Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

SLU Risk Assessment of Plant Pests

SLU.ua.2022.2.6-3074

January 24, 2023

Quick assessments of the potential for establishment in Sweden for a selection of new quarantine pests in 2022

Table of contents

Background

The list of union quarantine pests in the EU was updated with a number of new pests the 11th of April 2022 ((EU) 2019/2072). According to the plant health regulation regular surveys for all union quarantine pests shall be carried out on a regular basis by the Member States ((EU) 2016/2031). However, if it can be 'unequivocally concluded' that ecoclimatic conditions or the absence of hosts prevents the establishment or spread of the pest, surveys are not required. Previously, quick assessments of the potential for establishment were done for 73 of the quarantine pests for which it was uncertain whether the ecoclimatic conditions and host availability in Sweden allowed the establishment (Björklund and Boberg 2021[1]).

SLU Risk Assessment of Plant Pests was requested by the Swedish Board of Agriculture to make similar quick assessments of the following new EU quarantine pests; *Apriona cinerea, Apriona germari, Apriona rugicollis, Ceratothripoides claratris, Prodiplosis longifila, Trirachys sartus, Meloidogyne enterolobii, Citrus chlorotic spot virus* and *Lycorma delicatula*.

Assessments – method and definitions

The assessments were done following the method and definitions described in the previous report which had the same objective (Björklund and Boberg 2021[1]).

In short, the potential for establishment of the quarantine pests were assessed based on the likelihood of the pests to survive and reproduce in Sweden both outdoors and in protected cultivation in greenhouses. The degree to which conditions are suitable for establishment in Sweden was evaluated using the following scale:

- "Not suitable", i.e. the conditions does not support establishment.
- "Unlikely to be suitable", i.e. the conditions are unlikely to support establishment.
- "Likely to be suitable", i.e. the conditions are likely to support establishment.
- ”Very likely to be suitable", i.e. the conditions are very likely to support establishment.

Based on an assessment for each pest the most likely option was selected and the uncertainty was provided as the plausible minimum and maximum options.

[1] Björklund, N. and Boberg, J. (2021) Quick assessments of the potential for establishment in Sweden for a selection of quarantine pests, SLU ua 2020.2.6-4656. LINK

Overview of the assessments

Quick assessments were performed for in total nine individual quarantine pest species belonging to the organism groups insects, nematodes and viruses. An overview of the assessments is provided in Table 1 showing the assessment of the most suitable environment, i.e., outdoors or in greenhouses. A description of the assessment, the associated uncertainty, and the supporting literature is provided separately for each species in the following sections. The assessments were performed very rapidly and for some of the species the assessments were associated with a high uncertainty, this was especially the case for *Lycorma delicatula* (see grey fields in Table 1).

Table 1. Assessments of the degree to which the conditions are suitable for the establishment of individual pests in Sweden. For a description of the scale used for the assessments, see the section entitled "Assessments – methods and definitions". The assessment of the most likely scenario is denoted in the table with a cross and the uncertainty (the range between the plausible minimum and maximum options) is depicted with a grey shade.

Pest	EPPO code	Organism	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Apriona cinerea	APRICI	Insect	X			
Apriona germari	APRIGE	Insect	X			
Apriona rugicollis	APRIJA	Insect	X			
*Ceratothripoides claratris**	CRTZCL	Insect	X			
Lycorma delicatula	LYCMDE	Insect	X			
*Prodiplosis longifila**	PRDILO	Insect	X			
Trirachys sartus	AELSSA	Insect	X			
*Meloidogyne enterolobii**	MELGMY	Nematode		X		
Dichorhavirus citri (regulated as Citrus chlorotic spot virus)*	CICSV0	Virus	X			

* The assessments presented are done for greenhouses.

Apriona cinerea [APRICI]

Apriona cinerea is a longhorn beetle native to the region west of the Himalayan ranges and reported from the northwestern parts of India and Pakistan (EPPO 2022). Hosts are widespread in Sweden and includes for example poplar (*Populus* spp.), apple (*Malus* spp.), pear (*Pyrus* spp.), plum (*Prunus*) spp. and willow (*Salix* spp.) (EPPO 2021).

The length of the life cycle for *A. cinerea* is around 2 years and the beetle diapauses as a mature larvae during the second winter (Ibáñez Justicia et al. 2010; EPPO 2022). The pest has a restricted distribution and no detailed previous analysis of the climatic suitability range was found. EPPO (2021) concludes in their PRA that the potential distribution outdoors includes at least the north of the Mediterranean Basin. The area suitable for establishment is more uncertain than for the closely related species *A. germari*, which is described below.

Hosts are generally not grown in greenhouses for long periods of time and combined with the long life cycle of the pest it is assessed that the conditions in greenhouses are not suitable for establishment.

Assessment of the degree to which conditions are suitable for establishment in Sweden (outdoors):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☒	☐	☐

References

EPPO (2021) Pest Risk Analysis for *Apriona germari, A. japonica, A. cinerea*. EPPO, Paris. Original publication date 2013. https://gd.eppo.int/taxon/APRICI/documents

EPPO (2022) *Apriona cinerea*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int LINK

Ibáñez Justicia A, Potting R, van der Gaag DJ. 2010. Pest risk assessment *Apriona* spp. Plant Protection Service, Ministry of Agriculture, Nature and Food Quality, the Netherlands. LINK

Apriona germari [APRIGE]

The longhorn beetles *Apriona germari* and *A. rugicollis* were until 2011 considered as synonyms but a revision of the genus *Apriona* resulted in the split into two distinct species (EPPO 2015). Due to these taxonomic changes the geographic distribution of *A. germari* is now considered to be restricted to the southern parts of the previously described distribution range (Ibáñez Justicia et al. 2010; EPPO 2021). The beetle is reported as present in Bangladesh, Bhutan, Cambodia, Southern parts of China (Yunnan, Hainan, Macau), India, Laos, Myanmar, Nepal, Thailand, Vietnam (EPPO 2022).

Hosts are widespread in Sweden and includes for example poplar (*Populus* spp.), apple (*Malus* spp.), pear (*Pyrus* spp.) willow (*Salix* spp.) and elm (*Ulmus* spp.) (EPPO 2021). It should be noted that *A. germari* might need a *Moraceae* host for adult feeding (EPPO 2021). Although species within the family *Moraceae* are occasionally found in Sweden (Artfakta 2022) our assessment is that none of these host plants should be considered established in Sweden.

