A new part of the “DVRZ Flora” – “Flowering Monitor” – is available since March 2016.

General description

Many people guess that the plant life depends mostly on weather. Summarizing many years of observations, we may make the following suggestions:

1. The dates of blooming (as well as the rest of phenological events) mostly depend on the history of air temperatures during the past part of the year. The influence of earlier weather conditions (last year) is neglected. The ability of plants to forecast the weather is disclaimed – they can only know about the past, but not about the future.

2. Mean daily temperature has been selected as a main criterion for weather influence in the plants. The observations from central Kyiv weather station are used. We particularly acknowledge the “Climate Monitor” site (http://www.pogodaiklimat.ru/monitor.php?id=33345) for demonstrative, convenient and reliable listing of this information. Even though these temperatures are only related to the specific microclimate conditions, usually the difference between the temperatures in different parts of the city and its vicinities keeps a stable and predictable value, so the errors are automatically compensated.

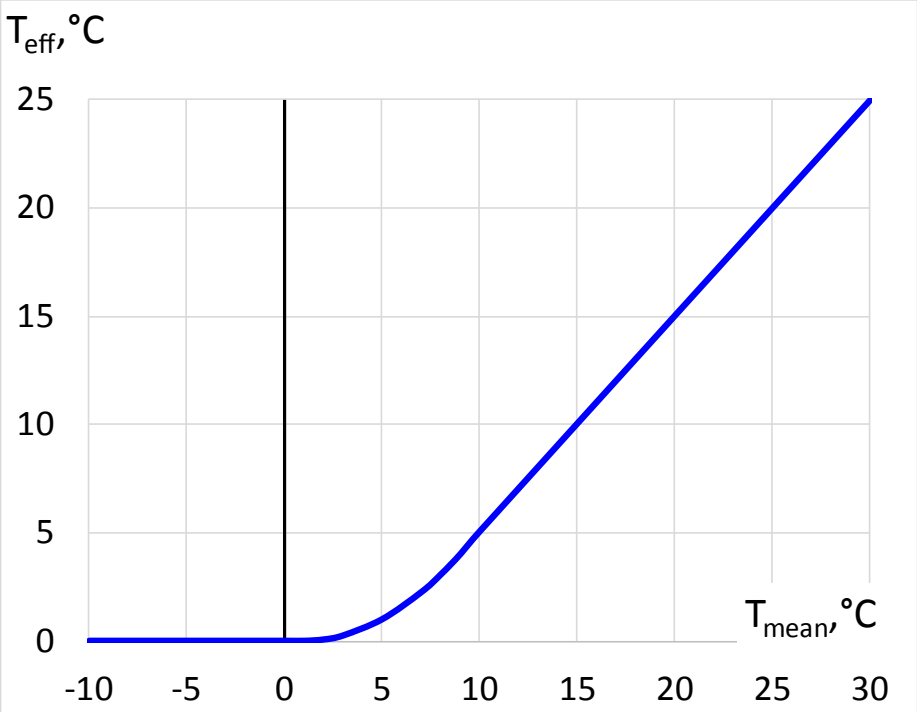
3. It is thought that from the beginning of the year (arbitrarily – 1st of January) the life processes in the plants move only in one direction – forward. Each warm day brings the blooming of a given species closer. However, for some species, even a few days with slightly positive temperatures are enough, and they bloom as early as February-March. The others need long and intensive warmth, and it is useless to wait their blooming until summer. Negative and close-to-zero temperatures make the event neither closer nor further – it is thought that the life processes just stop in the current position.

4. Positive mean daily temperatures (T_{mean}) are recalculated into the effective (T_{eff}) using a smooth mathematical function:

$$T_{\text{eff}} = 0, \text{ if } T_{\text{mean}} < 1;$$

$$T_{\text{eff}} = \frac{\left(T_{\text{mean}} - 1\right)^2}{16}, \text{ if } 1 \le T_{\text{mean}} < 9;$$

$$T_{\text{eff}} = T_{\text{mean}} - 5, \text{ if } T_{\text{mean}} \ge 9.$$



To avoid overestimation of the ability of plants to respond to the warmth in January, when they have not spent enough time in conditions of winter hibernation, the function is multiplied by a coefficient, growing linearly from 0 at the beginning of the year to 1 (31st of January):

$$T_{\text{eff (January)}} = T_{\text{eff}} \cdot \frac{\text{day\_of\_January}}{31}$$

Then these effective temperatures are summed up, and this sum is considered definitive if the given phenological event has occurred. A possibility of different sequence of the events in different years is neglected, due to lack of both observations and theoretical justifications. Therefore, we think that the folk proverbs like "If the leaves on an oak tree grow before the ash tree – the summer will be dry…" or otherwise – are not valid, for two reasons: 1) We do not recognize the ability of the plants to predict future – they only sum up the past; 2) The sequence of the events is believed to be fixed.

Analogously, the sayings like "Bird cherries in blossom bring cold weather / morning frosts" are also rejected. Actually, any plant has higher probability to bloom in warm weather; however, due to unstable spring weather, after a few days of warm change there often comes a cold change (but sometimes it does not…). And of course, there are no special weather-predicting properties in bird cherries.

