throughout the considerable part of the EU wherever suitable hosts occur (see map below). This conclusion can be extrapolated to EPPO countries.

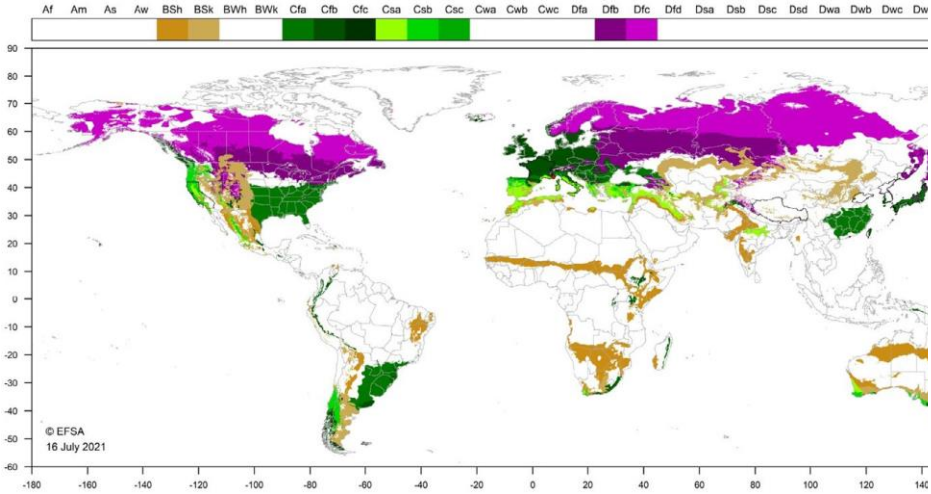

Fig. 1. World distribution of ten Köppen–Geiger climate types that occur in the EU and which occur in areas where *C. pini* has been reported (EFSA, 2021).

Characteristics (other than climatic) of the PRA area that would favour establishment:

The presence of other native and invasive conifer scale insects on *Pinus* and other hosts in the EPPO area increases the risk that infestations of *C. pini* might remain first undetected.

Which part of the PRA area is the area of potential establishment:

C. pini has the potential to establish throughout the considerable part of the EPPO region, wherever suitable hosts occur.

Spread

Briefly describe each mode of spread (natural, human assisted)

The following mechanisms were suggested in Bugiani & Finelli (2018) and EFSA (2021) as possible contributors to the spread of *C. pini*:

Natural spread by the first instars crawling will occur locally and relatively slowly (EFSA, 2021);
Spread by wind, animals or machinery is mentioned as occurring locally and relatively slowly (Bugiani & Finelli, 2018; EFSA, 2021);
Plants for planting would be the main mean of spread of the pest over long distances in short periods of time (EFSA, 2021; Boberg & Björklund, 2022);

Specific spread rates for this pest have not been reported, and it is difficult to determine the rate of spread in Italy as the date of the first introduction is not known. However, the rate of spread in the years since it was first observed has been low, and it has not dispersed beyond the initial infested zone within the last 2 years (Boselli *et al.*, 2018). Spread may also be slow because official measures have been taken (see section 16 of Bugiani & Finelli, 2018). Spread in the USA was also slow.
Faster spread will be due to adult females and immature stages being carried with plant material in trade, especially plants for planting (EFSA, 2021). In the close surroundings of the Italian outbreak, no ornamental nurseries are known, only few garden centres (Bugiani & Finelli, 2018). It cannot be excluded that the pest would spread over long distance via transportation of infested plants for planting if it was introduced in an area where nurseries are present.

POTENTIAL ECONOMIC CONSEQUENCES

How much economic impact does the pest have in its present distribution:

In China (native range), *C. pini* is reported to be a pest of *P. densiflora* (Japanese red pine), *P. massoniana* (Masson's pine), *P. tabuliformis* (Chinese red pine), *P. thunbergii* (black pine), *Abies* sp., *Keteleeria* sp. and *Larix* sp. (Chen et al., 2005). EFSA (2021) states that '*it has become a major pest of* P. densiflora *and* P. thunbergii *in Qingdao since about 1998, causing chlorosis, premature needle drop, branches drooping, poor or no growth, reduction in the size of the needles, and many trees were recorded to be on the verge of dying (Chen et al., 2005, 2006)*'. Tang (1984) recorded *C. pini* being injurious to *P. tabuliformis* in Northern China. The economic impact was not estimated.