In a Dutch pest risk assessment from 2010, the probability of establishment in the EU was analysed based on the estimated degree days required for development of the species (Ibáñez Justicia et al. 2010). The generation time for *Apriona germari* was previously considered to be 1-3 years but after the taxonomic revision it may be shorter since its distribution is now considered to be restricted to the southern parts of its previous range. Regardless, a much longer life cycle, i.e., a more than 5-years life cycle, would be necessary before the expected temperature requirement would be fulfilled in Sweden according to CLIMEX analysis (see Appendix 10 in Ibáñez Justicia et al. (2010). Since *A. germari* has a more limited and a more tropical distribution than was known when the CLIMEX analysis was performed it may consequently overestimate the potential range. Thus, establishment of *A. germari* in Sweden is even more unlikely with the current taxonomy.

Hosts are generally not grown in greenhouses for long periods of time and combined with the long life cycle of the pest it is assessed that the conditions in greenhouses are not suitable for establishment.

Assessment of the degree to which conditions are suitable for establishment in Sweden (outdoors):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☐	☐	☐

References

Artfakta (2022) Mullbärsväxter, *Moraceae* Artdatabanken, SLU. Available from https://artfakta.se/artbestamning/taxon/moraceae-2002759 [accessed 24 Aug 2022].

EPPO (2015) *Apriona germari* and *Apriona rugicollis* are two distinct species. EPPO Reporting Service no. 06 – 2015, Num. article: 2015/110. https://gd.eppo.int/reporting/article-4775

EPPO (2021) Pest Risk Analysis for *Apriona germari, A. japonica, A. cinerea*. EPPO, Paris. Original publication date 2013. LINK

Ibáñez Justicia A, Potting R, van der Gaag DJ. (2010). Pest risk assessment *Apriona* spp. Plant Protection Service, Ministry of Agriculture, Nature and Food Quality, the Netherlands. LINK

Apriona rugicollis [APRIJA]

The longhorn beetle *Apriona rugicollis* was until 2011 considered a synonym of *Apriona germari*, but it is currently considered a distinct species (EPPO 2022). Further, *Apriona japonica*, *A. gressitti*, and *A. plicicollis* are all now considered to be synonymous with *A. rugicollis*.

Apriona rugicollis has a more northern distribution range than *A. germari* and is reported to be present in China (Anhui, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Qinghai, Shandong, Sichuan, Xizhang, Zhejiang), Japan, North Korea, South Korea and Taiwan (EPPO 2022). Hosts are widespread in Sweden and includes for example poplar (*Populus* spp.), apple (*Malus* spp.) and hawthorn (*Crataegus* spp).

Developmental rates vary depending on the local temperature and the life cycle takes 1-3 years (EPPO 2022). A Dutch pest risk assessment performed before the taxonomic changes concluded, based on a CLIMEX analysis, that both *A. germari* and *A. japonica*, would require a more than 5-years life cycle before the expected temperature requirement would be fulfilled in Sweden. Since the combined distribution of *A. germari* and *A. japonica* before the taxonomic change (fig. 4 in EPPO 2021) include the current distribution of *A. rugicollis* (EPPO 2022), we should expect that the climatic conditions in Sweden are not suitable. Due to the more northern distribution of *A. rugicollis*, in comparison to *A. germari*, the uncertainty range for *A. rugicollis* was assessed to also include the category “Unlikely to be suitable”.

Hosts are generally not grown in greenhouses for long periods of time and combined with the long life cycle of the pest it is assessed that the conditions in greenhouses are not suitable for establishment.

Assessment of the degree to which conditions are suitable for establishment in Sweden (outdoors):

	Not suitable	**Unlikely to be suitable**	**Likely to be suitable**	**Very likely to be suitable**
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☒	☐	☐

References

EPPO (2021) Pest Risk Analysis for *Apriona germari, A. japonica, A. cinerea*. EPPO, Paris. Original publication date 2013. LINK

EPPO (2022) *Apriona rugicollis*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int LINK

Ceratothripoides claratris [CRTZCL]

Ceratothripoides claratris is a species of thrips reported from India, China (south part Yunnan), Philippines and Thailand (EPPO 2022). It is regarded as a pest of the hot and humid tropics and adapted to high temperatures (i.e. 30-35°C; Premachandra et al. 2004; EPPO 2017 and references therein). In a PRA performed by EPPO in 2017, it was concluded that *C. claratris* is not expected to establish outdoors in the EPPO region (EPPO 2017). In agreement with this, our assessment is that the climatic conditions outdoors in Sweden are not suitable for establishment of *C. claratris*.

Ceratothripoides claratris is a pest in glasshouses in Thailand (Premachandra et al. 2005). Tomato (*Solanum lycopersicum*) is considered the major host (EPPO 2022) and is commercially grown in Sweden in greenhouses on in average 419 000 m^2 (Widenfalk et al. 2022). Other known hosts, which are also commercially cultivated in Sweden (in greenhouses), are *Cucumis sativus* (ca 688 000 m^2), *Capsicum annuum, Cucumis melo, Lactuca sativa, Solanum melongena* (Appendix 1; Widenfalk et al. 2022; EPPO 2022). In the EPPO PRA, the likelihood of establishment in protected conditions in the EPPO region, except for the southern part, was assessed as low (with a moderate uncertainty) (EPPO 2017). According to the PRA, establishment in protected conditions should be considered unlikely if i) there is a sufficiently long crop-free period, ii) the growing medium is removed or treated and iii) the pest can not survive outdoors (EPPO 2017).

In general the production in greenhouses in Sweden of most of the above listed hosts include a crop free period during the winter and the growing medium is treated or replaced (Appendix 1). This suggest that the conditions for establishment are not suitable in greenhouses. However, it is uncertain whether the break in the production cycle in greenhouses is long enough to eliminate the pest and some producers do cultivate hosts year around, although to a limited extent (Appendix 1).

