Sveriges lantbruksuniversitet
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SLU Risk Assessment of Plant Pests

SLU.ua.2021.2.6-2872

September 8, 2021

Assessment of the potential impact of *Trichoferus campestris* (Coleoptera; Cerambycidae) in Sweden

1 Background

The longhorned beetle species *Trichoferus campestris* (Faldermann 1835) [EPPO code: HESOCA] was intercepted in Sweden in July 2021. Larvae were found in a type of windscreen made of willow (*Salix* sp.) canes imported from China.

The species is not listed as a quarantine pest in the EU ((EU) 2019/2072). However, based on Article 29 in the plant health law ((EU) 2016/2031) national measures against the pest has been taken in Germany (Swedish Board of Agriculture, pers. comm.). According to Article 29, an officially confirmed observation of a pest in a member state that may fulfil the criteria of a quarantine pest shall be assessed by the member state to conclude, based on criteria for a preliminary assessment, whether the pest provisionally qualify as union quarantine pest requiring temporary measures (Article 29 and Subsection 1, Section 3, Annex I in ((EU) 2016/2031).

The pest is recommended for regulation as a quarantine pest by EPPO (added to the A2-list in 2007) (EPPO 2020a; 2021a). It is also subjected to statutory action against findings in the UK (Fera 2021) and it is regulated in Canada, Morocco, New Zealand, Turkey and USA (EPPO 2021a; IPPC 2020).

In order to determine potential risk management actions in response to the interception of *T. campestris* in Sweden further information about the potential impact of the pest is needed. SLU Risk Assessment of Plant Pests was therefore requested by the Swedish Board of Agriculture to provide a quick assessment of the potential economic, social and environmental impact of *T. campestris* in Sweden in relation to the criteria for a quarantine pest ((EU) 2016/2031).

2 Methodology

Information was obtained from scientific and grey literature and literature searches were performed in ISI Web of Sciences and Google Scholar. The following other scientific names of *Trichoferus campestris* were included in the searches: *Callidium campestris, Hesperophanes campestris, Hesperophanes flavopubescens, Hesperophanes rusticus, Stromatium turkestanicum, Trichoferus flavopubescens, Trichoferus rusticus, Trichoferus turkestanicus* (obtained from EPPO (2021a)). The search was restricted to literature in English although there appear to be relevant literature in e.g. Russian and Chinese.

The assessment of the magnitude of potential impact was done using a 5-level scale (very low, low, moderate, high, very high) and an uncertainty rating was done using a 3-level scale (low, moderate, high) as used by EPPO (2020b). The potential impact was assessed based on a scenario that introduction and spread is possible in Sweden and that the ecoclimatic conditions in at least parts of southern Sweden is suitable for establishment of the pest (cf. Keszthelyi et al. 2019; Krishnankutty et al. 2020). An assessment for Sweden of the likelihood of introduction and establishment, as well as the rate of spread, may be carried out in a future separate report.

3 Short description of the pest

Common names of *T. campestris* are e.g., Mulberry longhorn beetle, Velvet longhorned beetle and Chinese longhorn beetle (EPPO 2021b). The adults are 10-24 mm long (EPPO 2021b). The life cycle is usually 1-2 years but may be longer, e.g. in dry wood (Švácha & Danilevsky 1988; EPPO 2021b). Eggs are laid on the bark of trunks and branches (Xinming & Miao 1998; EPPO 2021b). Larvae first feed on the inner bark and later enter the sapwood, but only in the part close to the cambium (Iwata & Yamada 1990). Remaining bark appear to be a requirement for early larval development (Iwata & Yamada 1990).

The species is very polyphagous and more than 50 plant genera are listed as hosts including both broadleaved and conifer tree species (EPPO 2021a, b). It is commonly reported on *Malus*, *Morus* and other fruit tree species (EPPO 2021b). In a Swedish context the following plant genera and species, reported as hosts by EPPO (2021a), may be particularly relevant: *Acer platanoides, Alnus, Betula**, Fagus, Fraxinus excelsior, Malus* (including *M. domestica*)* [#], *Picea**, Pinus**, Populus, Prunus, Pyrus, Quercus, Salix**, Sorbus aucuparia**, Tilia, Ulmus* (hosts with * are listed as ’living hosts’ by CAPS (2020) and hosts with [#] are listed as ’major hosts’ by EPPO (2021a)).

