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SLU Risk Assessment of Plant Pests

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Potential establishment of the priority pest *Anthonomus eugenii* in Sweden

Background and terms of reference

The European Commission has established a list of 20 priority pests (Commission Delegated regulation (EU) 2019/1702). The pests have been selected among the Union quarantine pests as the pests for which the potential economic, environmental and social impact is assessed to be the most severe in the EU.

For each priority pest Member States shall carry out annual surveys (article 24 in EU regulation 2016/2031). However, the regulation further states that:

"The surveys shall not be required to be carried out for pests for which it is unequivocally concluded that they cannot become established or spread in the Member State concerned due to its ecoclimatic conditions or to the absence of the host species."

For some of the priority pests it is currently uncertain whether the ecoclimatic conditions or host availability in Sweden allow their establishment in whole or part of the country.

The Swedish Board of Agriculture has requested SLU Risk Assessment of Plant Pests to assess whether certain priority pests are able to establish in Sweden and further, when relevant, identify the area of potential establishment. This report provides the assessment of the potential establishment of *Anthonomus eugenii* (EPPO code: ANTHEU).

Short description of *Anthonomus eugenii*

Anthonomus eugenii (pepper weevil) is a major pest on *Capsicum* (EFSA 2019). It is generally believed to be native in Mexico or surrounding regions based on the earliest reports of the weevil (Van de Vossenberg et al. 2019). It has, however, spread and its current distribution includes, in addition to Central America, the southern USA, French Polynesia, Puerto Rico and the Dominican Republic (Van de Vossenberg et al. 2019). In addition, transient populations have been found in northeastern USA (Ingerson-Mahar et al. 2015), southern Canada (Labbé et al. 2018), and in Italy (Speranza et al. 2014). The NPPO of Italy reported in February 2020 that the pest status is "Transient, under eradication" and that there have been no new findings during

the last five years (EPPO 2020). There is a pathway for the introduction of *A. eugenii* through the trade of e.g. capsicum fruit as demonstrated by >50 interceptions in EU (but none in Sweden) (EFSA 2019; EUROPHYT 2020; Ostojá-Starzewski et al. 2016).

Females lay their eggs on flower buds or fruits and the larvae develops therein. The adults feed on buds, flowers, fruits and leaves. It is the larval and adult feeding that leads to losses of marketable fruits. The weevil may have up to five generations per year (Wu et al. 2019). It is generally assumed that *A. eugenii* does not have a diapause (Baker et al. 2012; Ingerson-Mahar et al. 2015; Ostojá-Starzewski et al., 2016; Riley and Sparks 1995).

Presence and distribution of hosts

Anthonomus eugenii is confined to hosts within the genera *Capsicum* and *Solanum* for reproduction (but it may feed on other species) (EPPO 2020; van der Gaag and Loomans 2013). The weevil have a preference for *Capsicum* species but reproduction is also possible in some *Solanum* species, e.g. in *Solanum nigrum* (nattskatta) and *S. dulcamara* (besksöta) that are established in the wider environment in Sweden (van der Gaag and Loomans 2013; Fernández et al. 2017; SLU Swedish Species Information Centre 2020).

Commercial cultivation of chilies, peppers or aubergines, i.e. the main crops of *A. eugenii* does not occur to any great extent in Sweden. In 2017, chili and sweet peppers were produced in 7 230 m^2 of greenhouse whereas no production of aubergines were reported (Jordbruksverket 2018). However, according to Karlsson (2019) there is some small scale commercial production but no larger commercial production of aubergines in Sweden.

Ecoclimatic conditions

There are sufficient degree days for complete development of one generation of *A. eugenii* in Sweden, i.e. 256 degree days with a threshold of 9.6 °C (Toapanta et al. 2005). However, according to van der Gaag and Loomans (2013) the degree days in the areas where persistent populations are present is probably above 3,000 and normally three to five generations are produced each year (Wu et al. 2019). Such conditions are only reached in the southernmost parts of Europe (EFSA 2019).