In Japan (native range), no significant damage reported.

In California (USA) (introduced), recent literature suggests that it is not a pest, although in the early 1990s, it was reported that it could behave as a pest (EPPO, 2019).

In Washington, D.C. (USA) (introduced), the possibility of a stable population remains unconfirmed, and there are no reports of impacts (Lloyd, 2019).

In Italy (introduced), it was first detected in 2015 causing extensive damage to ornamental pines planted along streets and in private gardens in the seaside resort town of Cervia (Province of Ravenna), region of Emilia-Romagna (Bugiani & Finelli, 2018; EFSA, 2021). Severe decay of *P. pinaster* (maritime pine) and *P. pinea* (stone pine) was reported. In addition, the pest has caused significant social disruption at local level (Lloyd, 2019). The damage caused by the pest is significant, but the low rate of spread, and effectiveness of the applied control measures (though expensive and disruptive) limit the impact caused by this pest.
P. pinea is an iconic species in Italy and has shown a rapid decline in Campania and Lazio regions, partly due to the introduction of other invasive pests, including pine tortoise scale (*Toumeyella parvicornis*) and western conifer seed bug (*Leptoglossus occidentalis*). The impact on tree health by *C. pini* may be amplified in combination with these other invasive pests (EFSA, 2021).

In Monaco (introduced), no further details have been found about its detection in a Japanese garden in 2006 on adult trees. There is no indication it has spread beyond the initial finding, and no updates about follow up actions on the infested plants (Lloyd, 2019). The impact, if any, of *C. pini* in Monaco is unknow (EFSA, 2021).

Describe damage to potential hosts in PRA area:

The mealybug feeds on developing needles, resulting in yellowing and necrosis at the base of the needle (Boselli & Pellizzari, 2016). The mealybugs egest large quantities of sticky honeydew that smothers the plant and serves as a medium for the growth of sooty moulds, limiting photosynthesis and gas exchange (EPPO, 2019; EFSA, 2021).
The pest can cause chlorosis, premature needle drop, branches drooping, poor or no growth, reduction in the size of the needles, and trees may die.

How much economic impact would the pest have in the PRA area:

Pinus species are essential to woodlands in the EPPO region, and *C. pini* has the potential to have an environmental impact by reducing the health of pine forests (EFSA, 2021). However, the low rate of natural spread of the pest limits the impacts and provides opportunities for the implementation of phytosanitary measures in local outbreaks. There is also uncertainty regarding the host range which will affect the potential impact that *C. pini* may have in the EPPO region.

An economic evaluation has been done for **Sweden**. It is considered that damage and mortality of trees in streets, parks and private garden could lead to costs of control and removing and replanting of trees. The cost of replacing a park tree or a street is equivalent to 3000–7000 € per tree (Widenfalk *et al.*, 2022). A loss of 0.1–1.0% of *P. sylvestris* in near urban forests would generate losses of 0.024–0.24 million € annually, however, most likely the impact will be local, and damages is mainly expected on ornamental trees in urban areas (Boberg & Björklund, 2022).

Potential economic impact has also been calculated for **Great Britain** as low with low confidence (rated as small in the PRA). The industry at risk is very substantial, but the very low rate of spread of the pest and doubts about both the climatic suitability of the UK and the susceptibility of *P. sylvestris* limit the impact this pest might have (Lloyd, 2019).

In **Italy**, different actions have been undertaken. In winter 2015–2016, 231 amenity plants (cost about 40.000 €) and 237 private plants were felled and others were pruned. Replacement of trees costed more than 72.000 €. In August 2016, 652 insecticides trunk injections were performed. In 2017–2018, control was based on the release of the antagonist *Cryptolaemus montrouzieri* (1000 specimens/ha) only (cost about 30.000 €). Abamectin treatments reduced the population of *C. pini* in Italy (Boselli *et al*., 2018)

CONCLUSIONS OF PEST RISK ASSESSMENT

Summarize the major factors that influence the acceptability of the risk from this pest:

