

Table 1. The predicted averaged sum of degree days (DD) for phenological stages of *Betula pendula* and *Padus racemosa* (starting date – January 1) and statistical differences between predicted and observed degree-day sums in 8 observation sites (1960-2009): STDEV – the least standard deviation in days; percentage (-3 to 3) – percentage of deviation values between -3 and 3 days; ME – mean absolute error in days; R2 – coefficient of determination

Phenological stage	Base temperature	Parameter					
		DD	STDEV	Extreme deviations in days	Percentage (-3 to 3), %	ME (days)	R ²
<i>Betula pendula</i> leaf unfolding	0 °C	241	6.2	-25 to +18	48	0.4	0.53
	3 °C	145	4.6	-13 to +14	59	0.6	0.62
	5 °C	102	4.2	-10 to +13	64	0.8	0.63
	7 °C	70	3.9	-13 to +14	68	0.6	0.67
<i>Betula pendula</i> flowering	0 °C	265	7.7	-27 to +20	38	0.6	0.33
	3 °C	165	6.1	-23 to +19	47	0.9	0.42
	5 °C	119	5.6	-22 to +18	49	1.0	0.47
	7 °C	85	5.3	-22 to +18	55	1.1	0.51
<i>Padus racemosa</i> leaf unfolding	0 °C	206	6.9	-24 to +25	47	0.4	0.58
	3 °C	117	5.6	-15 to +26	55	0.8	0.66
	5 °C	78	5.7	-15 to +25	58	0.9	0.63
	7 °C	51	6.0	-14 to +25	59	1.0	0.59
<i>Padus racemosa</i> flowering	0 °C	329	5.3	-16 to +19	60	0.3	0.64
	3 °C	218	3.9	-12 to +15	68	0.4	0.74
	5 °C	164	3.7	-9 to +14	71	0.4	0.76
	7 °C	122	3.8	-10 to +15	69	0.7	0.75
	10 °C	74	4.4	10 to +15	69	1.0	0.69

Abstract

A phenological and meteorological data series for period 1960-2009 (Kalvane et al, 2009; **Figure 1**) were used to evaluate the usefulness of the degree-day approach (**Figure 2 and 3**) for forecasting beginning of leaf unfolding and flowering for two tree species – silver birch *Betula pendula* and bird cherry *Padus racemosa* in Latvia.

The degree days – sum of the active temperatures accumulated after the winter calm period – were calculated for a range of base temperatures (0, 3, 5, 7 and 10°C). The results were compared to the timing of the phenological events observed at eight stations in order to evaluate year-to-year variations (**Table 1; Figure 2**).

Different base temperatures gave surprisingly similar results. The most appropriate threshold temperatures was found to be +7°C for both the budburst and flowering of silver birch, +3°C for the budburst of bird cherry and +5°C for flowering of bird cherry (**Figures 4 and 5**). Giving the most appropriate es-

timated base temperatures, it is found that the budburst of the *Betula pendula* takes place when 70 degree-days after the winter calm is accumulated and the flowering takes place when 85 degree days are accumulated. The respective degree day values for the *Padus racemosa* are 117 and 164. The conclusions should be considered as indicative because the locations of the phenological observations originating from the network of the volunteers are not known exactly.

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References: Kalvane, G., Romanovskaja, D., Briede, A., Baksiene, E. 2009. Influence of the climate change to the phenological changes in Latvia and Lithuania. Climate Research. Vol. 39, 209-219.



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Forecasting plant phenology: evaluating the degree-day method for *Betula pendula* and *Padus racemosa* spring phases in Latvia

