Pollen transfer efficiency

as a function of pollen deposition and removal

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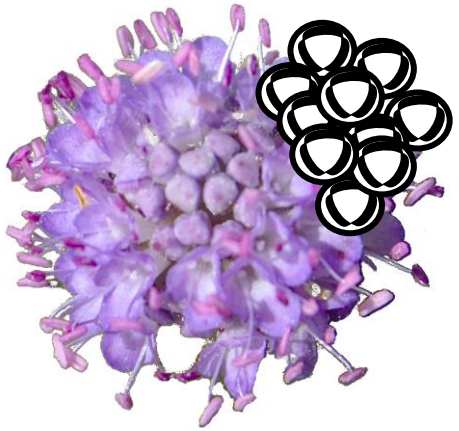
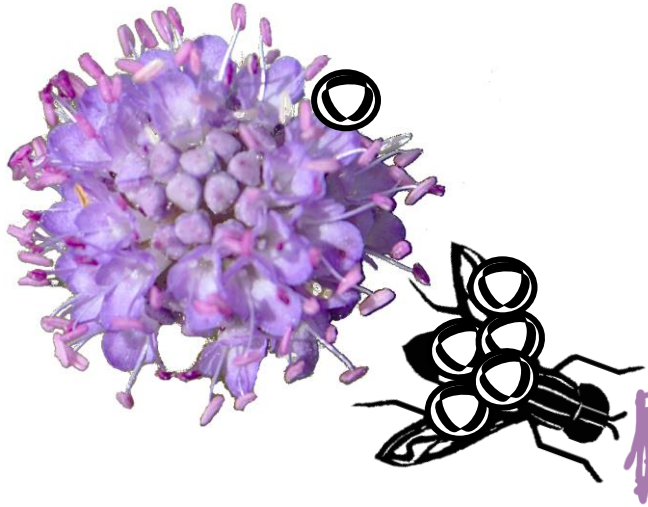
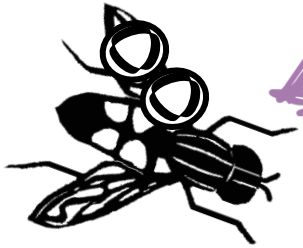
Pollen presentation



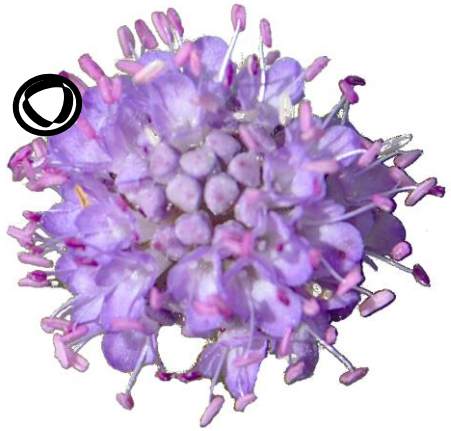
Pollen removal



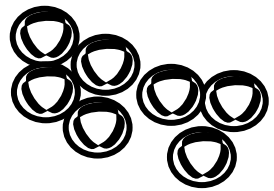
Pollen trasportation



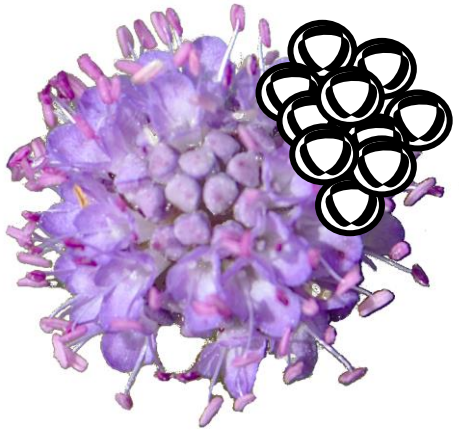
Pollen depotision



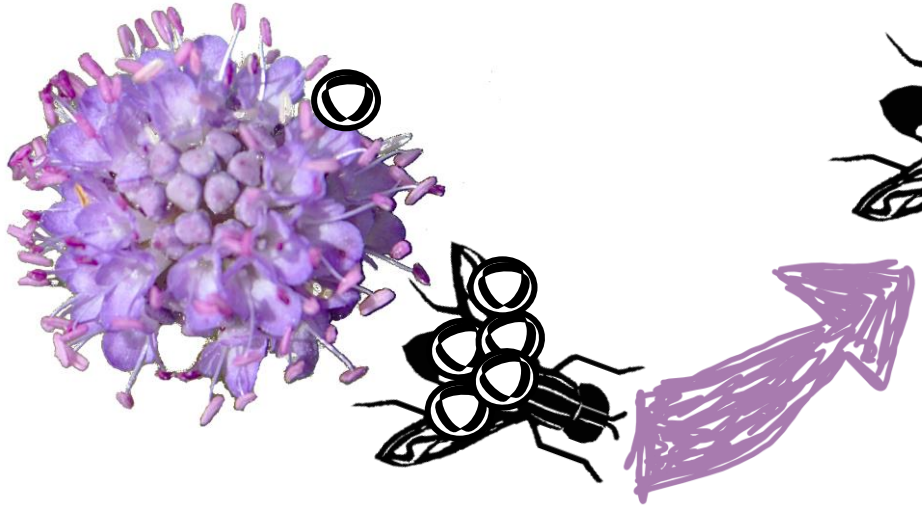
Nearly all pollen is lost !