Assessment of the degree to which conditions are suitable for establishment in Sweden (in greenhouses):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☒	☐	☐

References

EPPO (2017) Pest risk analysis for *Ceratothripoides brunneus* and *C. claratris*. EPPO, Paris. Available at http://www.eppo.int/QUARANTINE/Pest_Risk_Analysis/PRA_intro.htm and https://gd.eppo.int/taxon/CRTZBR

EPPO (2022) *Ceratothripoides claratris*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int LINK

Premachandra, W. T. S. D., Borgemeister, C., Chabi-Olaye, A., & Poehling, H. M. (2004). Influence of temperature on the development, reproduction and longevity of *Ceratothripoides claratris* (Thysanoptera: Thripidae) on tomatoes. Bulletin of entomological research, 94(4), 377-384. https://doi.org/10.1079/BER2004311

Premachandra, D. W., Borgemeister, C., Sétamou, M., Achilles, T., & Poehling, H. M. (2005). Spatio-temporal distribution of *Ceratothripoides claratris* (Thysanoptera: Thripidae) on tomatoes in Thailand. Environmental entomology, 34(4), 883-890. https://doi.org/10.1603/0046-225X-34.4.883

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 (pp. 46). Technical Report, External project leaders Björklund, N., Boberg, J. Greensway and SLU. LINK.

Lycorma delicatula **[LYCMDE]**

Lycorma delicatula is a planthopper also known as the spotted lanternfly. It is reported from Asia (China, Japan, Korea, Taiwan and Vietnam) and eastern USA (Connecticut, Delaware, Indiana, Maryland, New Jersey, North Carolina, Ohio, Pennsylvania, Virginia and West Virginia) (EPPO 2022).

In an EPPO PRA performed in 2016 it was expected that climatic conditions would not be a limiting factor for establishment based solely on the fact that *L. delicatula* occurs in a very wide range of climates (EPPO 2016). A recent study using the ecological niche model Maxent predicted low or medium suitability in large parts of Sweden (Wakie et al. 2020). However, yet another recent study based on the temperature requirements of the different developmental stages of *L. delicatula* indicate that the temperatures in Sweden are too low to allow the complete development of *L. delicatula* (Maino et al. 2022). Taken together these recent studies suggest that the climate suitability in Sweden for *L. delicatula* is low or not suitable at all.

The host range reported is extremely broad, but some hosts are only reported to harbour eggs while other hosts are associated with different life stages of the pest (EPPO 2022). Feeding has been associated with more than 100 plant species (Barringer and Ciafré 2020). Nymphs feed on a broad range of hosts, including many herbaceous plants, and as it matures, thicker tissues can be utilized and adults are mainly found on woody hosts (EPPO 2022). Some examples of hosts species reported to be feeding hosts and that are found in Sweden are; *Ailanthus altissima, Acer platanoides, Acer pseudoplatanus, Alnus incana, Amelanchier sp., Betula pendula, Fraxinus* sp., *Humulus lupulus,* different species of *Juglans, Juniperus chinesis, Liriodendron tulipifera, Malus sp., Pyrus sp.,* different species of *Rosa, Rubus* sp.*, Thuja occidentalis, Vitis* sp. and *Vitis vinifera* (Barringer and Ciafré 2020).

Ailanthus altissima is a preferred host by *L. delicatula*, associated with all life stages (Dara et al. 2015; Liu 2020; Uyi et al 2020). Liu (2020) claim, based on the results from a field study, that *A. altissima* plays an “irreplaceable role” in the seasonal development and life history of this pest and *A. altissima* is found in all invaded countries (Maino et al. 2022). The prevalence of this tree species is suggested to facilitate the expansion of the pest (Barringer and Ciafré 2020) and uncertainties has been raised whether the pest could establish long-term viable populations in areas where *A. altissima* does not occur (EPPO 2016). Recent studies have shown that *L. delicatula* can complete development from first instar to adult and reproduce on other hosts, i.e. *Cleatrus orbiculatus, Humulus lupulus, Juglans cinerea, Juglans nigra, Liriodendron tulipifera, Melia azedarach* and *Quercus acutissima* (Murman et al. 2020). *Ailanthus altissima* was also included in the study and *L. delicatula* could also fulfil the development on this host but only 5% survival to the adult stage was found (Murman et al. 2020). Other authors have suggested that feeding from a mix of hosts are required for *L. delicatula* to complete its lifecycle (Uyi et al. 2020). Development from first instar to adult was also observed in other studies mixing different hosts, e.g. *Salix babylonica*, *Acer saccharinum*, *Betula nigra, Juglans nigra* and *A. altissima* but fitness was reduced when *A. altissima* was not available, e.g. slower development and fewer egg masses laid (around seven times fewer) (Uyi et al. 2020; Uyi et al. 2021). The authors of those studies hypothesized that the slower development time resulted in shorter time for mating and oviposition before winter temperatures killed the adults. If confirmed, higher impact of the absence of *A. altissima* on fitness of the pest could thus perhaps be expected in areas with shorter vegetation periods. No effect on fitness was observed on the offspring (proportion hatched eggs and length of development time) depending on whether the parents were feeding on *A. altissima*, but it should be noted that the offspring was given access to *A. altissima* in this study (Uyi et al. 2021). No information was found on the effect of a continuous absence of *A. altissima* on the development of *L. delicatula* populations and it remains uncertain whether the pest can establish in regions were *A. altissima* is absent.

Ailanthus altissima is found in Sweden as an ornamental tree in parks, botanical gardens and cemeteries and has also been found naturalized (SLU Artdatabanken 2022). In total 323 observation locations records has been submitted to the Swedish species observation system (SLU Artdatabanken 2022). Southern Sweden constitutes the northern margin of the climatically determined range of *A. altissima* and according to Kowarik & Säumel (2007) and SLU Artdatabanken (2022) it occurs there sparingly. In addition, *Ailanthus altissima* is listed as an invasive alien species of union concern in the EU ((EU) 1143/2014; (EU) 2016/1141)). Following the EU regulation it is not allowed to sell, plant or grow the tree and already established trees shall be removed (Naturvårdsverket 2022). Accordingly, eradication of this tree species is currently taking place (SLU Artdatabanken 2022). In conclusion, the presence of *A. altissima* should not be able to support an establishment of *L. delicatula* in Sweden.

