DvN_Results

Bumblebat

12/11/2023

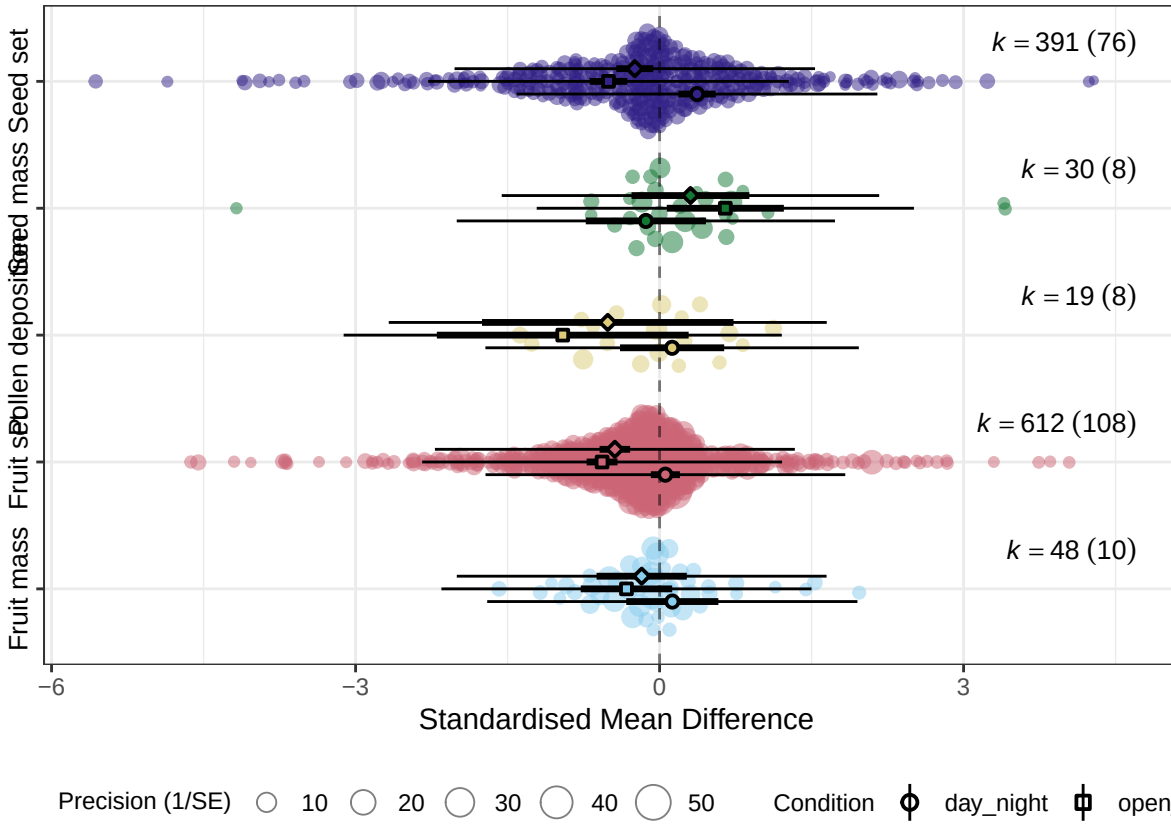
####Throughout (+ive) or (-ive) in brackets indicates that that treatment performs better if values are (+ive) or (-ive)

Effect size (ES) between pollination effectiveness measures

```
##
## Multivariate Meta-Analysis Model (k = 1100; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.1660  0.4074    136     no       study_ID   no
## sigma^2.2  0.6138  0.7834   1100     no      effect_ID   no
## sigma^2.3  0.0000  0.0001    140     no          phylo  yes
## sigma^2.4  0.0352  0.1877    140     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 1085) = 12228.7017, p-val < .0001
##
## Test of Moderators (coefficients 2:15):
## QM(df = 14) = 144.0705, p-val < .0001
##
## Model Results:
##
##                                                                  estimate
## intrcpt                                                            0.1258
## treatment_effectiveness_metricfruit set                           -0.0685
## treatment_effectiveness_metricpollen deposition                   -0.0021
## treatment_effectiveness_metricseed mass                           -0.2611
## treatment_effectiveness_metricseed set                             0.2443
## treatmentopen_day                                                 -0.4526
## treatmentopen_night                                               -0.3025
## treatment_effectiveness_metricfruit set:treatmentopen_day         -0.1721
## treatment_effectiveness_metricpollen deposition:treatmentopen_day -0.6268
## treatment_effectiveness_metricseed mass:treatmentopen_day          1.2366
## treatment_effectiveness_metricseed set:treatmentopen_day          -0.4216
## treatment_effectiveness_metricfruit set:treatmentopen_night       -0.1959
## treatment_effectiveness_metricpollen deposition:treatmentopen_night -0.3326
## treatment_effectiveness_metricseed mass:treatmentopen_night        0.7425
## treatment_effectiveness_metricseed set:treatmentopen_night        -0.3122
##                                                                      se
## intrcpt                                                          0.2321
```