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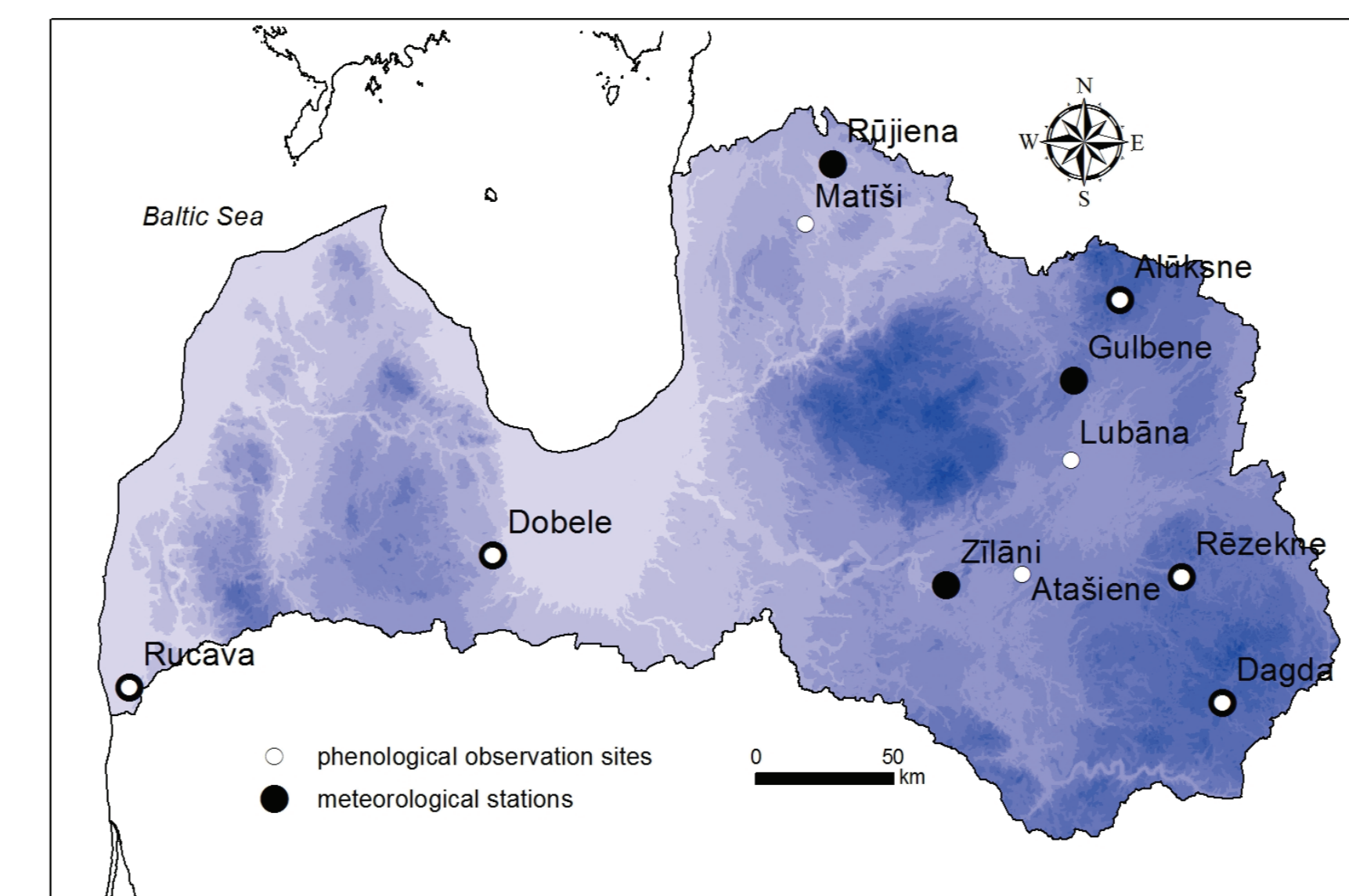


Figure 1. The observation sites on the map of Latvia. Grey circles refer to phenological observation sites and black ones for meteorological stations.