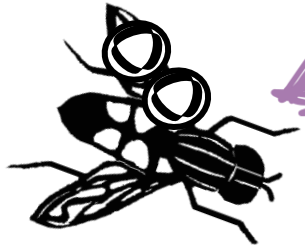
Pollen presentation



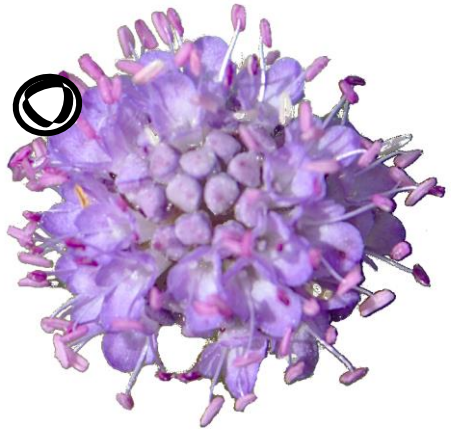
Pollen removal



Pollen trasportation



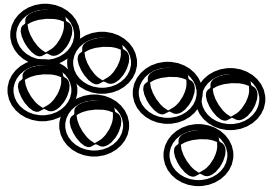
Pollen depotision



by eating

during transport

Nearly all pollen got lost



What we want to know

- How many pollen grains are present in every step of the pollination

  (ie. pollen removal, transport, deposition)