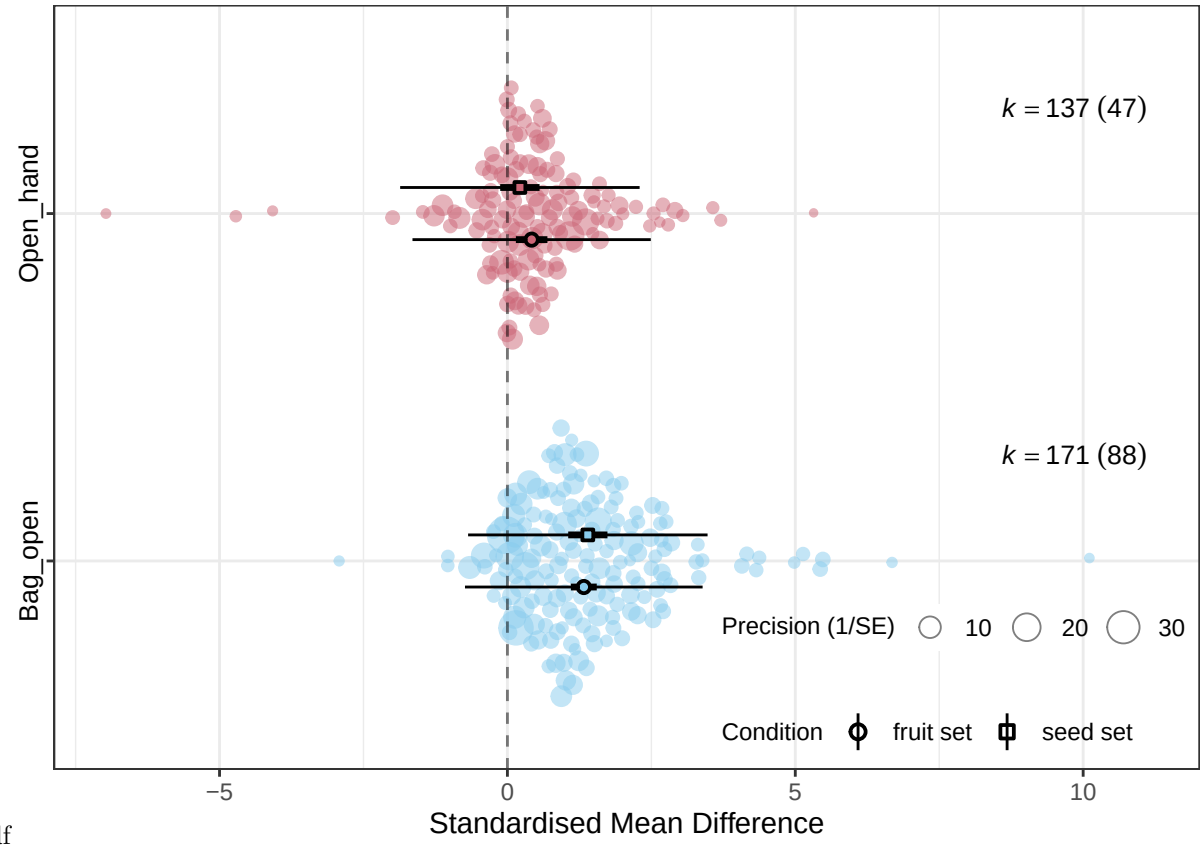
```
## treatment_effectiveness_metricfruit set                                0.2357
## treatment_effectiveness_metricpollen deposition                        0.3490
## treatment_effectiveness_metricseed mass                                0.3782
## treatment_effectiveness_metricseed set                                 0.2433
## treatmentopen_day                                                      0.2982
## treatmentopen_night                                                    0.2960
## treatment_effectiveness_metricfruit set:treatmentopen_day              0.3101
## treatment_effectiveness_metricpollen deposition:treatmentopen_day      0.7313
## treatment_effectiveness_metricseed mass:treatmentopen_day              0.4934
## treatment_effectiveness_metricseed set:treatmentopen_day               0.3194
## treatment_effectiveness_metricfruit set:treatmentopen_night            0.3079
## treatment_effectiveness_metricpollen deposition:treatmentopen_night    0.7298
## treatment_effectiveness_metricseed mass:treatmentopen_night            0.4938
## treatment_effectiveness_metricseed set:treatmentopen_night             0.3169
##                                                                           zval
## intrcpt                                                                0.5420
## treatment_effectiveness_metricfruit set                               -0.2908
## treatment_effectiveness_metricpollen deposition                       -0.0060
## treatment_effectiveness_metricseed mass                               -0.6903
## treatment_effectiveness_metricseed set                                 1.0044
## treatmentopen_day                                                     -1.5178
## treatmentopen_night                                                   -1.0220
## treatment_effectiveness_metricfruit set:treatmentopen_day             -0.5549
## treatment_effectiveness_metricpollen deposition:treatmentopen_day     -0.8571
## treatment_effectiveness_metricseed mass:treatmentopen_day              2.5063
## treatment_effectiveness_metricseed set:treatmentopen_day              -1.3201
## treatment_effectiveness_metricfruit set:treatmentopen_night           -0.6362
## treatment_effectiveness_metricpollen deposition:treatmentopen_night   -0.4558
## treatment_effectiveness_metricseed mass:treatmentopen_night            1.5036
## treatment_effectiveness_metricseed set:treatmentopen_night            -0.9850
##                                                                           pval
## intrcpt                                                                0.5878
## treatment_effectiveness_metricfruit set                                0.7712
## treatment_effectiveness_metricpollen deposition                        0.9953
## treatment_effectiveness_metricseed mass                                0.4900
## treatment_effectiveness_metricseed set                                 0.3152
## treatmentopen_day                                                      0.1291
## treatmentopen_night                                                    0.3068
## treatment_effectiveness_metricfruit set:treatmentopen_day              0.5789
## treatment_effectiveness_metricpollen deposition:treatmentopen_day      0.3914
## treatment_effectiveness_metricseed mass:treatmentopen_day              0.0122