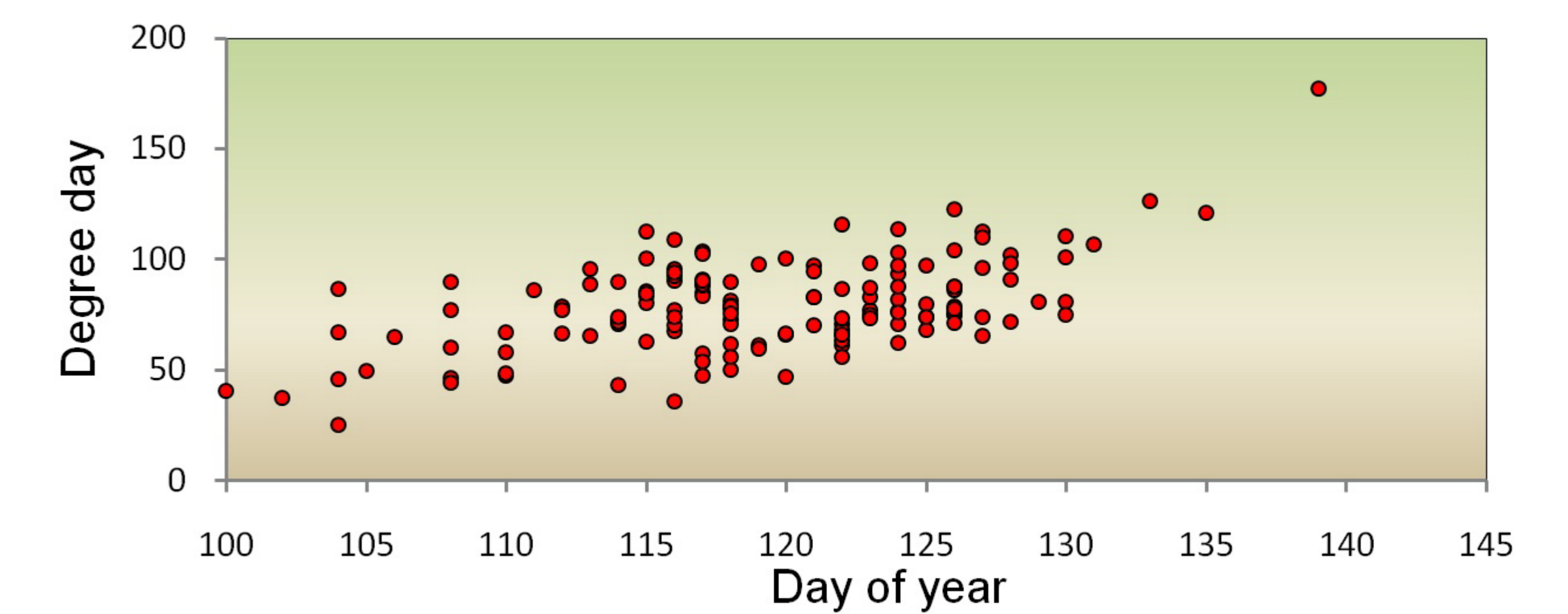


Figure 2. Calculated degree day sums and respective day of year (DOY) for leaf unfolding of bird cherry *Padus racemosa* (base temperature 5°C).

