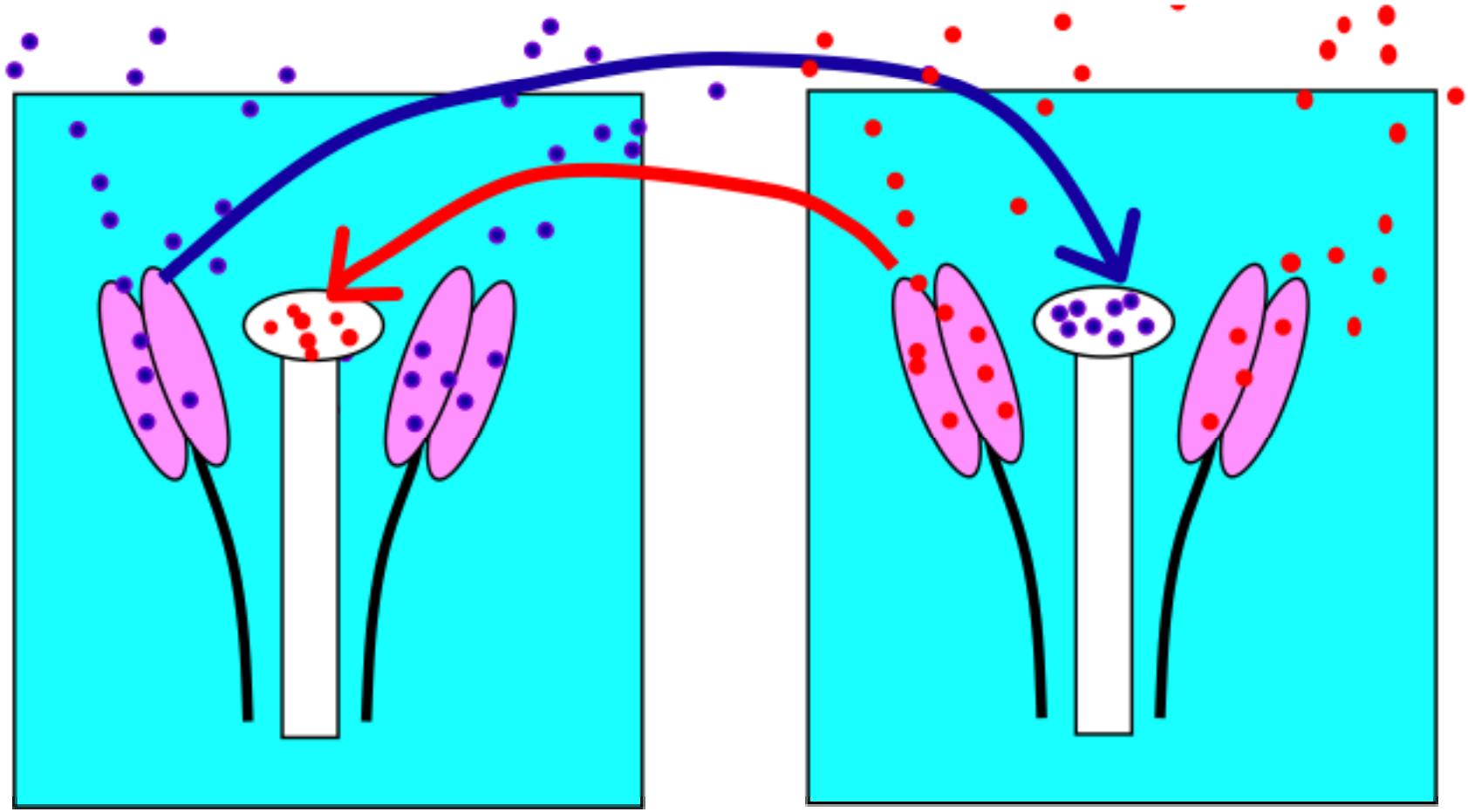
Understanding the relationship between physiology and fruit set in *Clarkia unguiculata and Clarkia exilis*

- Alberto Carreno
  - Santa Barbara City College
  - Biological Sciences
- Dr. Leah Dudley & Dr. Susan Mazer
  - EEMB
  - National Science Foundation

