EX SITU PHENOLOGICAL EXAMINATIONS OF WILD PLANT SPECIES, AND COMPARING THE RESULTS WITH NATIONAL AND INTERNATIONAL STUDIES

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ACTUALITY AND IMPORTANCE OF THE RESEARCH

- Global climate change, global warming
- Climate change significantly affects the life cycle of plants, phenology is a good indicator of global warming
- There is less available phenological data on wild-growing plants, especially long-term data which suits international standards
- Urban heat island as a model and forecast for possible future climate change
- Results may help adapting to climate change

LITERATURE BACKGROUND OF THE STUDY

- Long term monitoring of flowering phenology of **geophites** in the ELTE Botanical Garden by Szaniszló **Priszter** (1960-2000)
- Non-systematic phenological obsevations of cultivated and wild-growing plant species organized by the **Hungarian Meteorological Service** (1951-2000)
- Walkowsky: long term data of flowering phenology of *Robinia pseudoacacia (1998)*
- **Primack** (1985) described the **methodology** of collecting flowering phenology data.
- Differences and trends of spring phenophases in **urban and rural areas** in central Europa – Roetzer et. al (2000)
- Phenological patterns of flowering across biogeographical **regions of Europe** - *Templ et. al (2017)*

PLAN OF RESEARCH

- Plants representing **six different life forms**
- **Two locations with different mesoclimate:** Budapest, ELTE Botanical Garden (Füvészkert), MATE Botanical Garden of Gödöllő.
- **Observation of phenological patterns during 3 growing seasons (2020-2021-2022)** with weekly recording of data
- **Meteorological equipment** for exact local data (installation in November 2020)

AIM OF STUDY AND HYPOTHESIS

- How excess heat in **urban** environments affects the **phenological patterns** of species belonging to different life forms, and **how different the effect** is in colder **rural** mesoclimactic environments?
- We hypothesized that locations with higher mean temperatures would result (i) in an **earlier onset** and (ii) and an **earlier end of flowering**, compared to colder locations.

MATERIAL AND METHODS

- **6 different life-forms** of the **Raunkiær system** (phanerophytes, chamaephytes, hemicryptophytes, geophytes, hemitherophytes, therophytes) – 5 species in each life form – 5 repetitions in each locations
- **Standard**-sized flowerpots, standard soil mix, maximized **genetic conformity** in each species, standard irrigation protocol
- **2 locations – Budapest, Gödöllő**

MATERIAL AND METHODS

Ph	**Ch**	**He**
Cornus sanguinea	*Dianthus plumarius*	*Euphorbia polychroma*
Prunus spinosa	*Sedum album*	*Ajuga reptans*
Ligustrum vulgare	*Vinca minor*	*Inula ensifolia*
Prunus fruticosa	*Thymus vulgaris*	*Sedum acre*
Cotinus coggygria	*Cerastium tomentosum*	*Briza media*
Prunus tenella	*Globularia cordiflora*	
Rosa spinosissima		
Ge	**HT**	**Th**
Iris pumila	*Daucus carota* **	*Hibiscus trionum*
Polygonatum multiflorum	*Dipsacus pilosus* **	*Solanum nigrum*
Convallaria majalis	*Dipsacus laciniatus* **	*Silene latifolia*
Galanthus nivalis *	*Capsella bursa-pastoris*	*Portulaca oleracea*
Eranthis hyemalis *	*Malva sylvestris* **	*Consolida regalis*
		Papaver rhoeas