- How many pollen grains are lost inbetween these steps

- How are these pollen counts influenced by time and pollinators

How we want to find out

sampled data

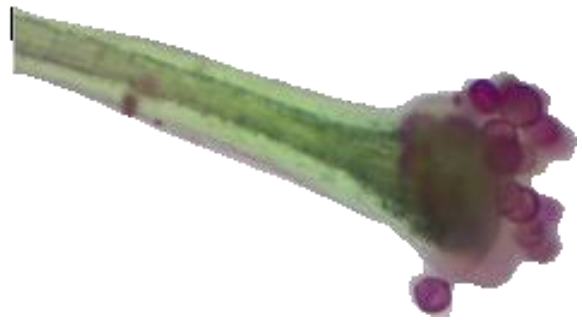
# of pollen grains presented

# of pollen remaining after <u>one visit</u>

# of pollen on pollinator‘s body

# of pollen grains deposited

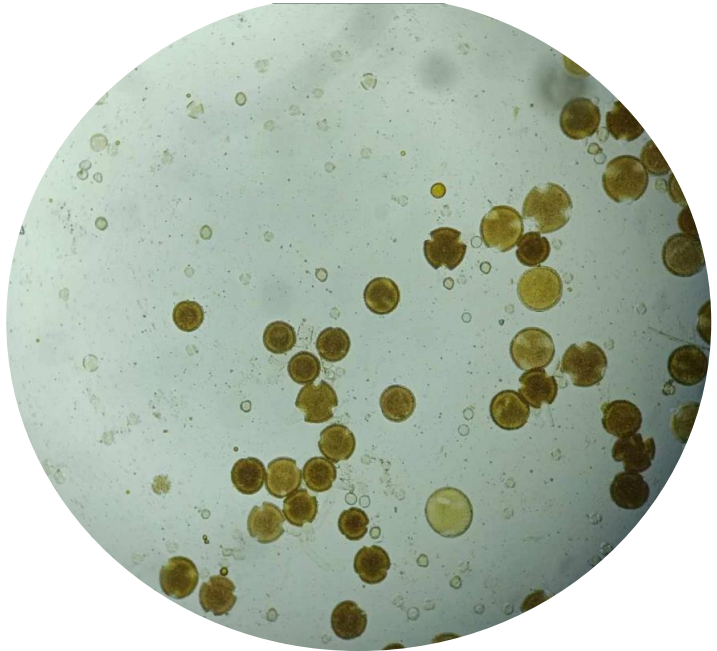
<u>Per visit</u> **<u>In total</u>**