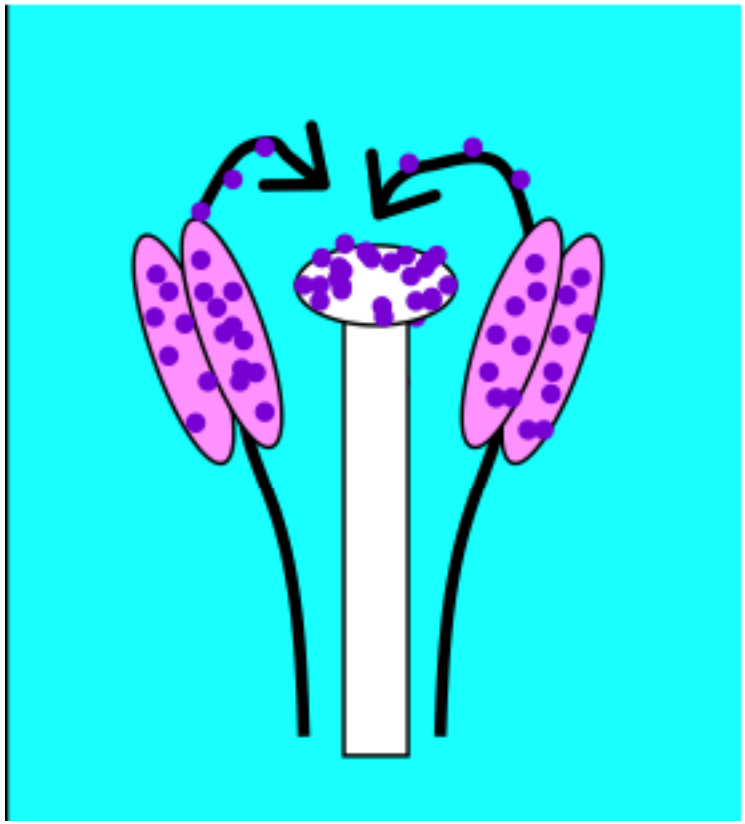
Clarkia unguiculata

Clarkia exilis

Clarkia unguiculata:Outcrosser



Clarkia exilis:Selfer



Clarkia unguiculata:Outcrosser

Clarkia exilis:Selfer


Carson City
Nevada
CALIFORNIA
C. UNGUICULATA
C. EXILIS
Pacific
Ocean

What we know

- These plants are regularly exposed to
  - High temperatures
  - YEARLY DROUGHT!!!
- Outcrossers flower in early summer
  - Water is a limiting factor
- Selfing plants flower sooner than outcrossers
  - Water is NOT a limiting factor

Hypothesis

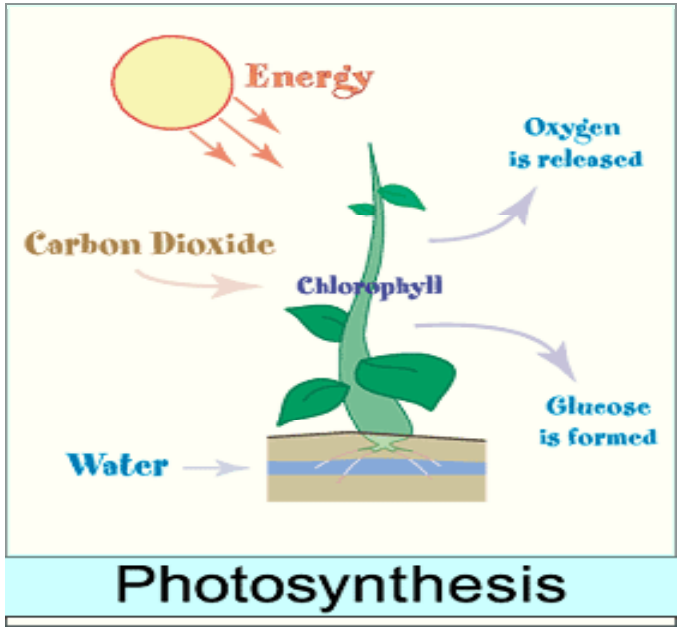
- Outcrossers will exhibit increased reproductive fitness with high water-use efficiency
- Selfers will exhibit increased reproductive fitness with low water-use efficiency

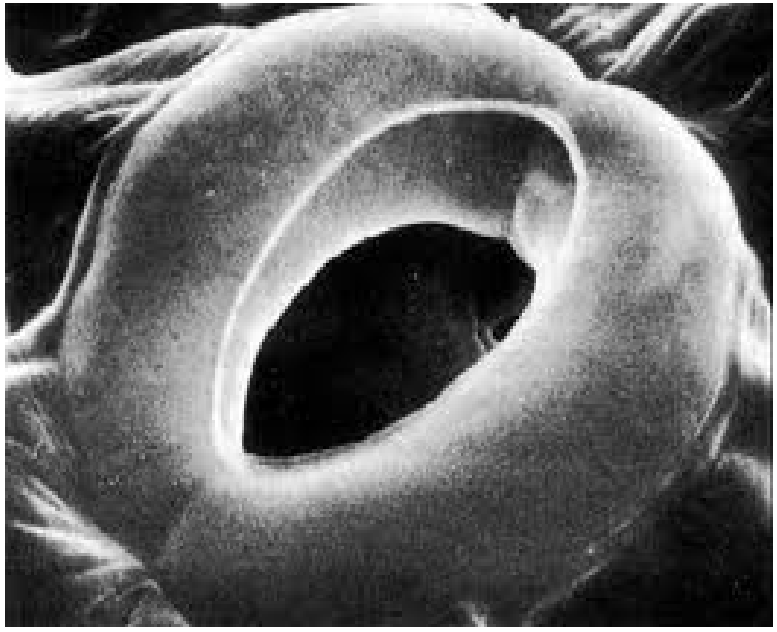
Physiological Rates

Water Use Efficiency= $\frac{\text{Photosynthetic Rate}}{\text{Transpiration Rate}}$