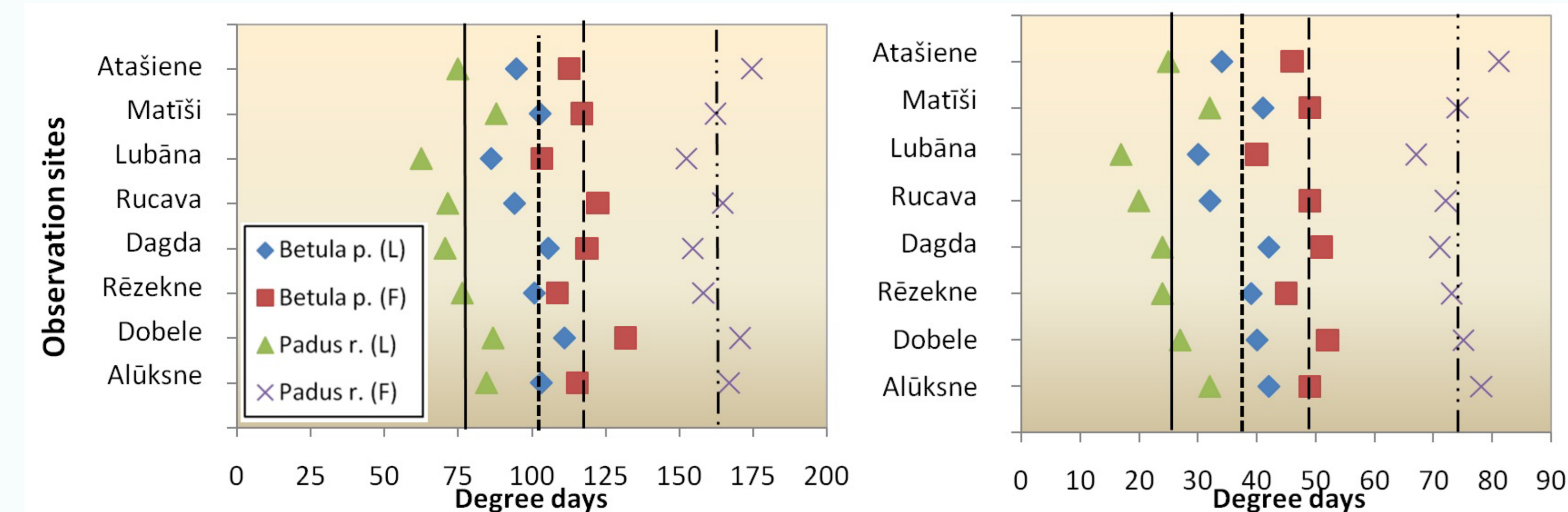


Figure 3. The deviations in days between predicted degree-day sum covering all observation points and average degree-day sum for spring phenological stages (L – leaf unfolding, F – beginning of flowering) of *Betula pendula* and *Padus racemosa* for each observation site: a - base temperature 5°C, b - 10°C. Vertical lines represent predicted degree day sum for each phase (see Table 1.): solid line – *Padus r.* (L); dashed thick line – *Betula p.* (L); dashed thin line – *Betula p.* (F); dashed dot line - *Padus r.* (F). Starting date – January 1.

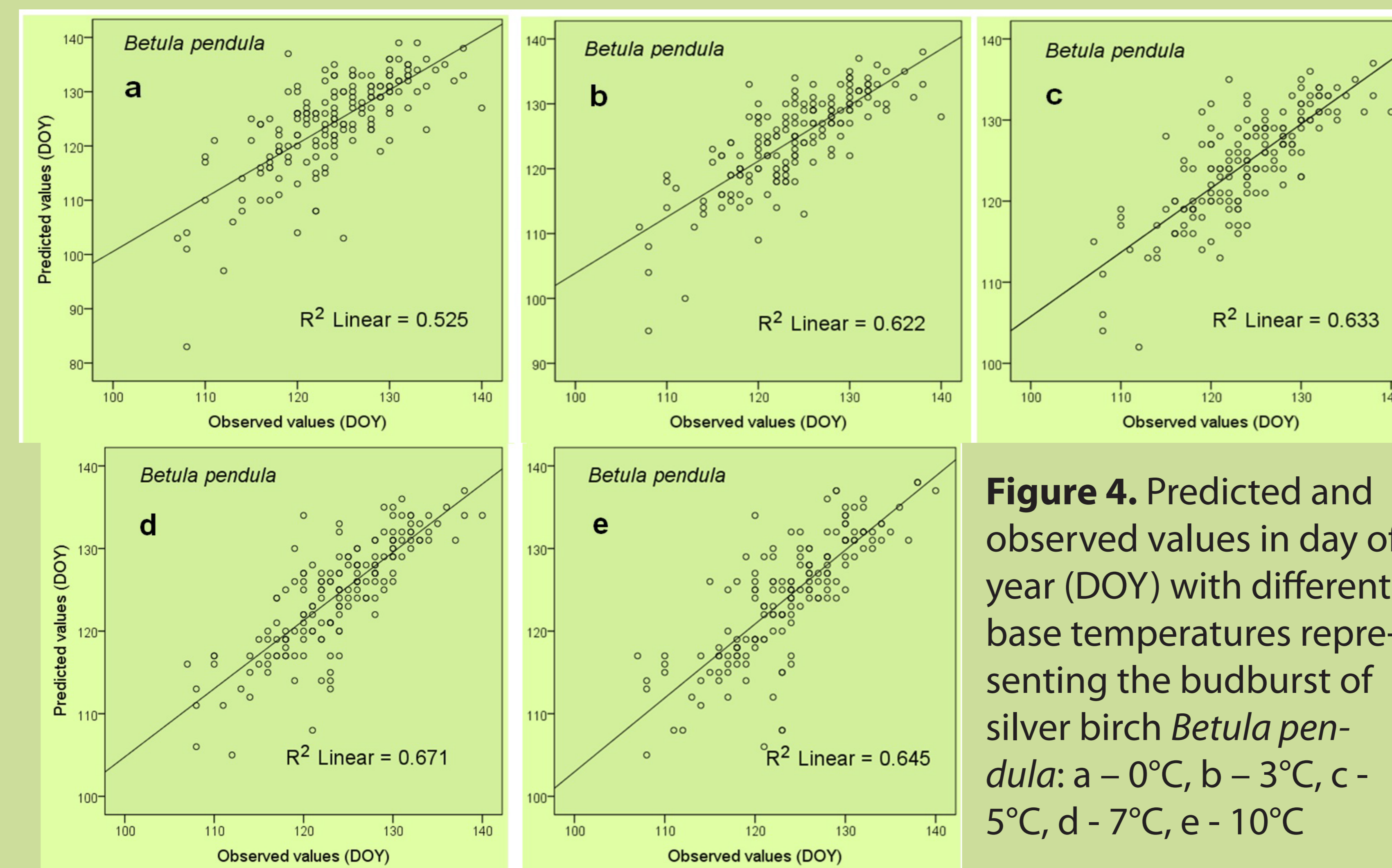


Figure 4. Predicted and observed values in day of year (DOY) with different base temperatures representing the budburst of silver birch *Betula pendula*: a – 0°C, b – 3°C, c – 5°C, d – 7°C, e – 10°C