Estimate the probability of entry:	Plants for planting are the main pathway although such imports are prohibited for most hosts in many EPPO countries. **The pest has already been introduced but the likelihood of a new entry is low with a moderate uncertainty.**
Estimate the probability of establishment:	Suitable conditions (host and climate) exist in the EPPO region. There is a high likelihood with a low uncertainty that the pest will establish in the EPPO region (see Fig. 1).
Estimate the magnitude of spread:	**Magnitude of spread is expected to be moderate with a moderate uncertainty in the EPPO region.** Although current magnitude of spread from the Italian outbreak is low, the magnitude would be higher if the pest was introduced in an area with nurseries. The rating of the magnitude of spread is as for *Chionaspis pinifoliae*, another *Pinus* scale (EPPO, 2022)
Estimate the potential economic impact:	**Potential economic impact is considered to be low (in the northern part of the region) and low to moderate (in the southern part of the region).**
Degree of uncertainty:	Importance of non-*Pinus* hosts, and range of *Pinus* species that are suitable hosts. Effectiveness of insecticide treatments (EFSA, 2021). Pest status in Monaco is also not clear.
OVERALL CONCLUSIONS	*C. pini* meets all the criteria to qualify as a quarantine pest. It has a limited distribution in the EPPO region, and measures aiming at containment of the pest (Decree from Emilia Romagna DPG/2022/9037 2022/05/06 based on biological control and elimination of infested parts or of whole trees) are implemented by the Italian NPPO. *C. pini* has been considered by EFSA to satisfy all the criteria that are within its remit to assess for it to be regarded as a potential Union quarantine pest (EFSA, 2021).

C. pini poses a risk to the EPPO region and risk management options should be considered.

STAGE 3: PEST RISK MANAGEMENT

IDENTIFICATION OF THE PATHWAYS

Evaluation of the need for management measures for the different hosts: because of the wide host range within *Pinus*, measures are recommended for the whole genus.

Management measures are proposed for
Plants for planting of *Pinus* spp.

No management measures required for the other pathways:
– fruits [conifer cones];
– wood [round wood (with or without bark), wood chips];
– bark;
– wood packaging material;
– natural spread;
– animals, conveyances, vehicles and equipment;
– hitchhiking.

Possible measures for plants for planting of *Pinus* (except seeds, tissue culture and pollen)

Measures related to the crop or to places of production:
Pest free area
Pest free place of production or pest free production site

Measures related to consignments:
Inspection of plants alone is not reliable as early infections of *C. pini* are difficult to detect if only a small number of nymphs are present. However, the mealybug has been intercepted during quarantine inspections in the US (EFSA, 2021).
Treatment of the plants with plant protection products such as abamectin will reduce the population of *C. pini* and has been used in Italy (Boselli *et al*., 2018). However, EFSA (2019) in the commodity risk assessment of black pine (*Pinus thunbergii*) bonsai from Japan stressed uncertainties regarding the efficacy of insecticide treatments (sprays).
In Pest Risk Analysis for *Chionaspis pinifoliae* (EPPO, 2022) a systems approach is also proposed. The Panel on Phytosanitary Measures considered that similar measures can be proposed for *C. pini*.
Inspection would ensure that the pest is absent or that the population is low. Dipping the whole plant in horticultural oils (summer oils or botanical oils) or insecticidal soap will ensure the elimination of the pest under such low pest population. The EPPO PRA on *C. pinifoliae* states that '*When the pest population is low or not detected, treating the whole plant by summer oils (Liang et al., 2010; Tansey et al., 2015; Tomkins et al., 1996; Khalid et al., 2012; Chueca et al., 2009; McKenna et al., 2007), botanical oils (Ciriminna et al., 2017; El Aalaoui et al., 2021)), or insecticidal soap (Walufa et al., 2017; Ralston et al., 1941; Parry & Rose, 1983), would kill most if not all of hidden eggs, crawlers and adults. Surviving adults, or eggs still protected by the scale, would be most probably detected by visual inspection when performed on small plants. The EWG recommended dipping the whole plant in [or similar approach guarantying that all the needles are covered by] these generalist products, which also makes this option mainly available for small plants because of practicality. For plants for planting, this option generally requires that there is no soil attached. Plant protection products (other than horticultural oils) against* C. pinifoliae *are available but the life stages that have a scale covering are difficult to kill with these products. Such life stages can be present on the plants throughout the year and thus, the pest cannot be eliminated from consignments with these insecticides.*'
In addition, storage and transportation conditions of the consignment should prevent new infestations, i.e. outside the crawler active period, or not in/through areas infested with the pest, or with a suitable packaging (i.e. solid material not net).