MATERIAL AND METHODS

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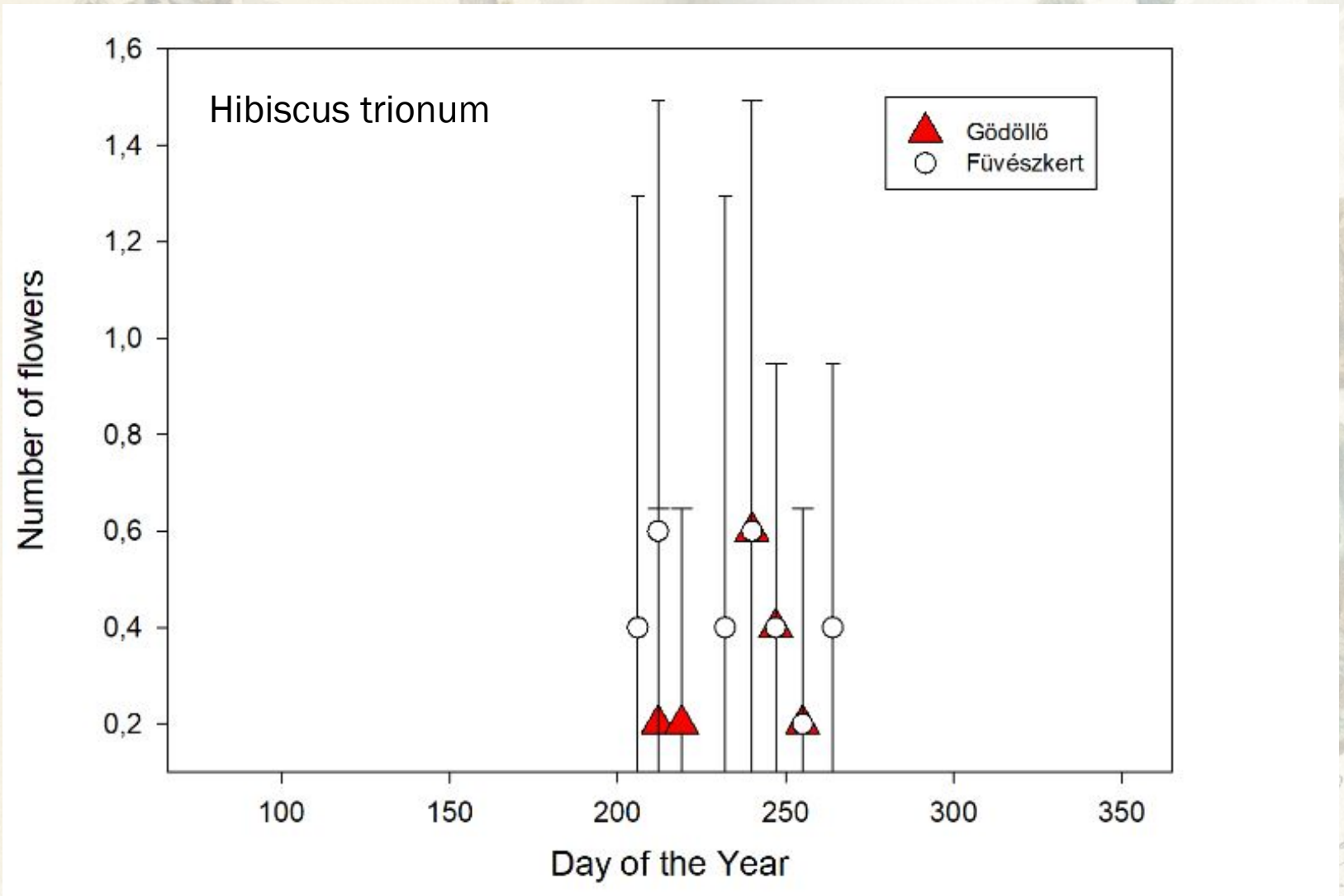
- **Reconding frequency:** once a week on the same day on both locations by phenological data, every 5 minutes by meteorological data
- **Recorded phenological data:** appearance of seedlings by therophytes, appearance of leaves by geophytes, budburst, leaf out, beginning, maximum and end of flowering (Primack's method), fruit ripening, percentage of leaf coloration, percentage of leaf fall
- **Recorded meteorological data:** amount of precipitation, wind direction and wind speed, air temperature, relative humidity of the air, barometric pressure, global radiation