Photosynthesis = Process by which carbon is gained

Transpiration = Plant water loss





Reproductive Fitness= capability of producing fertile offspring

Fruit Set= $\frac{\text{\# Fruits}}{\text{\# Flowers}}$

Populations

Field Work

- Visited 4 sites containing *C.unguiculata*

  and 2 sites containing C.e*xilis*

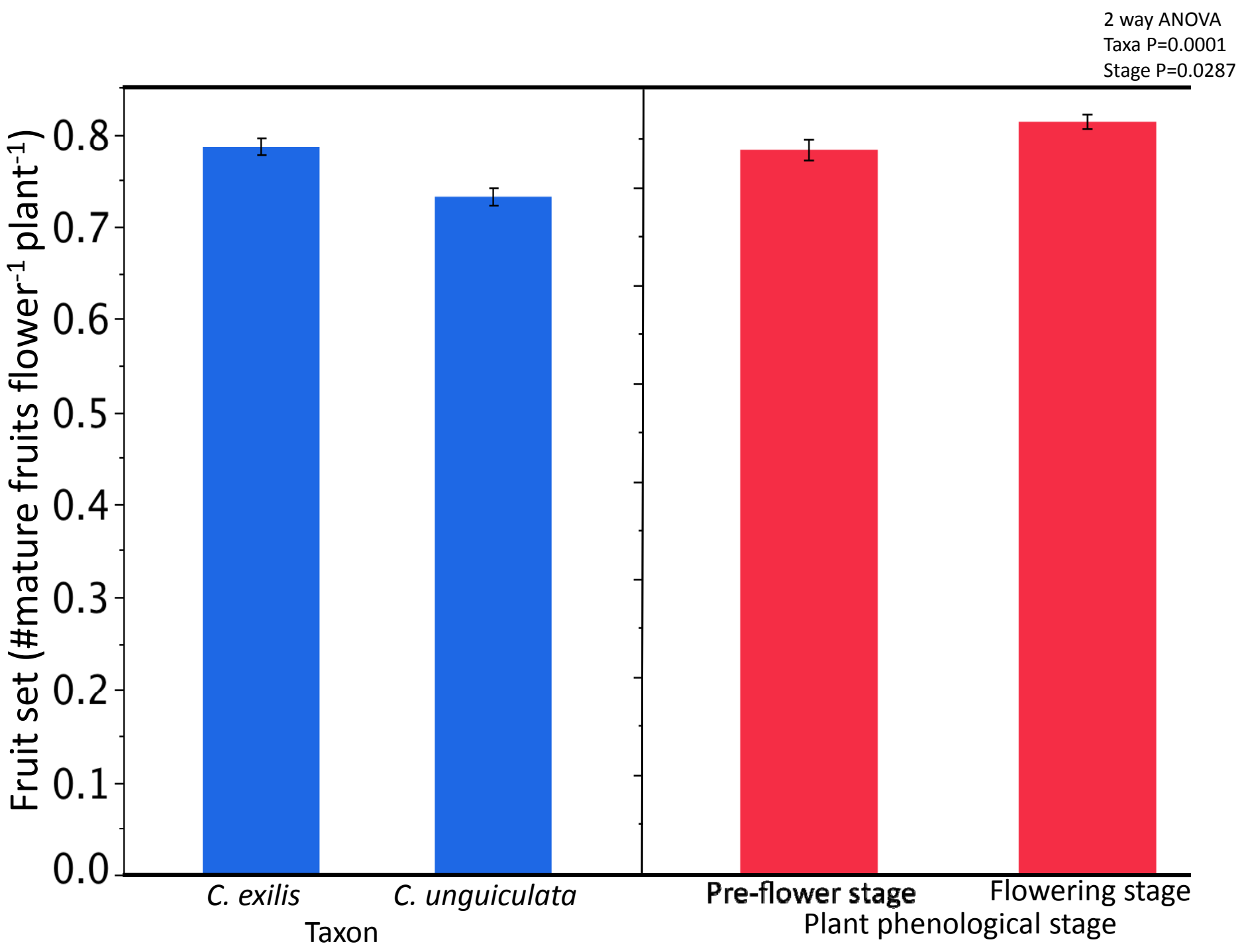
  - Gather physiological data of plants (before flowering and after flowering)
    - Measured carbon gain and water loss
    - Measured 90 pre-flowering and 90 flowering plants per population
  - Collect “pre-flowering” and “flowering” plants
    - 60 out of 90 plants were measured for fitness per population

