

Laying a cornerstone for cup plant breeding - agriculturally evaluation of native *Silphium* populations

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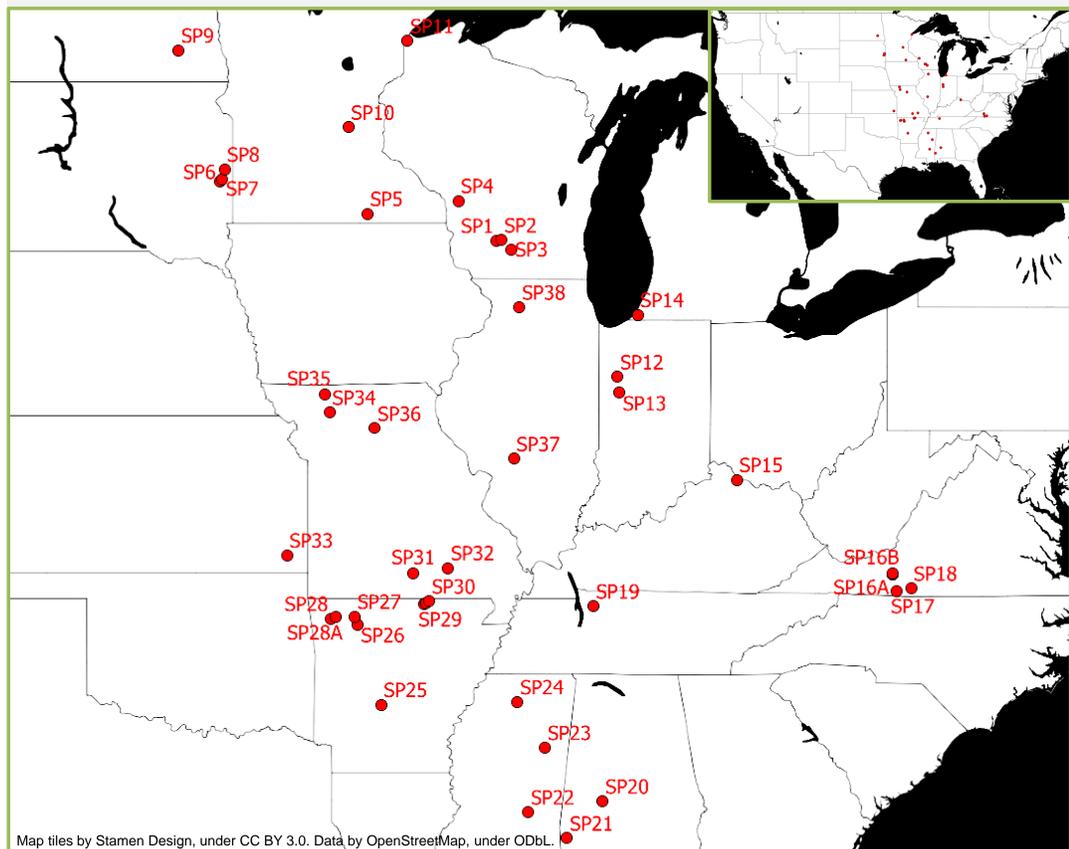
Bombus terrestris on *Silphium perfoliatum* flower taking up nectar and pollen.

Introduction

Today the demand for plant biomass is mainly covered by maize. This leads to massive monocultures and decreasing crop diversity of our landscapes. To solve these well-known problems we have to substitute parts of the silage maize by others or new crops respectively. The cup plant (*Silphium perfoliatum* L.) is like sunflower a member of the *Asteraceae* and promising to keep up with the biomass yields of maize for biogas and forage production. *Silphium* is a perennial plant, which is native to the US, with a deep going root architecture, thus more resistant to climate change and the wild plant offers a broad range of ecological benefits like a bee-friendly long flowering period. Due to low variations and small genetic distances within the available genotypes in Europe almost no breeding attempts have been successful until today.