There is large uncertainty regarding the predicted suitability of the climatic conditions in Sweden for the establishment of *L. delicatula.* The pest appears to be dependent on *A. altissima* for the development of a viable population but it is uncertain whether the access to *A. altissima* is a requirement. Taken together it is assessed that most likely the conditions are not suitable for the establishment of *L. delicatula* in Sweden, but that the uncertainty is very large.

Most of the host are woody plants, which are not grown to a large extent or for long periods of time in greenhouses in Sweden and it is assessed that the conditions in greenhouses are not suitable for establishment.

Assessment of the degree to which conditions are suitable for establishment in Sweden (outdoors):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☒	☒	☐

References

Barringer, L., & Ciafré, C. M. (2020). Worldwide feeding host plants of spotted lanternfly, with significant additions from North America. Environmental Entomology, 49(5), 999-1011. https://academic.oup.com/ee/article/49/5/999/5892805

Dara, S. K., Barringer, L., & Arthurs, S. P. (2015). *Lycorma delicatula* (Hemiptera: Fulgoridae): a new invasive pest in the United States. Journal of Integrated Pest Management, *6*(1), 20. https://doi.org/10.1093/jipm/pmv021

EPPO (2016) Pest risk analysis for *Lycorma delicatula*. EPPO, Paris. Available at https://gd.eppo.int/taxon/LYCMDE/documents

EPPO (2022) *Lycorma delicatula*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int, LINK

Jung, J. M., Jung, S., Byeon, D. H., & Lee, W. H. (2017). Model-based prediction of potential distribution of the invasive insect pest, spotted lanternfly *Lycorma delicatula* (Hemiptera: Fulgoridae), by using CLIMEX. Journal of Asia-Pacific Biodiversity, 10(4), 532-538. LINK

Kowarik, I., & Säumel, I. (2007). Biological flora of central Europe: *Ailanthus altissima* (Mill.) swingle. Perspectives in Plant Ecology, Evolution and Systematics, 8(4), 207-237. https://doi.org/10.1016/j.ppees.2007.03.002

Liu, H. (2020). Seasonal development, cumulative growing degree-days, and population density of spotted lanternfly (Hemiptera: Fulgoridae) on selected hosts and substrates. Environmental Entomology, 49(5), 1171-1184. https://doi.org/10.1093/ee/nvaa074

Maino, J.L., Schouten, R., Lye, J.C., Umina, P.A. & Reynolds, O.L. (2022) Mapping the life-history, development, and survival of spotted lantern fly in occupied and uninvaded ranges. *Biol Invasions* 24, 2155–2167. https://doi.org/10.1007/s10530-022-02764-z

Murman, K., Setliff, G. P., Pugh, C. V., Toolan, M. J., Canlas, I., Cannon, S., ... & Cooperband, M. F. (2020). Distribution, survival, and development of spotted lanternfly on host plants found in North America. Environmental Entomology, 49(6), 1270-1281. https://academic.oup.com/ee/article/49/6/1270/5947504

Naturvårdsverket (2022) Gudaträd. Availableat https://www.naturvardsverket.se/amnesomraden/invasiva-frammande-arter/Arter/eu-listade-etablerade-arter/gudatrad/ [Accessed: 23/08/2022]

SLU Artdatabanken (2022) Artfakta, Gudaträd, *Ailanthus altissima*. Available at https://artfakta.se/artbestamning/taxon/Ailanthus%20altissima-222201 [Accessed: 26/10/2022]

Uyi, O., Keller, J. A., Johnson, A., Long, D., Walsh, B., & Hoover, K. (2020). Spotted lanternfly (Hemiptera: Fulgoridae) can complete development and reproduce without access to the preferred host, *Ailanthus altissima*. Environmental Entomology, 49(5), 1185-1190. https://doi.org/10.1093/ee/nvaa083

Uyi, O., Keller, J. A., Swackhamer, E., & Hoover, K. (2021). Performance and host association of spotted lanternfly (*Lycorma delicatula*) among common woody ornamentals. Scientific reports, 11(1), 1-10. https://doi.org/10.1038/s41598-021-95376-x

Wakie, T. T., Neven, L. G., Yee, W. L., & Lu, Z. (2020). The establishment risk of *Lycorma delicatula* (Hemiptera: Fulgoridae) in the United States and globally. Journal of economic entomology, 113(1), 306-314. https://doi.org/10.1093/jee/toz259

Prodiplosis longifila [PRDILO]

The gall midge *Prodiplosis longifila* is a major pest of tomato and asparagus in South America (EPPO 2017). It is reported to be present in Colombia, Ecuador, Peru and USA (only in Florida) (EPPO 2022). The pest is very polyphagous and its host range includes plants that are extensively grown in Sweden both outdoors, e.g. potato (*Solanum tuberosum*) 24 000 ha, and in greenhouses, e.g. tomato (*S. lycopersicum*) 419 000 m^2 (Widenfalk et al. 2022). Other hosts are also grown in Swedish greenhouses, e.g. pepper (*Capsicum* spp.), grown on ca 8 000 m^2, and coriander (*Coriandrum sativum*), marigold (*Tagetes* sp.) and gerbera daisy (*Gerbera jamesonii*) (Widenfalk et al. 2022).

Prodiplosis longifila is favoured by warm climates with high relative humidity and based on a preliminary CLIMEX model the pest is only expected to be able to establish outdoors in the south and western areas of the EPPO region (EPPO 2017). It is not expected to establish in central and northern parts of the EPPO region, which are hit by frost (EPPO 2017). Thus, the climate outdoors in Sweden is assessed as not suitable for the pest.

Whether the conditions in Swedish greenhouses would allow establishment is more uncertain. In its native range, *P. longifila* is found in greenhouses (EPPO 2017). However, the likelihood that *P. longifila* would establish in Swedish greenhouses is less likely since it cannot survive outdoors and thus there will be no influx of new specimens from the surroundings (EPPO 2017). Further, the generation time for *P. longifila* is only 10-20 days and it is uncertain whether the species has diapaus (EPPO 2017). The hosts tomato and pepper are generally cultivated in Swedish greenhouses with a break during winter (Appendix 1). There are some exceptions, e.g. greenhouses that produce tomatoes all year around and production of coriander that occurs continuously. In addition, the pest has a broad host range and the short-term crops cultivated during the winter break in organic vegetable production may thus support a population of the pest year around (Appendix 1). However, production in greenhouses performed year around is done to a limited extent. Taken together, it was assessed that most likely the conditions in greenhouses are not suitable but that there is uncertainty.

