Analysis of Gentiana data (2010)

**1. Relations between fitness components and reproductive traits - Differences in selection gradients among populations**

Linear models with type II sums of squares

Fitness components (referred to the median shoot, NOT to the whole plant): number of intact fruits (n\_intact\_fruits), number of mature seeds (n\_seeds) 🡪 relativized to mean = 1 within each population (LokalID)

Reproductive traits: phenology index (phen\_index, continuous, varies from 1 to 6, higher values indicate earlier flowering), state of the most advanced bud (most\_adv, integer, varies from 1 to 6, higher values indicate earlier flowering), number of flowers (n\_fl), number of shoots (n\_shoots), height of the median shoot (h\_shoot) 🡪 standardized to mean = 0 and sd = 1 within each population (LokalID)

Both measures of phenology (phen\_index and most\_adv) are strongly correlated (r = 0.86), so we have to choose one to include in the models

Response: n\_intact\_fruits

Sum Sq Df F value Pr(>F)

phen\_index 0.7 1 0.4126 0.520742

n\_fl 334.0 1 207.4691 < 2.2e-16 \*\*\*

n\_shoots 3.8 1 2.3736 0.123562

h\_shoot 11.2 1 6.9753 0.008329 \*\* Estimate: 0.12448

phen\_index:LokalID 89.2 19 2.9155 2.438e-05 \*\*\*

n\_fl:LokalID 138.6 19 4.5310 2.929e-10 \*\*\*

n\_shoots:LokalID 37.1 19 1.2138 0.236191

h\_shoot:LokalID 35.8 19 1.1706 0.273867

Residuals 3176.4 1973

Response: n\_intact\_fruits

Sum Sq Df F value Pr(>F)

most\_adv 0.1 1 0.0476 0.82734

n\_fl 296.8 1 185.1523 < 2.2e-16 \*\*\*

n\_shoots 3.7 1 2.3261 0.12738

h\_shoot 12.7 1 7.9045 0.00498 \*\* Estimate: 0.129928

most\_adv:LokalID 103.4 19 3.3950 9.751e-07 \*\*\*

n\_fl:LokalID 119.8 19 3.9327 2.246e-08 \*\*\*

n\_shoots:LokalID 35.9 19 1.1783 0.26679

h\_shoot:LokalID 37.3 19 1.2245 0.22744

Residuals 3162.8 1973

Response: n\_seeds

Sum Sq Df F value Pr(>F)

phen\_index 5.28 1 7.9204 0.004983 \*\*

n\_fl 121.04 1 181.6890 < 2.2e-16 \*\*\*

n\_shoots 0.11 1 0.1706 0.679705

h\_shoot 5.42 1 8.1400 0.004418 \*\*

phen\_index:LokalID 27.56 19 2.1773 0.002500 \*\*

n\_fl:LokalID 61.90 19 4.8902 3.853e-11 \*\*\*

n\_shoots:LokalID 23.48 19 1.8547 0.014246 \*

h\_shoot:LokalID 27.87 19 2.2017 0.002179 \*\*

Residuals 674.21 1012

Response: n\_seeds

Sum Sq Df F value Pr(>F)

most\_adv 2.06 1 3.0933 0.0789161 .

