Flight activity of spruce bark beetle (*Ips typographus* L.) in Central Slovakia during spring season 2024

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- *In recent years the decline of spruce stands was detected in Slovakia area*
- *According the Green report 2024 share of spruce dropped from 26.0 % (1970) to 21.1 % (2023)*
- *The spruce is most share coniferous tree species in Slovak*
- *Ips typographus L. is significant bark beetle pest in spruce stand in Slovakia*
- *In 2024 above 500,000 m³ was damaged by spruce bark beetle in Horehronie region*
- *In recent years the I. typographus attacks native spruce ecosystems (High Tatras, Low Tatras)*
- *Monitoring of this pest based on STN 48 2711 (pheromony monitoring, classic trap tree) (Fig. 1-4)*
- *One of the reasons for this decline is the changed climatic conditions, which have a positive impact on bark beetle pests and a negative impact on the health of spruce stands.*

Fig. 1. Pheromone traps (Photo: Zúbrik)

Fig. 2. Adult of spruce bark beetle (Photo: Borowiec)

Calculation of degree-days

- We estimate the start of swarming with model PHENIPS (Beier et. al. 2007).
- We calculated the effective temperature (average daily temperature above 8.3°C) and we sum of deviations.
- Threshold of swarming was sum 60 degree-days.
- The second requirement of swarming was the three consecutive days with daily maximum temperature above 16.5°C.
- We compared the sum of degree-days calculated from 1st January and 1st April.
- The calculated start of swarming we comparison with catch of beetle individuals from pheromony monitoring of Forests of Slovakia.
- We used gridded data of mean and maximum daily temperature for computation of degree-days in PHENIPS model.
- The gridded data for the area of Slovakia is computed on SHMI on operational daily basis.
- These layers are created using slightly modified method of Frei (2014) and Hiebl & Frei (2016) which was originally used for temperature interpolation in complex orographies of Switzerland and Austria.
- We applied package „raster" in R for the computation of gridded degree-days from temperature data.
- Additionally we used QGIS for zonal statistics of gridded degree-days on areas of forest administration and depicting of map layouts.
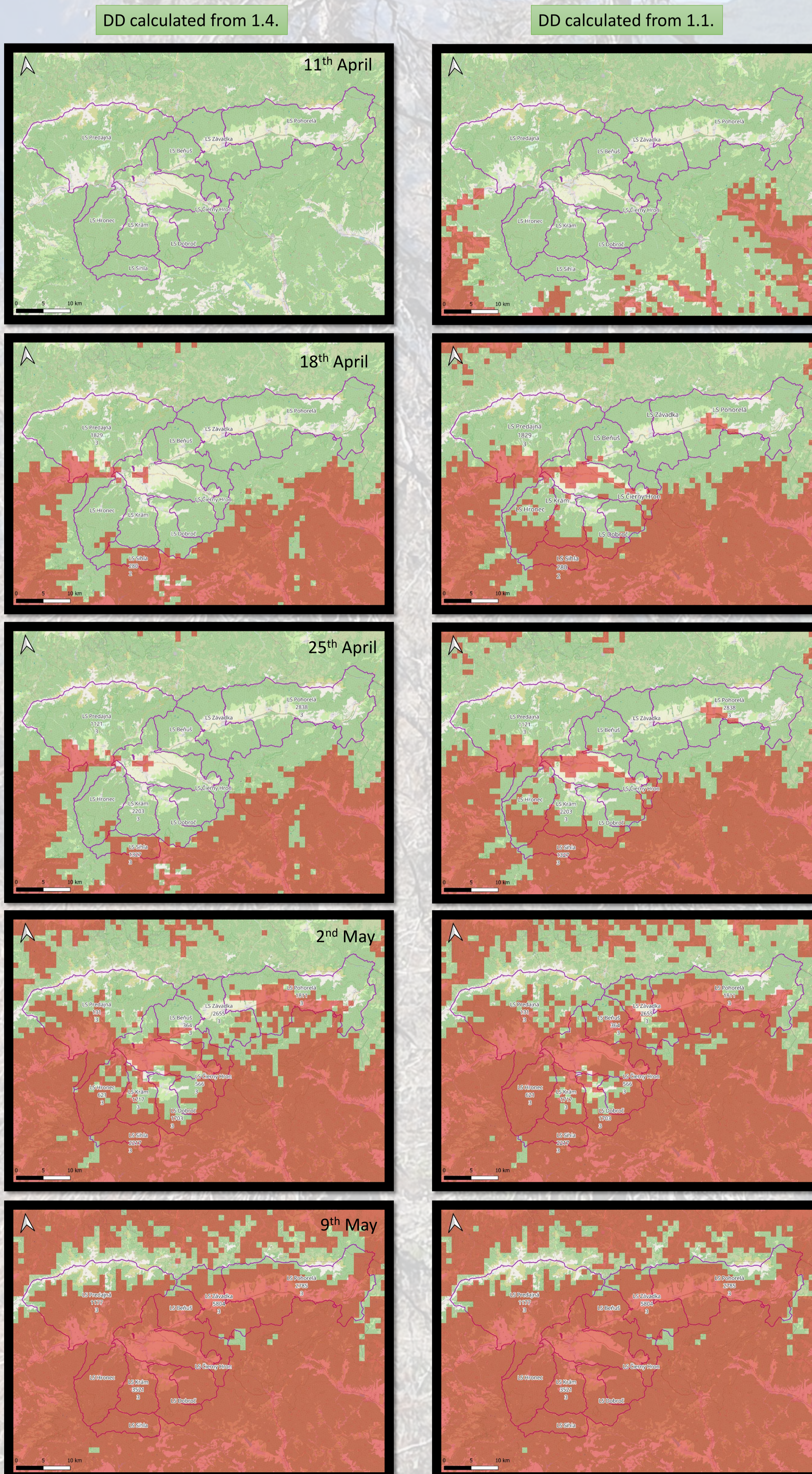
Fig. 3. Classic spruce trap tree (Photo: Zúbrik)

Fig. 4. Spruce stand damage by *I. typographus* (Photo: Zúbrik)

Flight activity of spruce bark beetle in 2024 calculated by PHENIPS

DD calculated from 1.4.