Trichoferus campestris is native in Asia (East Asia and probably also Central Asia) (Grebennikov et al. 2010; EPPO 2021b). The beetle has spread outside its native range westward into Europe and also to North America (where it is present both in Canada and USA) (EPPO 2021a,b). In the EU the pest is reported as ’present, no details’ in Poland and Romania, as ’present, with restricted distribution’ in Hungary and Lithuania, and as ’present, few occurences’ in Czech Republic, Germany, Latvia and Slovakia (EPPO 2021a). There is no evidence that *T. campestris* is established in Sweden (Björklund & Boberg 2021).

Trichoferus campestris has frequently been intercepted in different commodities (Connell et al. 2020). In the EU, 27 interceptions of the pest have been reported since 2015 in different wood packaging materials, crates, pallets and other wooden objects all originating in China (Europhyt 2020; EPPO 2021c). The pest has previously been intercepted in Sweden, also from wood packaging material from China, once in 2012 and once in 2017 (Dascălu et al. 2013; Europhyt 2020).

A pheromone for *T. campestris* has been identified (Ray et al. 2019) and a lure is used for surveys in the USA (CAPS 2021). Further information about methods for surveillance can be found in PPQ (2019) and CAPS (2021).

4 Impact assessment

4.1 Previous impact assessments

Previous risk assessments of the pest have been done. In a PRA for the EPPO region the potential economic impact was stated as 'Medium but little possibilities for pest control' and the overall uncertainty was assessed as low (EPPO 2005). In a PRA performed for the UK the potential economic, environmental and social impact was rated as small to medium with a high uncertainty (Defra 2015). In an express PRA for Germany they were not able to assess the damage potential of the pest due to lack of data (Steinmöller & Pfeilstetter, 2016). The risk of *T. campestris* to California has also been evaluated and a recently updated assessment propose to score the economic impact as medium and the environmental impact as high for the pest (CDFA 2021). It should be noted that the rating scheme they used in California differ from the other rating schemes cited here since it is based on the number of criteria that is fulfilled rather than on quantitative assessments. Despite the relatively high ratings of potential impacts they write 'It is not clear if *T. campestris* is able to attack healthy, unstressed trees or if it is having a significant economic impact anywhere.'.

4.2 Impact records in its current range

The pest is reported from dead wood (both fresh and dry) as well as stressed and healthy trees (EPPO 2005).

In China and Japan it is reported as an important pest of stored wood (Xinming & Miao 1998; Iwata & Yamada 1990 citing sources in Japanese and Chinese). The larvae are able to develop in very dry wood, also indoors (Iwata & Yamada 1990) and manufactured wood products may also be damaged (Xinming & Miao 1998). Particularly timber, lumber and dry wood of fir and pine is attacked (CAPS 2020 citing Kostin 1973).

Trichoferus campestris has also been reported as a pest of fruit trees (e.g. *Malus, Morus*) (EPPO 2021b). In its native range, it is reported as a pest of weak and withering trees (Xinming & Miao 1998; Zhang et al. 2017). In a Chinese study of Rosaceous fruit trees they found five species of longhorn beetles that infested apple trees (*Malus domestica*), *T. campestris* was the second most common species after *Mesosa myops* (Zhang et al. 2017). Further, it was the most common species infesting peach trees (*Prunus persica*) and the sixth most common species infesting cherry trees (*Prunus pseudocerasus*). They noted that *T. campestris* mainly infested the twigs and the long-term damage was therefore more limited than that of the pests that mainly infested the stem. It is also reported that *T. campestris* is a pest of living fruit trees, that it may attack large trees, mostly apple trees, and that in Russia, apparently healthy trees are also attacked (CAPS 2020 citing Kostin (1973) and Makhnovskii (1996)).