## treatment_effectiveness_metricseed set:treatmentopen_day               0.1868
## treatment_effectiveness_metricfruit set:treatmentopen_night            0.5247
## treatment_effectiveness_metricpollen deposition:treatmentopen_night    0.6485
## treatment_effectiveness_metricseed mass:treatmentopen_night            0.1327
## treatment_effectiveness_metricseed set:treatmentopen_night             0.3246
##                                                                          ci.lb
## intrcpt                                                               -0.3291
## treatment_effectiveness_metricfruit set                               -0.5305
## treatment_effectiveness_metricpollen deposition                       -0.6861
## treatment_effectiveness_metricseed mass                               -1.0024
## treatment_effectiveness_metricseed set                                -0.2324
## treatmentopen_day                                                     -1.0370
## treatmentopen_night                                                   -0.8827
```

```
## treatment_effectiveness_metricfruit set:treatmentopen_day            -0.7800
## treatment_effectiveness_metricpollen deposition:treatmentopen_day    -2.0601
## treatment_effectiveness_metricseed mass:treatmentopen_day             0.2696
## treatment_effectiveness_metricseed set:treatmentopen_day             -1.0475
## treatment_effectiveness_metricfruit set:treatmentopen_night          -0.7993
## treatment_effectiveness_metricpollen deposition:treatmentopen_night  -1.7630
## treatment_effectiveness_metricseed mass:treatmentopen_night          -0.2254
## treatment_effectiveness_metricseed set:treatmentopen_night           -0.9334
##                                                                       ci.ub
## intrcpt                                                              0.5806
## treatment_effectiveness_metricfruit set                              0.3934
## treatment_effectiveness_metricpollen deposition                      0.6820
## treatment_effectiveness_metricseed mass                              0.4802
## treatment_effectiveness_metricseed set                               0.7211
## treatmentopen_day                                                    0.1319
## treatmentopen_night                                                  0.2777
## treatment_effectiveness_metricfruit set:treatmentopen_day            0.4358
## treatment_effectiveness_metricpollen deposition:treatmentopen_day    0.8065
## treatment_effectiveness_metricseed mass:treatmentopen_day            2.2037  *
## treatment_effectiveness_metricseed set:treatmentopen_day             0.2044
## treatment_effectiveness_metricfruit set:treatmentopen_night          0.4076
## treatment_effectiveness_metricpollen deposition:treatmentopen_night  1.0977
## treatment_effectiveness_metricseed mass:treatmentopen_night          1.7103
## treatment_effectiveness_metricseed set:treatmentopen_night           0.3090
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



COMPARISONS-1.pdf

Summary of pollination dependency (bag (-ive) vs. open (+ive)) and limitation (open (-ive) vs. hand (+ive))



LIM summary-1.pdf

The influence of pollination dependency on day (-ive) vs. night (+ive) pollination for fruit and seed set

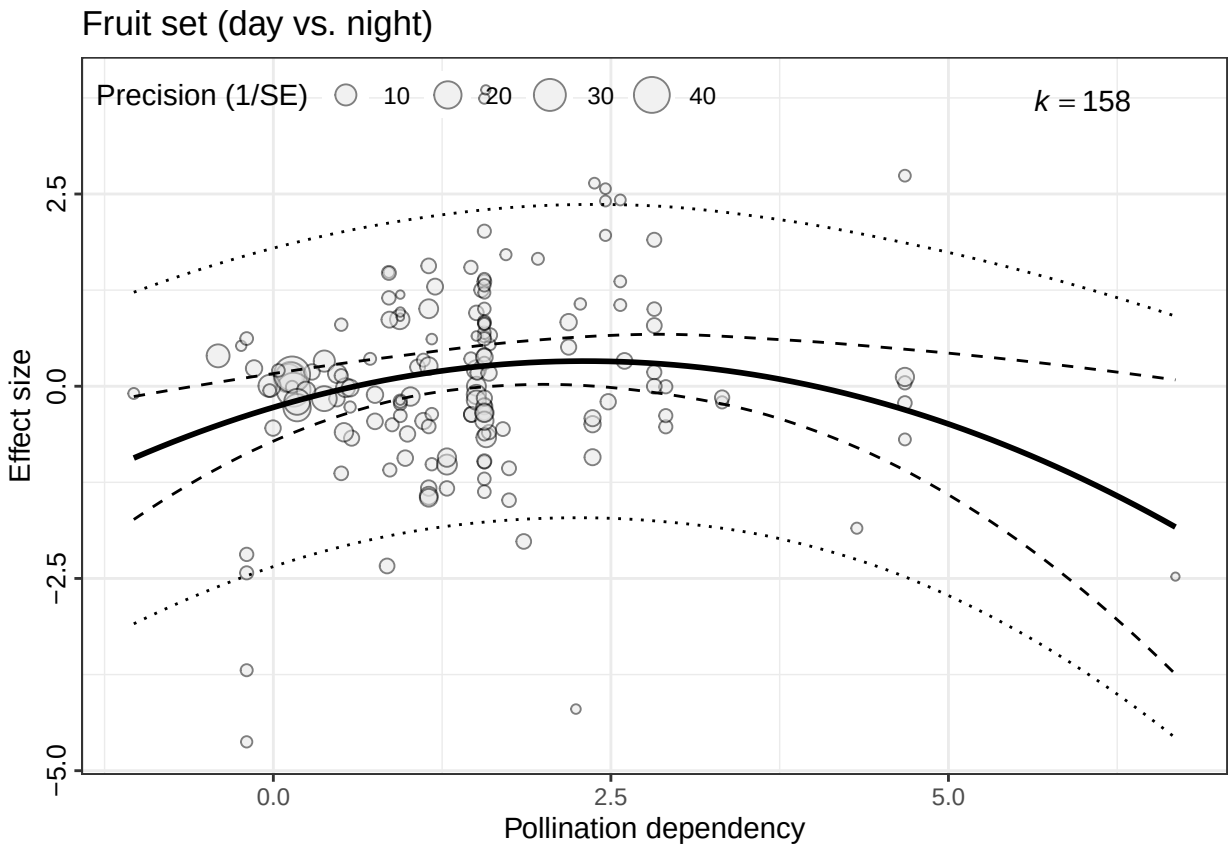
##Fruit set = significant quadratic relationship

##Seed set = insignificant