DD calculated from 1.1.

11th April

18th April

25th April

2nd May

9th May

1. At the Telgárt meteorological station, the largest positive deviations from normal values were recorded in February 2024 (+6.3°C above the 1991-2020 normal period) and March 2024 (+4°C above the 1991-2020 normal period).
2. **The value of 60 degree-days (calculaded from 1st January) exceeded for the first time in the Horehronie region around 11th April.**
3. With method by Beier et. al. 2007 calculating from April, a shift in onset is visible, but also a faster progression. The value of 60 degree-days was already reached on 17th April in Horehronie
4. **Swarming during spring of spruce bark betle in 2024 was at the earliest since 1991**
5. Shift to earlier termins of swarming was **18 - 31 days** in comparison to longterm average 1991-2020

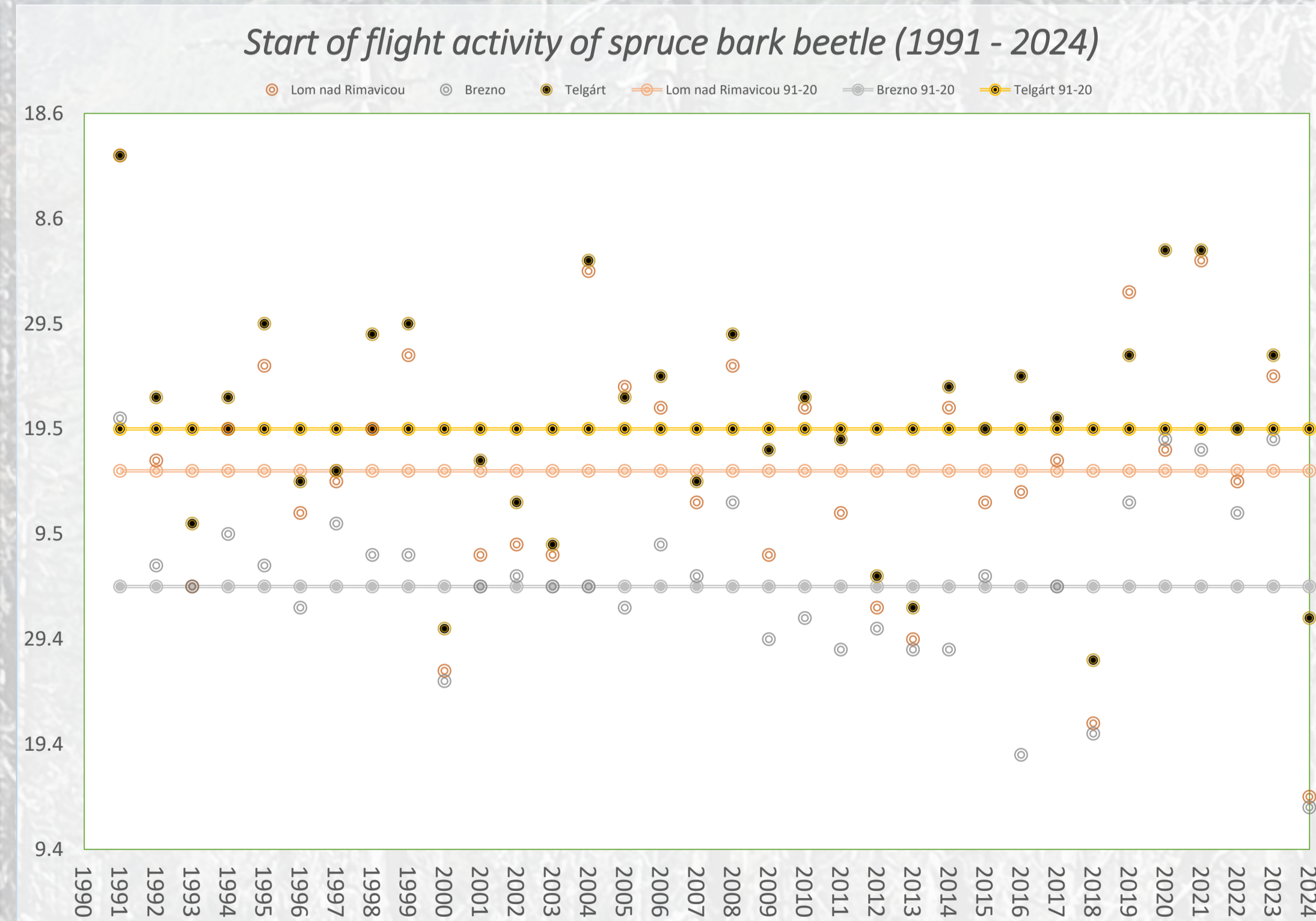Fig. 5. The date of start swarming in meteorical station Telgárt, Lom nad Rimavicou, Brezno in period 1991-2024

Based on air temperatures from the SHMI meteorological network, we can calculate the beginning of flight activity in areas with the dominant tree species Spruce using the Phenips model, which would greatly help to the timely planning and application of forest protection activities in forest stands.

References

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Frei, C. (2014). Interpolation of temperature in a mountainous region using nonlinear profiles and non-Euclidean distances. International Journal of Climatology, 34(5).
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Fig. 6. Calculated degree-day from 1.4. (left) and 1.1. (right) – the red color represent the complet of conditions of swarming (average catches per trap, catches degree)