Stamen loss as a developmental mechanism for accelerated flowering in *Arabidopsis thaliana*

Scarlett Dellacona*[1,2], Natalie Dresdner[1,3], Jimmy Bingman[1], Jeff Conner[1]

*scarlett.dellacona@gmail.com | [1]W.K. Kellogg Biological Station, Michigan State University

[2]University of Manchester, [3]Oberlin College

Introduction

- Trait loss is common across evolution
- The Brassicaceae family is specified by four long stamens & two short stamens[1]
- Some *Arabidopsis thaliana* ecotypes exhibit short stamen loss at the individual flower to population level[2]
- Few studies have directly demonstrated cost of traits undergoing loss
- *A. thaliana*'s switch to self-pollination renders short stamen largely non-functional and subject to relaxed selection[2]

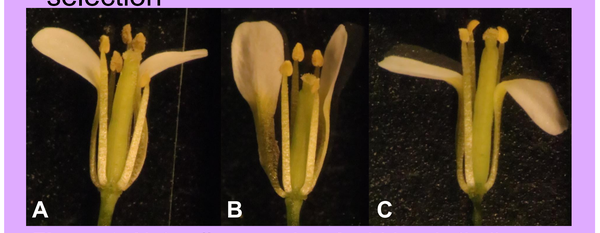

Figure 1. Naturally occurring *Arabidopsis thaliana* showing 2 (A), 1 (B), and 0 (C) short stamens. One long stamen has been removed.

Research Question

Is stamen loss a mechanism for accelerated flowering production?

Prediction: Stamen loss allows resource reallocation into accelerated flowering rate, resulting in increased fitness due to higher fruit count.

Methodology

- Recombinant inbred lines (RILs) were bred from a high stamen count and low stamen count parent
- 15 plants (with approximately 40 flowers per plant) were selected for short stamen variation
- Short stamen count was recorded non-invasively for each flower denoted by string (pink thread for 0 short stamen, grey for 1, blue for 2)

Natural Populations

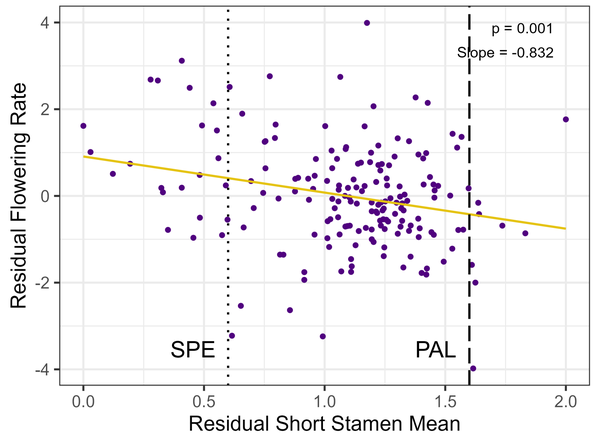

Figure 2. Residual flowering rate in response to residual plant short stamen mean by population. Residuals have been corrected for various life history traits. Dotted lines denote population means of RIL parents.

No Within-Flower Cost

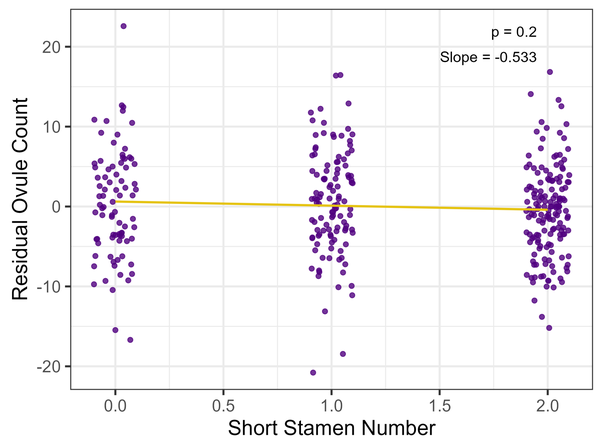

Figure 4. Stamen number and position of flower as a predictor of ovule count. Residual ovule count has been corrected for various life history traits.

Timelapse

- Flower opening date and time will be used to calculate the correlation between short stamen mean per day and the number of flowers opened per day
- A negative correlation would suggest less stamens on average allows for accelerated production of flowers and therefore fruits

Recombinant Inbred Lines

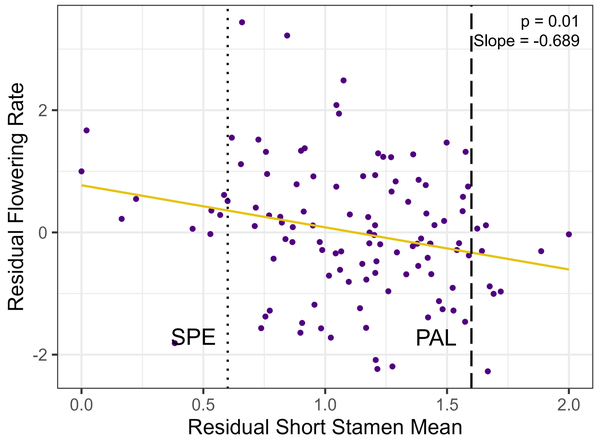

Figure 3. Residual flowering rate in response to residual plant short stamen mean. Residuals have been corrected for various life history traits.

Timelapse (cont.)

Figure 5. Timelapse setup of ten plants.

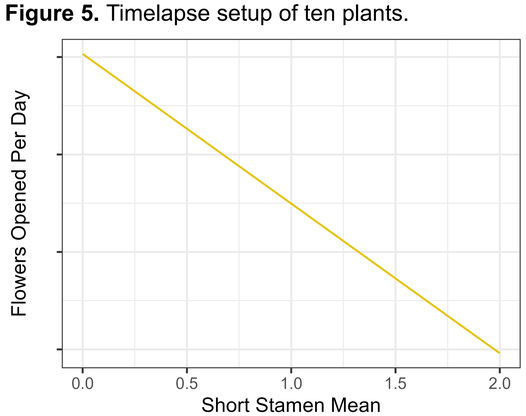

Figure 6. Expected results of timelapse analysis.

Discussion

Preliminary Results

- Both natural population and RIL analysis saw higher stamen number associated with slower flowering rate
- Weak stamen-ovule correlation (p=0.2) suggests minimal local reallocation of resources
- Initial timelapse analysis has shown that flowers tend to open between 6am-9am

Implications

- Confirmation that stamen loss accelerates flowering would shed light on adaptive trait reduction
- If supported, this would suggest resource reallocation favors fruit production over vestigial stamen function

Future Directions

- Seed count will be evaluated as a stronger fitness indicator than ovule count
- Further work would seek to understand why stamens are maintained at higher altitudes and latitudes

Acknowledgements

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References

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2. Royer, A.M., Kremer, C., George, K., Pérez, S.G., Schemske, D.W., Conner, J.K., 2016. Incomplete loss of a conserved trait: function, latitudinal cline, and genetic constraints. Evolution 70, 2853–2864. https://doi.org/10.1111/evo.13096