Assessment of the degree to which conditions are suitable for establishment in Sweden (in greenhouses):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☒	☐	☐

References

EPPO (2017) Express PRA for *Prodiplosis longifila*, EPPO, Paris. LINK

EPPO (2022) *Prodiplosis longifila*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int, LINK

Jordbruksverket (2011) Svensk växthusproduktion av tomater - Konkurrenskraft och utvecklingsmöjligheter. Rapport 2011:17. LINK

LRF (2022) Lanbrukarnas Riksförbund, Växthusgrönsaker, webbpage https://www.lrf.se/om-lrf/organisation/branschavdelningar/lrf-tradgard/produktionsinriktningar/vaxthusgronsaker/

Plöninge, P. (2008). Ekologisk odling av paprika och chilipeppar. Broschyr utgiven av Jordbruksverket LINK

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 (pp. 46). Technical Report, External project leaders Björklund, N., Boberg, J. Greensway and SLU. LINK

Trirachys sartus [AELSSA]

Trirachys sartus is a species of longhorned beetle often referred to using the synonym name *Aeolesthes sarta* (e.g. Hayat 2022). It is believed to be native to Pakistan and western parts of India, and is also reported from Afghanistan, China (Xizhang), Iran, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan (EPPO 2022a,b; Hayat 2022).

Trirachys sartus is polyphagous and a range of broadleaved trees are reported as hosts (EPPO 2022a). Preferred hosts are found in the following genera: *Populus, Ulmus, Platanus, Salix* and *Juglans* (EPPO 2022b). *Malus domestica* is also a major host (EPPO 2022a). Thus, the availability of hosts is not expected to prevent an establishment of the pest in Sweden.

The pest is found in countries where the climate is hot and dry but also reported from temperate mountain forests at altitudes below 2000 m (EPPO 2000; EPPO 2005; Vanhanen et al. 2008; EPPO 2022b). The pest colonizes large branches or stems of the trees (EPPO 2005). The life cycle is 2 years, and the pest overwinters as larvae during the first winter and as an imago during the second winter (EPPO 2005 and references therein).

The potential distribution range of the species in Europe has been analysed using the model CLIMEX, which predicted a distribution limited to the southern parts of Europe (Vanhanen et al. 2008). The modelling results are however associated with large uncertainties due to e.g. the lack of studies on laboratory rearing and detailed location records that the parameters could be based on and that the analysis was based on climate data for the time period 1931-1960 (with some additional data for Finland from 1980-1990). An analysis using a climate change scenario (i.e. an average global temperature increase of 2.9°C corresponding to scenario A1B by the year 2100) was also performed by Vanhanen et al. (2008). The predicted distribution then extended north and generated Ecoclimatic Indices (EI) values larger than 0 for some locations around the southern part of Sweden.

Considering the climatic conditions in the native and current distribution range most likely the conditions in Sweden are not suitable for the establishment of the pest. There are however large uncertainties due to e.g. the lack of knowledge regarding threshold temperatures and requirements for accumulated heat for development of the pest.

Since e.g. large trees are not cultivated in greenhouses and since the pest colonizes large branches or stems it is assessed that greenhouses are not suitable for establishment.

Assessment of the degree to which conditions are suitable for establishment in Sweden (outdoors):

	Not suitable	**Unlikely to be suitable**	**Likely to be suitable**	**Very likely to be suitable**
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☒	☐	☐

References

EPPO (2000) Pest risk assessment scheme – *Aeolesthes sarta*. https://gd.eppo.int/download/doc/1447_pra_full_AELSSA_renamed.pdf

EPPO (2005) *Aeolesthes sarta*. Data sheets on quarantine pests. EPPO Bulletin, 35: 387-389. https://doi.org/10.1111/j.1365-2338.2005.00843.x

EPPO (2022a) EPPO Global Database (available online). https://gd.eppo.int/taxon/AELSSA/hosts

EPPO (2022b) *Trirachys sartus*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int, LINK

Hayat, U. (2022). City longhorn beetle (*Aeolesthes sarta*): A review of the species, its distribution, ecology, damage, prevention and control. Journal of Forest Science, 68(6), 199-212. https://www.agriculturejournals.cz/web/jfs.htm?type=article&id=34_2022-JFS

Vanhanen, H., Veteli, T. O., & Niemelä, P. (2008). Potential distribution ranges in Europe for *Aeolesthes sarta*, *Tetropium gracilicorne* and *Xylotrechus altaicus*, a CLIMEX analysis. EPPO bulletin, 38(2), 239-248. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2338.2008.01211.x

Meloidogyne enterolobii [MELGMY]

The rot-knot nematode species *Meloidogyne enterolobii* is reported as present in South America and southern parts of North America, Africa, India, Southeast Asia, China and Europe (Portugal and Switzerland) (EPPO 2022). The nematode has a very broad host range and several hosts are cultivated in Sweden both outdoors (e.g. several *Solanum* species including potato) and in greenhouses (e.g. basil (*Ocimum basilicum*), peppers/chili (*Capsicum annuum*), cucumber (*Cucumis sativus*) and tomato (*Solanum lycopersicum*), which is a major host (EPPO 2022).

Meloidogyne enterolobii was originally considered to be restricted to regions with typical tropical climatic conditions but after it was detected in Florida in 2004 it was considered very likely that it could establish in the Mediterranean region (Castagnone-Sereno 2012). Since then, the likelihood of establishment in northern Europe has been evaluated by experts in at least the following four PRAs:

1) In a **Dutch PRA from 2008** they conclude that “The present distribution (Africa, USA (Florida), Central and South America and China) suggests this species will not survive outside greenhouses in northern parts of the EU.” (Karssen et al. 2008). They also write that:

   “Based on the present known distribution of *M. enterolobii*, it needs a relatively high temperature to develop, i.e. within the tropical-Mediterranean temperature range. These conditions are present in Europe in the southern part and in greenhouses in the northern part. Although the precise temperature requirements of *M. enterolobii* have not been studied so far, it is likely that the northern range within the field is comparable to *M. incognita*. The northern border of the current area of distribution of *M. incognita* in the open field is probably just below Paris (Karssen, 2002; Ritter, 1972)".