5. No attempt has been made to account for other weather conditions – precipitation, clear or overcast sky, and wind. First, in the cool climate of Kyiv the key factor for the spring events is the temperature. Second, the cultivated plants are often watered in the case of drought, so the influence of precipitation is mitigated. Third, usually if the spring and the early summer are dry, they are also abnormally hot as well. So, it is difficult to distinguish what part of the acceleration in the events compared to the average dates is due to the warmth, and what is due to the drought. We can just speculate that the plants would hurry to bloom if there is not enough moisture, not being able to grow the usual amount of leaves and shoots – to bring at least some offspring until the complete drying. The total crop will be low in such a case, though early.

6. For the plants blooming in the second half of summer or in autumn, instead of the sum of effective temperatures, we chose another factor – the day length. It is too long days in June-July that do not allow these plants to bloom earlier, so they can only grow the vegetative biomass. In subtropical latitudes, these plants could bloom much earlier. The day length is strictly defined by the calendar date and the geographical latitude, not depending on the weather. Thus, in any year the blooming dates of such "short-day" plants are expected to be approximately the same.

Observing the surrounding plants over many years, it is possible to accumulate some experience – which exemplar blooms first. Usually it is related to the cultivar features, or to the abnormally warm microclimate – like closeness to a house wall that is heated in the spring sun, or to underground central heating lines. To follow the large number of species, this experience is very valuable – you should clearly predict what and when to observe. Currently, there are 387 lines in the "Flowering Monitor" for the plants depending on the sum of effective temperatures, and 14 additional lines for those depending on the day length. In some cases, the same plant is repeated – to emphasize the role of microclimate. For example, apricots start to bloom from the braches touching the warm southern walls of the houses; however, it cannot be considered a real full blooming, because the other branches of the same tree still stay empty for long time. Only after 1-2 weeks, the complete widespread blooming happens, including the trees standing far from the houses. And in the forest, where the houses and the asphalt are absent, and the snow or ice cover of the soil and lakes keeps much longer, apricots begin to bloom even later.

So far, the dates of blooming of the first exemplars of the most abundant species in Kyiv have been fixed quite accurately. Unfortunately, not all the observations can be praised for such reliability. Thus, if you notice some plant blooming much earlier than the calculated date, we kindly ask you to notify us at site@lisky.org.ua with a message. It is desirable to prove your observation with a photo. We would be very grateful for your contribution into the project.

In particular, there is no information in the "Flowering Monitor" for the blooming dates of the following plants:

Plant	Probable dates of blooming
Arum, bog	June-July
Burnet, great	June-July
Burnet Saxifrage	June-July
Cattail; Bulrush	?
Chinese lantern	June-July
Cocklebur	June-July
Couch grass	May-June
Duckweed	?
Gumweed, curlycup	June-July
Hellebore, false	June-July
Hemlock	May-June
Hemp, wild	June-July
Hibiscus	June-July
Lifeforever; Hen-and-chicks	?
Marigold, pot	June-July
Mistletoe	?

Nightshade, bittersweet (woody)	June-July
Orach; Lambsquarters	June-July
Purslane	May-June
Summer Cypress	June-July
Virginia creeper	May-June
Wall-rocket, perennial	June-July
Wintergreen, common	June-July
Wormwood	June-July

What if some reader could help to fill these gaps?

Archive of the past years

Since 2017, there is a new feature in "Flowering Monitor" offers a possibility to look through the blooming dates of the plants in the past years (2001-2016, which refers to the range of data in "Climate monitor").

It should be noted that all these dates are not actual observations, but are calculated according to the weather archives.

Moreover, we cannot guarantee that all the plants did really grow and bloom in Kyiv in those years. It is known that not all the species listed in the "Flowering Monitor" are indigenous members of the Kyiv flora; some of them have been introduced intentionally or accidentally only in recent years. So, the dates given are hypothetical – "When the plant would bloom if it grew in Kyiv in that year".

Calculations for the locations other than Kyiv

Without a doubt, it is very tempting to use the described method of calculation of the blooming dates not only for Kyiv, but also for any other geographical locations where the data on the weather are available from "Climate monitor".

However, it is clear that some new problems arise in this case:

1. If a city's climate differs significantly from Kyiv, the calculation method may stop working. It is meaningless to use it for warm subtropical and tropical climate, where no winter exists (as a time when the temperature is mostly below at least +5°C), so it is impossible to select a starting point from which the effective temperatures are summed up. Moreover, the sensitivity of the plants to warmth differs regarding if they have been affected by a given number of days with low temperature, or not. For example, we know that even strong warm anomalies in November usually cannot force any plant to bloom. The same behaviour is expected in the subtropics – despite the quite warm winter, the plants will not hurry to bloom.

If the climate is much colder than in Kyiv, our model's forecast is not reliable as well. This especially relates to the plants blooming in Kyiv lately – from June. In cold subarctic climate, it may happen that the required sum of effective temperatures will not accumulate even until autumn – i.e. the model says these plants cannot bloom at all. The reality may be different – in the northern climate, the plants could have adapted to use scarce warmth and to bloom at lower sum of effective temperatures, guided by the day length that is going shorter.

Unfortunately, it is not yet clear how to describe these factors mathematically. The situation is complicated by the absence of observation data available to us from either subtropics or northern regions.

2. Surely, the set of the plants at other geographical locations cannot coincide with Kyiv. The more different is the climate and the further is the location from Kyiv, the more differences in flora are expected. Many plants of Kyiv cannot grow in some locations at all, since the climate there is too cold, or hot, or dry, etc. On the other hand, some new plants appear when we move away from Kyiv, and we have no data on their behaviour in “Flowering Monitor”.

Again, the calculated dates are hypothetical – “When the plant would bloom if it grew in the given location”.