n\_fl 103.64 1 155.7308 < 2.2e-16 \*\*\*

n\_shoots 0.11 1 0.1587 0.6904713

h\_shoot 5.57 1 8.3680 0.0039006 \*\*

most\_adv:LokalID 31.51 19 2.4917 0.0004001 \*\*\*

n\_fl:LokalID 46.29 19 3.6605 2.106e-07 \*\*\*

n\_shoots:LokalID 21.24 19 1.6797 0.0339156 \*

h\_shoot:LokalID 30.85 19 2.4401 0.0005447 \*\*\*

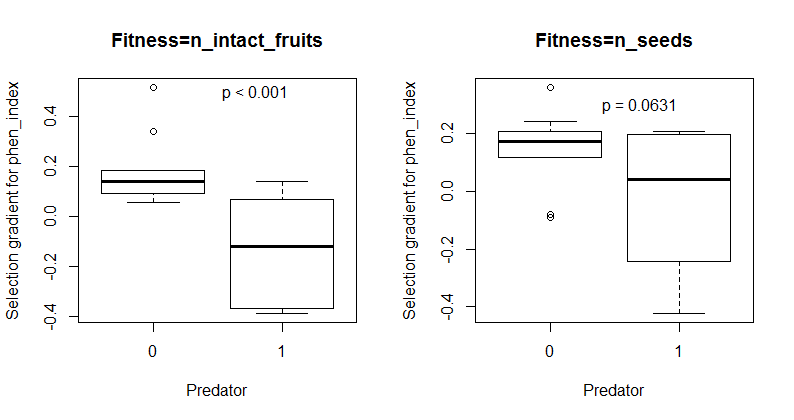
Residuals 673.48 1012

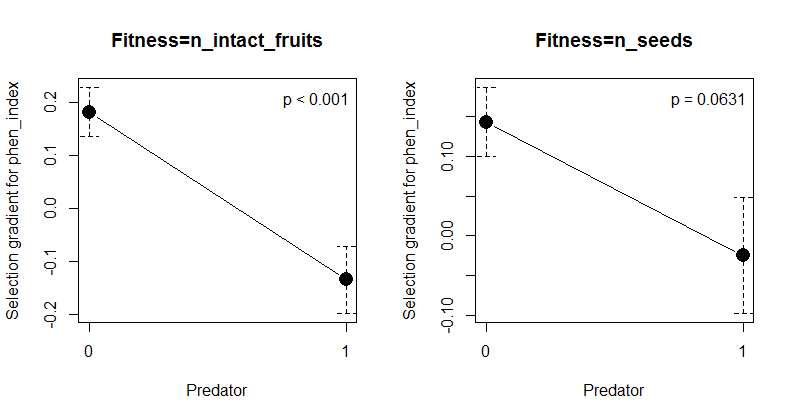
There are differences in selection gradients for phenology and flower number between populations, either using number of fruits or number of seeds as fitness measures. Using number of fruits, the selection for higher shoots is constant between populations. Using number of seeds, there are also differences in selection gradients for number and height of shoots.

A) Using phen\_index as a measure of phenology

**2. Differences in selection gradients between populations with/without predator**

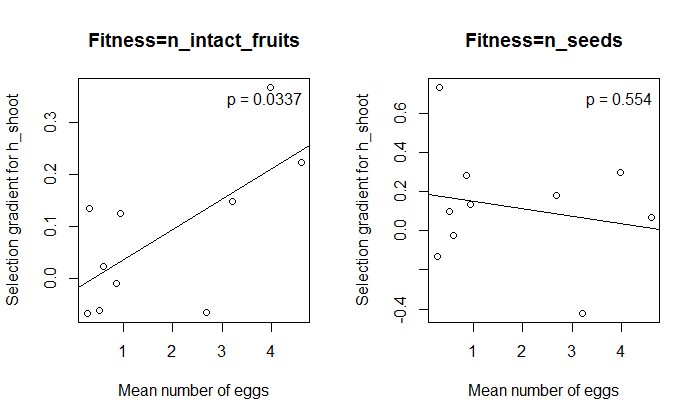
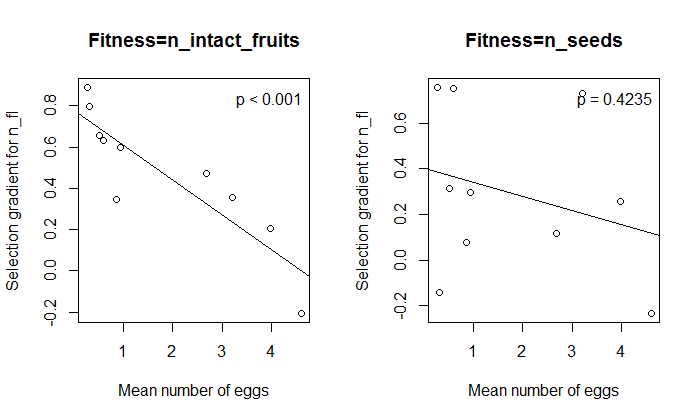
Selection gradients for each trait and population were calculated as the slope (beta-value) of the relationship between fitness and traits within that population.