Anthonomus eugenii is known from areas with plant hardiness zone 9-10 and higher, which does not occur in Sweden (van der Gaag and Loomans 2013). Similarily, the distribution of *persistent* populations of *A. eugenii,* according to van der Gaag and Loomans (2013), does not include any of the Köppen-Geiger climate zones that are found in Sweden (Beck et al. 2018). However, *transient* populations have been found in colder areas (van der Gaag and Loomans 2013; EPPO 2019) as will be discussed below.

Further, also too cold winters have been argued to prevent survival of *A. eugenii* outdoors in northern Europe (Van De Vossenberg et al. 2019). Van de Vossenberg et al. (2019) claim that populations of *A. eugenii* die out when temperatures reach -5.0˚C (referring to an article in Italian), and that such temperatures are reached during a typical winter in northern Europe. A Canadian study showed that *A. eugenii* can survive for at least one hour at -10 °C, but not -

15°C, whereas a complementary field survival experiment performed in Ontario showed that the weevils did not survive the whole winter outdoors (Fernández et al. 2017).

Finally, it is frequently claimed that *A. eugenii* can only establish in areas where food plants are available throughout the year since the pest cannot diapause (Baker et al. 2012; Capinera 2004; van der Gaag and Loomans 2013; Ingerson-Mahar et al. 2015; Ostojá-Starzewski et al., 2016; Riley and Sparks 1995; see also Wu et al. (2019) for empirical support). Since the green parts of *Capsicum* and *Solanum* spp. usually do not even survive temperatures below 0°C that would prevent establishment outdoors in Sweden (van der Gaag and Loomans 2013).

It should be noted that the ecoclimatic conditions in Sweden does probably not prevent the occurrence of transient populations. *Anthonomus eugenii* may arrive through the trade of e.g. capsicum fruit or by escaping from greenhouses by natural migration or by human assisted pathways (van der Gaag and Loomans 2013). For example in Canada transient localised field populations of *A. eugenii* has caused damages in areas including Köppen-Geiger climate zone Dfb, which also is the climate zone covering southern Sweden (Beck et al. 2018; Labbé et al. 2018).

Establishment in greenhouses

Anthonomus eugenii has caused damages in greenhouses in e.g. Canada (Fernández et al. 2017), Italy (Speranza et al. 2014) and in the Netherlands (van der Gaag and Loomans 2013; EPPO 2020). Preventing establishment would require specific measures such as creating a complete host crop break combined with a careful clean-up (Baker et al. 2012). However, the production of host plants of *A. eugenii* in greenhouses in Sweden is relatively small (see section “Presence and distribution of hosts” above).

Previous assessments of the likelihood of establishment

- In a rapid pest risk analysis for UK it was concluded that establishment outdoor was very unlikely whereas establishment under protection was very likely (Baker et al. 2012).

- In a PRA for the EU it was concluded that *A. eugenii* may establish outdoors in the Mediterranean coastal regions, the islands in the Mediterranean Sea, southern Portugal and the western half of Portugal (van der Gaag and Loomans 2013). Further, it was concluded that *A. eugenii* can likely establish in greenhouses with a nearly continuous *Capsicum* fruit crop.

- EFSA (2019) considered the establishment outdoors is possible in the following regions; southern Spain, southern Portugal, Madeira, the Azores, southern Italy, Malta, southern Greece and Cyprus. *Anthonomus eugenii* was assessed to be able to establish in greenhouses throughout the EU.

- Van de Vossenberg (2019) state that survival outdoors in northern Europe is unlikely.

Conclusion

Based on the information presented above our assessment is that *A. eugenii* cannot become established in the wider environment in Sweden due to the ecoclimatic conditions. The uncertainty of this conclusion was assessed to be low. *Anthonomus eugenii* has already proved that it is capable to establish in greenhouses but the production of hosts in Sweden is relatively small. These assessments are in line with previous assessments of this pest (Baker et al. 2012; EFSA 2019; van der Gaag and Loomans 2013).

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, S-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

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