This is in agreement with the results of a CLIMEX model constructed a few years later, which indicate that the area of potential establishment outdoors is restricted to the southern part of Europe (Robinet et al. 2012). In the Dutch PRA they also conclude that "Findings in France and Switzerland show that *M. enterolobii* can establish in greenhouses." (Karssen et al. 2008).

2) In an **EPPO PRA from 2010** they conclude that:

   "Based on the present knowledge of distribution of *M. enterolobii*, this species needs a relatively high temperature to develop. These conditions are present outside in the southern part of the EPPO region and in greenhouses in the entire EPPO region. The precise temperature requirements of *M. enterolobii* have not been studied." (EPPO 2010).

   It can also be noted that although *M. enterolobii* have established further north in USA since 2010, i.e. up to North Carolina, it is still considered that this species will not be able to survive outside greenhouses in northern countries of Europe (EPPO 2022).

3) In a **German PRA from 2012** they conclude that *M. enterolobii* may pose a phytosanitary risk to northern EU member states, especially for greenhouse crops (Schrader et al. 2012). For southern member states the nematode also constitutes a threat to field crops.

4) In a **Polish PRA from 2019** they state that no data on the influence of temperature on the level of infectivity and on the development of *M. enterolobii* are available, but assume that the nematode development will slow down or be inhibited at temperatures below 20°C, and that temperatures close to or below 0°C may cause death (Dobosz et al. 2019).

Previously the temperature required for their development and life cycle completion was unknown for *M. enterolobii*. In a recently published study, however, they found support for the previously claimed similarity with *M. incognita* regarding temperature requirements (Velloso et al. 2022). This information should decrease the uncertainty regarding the potential area of establishment.

In the Netherlands, the related species, *M. incognita*, is a problem in e.g. organic vegetable production in greenhouses (Wurff et al. 2010). The eggs can survive for long time-periods in root debris but the largest problems are found in greenhouses with production year around (Wurff et al. 2010).

In general the production of tomato in greenhouses in Sweden is done in growing medium that is treated or replaced between growing seasons (Appendix 1). A very limited extent of the production of plants that are hosts for *M. enterolobii* is done in soil and also include a short term crop during the winter, e.g. in organic production (Appendix 1).

In conclusion, *M. enterolobii* is not expected to be able to establish outdoors in Sweden while establishment in greenhouses are assessed as unlikely to be suitable.

Assessment of the degree to which conditions are suitable for establishment in Sweden (in greenhouses):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☐	☒	☐	☐
Uncertainty range	☒	☒	☐	☐

References

Castagnone-Sereno, P. (2012). *Meloidogyne enterolobii* (= *M. mayaguensis*): profile of an emerging, highly pathogenic, root-knot nematode species. Nematology, 14(2), 133-138. LINK

EPPO (2010) Pest risk analysis for *Meloidogyne enterolobii,* EPPO, Paris. LINK

EPPO (2022) *Meloidogyne enterolobii*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int/taxon/MELGMY/datasheet [Accessed 2022-09-14]

Schrader, G., Niere, B., Steinmöller, S. (2012) Express – PRA zu *Meloidogyne enterolobii*, Julius Kühn-Institut, Institut für nationale und internationale Angelegenheiten der Pflanzengesundheit, 29. Mai 2012. (In German) LINK

Karssen, G., van der Gaag, D.-J., Lammers, W. (2008) Pest Risk Assessment *Meloidogyne enterolobii*, Plant Protection Service, Wageningen, NL LINK

Dobosz, R., Gawlak, M., Rzepecka, D., Kaluski, T. (2019) Analizy Zagrożenia Agrofagiem (Ekspres PRA) dla *Meloidogyne enterolobii.* Instytut Ochrony Roslin (In Polish) LINK

Robinet, C., Kehlenbeck, H., Kriticos, D. J., Baker, R. H., Battisti, A., Brunel, S., ... & van der Werf, W. (2012). A suite of models to support the quantitative assessment of spread in pest risk analysis. Supplementary material 2, Case studies. PLoS ONE 7(10): e43366. https://doi.org/10.1371/journal.pone.0043366

Velloso, J. A., Maquilan, M. A. D., Campos, V. P., Brito, J. A., & Dickson, D. W. (2022). Temperature effects on development of *Meloidogyne enterolobii* and *M. floridensis*. *Journal of Nematology*, *54*(1). LINK

Van der Wurff, A.W.G., Janse, J., Kok, C.J., Zoon, F.C. (2010) Biological control of root knot nematodes in organic vegetable and flower greenhouse cultivation. State of Science, Report of a study over the period 2005-2010. Report 321. Wageningen UR Greenhouse Horticulture, Bleiswijk. https://edepot.wur.nl/154456

Dichorhavirus citri (regulated as *Citrus chlorotic virus*) [CICSV0][2]

Citrus chlorotic spot virus [CICSV0] is one of many viruses that cause the disease Citrus leprosis. It was identified and characterized in Brazil in 2018 (Chabi-Jesus et al. 2018). It was recently added as a quarantine pest but no risk assessment supporting that decision was found. EFSA performed a pest categorisation in 2017 of all currently known viruses causing leprosis disease in citrus at that time, however since CICSV0 was not yet discovered, it was not included in their assessment (EFSA 2017; Chabi-Jesus et al. 2018).

The establishment of CICSV0 is dependent on: (1) the presence of suitable host plants, (2) the presence of vectors and (3) the suitability of the environment (New Zealand Ministry for Primary Industries 2021).

(1) Hosts: The disease Citrus leprosis can develop on many, mainly *Citrus*, species but there are several viruses that cause this disease (EFSA 2017). The only known hosts for the specific virus assessed here, i.e. CICSV0, are sweet orange (*Citrus sinensis*), beach hibiscus (*Hibiscus tileaceus*) and the ornamental succulent plant *Agave desmettiana* (Chabi-Jesus et al. 2018; 2019; New Zealand Ministry for Primary Industries 2021). None of these species are native to Sweden or produced to any extent in Sweden (Artdatabanken 2022; Widenfalk et al. 2022).