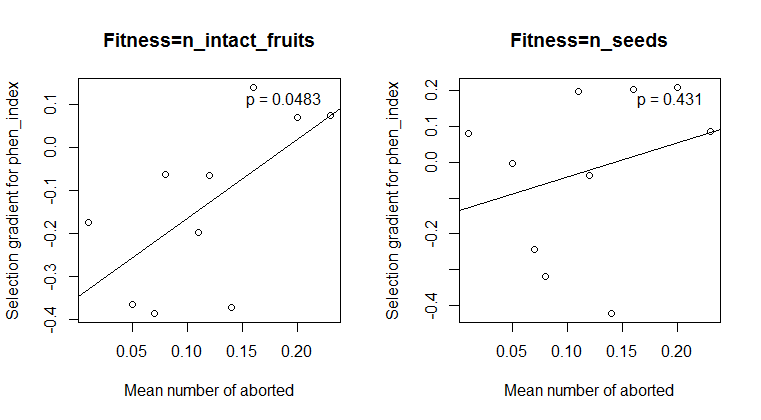


The selection gradients for phenology were different between populations with and without predator. In populations where the predator is absent there was selection for earlier flowering (higher phen\_index), while in populations where the predator was present there was selection for later flowering (lower phen\_index). There were not differences in selection gradients for the other traits between populations with and without predator.

**3. Variation in selection gradients with predation intensity**



Selection gradients for flower number and shoot height are significantly related to interaction intensity measured as mean number of eggs per population (considering the 10 populations where the predator was present). This relation is significant when considering n\_intact\_fruits as a fitness measure, but not when considering n\_seeds (maybe because seeds are counted both in intact and predated fruits?). Populations with higher intensity of predation (higher number of eggs) show selection for lower number of flowers and higher shoots (should not be the opposite, as butterflies will more easily detect higher shoots?). There is, however, no relation between intensity of predation (measured as mean number of eggs) and selection gradient for phenology.



On the other hand, there is a (marginally significant) relation between intensity of predation (measured as mean number of aborted flowers, fruits and buds per population) and selection gradient for phenology. Populations with higher intensity of predation (higher number of aborted flowers, fruits and buds) show selection for earlier phenology (higher phen\_index) (strange? Is number of aborted flowers, fruits and buds really a measure of predation intensity, or is abortion determined also by some other factors?). 🡪 explore this

Intensity of predation measured as mean number of predated flowers, fruits and buds did not show any significant relationship with any of the selection gradients for traits.

**4. Effects of traits on interaction intensity**

(in 10 populations where the predator is present)

Response: n\_eggs

Sum Sq Df F value Pr(>F)

phen\_index 490.9 1 57.5277 7.578e-14 \*\*\*

n\_fl 1114.2 1 130.5807 < 2.2e-16 \*\*\*

n\_shoots 9.9 1 1.1620 0.2813

h\_shoot 1.6 1 0.1922 0.6612

LokalID 2576.0 9 33.5433 < 2.2e-16 \*\*\*

phen\_index:LokalID 797.9 9 10.3902 1.854e-15 \*\*\*

n\_fl:LokalID 1163.1 9 15.1453 < 2.2e-16 \*\*\*

n\_shoots:LokalID 74.5 9 0.9700 0.4633

h\_shoot:LokalID 48.6 9 0.6326 0.7698

Residuals 8567.1 1004

Response: n\_pred\_all

Sum Sq Df F value Pr(>F)

phen\_index 8.59 1 9.7565 0.001838 \*\* Estimate: 0.12394

n\_fl 373.20 1 424.0711 < 2.2e-16 \*\*\*

n\_shoots 0.05 1 0.0599 0.806727

h\_shoot 3.84 1 4.3626 0.036988 \* Estimate: 0.11456

LokalID 219.11 9 27.6641 < 2.2e-16 \*\*\*

phen\_index:LokalID 9.39 9 1.1860 0.300152

n\_fl:LokalID 79.41 9 10.0254 7.458e-15 \*\*\*

n\_shoots:LokalID 9.69 9 1.2232 0.276597

h\_shoot:LokalID 12.61 9 1.5922 0.112786

Residuals 883.57 1004

Response: n\_aborted\_all

Sum Sq Df F value Pr(>F)