```
## **Fruit set and species-level pollination dependency. Order is DvN, OvD, OvN**

##
## Multivariate Meta-Analysis Model (k = 158; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.3835  0.6193     81     no       study_ID   no
## sigma^2.2  0.4539  0.6737    158     no      effect_ID   no
## sigma^2.3  0.0000  0.0000     76     no          phylo  yes
## sigma^2.4  0.2187  0.4676     76     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 155) = 1828.0406, p-val < .0001
##
## Test of Moderators (coefficients 2:3):
```

```
## QM(df = 2) = 6.5072, p-val = 0.0386
##
## Model Results:
##
##                     estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt              -0.2747  0.2050  -1.3399  0.1803  -0.6764   0.1271
## spp.poll.dep          0.5210  0.2142   2.4325  0.0150   0.1012   0.9408  *
## I(spp.poll.dep^2)    -0.1129  0.0448  -2.5189  0.0118  -0.2007  -0.0250  *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



DEP-1.pdf

```
##
## Multivariate Meta-Analysis Model (k = 59; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.0000  0.0000     39     no       study_ID   no
## sigma^2.2  0.2384  0.4883     59     no      effect_ID   no
## sigma^2.3  0.1917  0.4378     36     no          phylo  yes
## sigma^2.4  1.6052  1.2670     36     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 57) = 1081.5958, p-val < .0001
##
## Test of Moderators (coefficient 2):
```

```
## QM(df = 1) = 1.1791, p-val = 0.2775
##
## Model Results:
##
##               estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt         0.1980  0.3616   0.5476  0.5840  -0.5107  0.9068
## spp.poll.dep   -0.1677  0.1544  -1.0859  0.2775  -0.4704  0.1350
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The influence of pollen limitation (open (-ive) vs. hand (+ive)) on day (-ive) vs. night (+ive) pollination for fruit and seed set

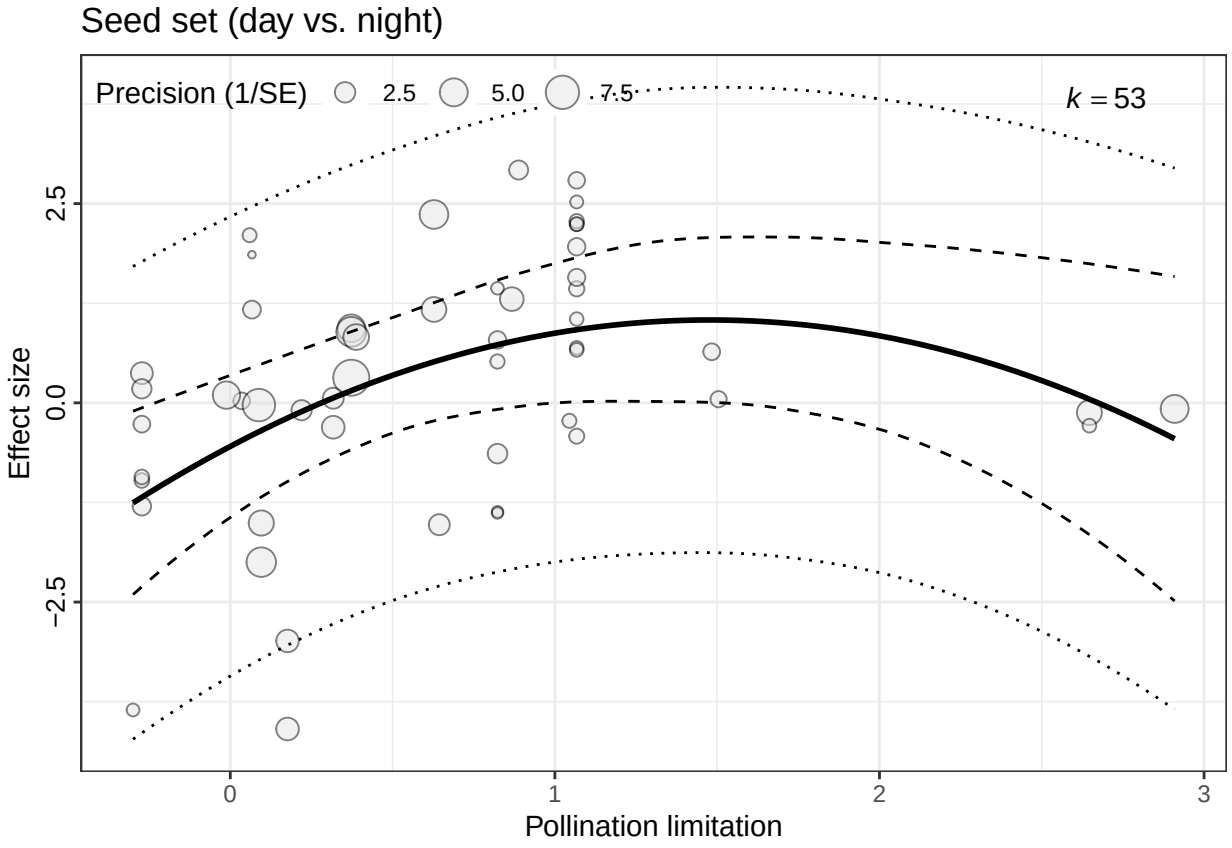
##Fruit set = insignificant

##Seed set = significant quadratic relationship

```
##
## Multivariate Meta-Analysis Model (k = 110; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.6988  0.8360     46     no       study_ID   no
## sigma^2.2  0.4282  0.6544    110     no      effect_ID   no
## sigma^2.3  0.0000  0.0001     42     no          phylo  yes
## sigma^2.4  0.1843  0.4293     42     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 107) = 1455.9893, p-val < .0001
##
## Test of Moderators (coefficients 2:3):
## QM(df = 2) = 0.1089, p-val = 0.9470
##
## Model Results:
##
##                    estimate      se     zval    pval    ci.lb   ci.ub
## intrcpt              0.1246  0.2092   0.5959  0.5512  -0.2853  0.5346
## spp.poll.lim         0.0953  0.3184   0.2993  0.7647  -0.5287  0.7193
## I(spp.poll.lim^2)   -0.0255  0.0785  -0.3251  0.7451  -0.1793  0.1283
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Multivariate Meta-Analysis Model (k = 53; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.0000  0.0000     26     no       study_ID   no
## sigma^2.2  0.2637  0.5135     53     no      effect_ID   no
## sigma^2.3  0.0000  0.0001     24     no          phylo  yes
## sigma^2.4  1.6802  1.2962     24     no  accepted_name   no
```

```
##
## Test for Residual Heterogeneity:
## QE(df = 50) = 647.1124, p-val < .0001
##
## Test of Moderators (coefficients 2:3):
## QM(df = 2) = 4.8734, p-val = 0.0874
##
## Model Results:
##
##                    estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt             -0.5463  0.4265  -1.2809  0.2002  -1.3824   0.2897
## spp.poll.lim         2.1474  0.9753   2.2018  0.0277   0.2359   4.0588  *
## I(spp.poll.lim^2)   -0.7268  0.3660  -1.9858  0.0471  -1.4442  -0.0094  *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



LIM-1.pdf

The influence of plant trait dimensions: Flower dimensions (PC1, negative correlation), Plant size and to a lesser extent, style length (PC2, negative correlation), and plant size (PC3, positive correlation) & environment

##Flower dimensions seem to be more important in improving day pollination relative to open conditions than night pollination. Could this be associated with visual cues?

```
##   PC1   PC2   PC3   PC4
## 51.93 21.69 21.18  5.19
```

```
## [1] 94.8
```

```
## Phylogenetic pca
## Standard deviations:
##        PC1        PC2        PC3        PC4
## 0.15146681 0.09788505 0.09673811 0.04789623
## Loads:
##                                  PC1        PC2        PC3          PC4
## flower_width_midpoint_mm  -0.7817083  0.5384239  0.2927808  0.115374273
## flower_length_midpoint_mm -0.9051256 -0.1198546 -0.1916796 -0.360057489
## style_length_midpoint_mm  -0.7384342 -0.4756881 -0.3912048  0.274580677
## plant_height_midpoint_m   -0.2042648 -0.5624059  0.8011899 -0.008387344
## lambda:
## [1] 0.8824116
```