Measures upon entry of the consignments:
Inspection or treatment are not sufficient alone (see above).

Post entry quarantine for one year.

EVALUATION OF THE MEASURES IDENTIFIED IN RELATION TO THE RISKS PRESENTED BY THE PATHWAYS

The pest could be difficult to eradicate or contain if introduced therefore measures should be taken to prevent its further entry and spread in the PRA area. Boberg & Björklund (2022) note that generally mealybug are difficult to control.

Degree of uncertainty	Uncertainties in the management part are: Host plants, in particular the host status of *P. sylvestris*. Status of the pest in Monaco. Efficacy of insecticide treatments.

IDENTIFICATION OF POSSIBLE MEASURES

Pathway	Measures
Plants for planting of *Pinus* spp. (except seeds, tissue culture and pollen)	Pest free area (ISPM 4, ISPM 29) (see requirements below) **OR** Plants should be produced in a pest-free place/site of production[1] for *Crisicoccus pini* established according to EPPO Standard PM 5/8 *Guidelines on the phytosanitary measure 'Plants grown under physical isolation'* **OR** Systems approach combining: • Absence of *C. pini* after visual inspection of the consignment • Dipping the whole plant in horticultural oils (summer oils or botanical oils) or insecticidal soap • Storage and transportation in conditions preventing new infestation, i.e. outside the crawler active period, or not in/through areas infested with the pest, or with a suitable packaging (i.e. solid material not net) **OR** Post-entry quarantine for 1 year (in the framework of a bilateral agreement)

[1]*: The choice between PFPP and PFPS is a decision to be taken by the NPPO based on the operational capacities of the producers and biological elements.*

Requirements for establishing a PFA: .
• To establish and maintain the PFA, detailed surveys and monitoring should be conducted in the area in the 2 years prior to establishment of the PFA and continued every year. Specific surveys should also be carried out in the zone between the PFA and known infestation to demonstrate pest freedom. The surveys should be targeted for the pest and should be based on visual examination of host trees.
• Surveys should include high risk locations, such as places where potentially infested material may have been imported/introduced.
• There should be restrictions on the movement of host material (originating from areas where the pest is known to be present) into the PFA, and into the area surrounding the PFA, especially the area between the PFA and the closest area of known infestation.

According to the Italian PRA, **containment and eradication** of the pest, and application of effective phytosanitary measures would be possible (including trunk injections with insecticides and the release of biocontrol agents). However, mealybugs are generally difficult to control.

In Italy, a control plan aiming to contain (and if possible eradicate) the pest has been developed and was revised in 2022 (Italian NPPO, 2022). The main objectives are:

- to adopt phytosanitary control strategies with a low environmental impact, according to the principles of integrated and biological control. Such measures include:
    - the elimination of the plants that are considered severely affected by the pest and pruning of those expected to recover;
    - in private areas application of abamectin by trunk injection of less severely affected plants;

- the release in Spring and Summer each year of its natural predator *Cryptolaemus montrouzieri*;

- to provide information and perform a communication campaign on the pest and measures implemented.
- to train technicians and organize technical meetings for e.g. professionals, local gardeners as well as trade associations.

References

Boberg J, Björklund N (2022) Risk assessment of *Crisicoccus pini* for Sweden. SLU, Sweden: SLU.ua.2022.2.6-1304, 17 p. (available at: https://pra.eppo.int/pra/7c75268c-e169-4efa-aeb5-9c06f24f8edf; accesses on 02 March 2023)

Boselli M, Pellizzari G (2016). First record of the Kuwana pine mealybug *Crisicoccus pini* (Kuwana) in Italy: a new threat to Italian pine forests? *Zootaxa* 4083(2), 293–296.