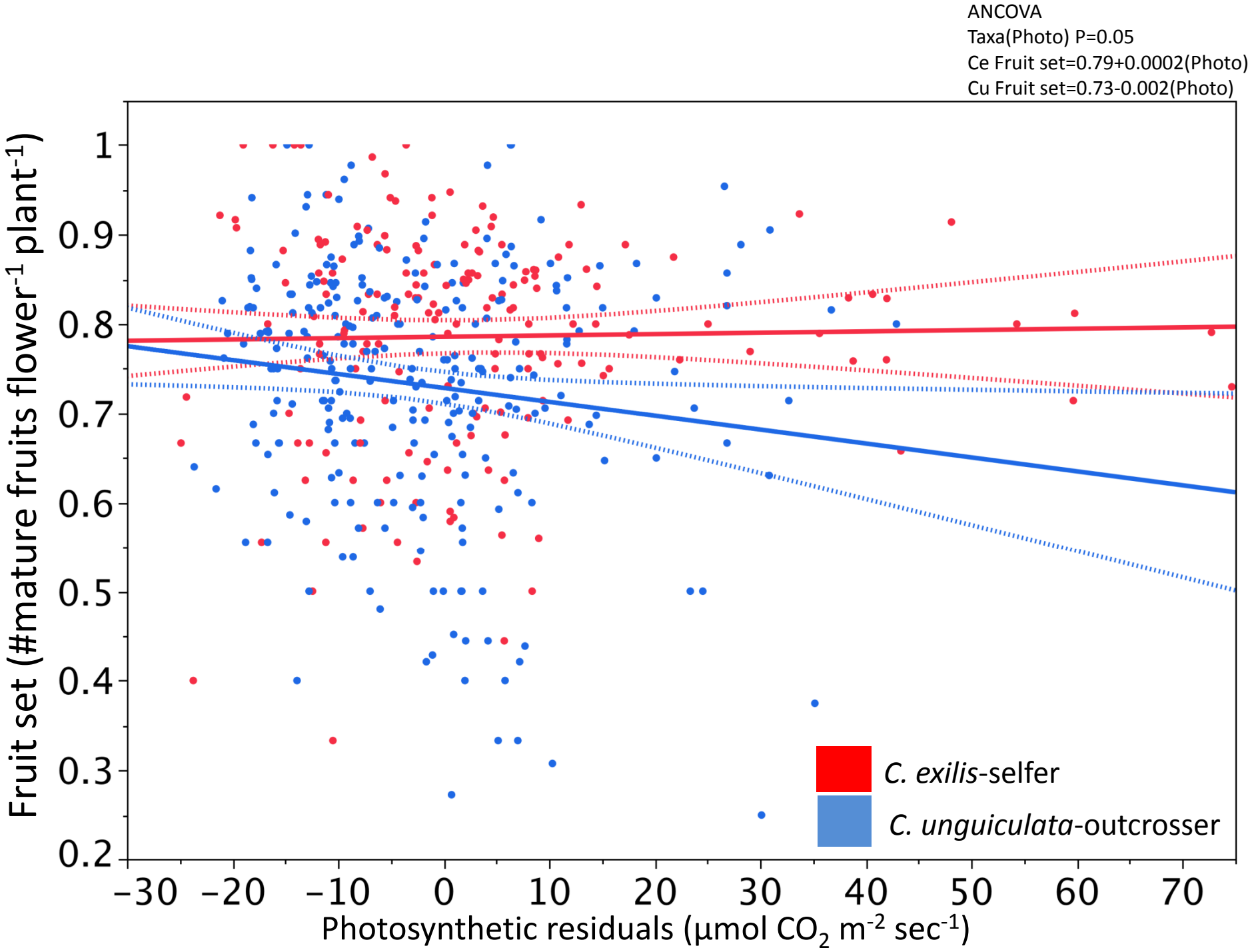
Lab Work

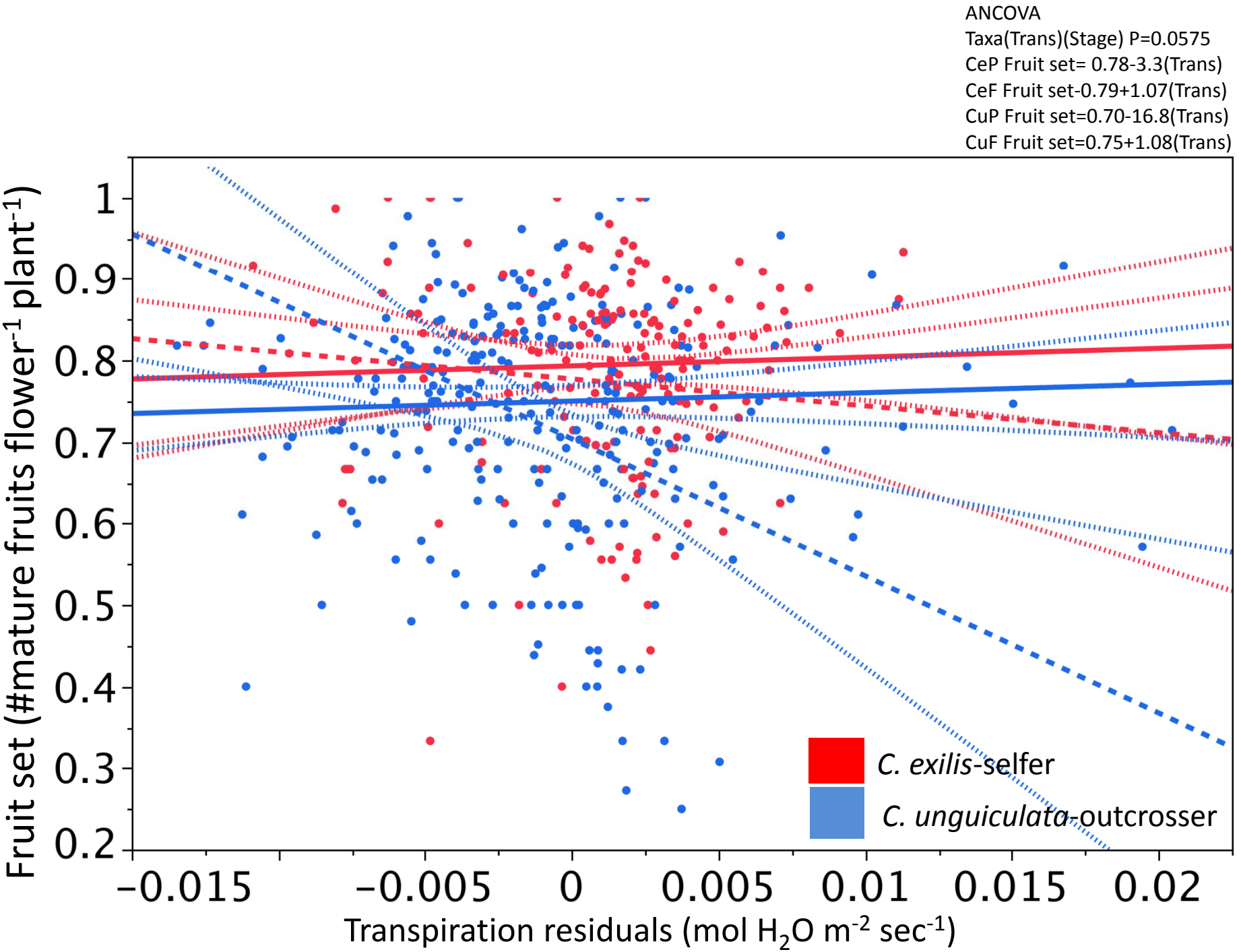
- Quantify Fruit Set
  - Count # of fruits present in plants
    - Mature well formed fruits
    - Aborted fruits
  - Count # of nodes present in plants