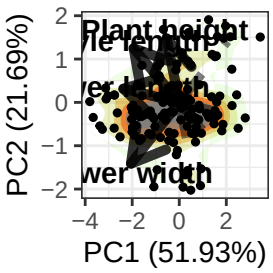
```
##   PC1
## 51.93
```

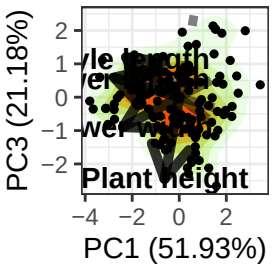
```
##   PC2
## 21.69
```

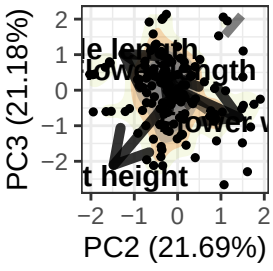
```
## Warning: `aes_string()` was deprecated in ggplot2 3.0.0.
## i Please use tidy evaluation idioms with `aes()`.
## i See also `vignette("ggplot2-in-packages")` for more information.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use `linewidth` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
## Warning: The dot-dot notation (`..level..`) was deprecated in ggplot2 3.4.0.
## i Please use `after_stat(level)` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```







summary-1.pdf

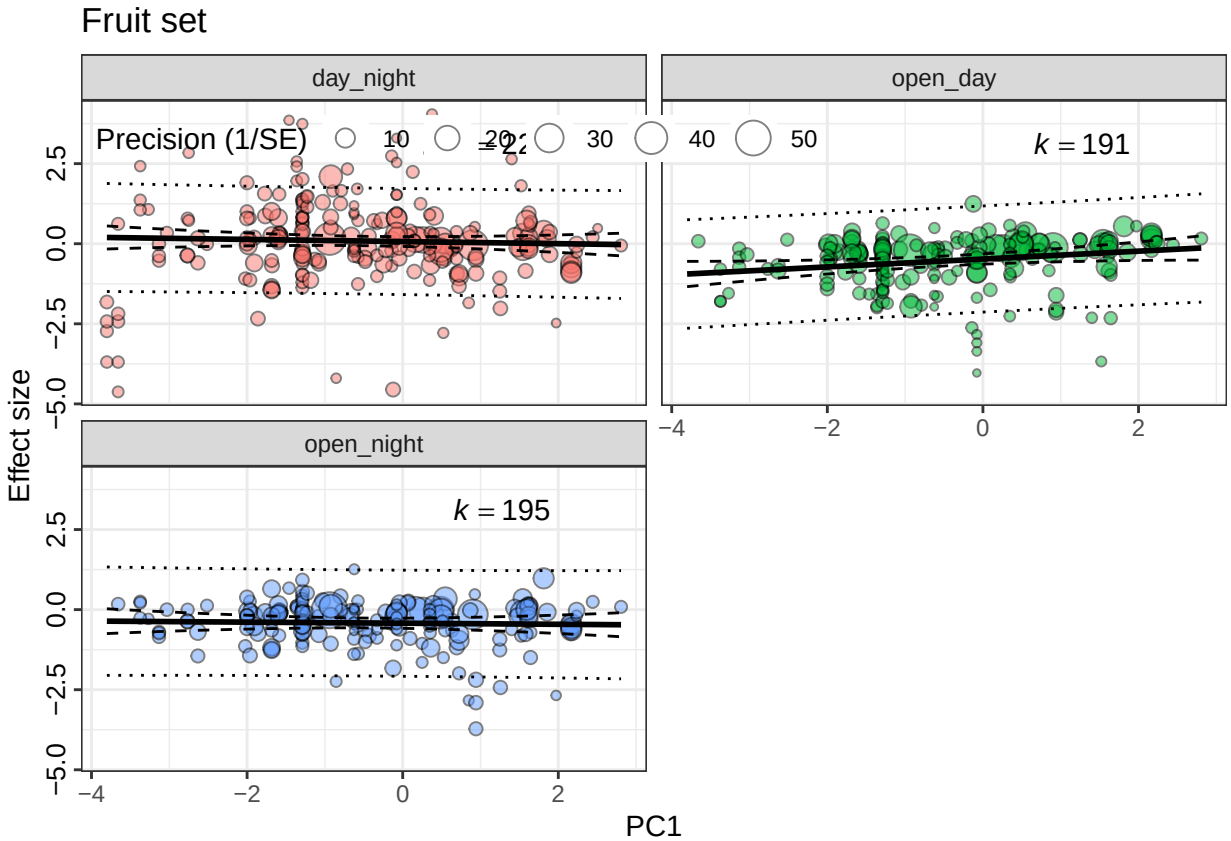
###Fruit set and traits and environment

##Very weak effects of DTR ##Some interactions open_day and PC1

#weak interaction between Daylength and open_day (will be borderline if slope is sig diff from 0)

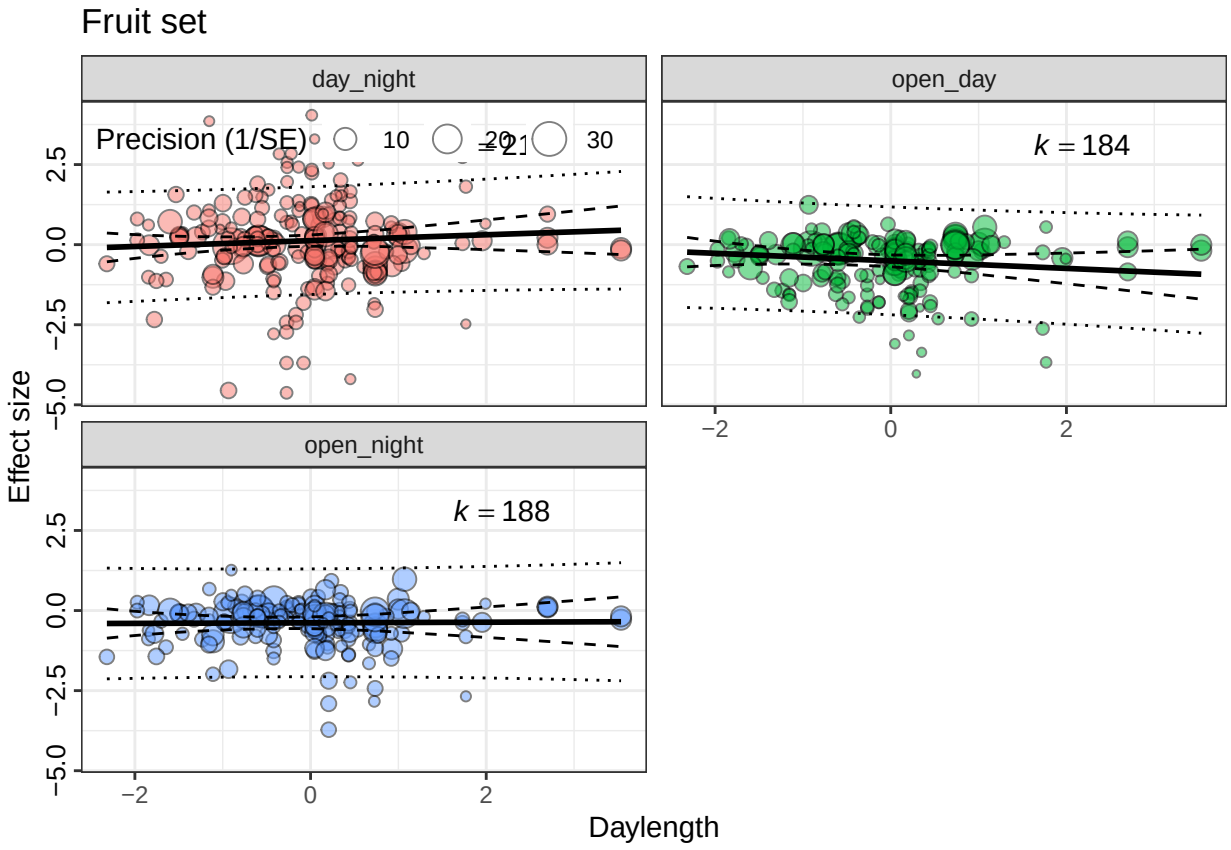
```
##
## Multivariate Meta-Analysis Model (k = 612; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.2433  0.4933    108     no       study_ID   no
## sigma^2.2  0.4645  0.6815    612     no      effect_ID   no
## sigma^2.3  0.0000  0.0000    113     no          phylo  yes
## sigma^2.4  0.0000  0.0001    113     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 600) = 7535.8627, p-val < .0001
##
## Test of Moderators (coefficients 2:12):
## QM(df = 11) = 91.8854, p-val < .0001
##
## Model Results:
##
##                          estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt                    0.0792  0.0769   1.0299  0.3030  -0.0715   0.2299
## treatmentopen_day         -0.5024  0.0824  -6.0968  <.0001  -0.6640  -0.3409
```