phen\_index 4.720 1 34.5012 5.788e-09 \*\*\*

n\_fl 3.099 1 22.6541 2.224e-06 \*\*\*

n\_shoots 0.152 1 1.1125 0.291802

h\_shoot 0.158 1 1.1526 0.283259

LokalID 3.288 9 2.6703 0.004575 \*\*

phen\_index:LokalID 3.659 9 2.9720 0.001698 \*\*

n\_fl:LokalID 6.020 9 4.8896 1.965e-06 \*\*\*

n\_shoots:LokalID 2.560 9 2.0796 0.028731 \*

h\_shoot:LokalID 2.995 9 2.4328 0.009757 \*\*

Residuals 137.342 1004

Selection on phenology and flower number seems to be in part determined by the intensity of predation.

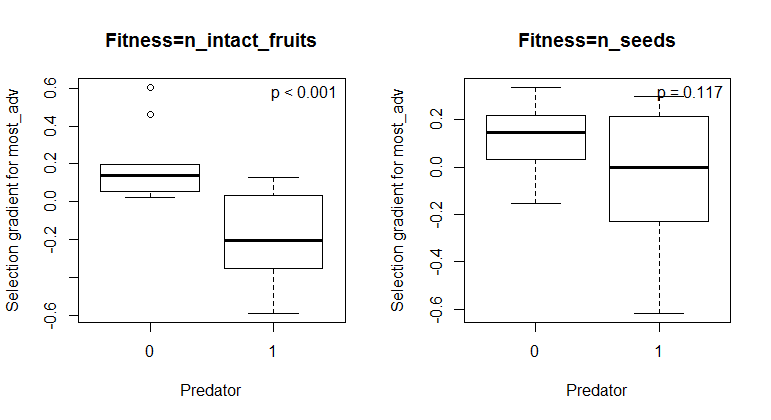
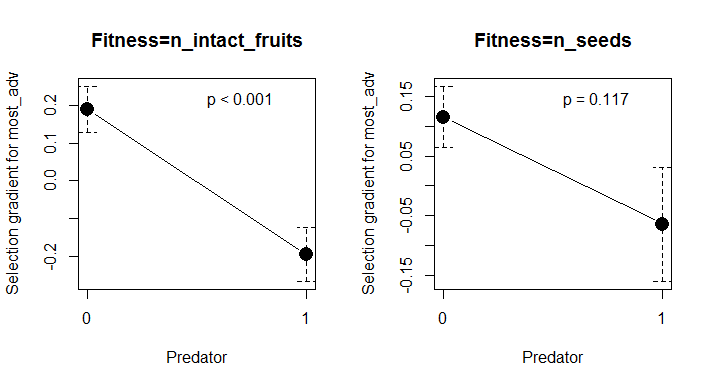
The relationship between the number of eggs and phenology and between number of eggs and flower number varied among populations.