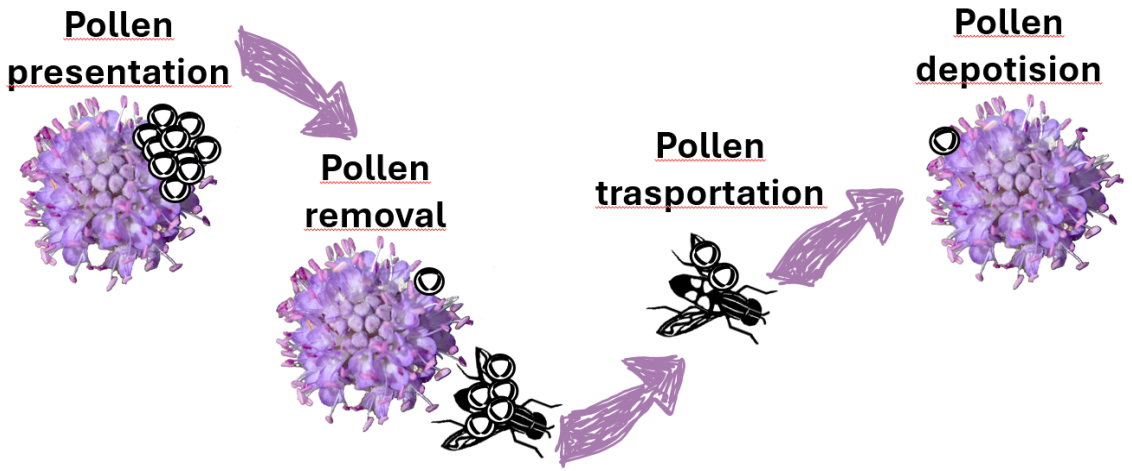
How we want to find out

sampled data – for losses

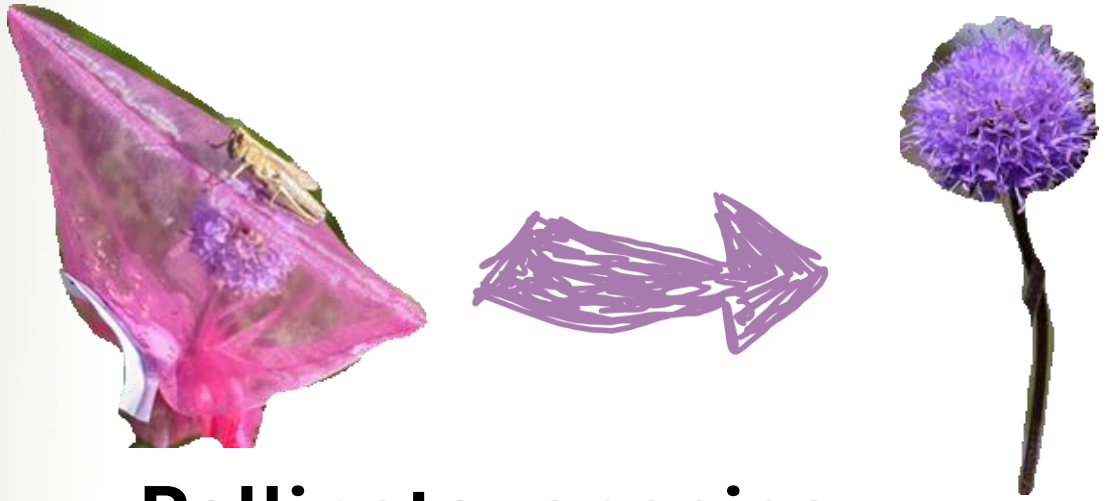
of pollen in pollinator‘s gut



Overall # of pollen missing inbetween steps

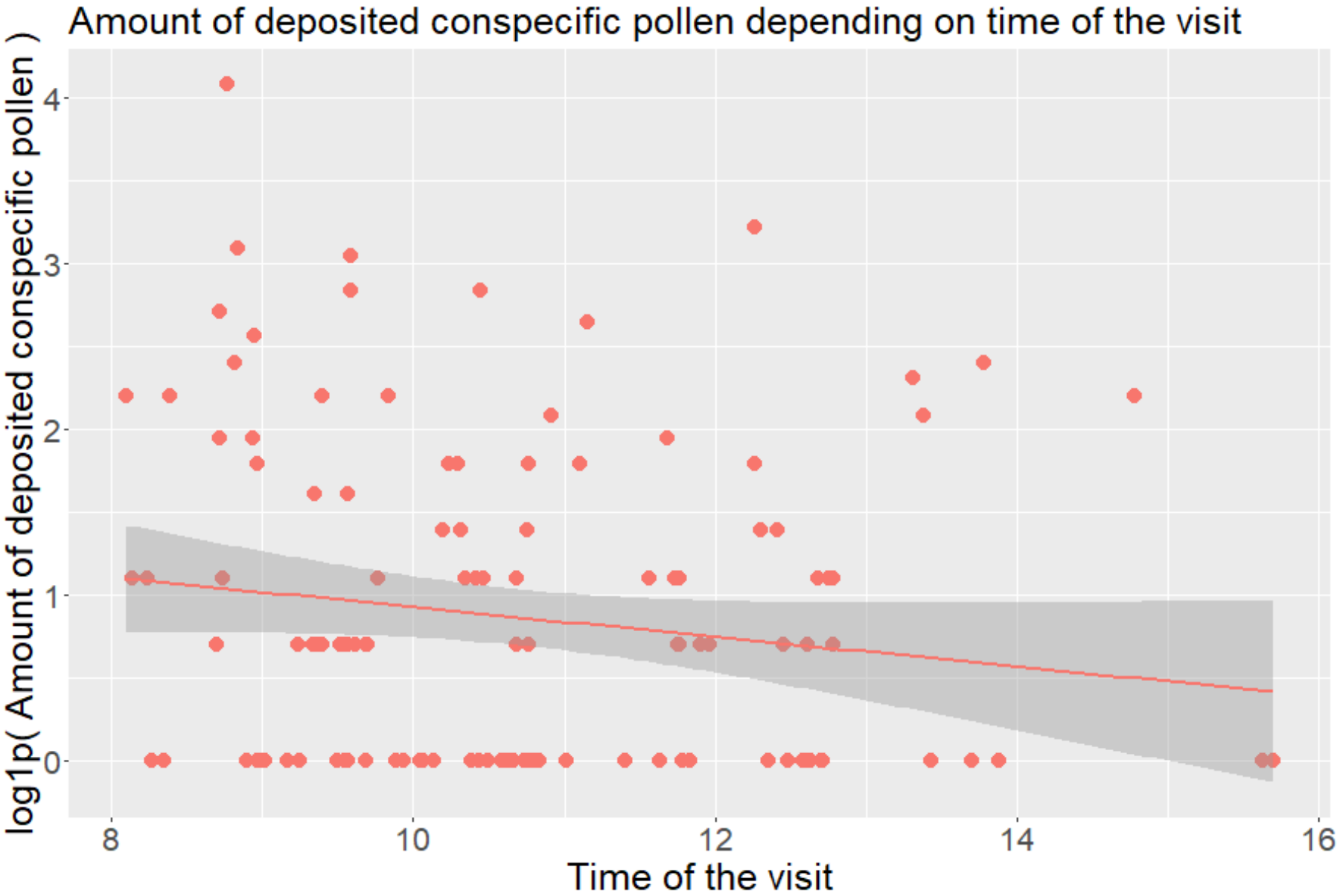


Deposition

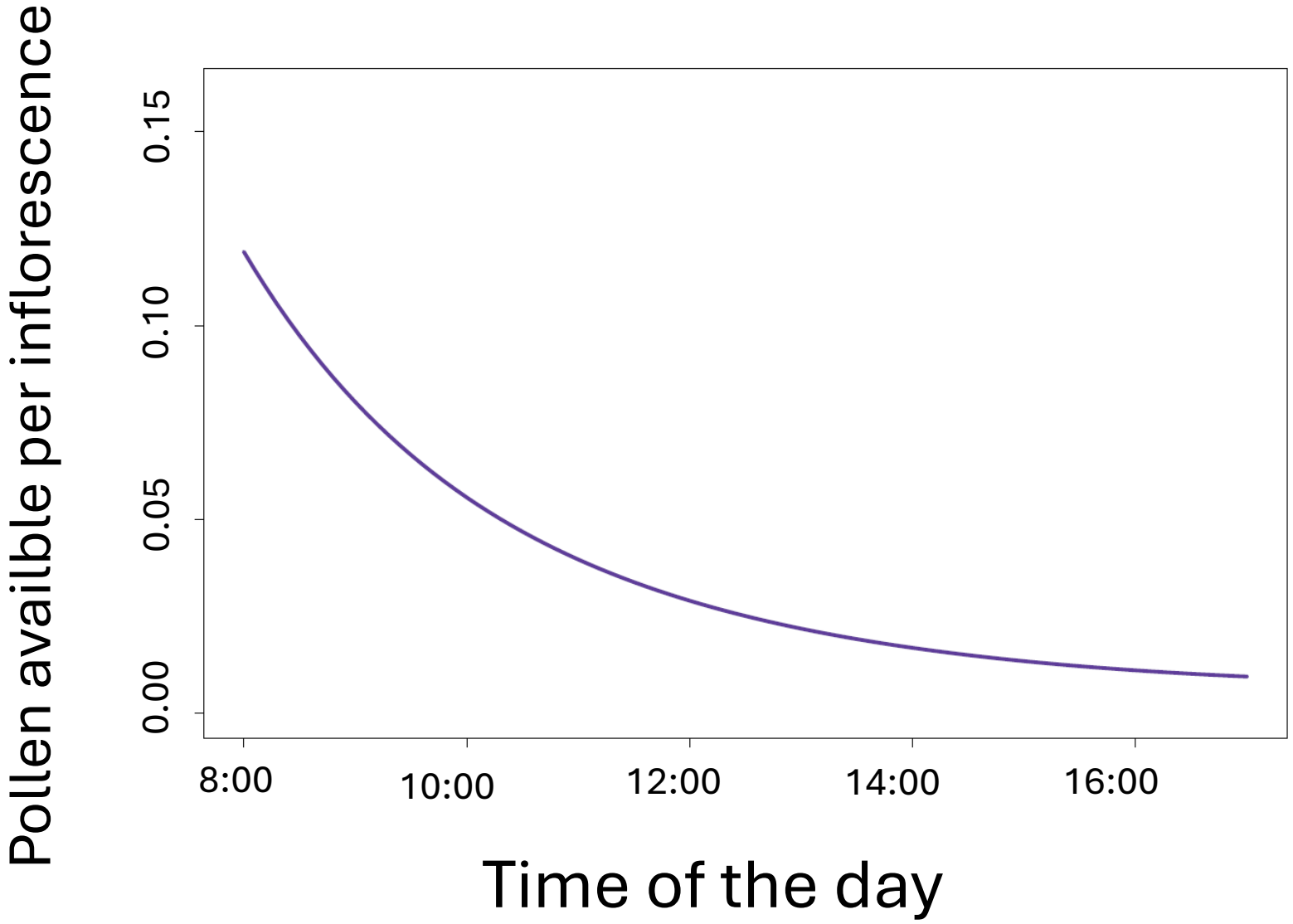


- Pollinator species
- Pollinator‘s sex
- Behaviour (pollen x nectar)
- Duration of a visit
- Time of a visit