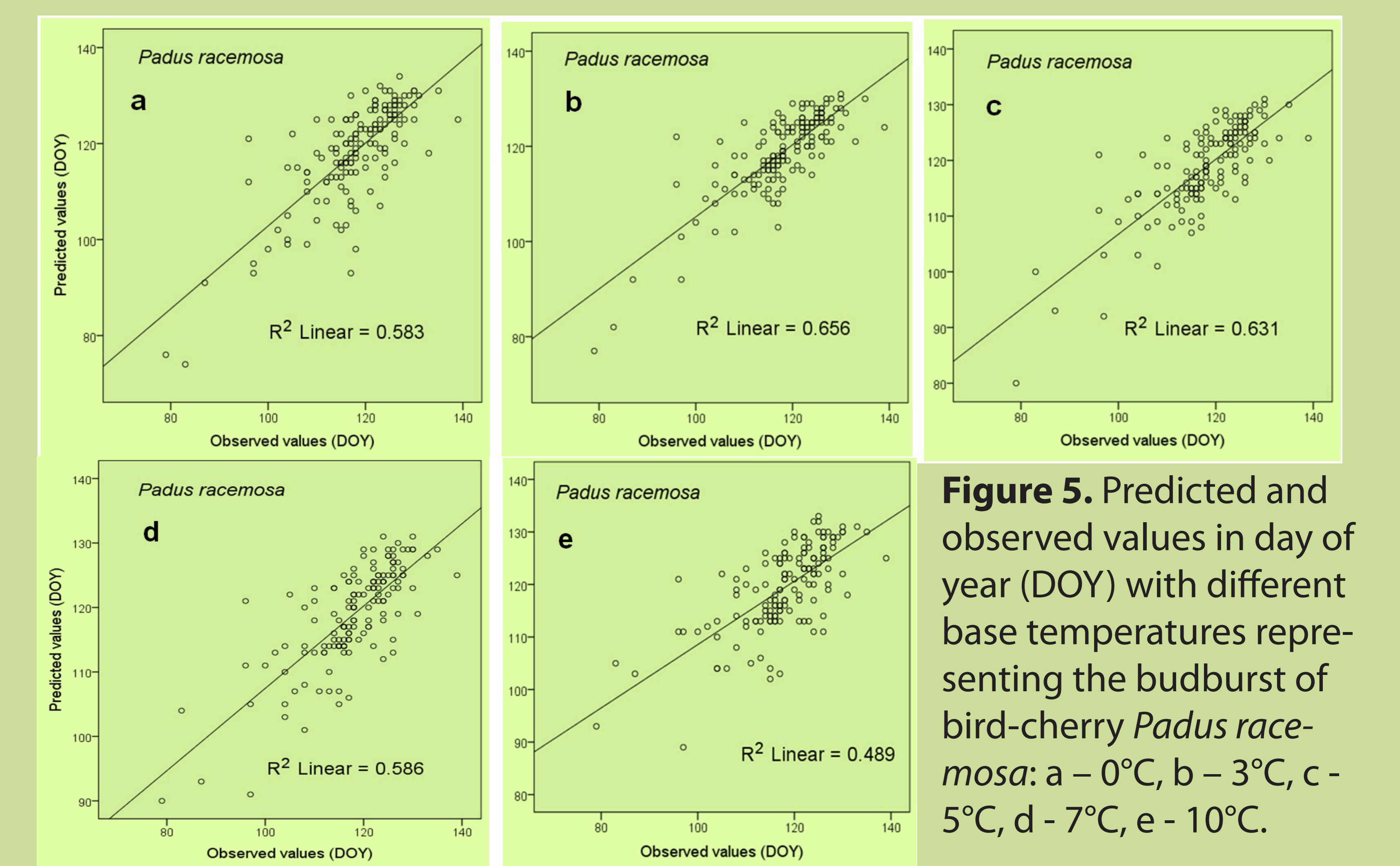


Figure 5. Predicted and observed values in day of year (DOY) with different base temperatures representing the budburst of bird-cherry *Padus racemosa*: a – 0°C, b – 3°C, c – 5°C, d – 7°C, e – 10°C.