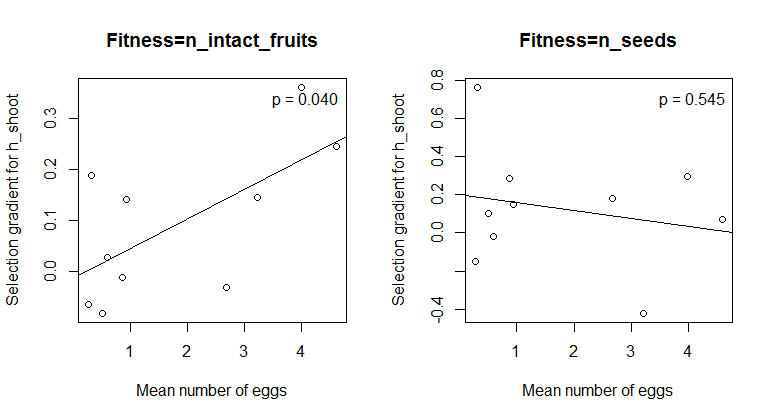
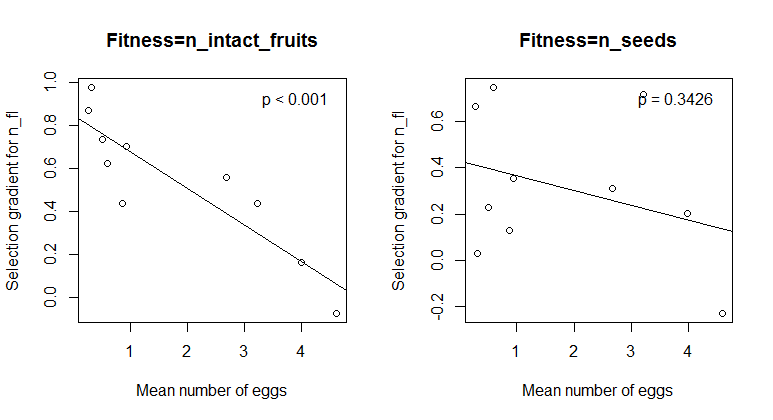
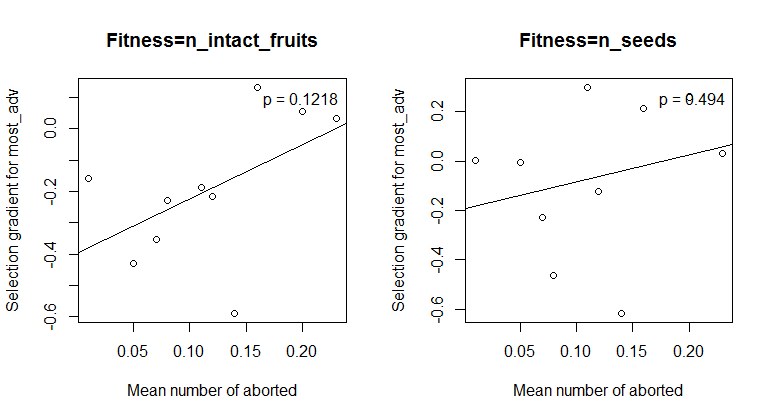
The relationship between the number of predated flowers, fruits and buds and flower number varied between populations. However, the relation between the number of predated flowers, fruits and buds and phenology and shoot height was consistent across populations, with more predation in plants flowering early and with higher shoots.

The relationship between the number of aborted flowers, fruits and buds and all the studied traits varied between populations.

A) Using most\_adv as a measure of phenology

**2. Differences in selection gradients between populations with/without predator**

**3. Variation in selection gradients with predation intensity** 

**4. Effects of traits on interaction intensity**

Response: n\_eggs

Sum Sq Df F value Pr(>F)

most\_adv 525.5 1 61.7037 1.023e-14 \*\*\*

n\_fl 643.0 1 75.5061 < 2.2e-16 \*\*\*

n\_shoots 8.8 1 1.0306 0.3103

h\_shoot 0.1 1 0.0131 0.9088

LokalID 2548.8 9 33.2563 < 2.2e-16 \*\*\*

most\_adv:LokalID 780.6 9 10.1849 4.057e-15 \*\*\*

n\_fl:LokalID 635.3 9 8.2894 5.600e-12 \*\*\*

n\_shoots:LokalID 80.6 9 1.0517 0.3965

h\_shoot:LokalID 53.7 9 0.7011 0.7083

Residuals 8549.8 1004

Response: n\_pred\_all

Sum Sq Df F value Pr(>F)

most\_adv 10.44 1 11.8112 0.0006129 \*\*\*

n\_fl 308.36 1 348.7797 < 2.2e-16 \*\*\*

n\_shoots 0.02 1 0.0238 0.8774268

h\_shoot 3.24 1 3.6669 0.0557879 .

LokalID 216.04 9 27.1503 < 2.2e-16 \*\*\*

most\_adv:LokalID 3.45 9 0.4338 0.9172326

n\_fl:LokalID 69.79 9 8.7714 8.925e-13 \*\*\*

n\_shoots:LokalID 10.06 9 1.2643 0.2521905

h\_shoot:LokalID 10.86 9 1.3652 0.1993350

Residuals 887.65 1004

Response: n\_aborted\_all

Sum Sq Df F value Pr(>F)