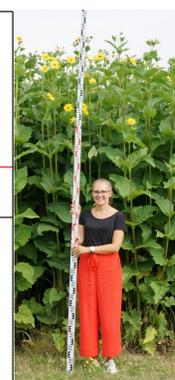
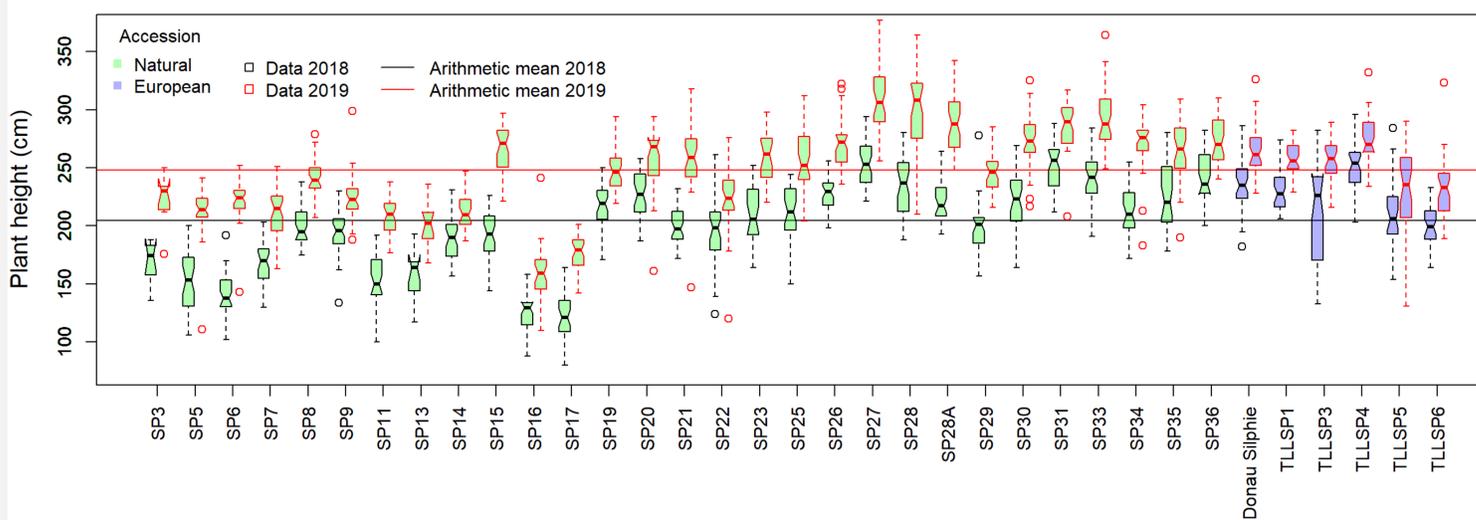
Silphium perfoliatum hunting trip (USA)

- Aims to increase the available diversity of *Silphium* for plant breeding
- Use of herbarium data to locate *Silphium* populations
- Unique collection of about 40 populations
- Discover new agriculturally interesting traits (e.g. flowering time, cuplessness)
- Establish the worldwide largest field trial of different *Silphium* accessions



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Locations of collected natural *Silphium perfoliatum* populations (SP1 – SP38), covering the borders of the native distribution area in North America.

First results



Left: Boxplots (n=36) of plant height subset of the second and third vegetation period (2018, 2019) as a function of *Silphium* accessions. The black boxplots display data of 2018 and the red ones of 2019. The green filled boxplots indicate natural accessions, the blue ones European accessions. The horizontal black line across the graphic shows the arithmetic mean of all data of 2018, the red line displays the same for the data of 2019. Plant heights were measured as above ground plant parts till the first flower stalk. All plants were established in a field trial (plot-design) with three replications at Campus Klein-Altendorf, near Bonn, Germany. Right: Measuring plant height in front of *Silphium* crop.

- Plant height of all accessions increases significantly from the vegetation period 2018 (black) to 2019 (red)
- Natural accessions (green) show gapless significant differences over the whole value range in both years
- European accessions (blue) are located at the level of the overall arithmetic mean in both years



Silphium inflorescences.

Outlook

- Field trial observation for the rest of the establishment phase
- Evaluating other agricultural interesting parameters (phenotype, chemical composition, etc.)
- Creation of *Silphium*-specific parameters like a Cup-Index
- Selection of the best individuals out of the populations