(2) Vector: Citrus leprosis viruses are generally transmitted by mites of the genus *Brevipalpus* that occur on citrus plants worldwide (Catara 2021) and this seems to be the case also for CICSV0 (Chabi-Jesus et al. 2018). *Brevipalpus obovatus*, and other *Brevipalpus* spp., appears to occur as greenhouse pests in Sweden (Jordbruksverket 2009; 2018), but no observations of any species within the genus *Brevipalpus* have been reported outdoors in Sweden (Artdatabanken 2022).

(3) Environment: The suitability of the environment in Sweden for CICSV0 is not known but it can be noted that the virus has only been found in an area where the environmental conditions differ substantially from those in Sweden, i.e. it has only been found in a small area in northeastern Brazil (Chabi-Jesus et al. 2018; 2019).

[2] It is preferable if the EPPO code, i.e. CICSV0, was added to the text in the Commission implementing regulation (EU) 2019/2072. It is also preferable if the name "Citrus chlorotic spot virus" was replaced with the, according to EPPO, currently preferred name, i.e. "*Dichorhavirus citri*" (see https://gd.eppo.int/taxon/CICSV0)

Due to lack of known hosts (and vectors) the virus is not assessed to be able to establish outdoors. No information was found of any production of the known hosts in greenhouses in Sweden and thus most likely the virus can not establish in greenhouses either.

Assessment of the degree to which conditions are suitable for establishment in Sweden (in greenhouses):

	Not suitable	Unlikely to be suitable	Likely to be suitable	Very likely to be suitable
Most likely	☒	☐	☐	☐
Uncertainty range	☒	☐	☐	☐

References

Artdatabanken (2022) Artfakta, Artdatabanken, Swedish University of Agricultural Sciences. Available from https://artfakta.se/artbestamning [Accessed 2022-09-15]

Catara, A. F., Bar-Joseph, M., & Licciardello, G. (2021). Exotic and emergent citrus viruses relevant to the Mediterranean region. Agriculture, 11(9), 839. LINK

Chabi-Jesus, C., Ramos-González, P. L., Tassi, A. D., Guerra-Peraza, O., Kitajima, E. W., Harakava, R., ... & Freitas-Astúa, J. (2018). Identification and characterization of citrus chlorotic spot virus, a new dichorhavirus associated with citrus leprosis-like symptoms. Plant Disease, 102(8), 1588-1598. LINK

Chabi-Jesus, C., Ramos-González, P. L., Tassi, A. D., Barguil, B. M., Beserra Junior, J. E. A., Harakava, R., ... & Freitas-Astúa, J. (2019). First report of citrus chlorotic spot virus infecting the succulent plant *Agave desmettiana*. Plant Disease, 103(6), 1438-1438. LINK

EFSA (2017) EFSA Panel on Plant Health. Jeger, M; Bragard, C; Caffier, D; Dehnen-Schmutz, K; Gilioli, G; Gregoire, J C; Jaques Miret, JA; MacLeod, A; Navajas Navarro, M; Niere, B; Parnell, S; Potting, R; Rafoss, T; Rossi, V; Urek, G; Van Bruggen, A; Van der Werf, W; West, J; Chatzivassiliou, E; Winter, S; Catara, A; Duran-Vila, N; Hollo, G; Candresse, T. Pest categorisation of Citrus leprosis viruses. EFSA Journal, 15(12): 5110, 32 pages. https://doi.org/10.2903/j.efsa.2017.5110.

Jordbruksverket (2009) Biologiskt växtskydd i prydnadsväxtodling. Jordbruksinformation 2-2009. Available online: http://www2.jordbruksverket.se/webdav/files/SJV/trycksaker/Pdf_jo/jo09_2.pdf

Jordbruksverket (2018) Bekämpning i yrkesmässig trädgårdsodling. Available online: https://www2.jordbruksverket.se/download/18.628f97e316796cb23a96b6d3/1544516032079/be8v6.pdf

New Zealand Ministry for Primary Industries (2021) Import risk analysis: leafless Citrus budwood for propagation. Available from EPPO Platform on PRAs (visible only for registered users) https://www.eppo.int/RESOURCES/eppo_databases/pra_platform

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 (pp. 46). Technical Report, External project leaders Björklund, N., Boberg, J. Greensway and SLU. LINK

Acknowledgement

We would like to thank Monika Almlöf, Johanna Jansson and colleges at the Swedish Board of Agriculture for answering our questions about greenhouse cultivation in Sweden.

Authors

This report was prepared by SLU Risk Assessment of Plant Pests at the Swedish University of Agricultural Sciences:

Niklas Björklund, Dept. of Ecology, Swedish University of Agricultural Sciences, P.O. Box 7044, SE-750 07 Uppsala, Sweden. Visiting address: Ullsväg 16, E-mail: Niklas.Bjorklund@slu.se

Johanna Boberg, Dept. of Forest Mycology and Plant Pathology, Swedish University of Agricultural Sciences, PO Box 7026, SE-750 07 Uppsala, Sweden. Visiting address: Almas allé 5, E-mail: Johanna.Boberg@slu.se

Appendix 1. Cultivation in greenhouses in Sweden

Details of the production system used in greenhouses in Sweden relevant for assessments of the likelihood of establishment of pests

A short description of some aspects of the production systems used in greenhouses in Sweden relevant for the quick assessments of the potential for establishment in Sweden for a selection of new quarantine pests. The description is based on information provided by Monika Almlöf, Johanna Jansson and colleges at the Swedish Board of Agriculture (pers. comm., November 2022).

Tomato production is in most production units done with a break in cultivation during winter, but the length of the break varies to a large degree. In intensive production performed without artificial light the tomato plants are generally removed from the greenhouses in October and the earliest planting of new plants is done in January. Some growers do use artificial light to grow their own seedlings and can do so already in December. This is, however, often done in a growing unit separate from the unit used for the main cultivation.