```
## treatmentopen_night       -0.4632  0.0822  -5.6362  <.0001  -0.6243  -0.3021
## PC1                       -0.0332  0.0490  -0.6781  0.4977  -0.1293   0.0628
## PC2                       -0.0127  0.0915  -0.1390  0.8894  -0.1921   0.1667
## PC3                        0.0711  0.0821   0.8656  0.3867  -0.0899   0.2320
## treatmentopen_day:PC1      0.1561  0.0577   2.7076  0.0068   0.0431   0.2691
## treatmentopen_night:PC1    0.0164  0.0570   0.2882  0.7732  -0.0953   0.1281
## treatmentopen_day:PC2      0.1112  0.1013   1.0978  0.2723  -0.0873   0.3098
## treatmentopen_night:PC2    0.0502  0.1012   0.4966  0.6194  -0.1480   0.2485
## treatmentopen_day:PC3      0.0895  0.0869   1.0295  0.3032  -0.0809   0.2599
## treatmentopen_night:PC3    0.0909  0.0868   1.0477  0.2948  -0.0792   0.2610
##
## intrcpt
## treatmentopen_day         ***
## treatmentopen_night       ***
## PC1
## PC2
## PC3
## treatmentopen_day:PC1      **
## treatmentopen_night:PC1
## treatmentopen_day:PC2
## treatmentopen_night:PC2
## treatmentopen_day:PC3
## treatmentopen_night:PC3
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



env fruit set-1.pdf

```
## Warning: 21 rows with NAs omitted from model fitting.
```



env fruit set-2.pdf

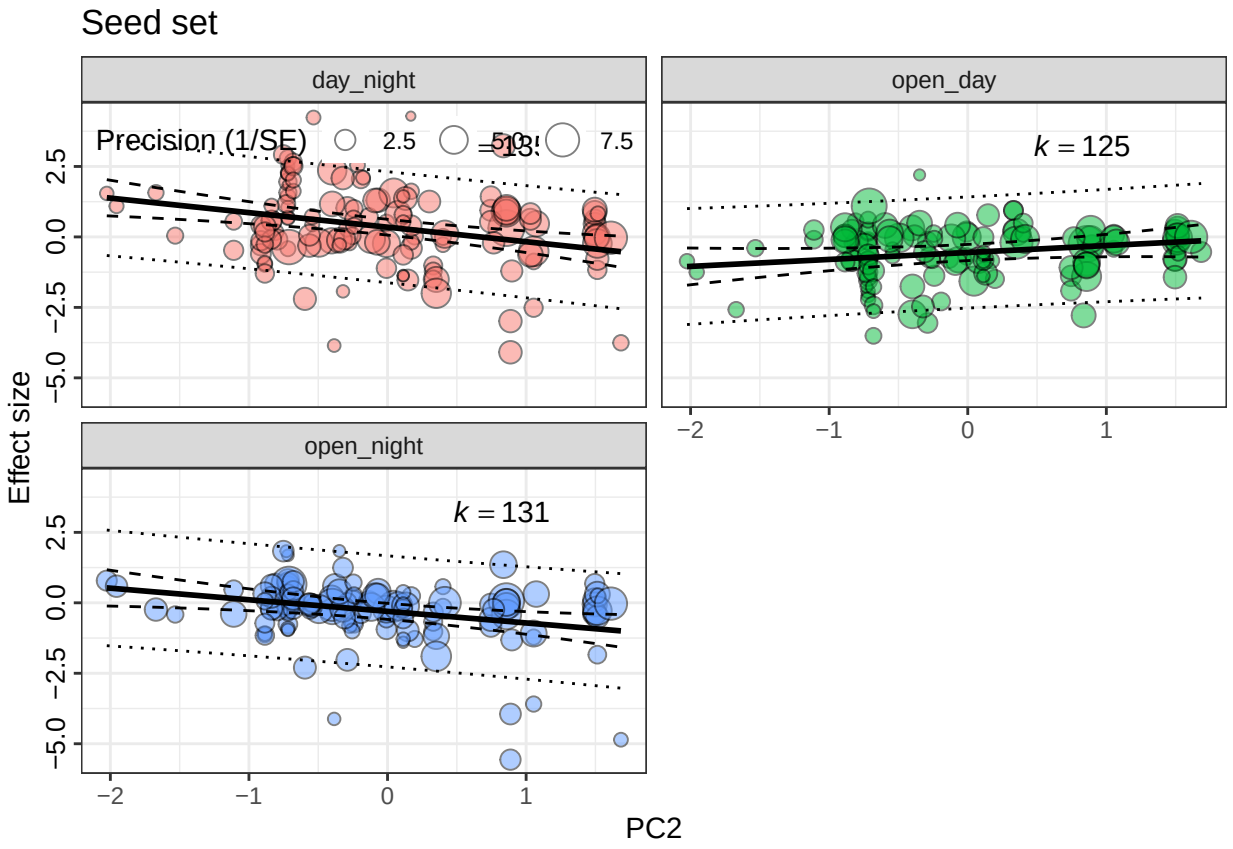
###Seed set and traits and environment

##strong effect of PC2 - negative for day vs night (+ive) and night (-ive) vs. open (+ive) , and then positive for day (-ive) vs. open (+ive) ##strong effect of PC3 on open_day

