Reconstructing parallel clines in flowering phenology using herbarium specimens of *Lythrum salicaria*

Yihan Wu and Robert I. Colautti
I look at the teeth of different dead animals to figure out how they shared food while living at the same time and place.

(Reeeally wish #mammals, #carnivores, or even meat-eating were on that list!)

#CSEETweetShop

Cylita Guy @CylitaGuy · 1h

Replied to @KirstenGrant3

Nice summary!

Loving these common word research summaries from the #CSEETweetShop!
I find photographs of plants from the past,
measure how long their sex parts are,
and when their sex parts open
and close over the years.
Global Biodiversity Information Facility

~ 75 million preserved specimens records
Montague et al. 2008

Glasshouse

Days to first flower

Latitude (°N)

200 km

Montague et al. 2008
1) Parallel clines across North America
2) Phenological shifts over time
1978-07-08
Illinois, Lake County,
T_46N R_9E S_28
The graph illustrates the change in the variable $phind$ over time. The equation is given by:

$$\text{phind} = \frac{0.5 \times \text{flowers} + 1 \times \text{fruits}}{\text{total inflorescence}}$$
Sept 6, 2008

Kentucky

Wisconsin
Wallace Lake, Wisconsin

July 18, 1988

Oct 10, 1988
Growing-Degree-Days

\[ GDD = \frac{T_{\text{max}} + T_{\text{min}}}{2} - T_{\text{base}} \]
62,208 annual weather records
6,303 unique weather stations
$\sum_{i=1}^{n} \frac{GDD_i}{d_i}$

3,427 herbarium specimens
6,303 unique weather stations

$GDD = \frac{\sum_{i=1}^{n} \frac{GDD_i}{d_i}}{\sum_{i}^{n} \frac{1}{d_i}}$
Parallel clines across North America
2) Phenological shifts over time

Growing-Degree-Days

$phind$
phind \sim \frac{1}{1 + \left(\frac{GDDc}{f}\right)^{-r}}

Variables in \( f \) and \( r \):
- Time since invasion
- Season Length

Non-linear least squares model
The graphs illustrate the relationship between cumulative growing-degree-days (GDDc) and a hypothetical variable, phind, across different growing seasons. The x-axis represents cumulative growing-degree-days, while the y-axis shows the value of phind.

- **Short Growing Season**: Shows the least GDDc but the highest phind value compared to the other two seasons.
- **Median Growing Season**: Displays a moderate level of GDDc and a mid-range phind value.
- **Long Growing Season**: Exhibits the highest level of GDDc but the lowest phind value.

Legend:
- **Population Age**
  - **New**
  - **Intermediate**
  - **Old**

Each season is represented by different line styles and colors in the graphs.
• Replicated clines in phenology across North America
• Phenological clines have strengthened over time
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VASCAN
SEINET

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Questions?

Colautti and Eckert Lab members
Dr. Stephen Lougheed
Dr. Vicki Friesen

Image Sources:
Flickr
Noun Project
Flowering time index

\[ fti \sim phind + Ratio_{GDDc} \]