In the introduced range in North America, *T. campestris* is found in some orchards, ornamental landscapes and along waterways (Spears et al. 2020). In Utah, it is widespread in some counties and is locally very numerous. It has been reported to occur in high densities near riparian habitat associated with golf courses and in commercial fruit production areas (Burfitt et al. 2015), e.g. >5000 individuals were captured during 2014-2016 in a single orchard (Watson et al. 2016; Ray et al. 2019; Wu et al. 2020). It is stated to be unknown if *T. campestris* prefers stressed or healthy trees, but it appears to be more attracted to medium to large sized trees (Spears et al. 2020). The larval tunnelling in stems and branches can lead to thinning crowns, yellowing of the leaves and shorter tree lifespans (Everatt et al. 2015). The pest does not cause rapid tree death (Spears and Ramirez 2014), but EPPO (2005) report that high number of beetles attacking the same tree may cause death in 1-2 years. Infested branches may also be more prone to breakage during strong winds (Spears et al. 2020). It is stated that the pest can negatively impact fruit yield, tree longevity and wood marketability (Rodman et al. 2020), but this is not well documented (Carroll & Parker 2020)

In Minnesota, *T. campestris* has been observed since 2010 and surveys using traps with species-specific lures in 2018-2019 found the pest in 22 locations (MDA 2020). The report state that no tree mortality has been documented and that the impacts of *T. campestris* to forest health is unknown.

There are no report of severe economic impact (EPPO 2021b) and no quantitative data on impact were found in preparation for this impact assessment.

Since a large part of the life cycle of *T. campestris* occurs protected inside the host tree, it is difficult to control, e.g. using insecticides (Everatt et al. 2015). Few natural enemies of *T. campestris* are known (EPPO 2021b).

4.3 Potential impact in Sweden

Susceptible hosts are widely present in Sweden and *T. campestris* is expected to be able to infest live trees, apparently healthy, stressed and dying, as well as fresh and dry wood as observed in its current distribution range.

Despite the fact that *T. campestris* has invaded many regions both in Europe and North America during the last three decades (Dascălu 2013; EPPO 2021a), and that it has become locally very abundant (Wu et al. 2020), no reports of high impact was found from any of the invaded regions.

In the introduced range the pest appears to mostly be observed in urban landscapes and fruit orchards. How commonly the pest occurs in natural forests is unclear from the available literature, but it has been reported to be a pest of stored wood in its native range. It has the potential to become a technical pest[1] of stored logs also in Sweden. It should however be noted

[1] A technical pest is a pest that cause damage by boring holes in stored wood rather than by attacking living or dying hosts.

that in modern forestry the time that wood is stored before being processed is shorter now than it was previously (Långström 2017) and thus the impact on stored wood is expected to be lower now than it was historically.

Widespread mortality of trees is not expected, but the pest could potentially accelerate decline of trees in some circumstances, e.g. already stressed trees. Only one of the hosts classified as 'major hosts' by EPPO (2021a) is common in Sweden, i.e. *Malus domestica,* which is a common tree species in private gardens and grown in commercial fruit orchards on 1655 Ha (Swedish Board of Agriculture 2021). Thus, the potential impact in Sweden is expected to be lower than in areas where major hosts are grown more extensively. It should be noted though that *T. campestris* is a very polyphagous species and, although not classified as 'major hosts', hosts are widely present in Sweden and some of them are of great importance such as *Betula, Picea, Pinus* and *Quercus. Trichoferus campestris* appear to be able to utilize at least some of these hosts in a continuum from dry wood to living trees. Although the impact on the local scale in general is expected to be very low the cumulative impact at a regional scale may be higher due to the large number of host species with extensive distributions in Sweden.

Based on the available literature the magnitude of potential economic impact in Sweden is rated as low to moderate with a medium uncertainty. The environmental and social impact is rated to be very low with medium uncertainty since no information was found that would support higher ratings.

Main uncertainties are; i) whether *T. campestris* can attack healthy trees or if it is restricted to stressed or dead trees, ii) if the climatic conditions in Sweden would lead to longer development times and thus lower impact and iii) if logs are stored during a short enough time period in Sweden to limit the impact of *T. campestris* as a technical pest.

5 Conclusion

If *T. campestris* would establish in Sweden it is expected to cause some economic damage, i.e. similar to that in its current range. Such damage levels is assessed to equal a low to moderate potential impact rating with a medium uncertainty according to the scale used by EPPO (2021a). The environmental and social impact is assessed to be very low with a medium uncertainty.

Based on this assessment, *T. campestris* would have a potential to cause impact to some degree as regards the following points in the criteria that are used to identify quarantine pests ((EU) 2016/2031, Annex I, Section I (4)), for example:

(a) crop losses in terms of yield and quality

(b) costs of control measures

(c) costs of replanting and/or losses due to the necessity of growing substitute plants

(e) effects on street trees, parks and natural and planted areas

6 Acknowledgement

We would like to thank Åke Lindelöw (SLU) for reviewing the report.

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