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Swedish University of Agricultural Sciences

SLU Risk Assessment of Plant Pests

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Temperature accumulation maps to support surveys for *Agrilus anxius* in Sweden

1 Background

Agrilus anxius is a quarantine pest in the EU ((EU) 2019/2072)¹. It is also listed as a priority pest and thus annual surveys and a contingency plan is required for it ((EU) 2019/1702)². In survey planning and development of contingency plans for quarantine pests the area of potential establishment is an important factor to take into account.

Agrilus anxius is native in North America and widespread in boreal and northern temperate regions in both USA and Canada (EPPO 2021a,b). In a PRA by EPPO (2011) it is considered that the temperature accumulation required for the development of *A. anxius* would be at least 250 degree days above the threshold temperature of 10°C. This assumption was based on the climate in the northern limit of the distribution in North America. Where in the EPPO region the threshold temperature accumulation was reached was analysed using monthly average temperature data for the time period 1961-1990. This analysis indicated that the thermal requirements were not met in the north-western parts of Sweden.

Here, more recent temperature data from the last 20 years were used to calculate the degree days above 10°C across Sweden. These maps can be used together with other information to estimate the area of potential establishment of *A. anxius* in Sweden, e.g. together with the distribution of available hosts and minimum temperature for oviposition (EFSA 2021).

¹ Commission Implementing Regulation (EU) 2019/2072 of 28 November 2019 establishing uniform conditions for the implementation of Regulation (EU) 2016/2031 of the European Parliament and the Council, as regards protective measures against pests of plants, and repealing Commission Regulation (EC) No 690/2008 and amending Commission Implementing Regulation (EU) 2018/2019. OJ L 319, 10.12.2019, p. 1–279.

² Commission Delegated Regulation (EU) 2019/1702 of 1 August 2019 supplementing Regulation (EU) 2016/2031 of the European Parliament and of the Council by establishing the list of priority pests. OJ L 260, 11.10.2019, p. 8–10

2 Material and methods

The degree days above 10°C in Sweden was calculated using gridded Agro-Meteorological Data provided by the Joint Research Center, which contain daily observation data from weather stations interpolated on a 25x25 km grid (JRC, 2021). Daily maximum and minimum air temperature data for the time period 2001-2020 was used for the analysis. Calculations were run in R (R Core Team, 2019) using the R code by Korycinska (2020) and maps were created with QGIS (QGIS Development Team, 2021).

3 Results and discussion

The analysis indicate that the required temperature accumulation for development of *A. anxius*, i.e. at least 250 degree days above the threshold temperature of 10°C, is fulfilled in most parts of Sweden (Figure 1). Only the north-western parts of Sweden do not fulfill this requirement. As expected the area in Sweden which does not fulfill this requirement is smaller in the current analysis compared to the one presented in EPPO (2011) where older data were used.

It should, however, be noted that the results presented above are based on mean values for the 20-year period. Thus for individual years, the temperature accumulation may be higher or lower. The maximum number of consecutive years when the annual temperature accumulation was above the threshold is visualized in figure 2. A larger area in the north-western parts of Sweden did not consistently have an annual temperature accumulation above 250 degree days (base 10°C) over the whole time period 2001-2020 (Figure 2), compared to the corresponding area calculated from the average values during that period (Figure 1). This area thus also includes areas where the thermal requirements only permits development of *A. anxius* during some years.

Finally it should be noted that the analysis indicate that there are very small areas in Sweden where the thermal requirements consistently would have prevented the development of *A. anxius*, i.e. in the white grid cells in Figure 2.

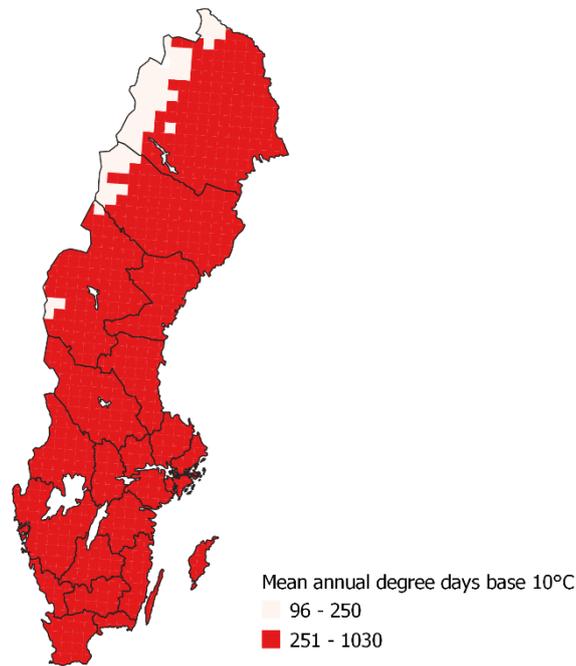


Figure 1. Temperature accumulation as the mean annual degree days above 10°C for the time period 2001-2020 based on daily max and min temperatures from JRC (2021). Map of the Swedish counties are from SCB (2020).

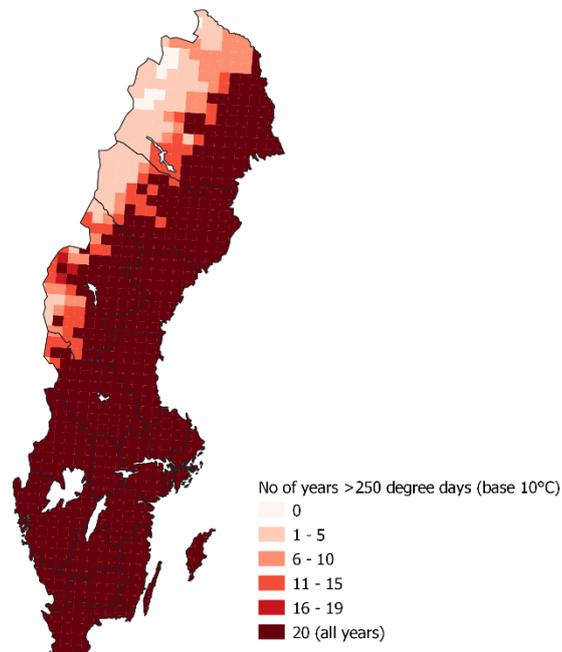


Figure 2. Number of consecutive years during 2001-2020 when the annual temperature accumulation was above 250 degree days base 10°C. Map of the Swedish counties are from SCB (2020).

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