

The effect of phosphate deficiency on the relationship between host *Arabidopsis thaliana* and facultative root hemiparasite *Phtheirospermum japonicum*

GU YULIANG (筑波大学 生物学類) 指導教員: Louis Irving (筑波大学 生命環境系)

1. Introduction

Parasitic plants steal resources from a host plant, causing an increase in parasite mass at the expense of the host plant. In a previous study focusing on the effect of N supply on the alfalfa – *Phtheirospermum japonicum* (Pj) relationship, it was found that N supply to host suppressed parasitism (Irving et al. 2019). In this experiment, we aim to explore the effects of host and parasite P status on the parasitic relationship between a host (*Arabidopsis thaliana*) and the parasite (*P. japonicum*).

2. Material & Methods

Plants were grown in root boxes as shown in Fig. 1. Half the boxes had plastic straw bridges between the host-only and interaction sections, allowing host – parasite connection. Control boxes did not have this bridge. The boxes were filled with vermiculite. Nutrient supply to the host and the parasite could be controlled independently by feeding nutrients to the host-only and parasite only sections, respectively. After plant establishment, we provided + and -P Hoagland nutrient solutions to the host-only and parasite only sections in a full factorial design for four weeks. At harvest, each plant had the dry mass measured. In experiment two, we quantified parasite N and P status.

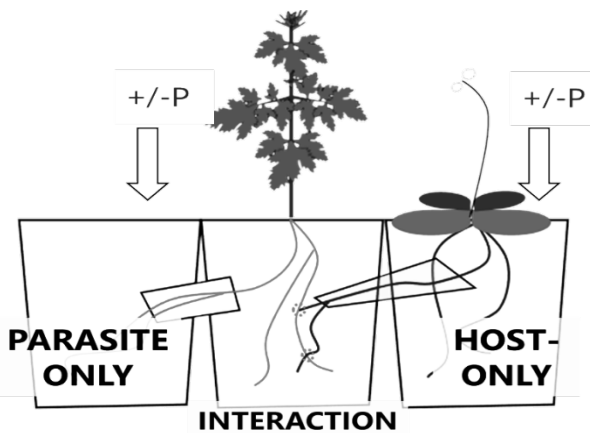


Fig.1. Split-root box design.

3. Results

3.1 Experiment one

Attachment caused an increase in Pj biomass in experiment one but did not affect host mass. -P parasites achieved much higher shoot mass than +P parasites.

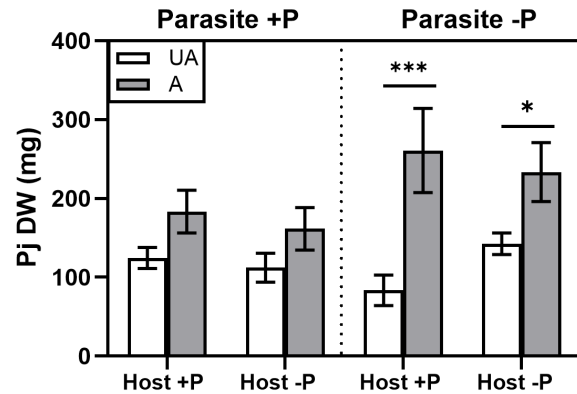


Fig.2. Biomass of *P. japonicum* at low and high phosphorus levels, in the presence and absence of *A. thaliana*.

3.2 Experiment two

Attachment caused a decrease in host mass, and an increase in P content, with the increase being larger in -P parasites.

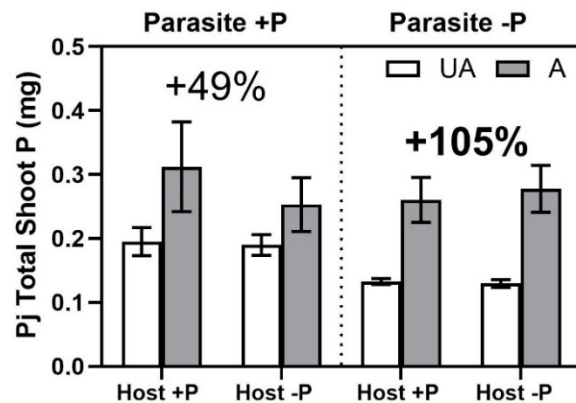


Fig.3. P content of *P. japonicum* at low and high phosphorus levels, in the presence and absence of *A. thaliana*.

4. Discussion

Our data suggests that -P parasites were more strongly parasitic than +P parasites, presumably due to resource abstraction. It is possible that the parasite had greater sink strength. Another possibility is that the -P parasites formed a greater number of haustorial connections, as found under -P conditions in *Rhinanthus minor* by Davies and Graves (2000)

In a future experiment, we would plant to use more replicates, or increase the treatment duration to decrease variability. Isotopic tracers may also be used to quantify host to parasite P flux.

References

- Irving LJ et al., 2019 *Env Exp Bot* **162** 125 – 132
- Davies and Graves, 2000 *Oecologia* **124**:100–106