PRELIMINARY RESULTS

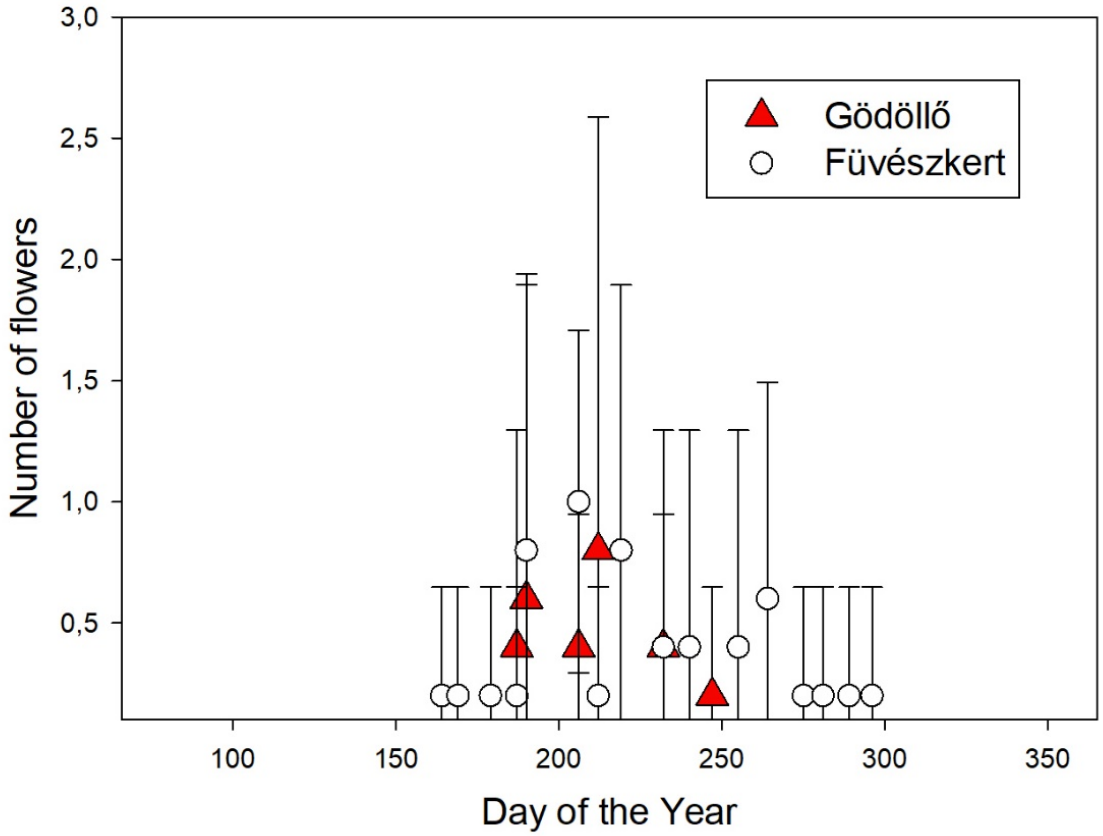
- **Earlier flowering in Budapest:** the average difference in the onset of flowering was 10.66 days. The peak of the flowering showed 12.94 days of difference, the end of flowering showed 2.9 days of difference. According to our expectations. ☺
- Strong significant difference ($P < 0.001$) in the onset of the flowering of *Globularia cordifolia* between the locations and **peaks of flowering there was a strong significance** ($P < 0.001$) for *Inula ensifolia* medium significance ($P < 0.01$) **end of flowering there is a strong significance** ($P < 0.001$) *for Polygonatum multiflorum*

PRELIMINARY RESULTS



PRELIMINARY RESULTS

Silene latifolia subsp. alba



PRELIMINARY RESULTS

DISCUSSION

- Roetzer et. al. (2000) showed, that in European cities with strong urban climate effects e.g., Munich, Vienna and Hamburg, phenophases are beginning 3–16 days earlier. His results are in agreement with our results.
- To clarify the driving forces of flowering phenology patterns we installed micrometeorological equipment to continuously measure abiotic parameters on both locations.

CONCLUSION

- The experiment confirmed our hypotheses. ☺
- As a result of increasing temperature, we can count on earlier onset and end of flowering.
- Excess heat in urban environments can serve as model of ongoing and upcoming global warming.

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SZENT ISTVÁN EGYETEM
GÖDÖLLŐI BOTANIKUS KERT

- ELTE Botanical Garden, Füvészkert

FÜVÉSZKERT
1771
Eötvös Loránd Tudományegyetem
BOTANICAL GARDEN

- Beretvás Kertészet Ltd.

BERETVÁS KERTÉSZET

- ÚNKP Scholarship

Új Nemzeti Kiválóság Program

NEMZETI KUTATÁSI, FEJLESZTÉSI ÉS INNOVÁCIÓS HIVATAL

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1891 év.

Magyar hegység.

Német hegység

1892 év.

Felső hegység. (Német)

Alsóhegység. (Magyar)

Thank you for your attention!