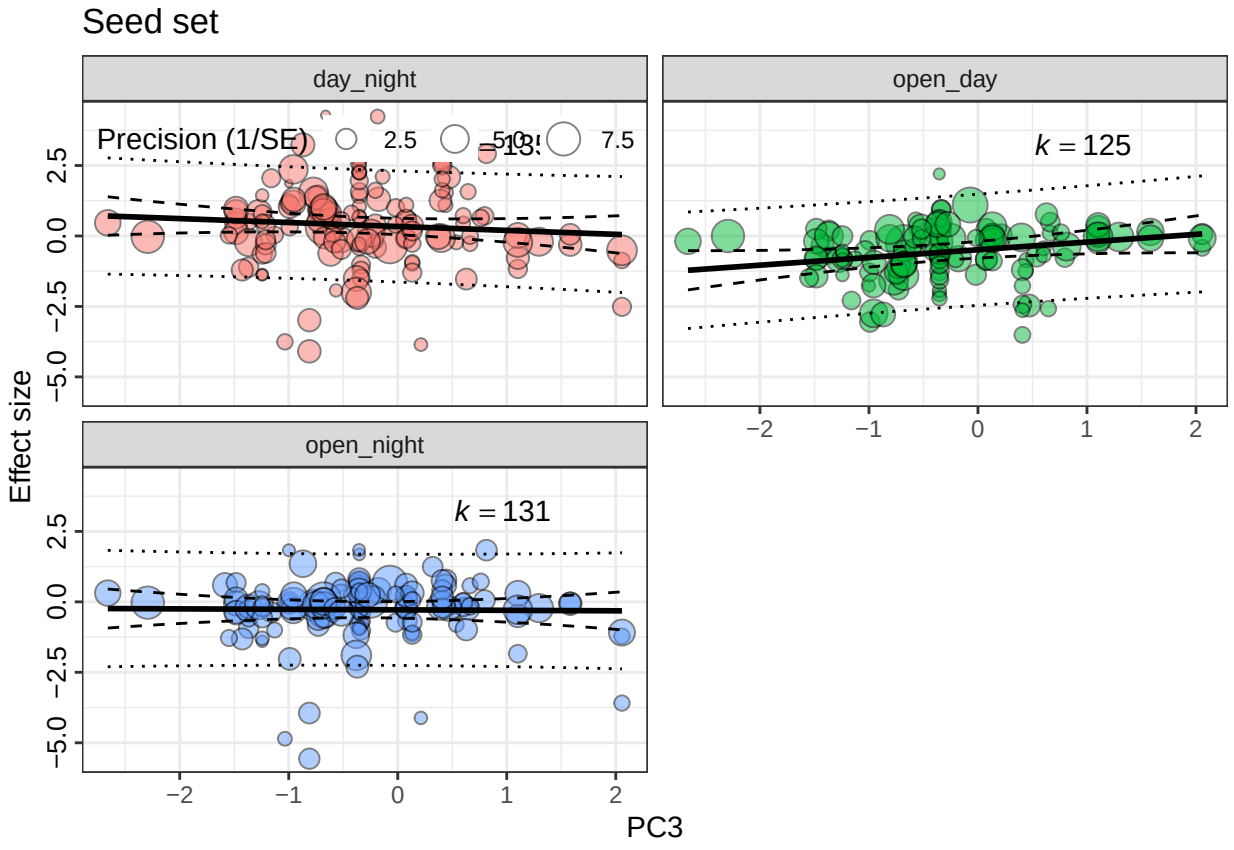
#weak interaction between Daylength and open_day (will be borderline if slope is sig diff from 0)

```
##
## Multivariate Meta-Analysis Model (k = 391; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.0000  0.0001     76     no       study_ID   no
## sigma^2.2  0.7768  0.8813    391     no      effect_ID   no
## sigma^2.3  0.0604  0.2458     75     no          phylo  yes
## sigma^2.4  0.1537  0.3920     75     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 379) = 3208.1891, p-val < .0001
##
## Test of Moderators (coefficients 2:12):
## QM(df = 11) = 87.3262, p-val < .0001
##
## Model Results:
##
##                          estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt                    0.3343  0.1452   2.3024  0.0213   0.0497   0.6188
```

```
## treatmentopen_day          -0.8481  0.1362  -6.2250  <.0001  -1.1151  -0.5811
## treatmentopen_night        -0.6212  0.1371  -4.5325  <.0001  -0.8899  -0.3526
## PC1                         0.0605  0.0799   0.7567  0.4492  -0.0962   0.2172
## PC2                        -0.5158  0.1423  -3.6249  0.0003  -0.7948  -0.2369
## PC3                        -0.1396  0.1302  -1.0723  0.2836  -0.3947   0.1156
## treatmentopen_day:PC1      -0.1429  0.0963  -1.4841  0.1378  -0.3315   0.0458
## treatmentopen_night:PC1    -0.0165  0.0948  -0.1737  0.8621  -0.2023   0.1694
## treatmentopen_day:PC2       0.7623  0.1724   4.4213  <.0001   0.4244   1.1002
## treatmentopen_night:PC2     0.1045  0.1720   0.6076  0.5435  -0.2326   0.4416
## treatmentopen_day:PC3       0.4132  0.1472   2.8067  0.0050   0.1246   0.7017
## treatmentopen_night:PC3     0.1224  0.1487   0.8230  0.4105  -0.1691   0.4138
##
## intrcpt                      *
## treatmentopen_day          ***
## treatmentopen_night        ***
## PC1
## PC2                        ***
## PC3
## treatmentopen_day:PC1
## treatmentopen_night:PC1
## treatmentopen_day:PC2      ***
## treatmentopen_night:PC2
## treatmentopen_day:PC3       **
## treatmentopen_night:PC3
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



env seed set-1.pdf



env seed set-2.pdf