Time matters: Deposited pollen

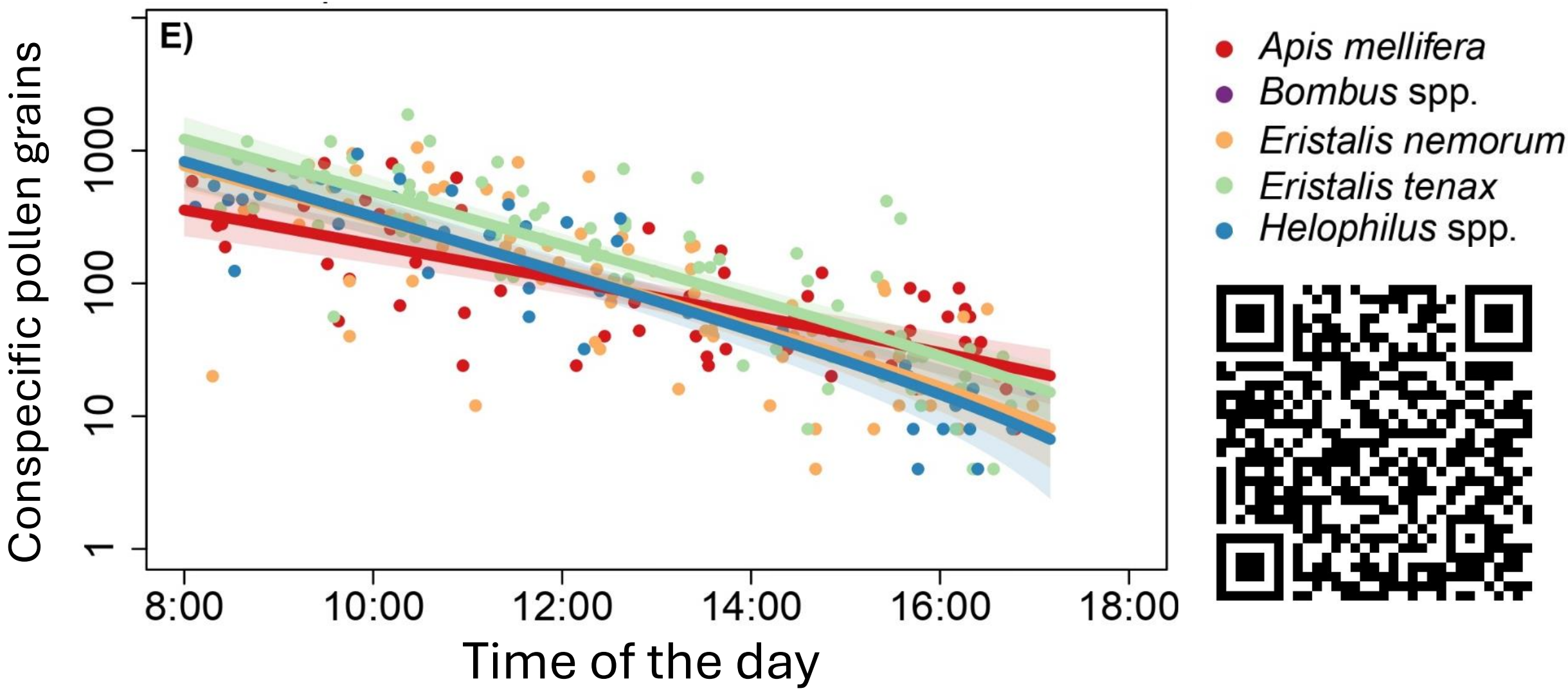


Diurnal pollen availability on flowers



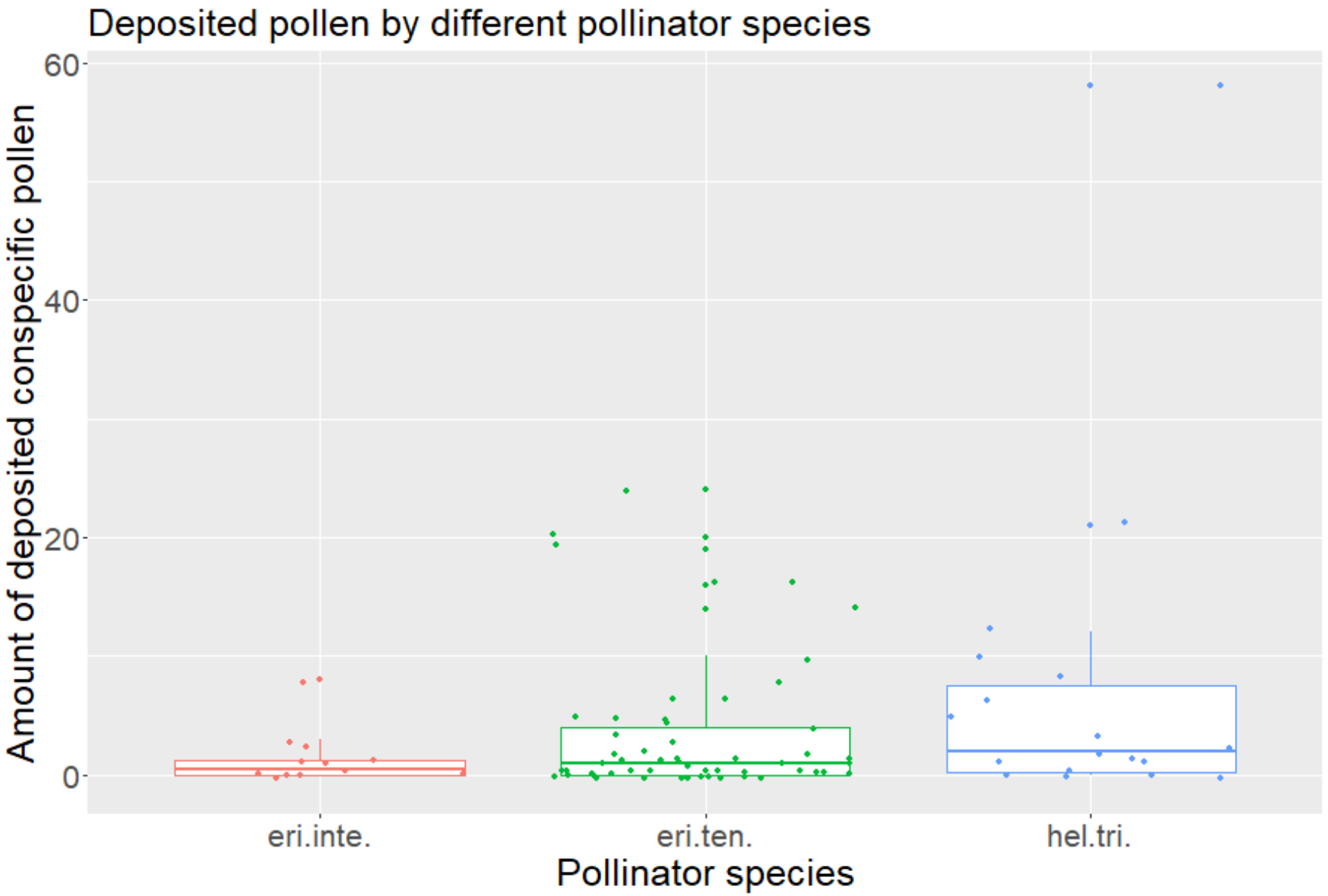
Štenc, J., L. Janošík, E. Matoušková, J. Hadrava, M. Mikát, and Z. Janovský. 2023. Pollinator visitation closely tracks diurnal patterns in pollen release. American Journal of Botany