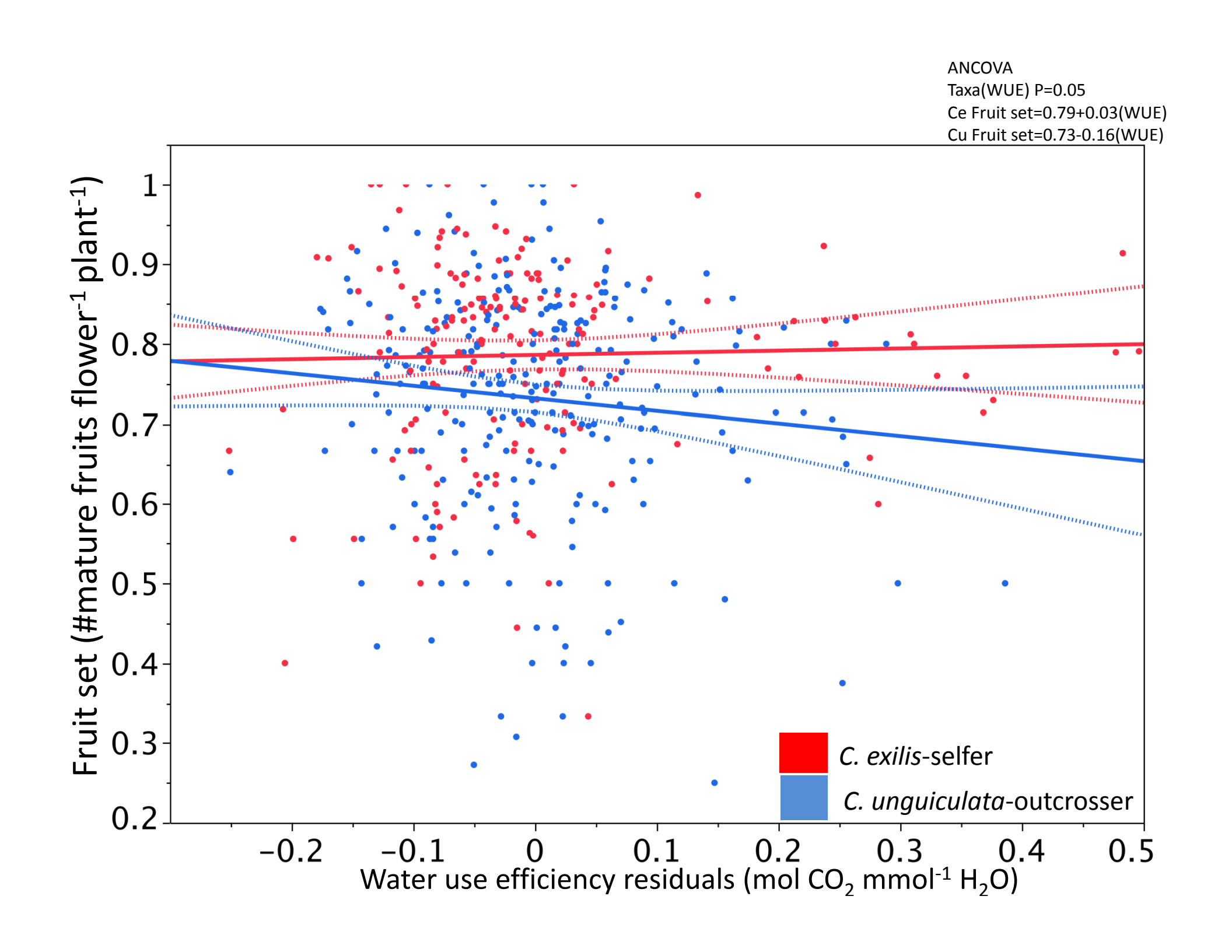
Lab Work

- Leaf area measurements
  - In order to correct the physiological data


2 way ANOVA
Taxa P=0.0001
Stage P=0.0287
Fruit set (#mature fruits flower-1 plant-1)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
C. exilis
C. unguiculata
Taxon
Pre-flower stage
Flowering stage
Plant phenological stage


ANCOVA
Taxa(Photo) P=0.05
Ce Fruit set=0.79+0.0002(Photo)
Cu Fruit set=0.73-0.002(Photo)
Fruit set (#mature fruits flower-1 plant-1)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
−30
−20
−10
0
10
20
30
40
50
60
70
Photosynthetic residuals (µmol CO2 m-2 sec-1)
C. exilis-selfer
C. unguiculata-outcrosser


ANCOVA
Taxa(Trans)(Stage) P=0.0575
CeP Fruit set= 0.78-3.3(Trans)
CeF Fruit set-0.79+1.07(Trans)
CuP Fruit set=0.70-16.8(Trans)
CuF Fruit set=0.75+1.08(Trans)
Fruit set (#mature fruits flower-1 plant-1)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
−0.015
−0.005
0
0.005
0.01
0.015
0.02
Transpiration residuals (mol H2O m-2 sec-1)
C. exilis-selfer
C. unguiculata-outcrosser


ANCOVA
Taxa(WUE) P=0.05
Ce Fruit set=0.79+0.03(WUE)
Cu Fruit set=0.73-0.16(WUE)
Fruit set (#mature fruits flower-1 plant-1)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
−0.2
−0.1
0
0.1
0.2
0.3
0.4
0.5
Water use efficiency residuals (mol CO2 mmol-1 H2O)
C. exilis-selfer
C. unguiculata-outcrosser

Discussion

- For *C. exilis,* fruit set was affected by transpiration in pre-flowering plants
- Factors other than water-use efficiency are affecting fruit set
- Microhabitats may be affecting results
- Results could change if only measuring total number of fruits