```
## Warning: 9 rows with NAs omitted from model fitting.
```

```
##
## Multivariate Meta-Analysis Model (k = 382; method: REML)
##
## Variance Components:
##
##             estim    sqrt  nlvls  fixed         factor    R
## sigma^2.1  0.0000  0.0001     74     no       study_ID   no
## sigma^2.2  0.7111  0.8433    382     no      effect_ID   no
## sigma^2.3  0.0708  0.2662     73     no          phylo  yes
## sigma^2.4  0.1494  0.3865     73     no  accepted_name   no
##
## Test for Residual Heterogeneity:
## QE(df = 364) = 2799.3359, p-val < .0001
##
## Test of Moderators (coefficients 2:18):
## QM(df = 17) = 101.6204, p-val < .0001
##
## Model Results:
##
##                          estimate      se     zval    pval    ci.lb    ci.ub
## intrcpt                    0.3780  0.1722   2.1956  0.0281   0.0406   0.7154
## treatmentopen_day         -0.8483  0.1334  -6.3566  <.0001  -1.1098  -0.5867
## treatmentopen_night       -0.6381  0.1348  -4.7344  <.0001  -0.9022  -0.3739
## PC1                        0.0747  0.0876   0.8520  0.3942  -0.0971   0.2464
## PC2                       -0.4254  0.1524  -2.7918  0.0052  -0.7241  -0.1268
## PC3                       -0.1037  0.1453  -0.7143  0.4751  -0.3884   0.1809
```

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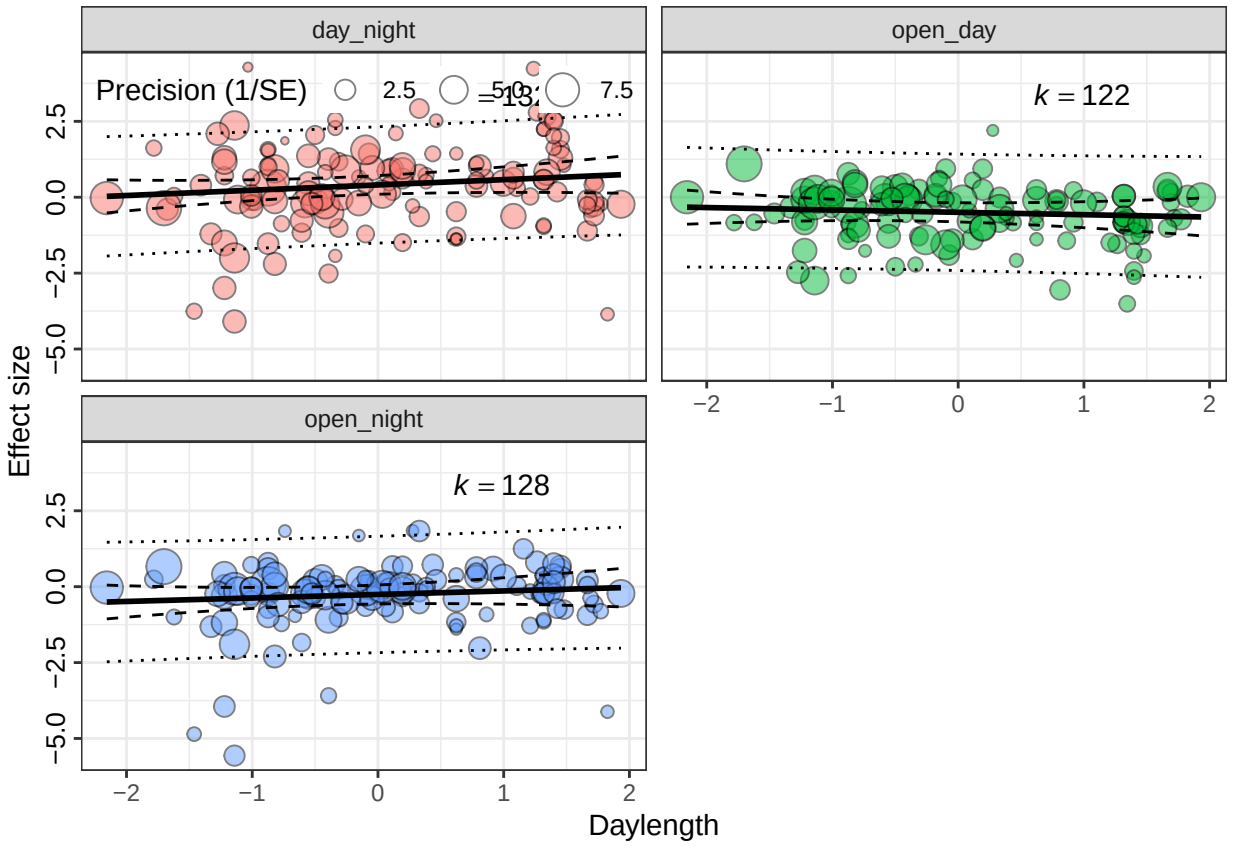
## sDTR                         0.2034  0.1618   1.2573  0.2086  -0.1137   0.5204
## treatmentopen_day:PC1       -0.2211  0.0949  -2.3291  0.0199  -0.4071  -0.0350
## treatmentopen_night:PC1     -0.0322  0.0935  -0.3441  0.7308  -0.2154   0.1511
## treatmentopen_day:PC2        0.7825  0.1749   4.4728  <.0001   0.4396   1.1254
## treatmentopen_night:PC2      0.1203  0.1746   0.6893  0.4906  -0.2218   0.4625
## treatmentopen_day:PC3        0.3413  0.1456   2.3439  0.0191   0.0559   0.6267
## treatmentopen_night:PC3      0.0977  0.1476   0.6614  0.5084  -0.1917   0.3870
## treatmentopen_day:sDTR      -0.2528  0.1317  -1.9190  0.0550  -0.5110   0.0054
## treatmentopen_night:sDTR    -0.0589  0.1322  -0.4452  0.6562  -0.3180   0.2003
## PC1:sDTR                    -0.0434  0.0798  -0.5432  0.5870  -0.1998   0.1131
## PC2:sDTR                     0.2738  0.1249   2.1919  0.0284   0.0290   0.5187
## PC3:sDTR                     0.0993  0.1282   0.7745  0.4386  -0.1519   0.3505
##
## intrcpt                       *
## treatmentopen_day           ***
## treatmentopen_night         ***
## PC1
## PC2                          **
## PC3
## sDTR
## treatmentopen_day:PC1         *
## treatmentopen_night:PC1
## treatmentopen_day:PC2       ***
## treatmentopen_night:PC2
## treatmentopen_day:PC3         *
## treatmentopen_night:PC3
## treatmentopen_day:sDTR        .
## treatmentopen_night:sDTR
## PC1:sDTR
## PC2:sDTR                      *
## PC3:sDTR
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

## Warning: 9 rows with NAs omitted from model fitting.

## $title
## [1] "Seed set"
##
## attr(,"class")
## [1] "labels"
```



env seed set-3.pdf