Pollen grains on pollinator‘s body



Jakub Štenc, Martin Freudenfeld, et al.

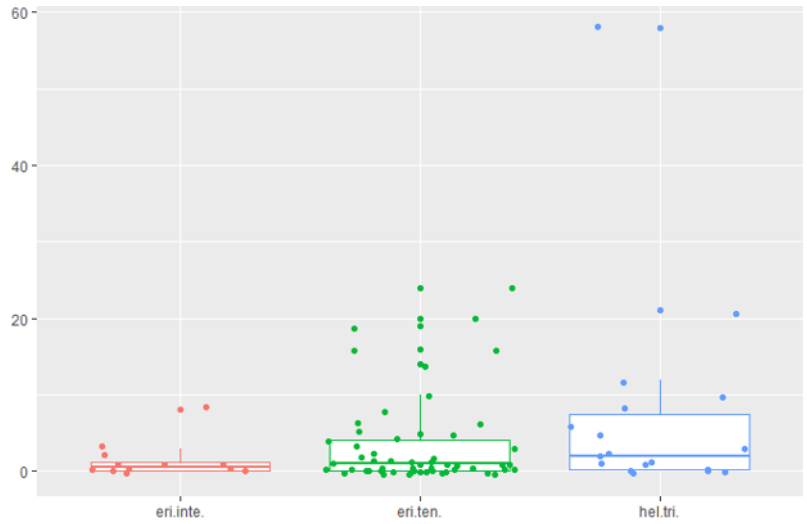
Pollinator species matters: but...



But deposition success rate depends on time

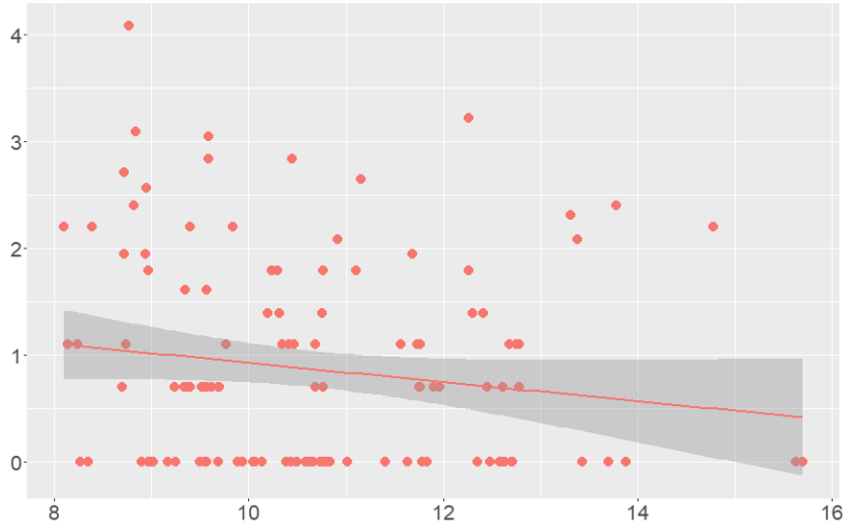
Quantity of deposited pollen from zero is determited by pollinators

Hurdle model	
Count model coefficients (truncated poisson with log link)	
	P-value
Eristalis interuptus-intercept	0.000426 ***
Eristalis tenax	0.004948 **
Helophilus trivittatus	2.57e-06 ***
time	0.055872 .