Acknowledgments

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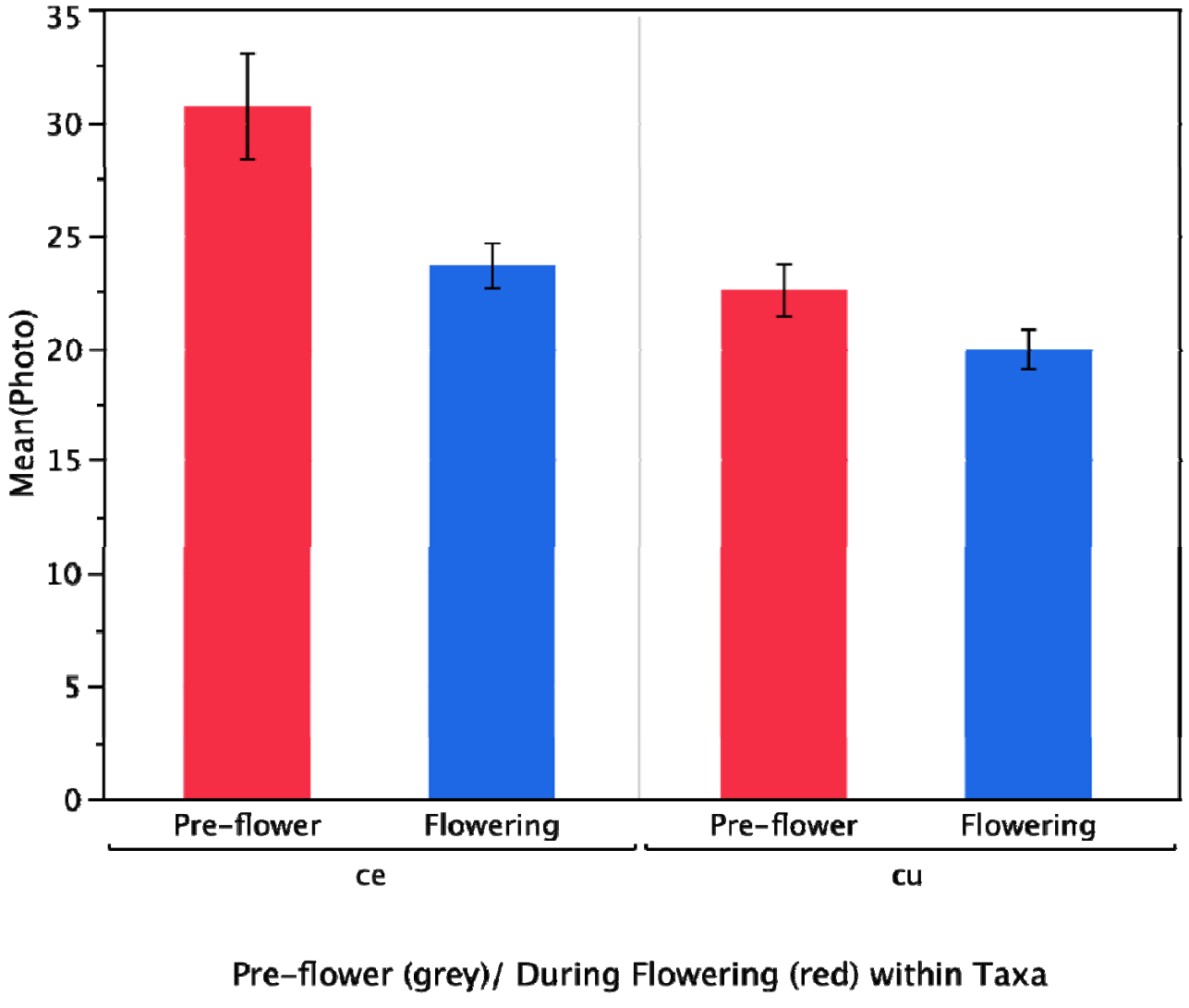
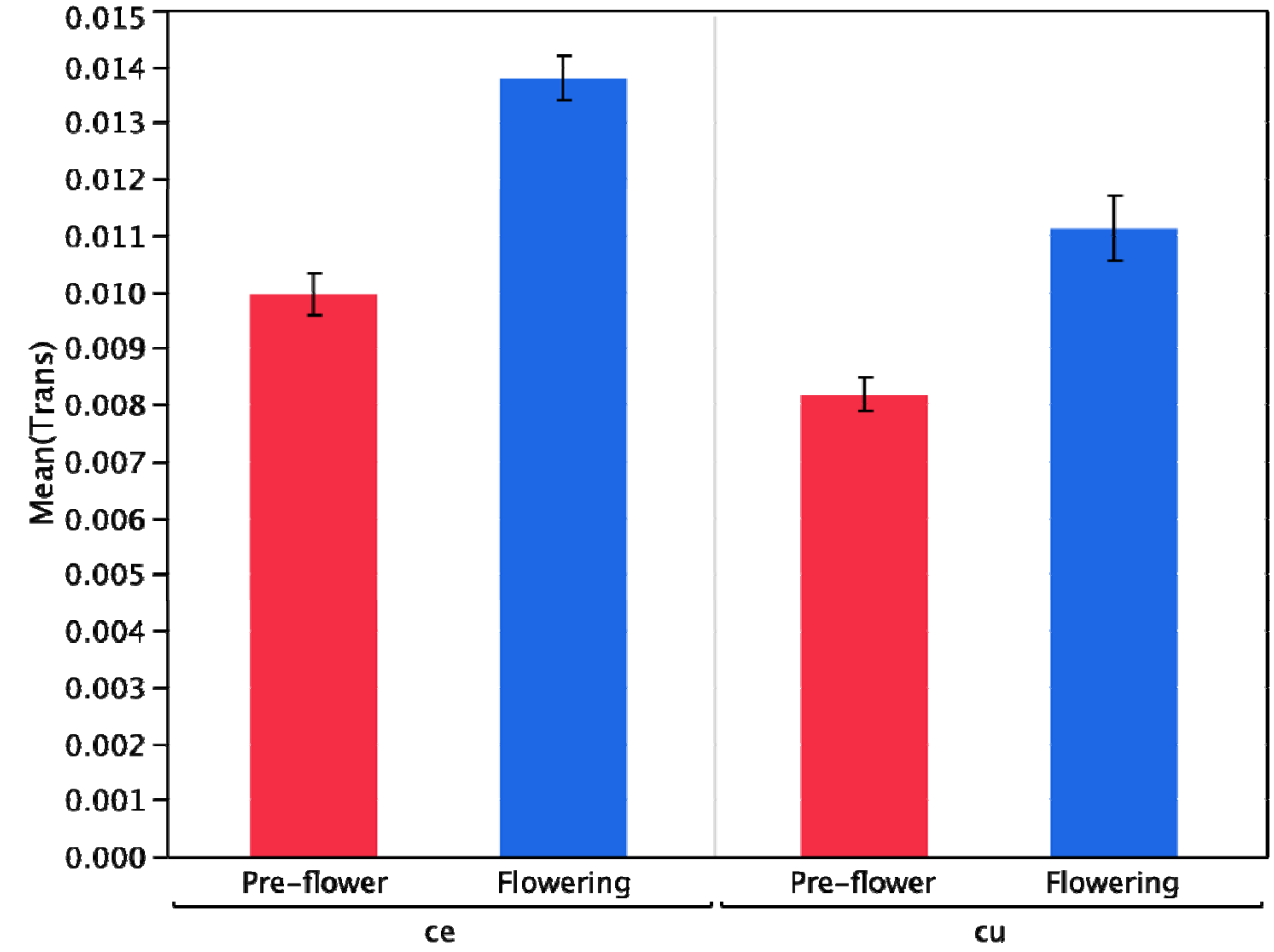
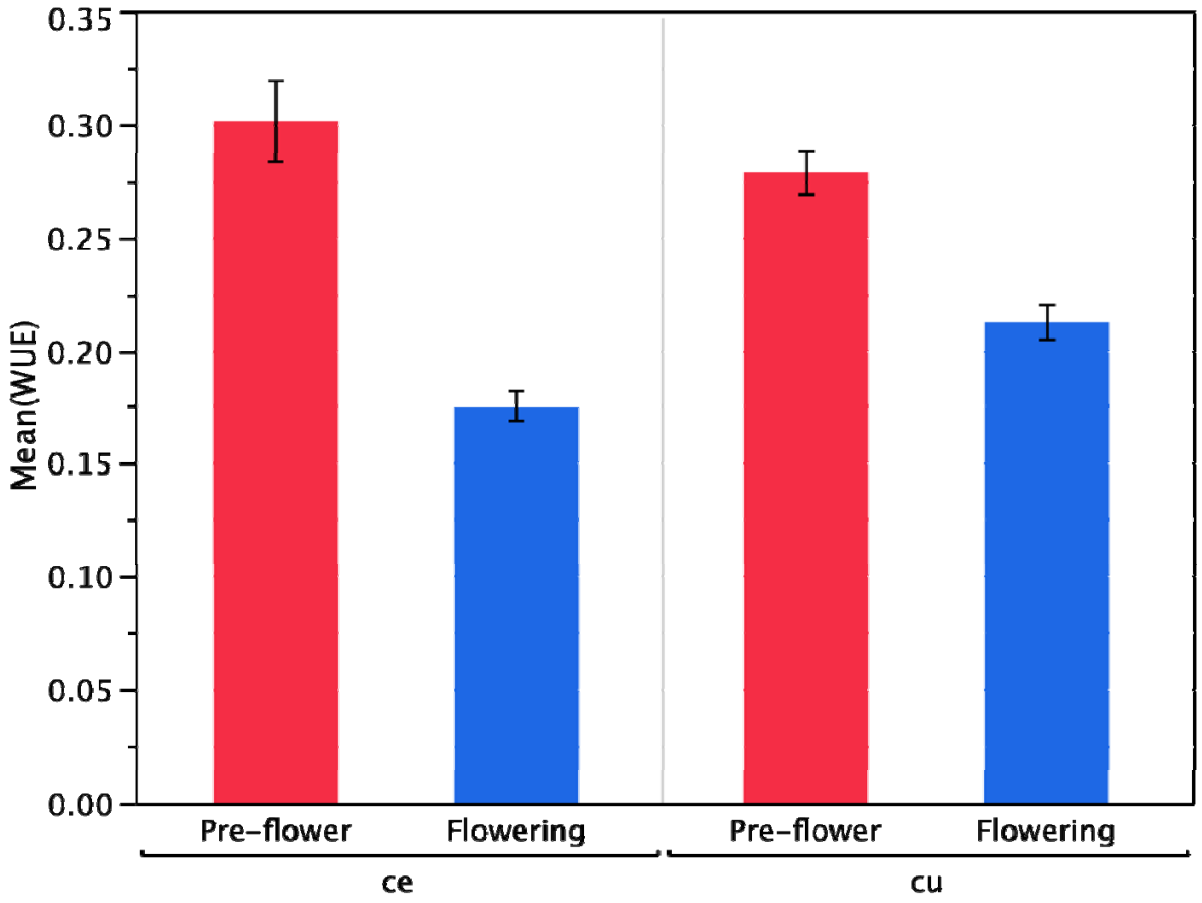
- Arica Lubin


35
30
25
20
15
10
5
0
Mean(Photo)
Pre-flower
Flowering
Pre-flower
Flowering
ce
cu
Pre-flower (grey)/ During Flowering (red) within Taxa
Pre-flower (grey)/ During Flowering (red)
Pre-flower
Flowering


0.015
0.014
0.013
0.012
0.011
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
Mean(Trans)
Pre-flower
Flowering
Pre-flower
Flowering
ce
cu
Pre-flower (grey)/ During Flowering (red) within Taxa
Pre-flower (grey)/ During Flowering (red)
Pre-flower
Flowering



Pre-flower (grey)/ During Flowering (red)

Pre-flower Flowering