Boselli M, Vai N, Mirotti A, Mazzini F, Mazzoni F, Mosti M, Foschi S, Scapini C (2018) [*Crisicoccus pini* (Hemiptera, Pseudococcidae) in Emilia-Romagna: delimitation of the infested area and control plan] (in Italian). Paper presented at the Giornate Fitopatologiche (Chianciano Terme, IT, 2018-03-06/09). (available at: http://www.geasnc.eu/wp-content/uploads/2018/03/CRISICOCCUS-PINI-IN-EMILIA-ROMAGNA_DELIMITAZIONE-DELL%E2%80%99AREA-INFESTATA-E-PIANO-DI-CONTROLLO.pdf; accesses on 02 March 2023)

Bugiani R, Finelli F (2018) Express PRA for *Crisicoccus pini* (synonym *Dactylopius pini*) Japanese pine mealybug (available at: https://pra.eppo.int/pra/b8303eaa-2d15-4f37-948a-d9c268f0896c; accesses on 02 March 2023)

Chen S, Chen R, Chen Q, He L, Lui Z (2005) Bionomics of *Crisicoccus pini* in Qingdao area. *Zhongguo Senlin Bingchong* 24, 8–11.

Chen S, Chen R, Yin T, Li B, Xu H, Zhang X (2006) Influence of gradient constant temperatures on the experimental population of *Crisicoccus pini*. *Zhongguo Senlin Bingchong* 25, 13–16.

Danzig EM, Gavrilov-Zimin I (2010) Mealybugs of the genera *Planococcus* Ferris and *Crisicoccus* Ferris (Sternorrhyncha: Pseudococcidae) of Russia and adjacent countries. *Zoosystematica Rossica* 19, 39–49.

EFSA Panel on Plant Health (PLH), Bragard C, Di Serio F, Gonthier P, Jaques Miret JA, Justesen AF, Magnusson CS, Milonas P, Navas-Cortes JA, Parnell S, Potting R, Reignault PL, Thulke HH, Van der Werf W, Vicent Civera A, Yuen J, Zappala L, Gregoire J-C, Malumphy C, Czwienczek E, Kertesz V, Maiorano A, MacLeod A (2021) Pest categorisation of *Crisicoccus pini*. *EFSA Journal* 19(11), 6928, 20 pp. (available at: https://doi.org/10.2903/j.efsa.2021.6928 and https://pra.eppo.int/pra/e48d8406-ac05-4110-8da5-c2bfeb3c51e6; accesses on 02 March 2023)

EPPO (2019) *Crisicoccus pini* (Hemiptera: Coccidae): addition to the EPPO Alert. *EPPO Reporting Service no*. 01 – 2019. Num. article: 2019/011. (available at: https://gd.eppo.int/reporting/article-6441; accesses on 02 March 2023)

EPPO (2022) EPPO Technical Document No. 1087. Pest risk analysis for *Chionaspis pinifoliae*. EPPO, Paris. Available at https://gd.eppo.int/taxon/PHECPI/documents

Euforgen (2021) European Forest Genetic Resources Programme (EUFORGEN). (available at: http://www.euforgen.org/; accesses on 02 March 2023)

Farjon A, Filer D (2013) An Atlas of the World's Conifers. An Analysis of Their Distribution, Biogeography, Diversity and Conservation Status. Brill: Leiden. ISBN: 978-90-04-21180-3.

Italian NPPO (2022) Administrative acts, Regional Council, Act of the Director Determination No. 8574 of 06/05/2022 Phytosanitary measures for combating and controlling *Chrysococcus pini* https://servizissiir.regione.emilia-romagna.it/deliberegiunta/servlet/AdapterHTTP?action_name=ACTIONRICERCADELIBERE&operation=leggi&cod_protocollo=DPG/2022/9037&ENTE=1

Lloyd S (2019) Rapid Pest Risk Analysis (PRA) for: *Crisicoccus pini*. DEFRA, UK. (available at: https://pra.eppo.int/pra/46048bd2-261a-4511-b933-19858e0d3e0f; accesses on 02 March 2023)

Tang FT (1984) Observation on the scale insects injurious to forestry of North China. *Shanxi Agricultural University Press Research Publication* 2, 122–133.

Widenfalk O, Jakobsson M, Hammarström A, Widenfalk L, Josefsson J, Keith S, Vanduijn B (2022) Trade and production of plants and plant products in Sweden – A knowledge base for pest risk analysis – Update 2022. Technical Report, External project leaders Björklund N., Boberg J. Greensway AV and SLU, 46 pp. (available at: https://www.slu.se/globalassets/ew/org/centrb/riskv/pub/trade-and-production-of-plants-and-plantproducts-in-sweden_update-2022.pdf; accesses on 02 March 2023)