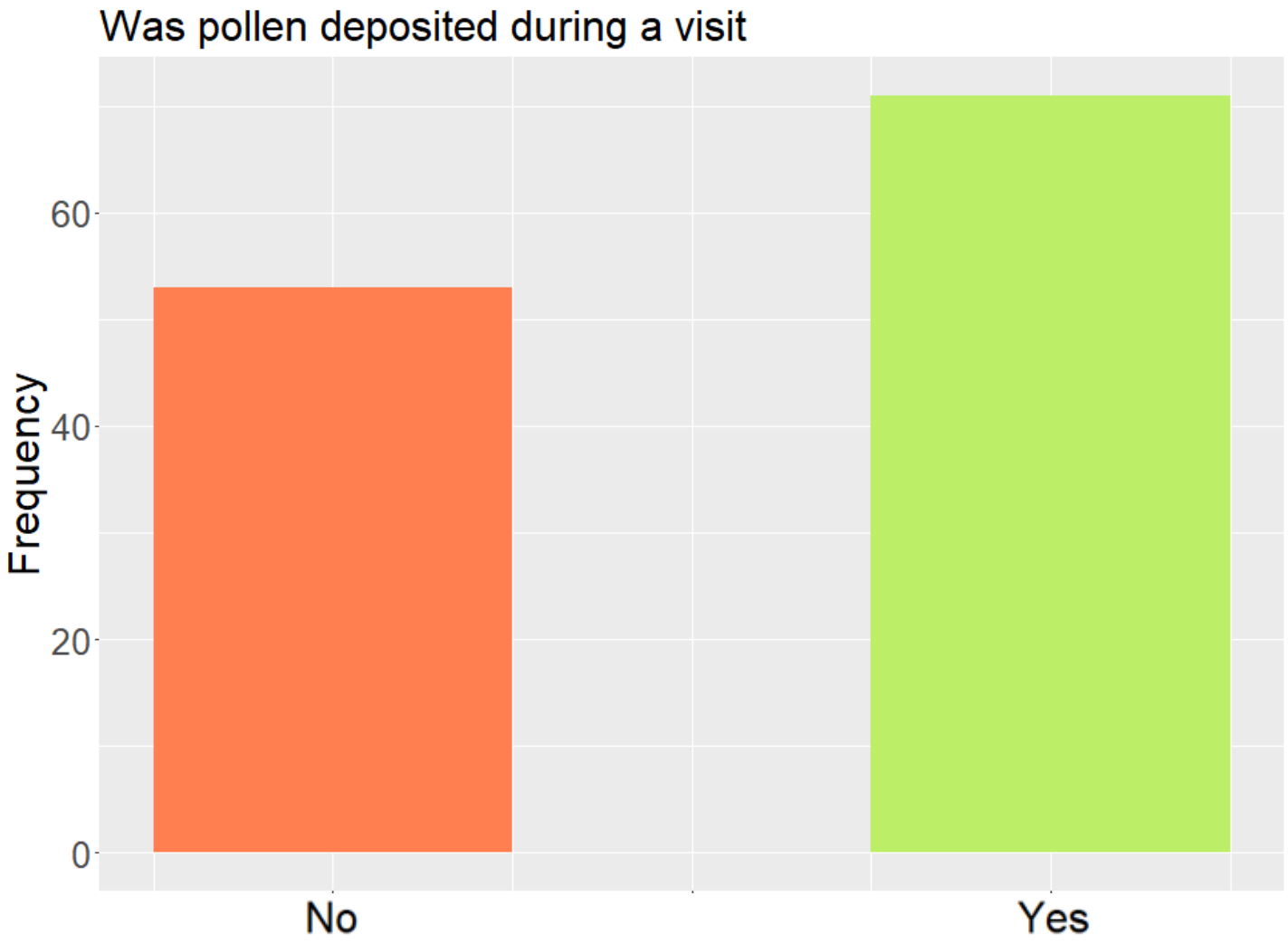


Non-zero deposition succes rate is determined by time

Hurdle model	
Zero hurdle model coefficients (binomial with logit link)	
	P-value
Eristalis interuptus-intercept	0.0286 *
Eristalis tenax	0.5701
Helophilus trivittatus	0.4688
time	0.0234 *



And a lot of visits are not succesfull



Only 57 % of visits resulted into pollen deposition

Succisa needs many visits to obtain pollen

Single visit	Total per floret	Inflorescence with 100 florets
3.355 pollen grains deposited	**20.54** pollen grains deposited	**2054** pollen grains deposited

6.12 visits

612 visits

Presented and Removed pollen

pollen grains presented

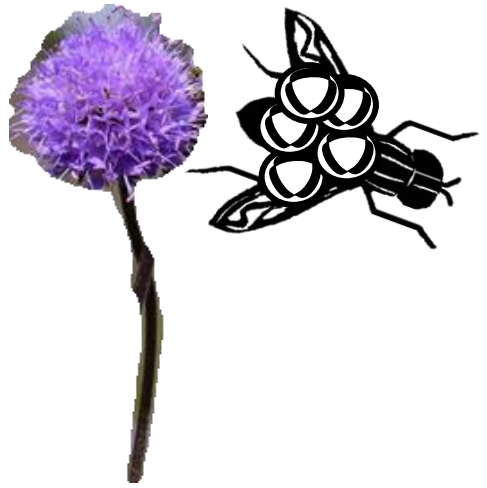
−

pollen remaining after one visit

=

<u>Pollen removed</u>

Presented pollen and Pollen after visit does not differ enough



pollen grains presented

Presented	
median	mean
230	305

After visit	
median	mean
180	242

pollen remaining after one visit

Wilcoxon rank sum test

P-value = 0.201

Calculating pollen removal is problem now

We can also calculate Removed pollen from production

Pollen presented − Pollen remainning after visit = is it trustworthy ?