Conventional tomato production generally grow the tomato plants in inert substrates such as pumice, rock wool or perlite (not commonly used). Pumice and perlite is treated with steam and reused while rock wool is replaced after one season. The irrigation system is decontaminated using hydrogen peroxide. Organic tomato production is done in soil but the organic production is done to a very limited extent, approximately on 2.6 ha (in addition a very small proportion of the total production is grown in soil by producers which are not certified organic producers). All organic cultivation is done with a break for winter. However, due to the legislation for organic farming and in order to decrease the time period when the soil is bare in the greenhouse/tunnels a short-term crop is grown during the break, e.g. green manure crops, legumes, leafy vegetables or cabbage etc. There are however exceptions where producers cultivate plants all year around. Some growers of tomato and cucumber have facilities with artificial light and the potential to grow year around, corresponding to in total about 1.5-2 ha of tomato and roughly 6.5-7.5 ha of cucumber. These production facilities are located across Sweden.

Other vegetable crops produced in greenhouses in Sweden, such as cucumber, peppers/chili, melon and aubergine are all produced in production systems similar to that of tomato (i.e. generally in inert substrates and with a winter break of the crop except for organic production for which the production must occur in soil).

Lettuce and fresh herbs produced as potted plants are cultivated year around at the large producers. Large producers (and some smaller) of ornamental plants also produce plants year around but the plant species grown changes along with the season. However, a large part of the small producers only produce plants during the spring and the greenhouses are then not used during autumn and winter.

At least one producer grow both vegetables, such as cucumber grown in inert substrates, and lettuce/herbs as potted plants using soil year around. However, it is not known whether there is any access between the production units.

Greenhouse production in Sweden in numbers

Commercial production in greenhouses in Sweden was in year 2020 performed on around 291 ha by 689 producers (table 1 data on greenhouses only; Jordbruksverket 2022). A major part of the greenhouse area was heated (86% according to Jordbruksverket (2020)).

The production can be divided into three main categories - vegetables, berries and ornamental plants and some companies produce more than one type of crop (table 1). Most of the greenhouse production is found in the southern parts of Sweden although some greenhouse production is found in all counties in Sweden (table 2).

Table 1. Greenhouse production in Sweden of different crops as number of companies and either area under production or number of pots produced. Data from the Swedish Board of Agriculture (Jordbruksverket 2022), which includes data from companies with a production area larger than 200 m^2.

Plant common name	Latin name	Number of companies	Greenhouse area, ha	Production, million pots
All cultivation		**689**	**291**	
Vegetables		**329**	**141**	
Tomato	*Solanum lycopersicum*	230	46	
Cucumber	*Cucumis sativus*	209	70	
Fresh herbs, such as basil, coriander, dill, lemon balm, mint, parsley, rosemary, thyme, chives	*e.g. Ocimum basilicum, Coriandrum sativum, Anethum graveolens, Melissa officinalis, Mentha sp., Petroselinum crispum, Rosmarinus officinalis, Thymus vulgaris, Allium schoenoprasum*	52	12	
Peppers	*Capsicum annuum*	51	0.5	
Chili	*Capsicum annuum*	49	0.4	
Aubergine	*Solanum melongena*	35	0.4	
Lettuce, not potted	*Lactuca sativa*	24	6	
Lettuce, potted	*Lactuca sativa*	15	4	
Melon	*Cucumis melo*	14	0.2	
Other vegetables		43	1.3	
Berries		**32**	**8.3**	

Plant common name	Latin name	Number of companies	Greenhouse area, ha	Production, million pots
Raspberries	*Rubus idaeus*	16	1.5	
Strawberries	Fragaria × ananassa	21	6.3	
Other berries		6	0.5	
Ornamental plants		**445**	**142**	
Bulbous flowers (potted)		115		15.8
Amaryllis	*Amaryllis* sp.	89		2.6
Hyacinth	*Hyacinthus orientalis*	70		7.2
Daffodils	*Narcissus* sp.	75		5.6
Other bulbous flowers		38		0.5
Cut flowers		134		151
Tulips	*Tulipa* sp.	63		146
Daffodils	*Narcissus* sp.	29		0.039
Other bulbous cut flowers		18		1.4
Other cut flowers		77		3.6
Potted plants and plants for planting				**77.7**
Begonia	*Begonia* sp.	172		1.5
Persian cyclamen	*Cyklamen persicum*	43		0.9
Poinsetta	*Euphorbia pulcherrima*	73		2.4
Kalanchoe	*Kalanchoe* sp.	11		0.8
Lobelia	*Lobelia erinus*	293		4.4
Marguerite daisy	*Argyranthemum frutescens*	156		1.0
Geraniums	*Pelargonium* sp.	304		9.5
Garden pansy	*Viola × wittrockiana*	265		23
Petunia	*Petunia* sp. and hybrids	318		6.6
Marigold	*Tagetes* sp. and hybrids	302		3.7
Other potted plants				24

Table 2. Greenhouse production in each of the Swedish counties. Data from 2020 (Jordbruksverkets statistik 2022) and sorted in descending order according to greenhouse area.

	Number of companies	Greenhouse area, ha
Skåne län	178	157
Stockholms län	56	23
Hallands län	42	20
Västra Götalands län	82	20
Blekinge län	15	13
Östergötlands län	41	8.7
Västerbottens län	14	6.7
Södermanlands län	28	5.6
Västernorrlands län	19	5
Kalmar län	32	4.3
Norrbottens län	23	3.7
Gävleborgs län	17	3.4
Västmanlands län	10	3.3
Gotlands län	16	3.1
Jönköpings län	15	2.5
Örebro län	20	2.4
Kronobergs län	14	2.3
Värmlands län	15	2.3
Dalarnas län	24	2.2
Uppsala län	18	1.8
Jämtlands län	10	0.6

References

Jordbruksverket (2020) Trädgårdsproduktion 2020. Jordbruksverkets statistikrapporter JO0102. https://jordbruksverket.se/om-jordbruksverket/jordbruksverkets-officiella-statistik/jordbruksverkets-statistikrapporter/statistik/2021-06-29-tradgardsproduktion-2020

Jordbruksverket (2022) Statistikdatabasen. Trädgårdsodling. https://jordbruksverket.se/om-jordbruksverket/jordbruksverkets-officiella-statistik/statistikdatabasen