Pollen removal

Pollen produced − Pollen remainning after visit

The interpretation changes dramatically

Pollinators remove nearly nothing
Pollen presented – after visit

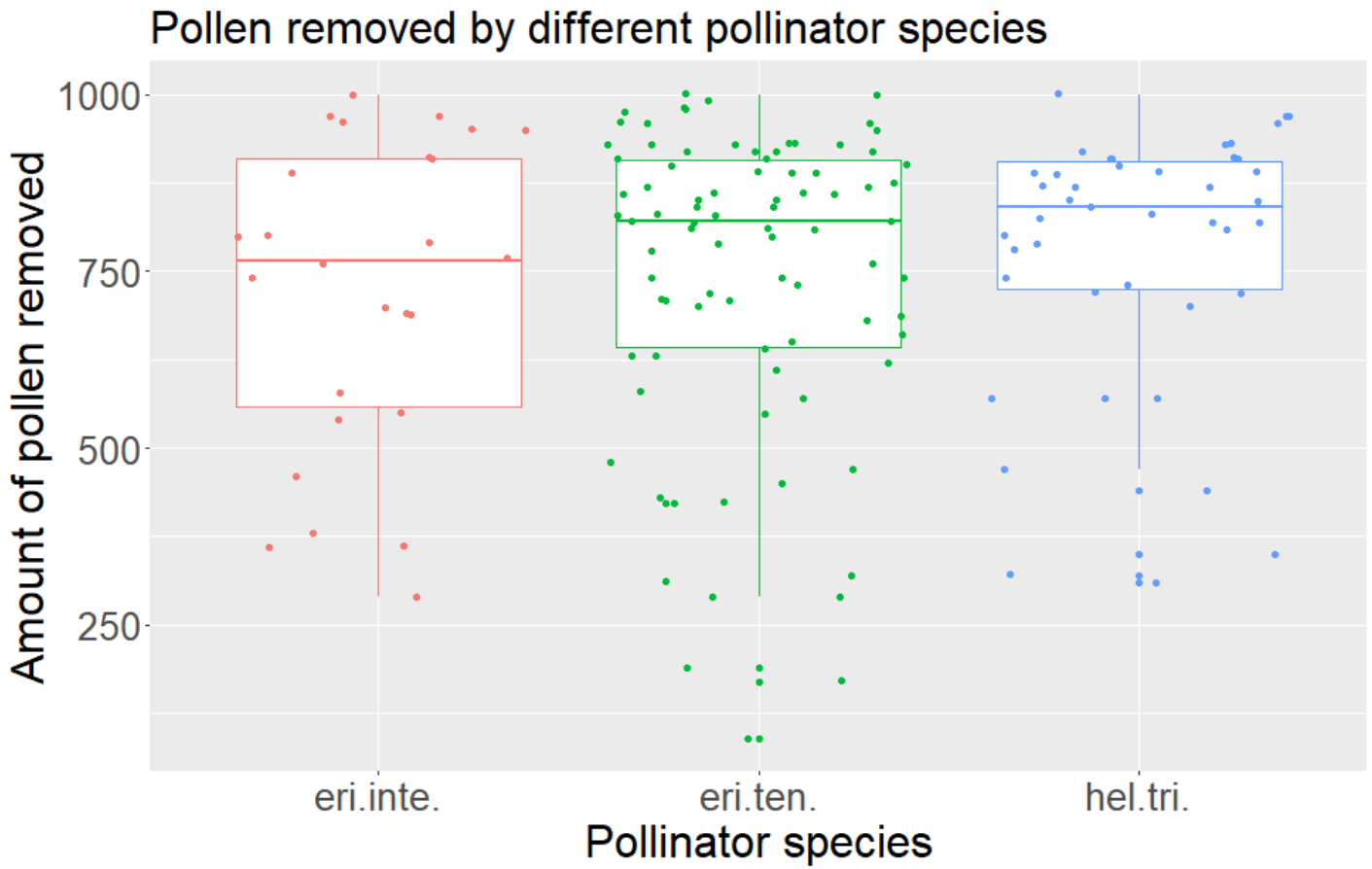
Pollinators remove nearly everything
Pollen production – after visit

pollen grains presented

Presented	
median	mean
230	305

pollen remaining after one visit

After visit	
median	mean
180	242



What is the correct approach To deal with „the removal dilemma“?

Pollinators remove nearly nothing
Pollen presented – after visit

Pollinators remove nearly everything
Pollen production – after visit

Why pollen counts are similar before and after visit

- Pollinators mostly remove pollen from floret in front of the visited one
- Mistakes during methodology were done
- Pollinators really remove small quantity of pollen and inflorescence variability in pollen presented is greater

Pollen presentation

Pollen removal

Pollen trasportation

To do:

Pollen depotision

To do:

Pollen lost by eating

Thank you for your attention!

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Charles University

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Presentation