most\_adv 3.869 1 28.1114 1.408e-07 \*\*\*

n\_fl 4.603 1 33.4450 9.784e-09 \*\*\*

n\_shoots 0.168 1 1.2196 0.269707

h\_shoot 0.146 1 1.0587 0.303758

LokalID 3.188 9 2.5741 0.006234 \*\*

most\_adv:LokalID 3.671 9 2.9639 0.001744 \*\*

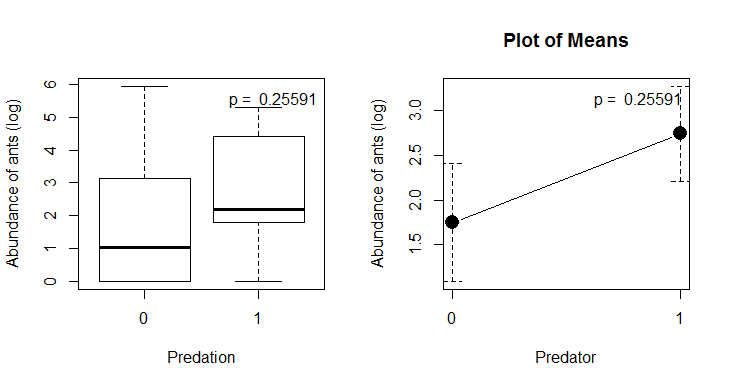
n\_fl:LokalID 7.060 9 5.6999 9.858e-08 \*\*\*

n\_shoots:LokalID 2.059 9 1.6621 0.093710 .

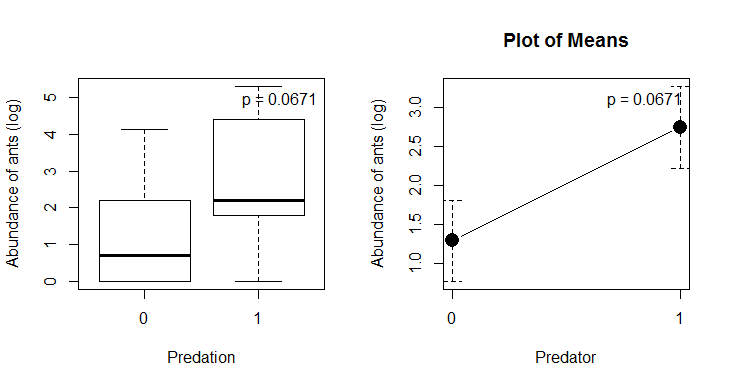
h\_shoot:LokalID 3.135 9 2.5308 0.007158 \*\*

Residuals 138.180 1004

**5. Ants 2010**



There are no significant differences in ant abundance between populations where the predator is present and absent. However, ant abundance is higher in populations where the predator is present and if we remove one outlier (a population, Mar001, with no butterflies but with high number of ants), the differences are nearly significant (see below).



Call:

glm(formula = pred ~ log(ants + 1), family = binomial, data = ants)

Deviance Residuals:

Min 1Q Median 3Q Max

-1.67542 -1.00910 -0.04623 1.17477 1.47286

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -0.6722 0.7345 -0.915 0.360

log(ants + 1) 0.3020 0.2599 1.162 0.245

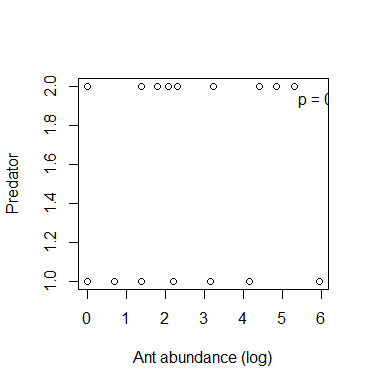
(Dispersion parameter for binomial family taken to be 1)

Null deviance: 27.726 on 19 degrees of freedom

Residual deviance: 26.268 on 18 degrees of freedom

AIC: 30.268

Number of Fisher Scoring iterations: 4



If we see it the other way round with a logistic regression, ant abundance has no effect on the presence of the butterfly.

If we remove the outlier, the effect of ant abundance on butterfly presence is marginally significant (see below).

Call:

glm(formula = pred ~ log(ants + 1), family = binomial, data = ants\_sub)

Deviance Residuals:

Min 1Q Median 3Q Max

-1.7970 -0.8451 0.4856 1.0781 1.6462

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -1.0567 0.8136 -1.299 0.1940

log(ants + 1) 0.5912 0.3413 1.732 0.0833 .

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

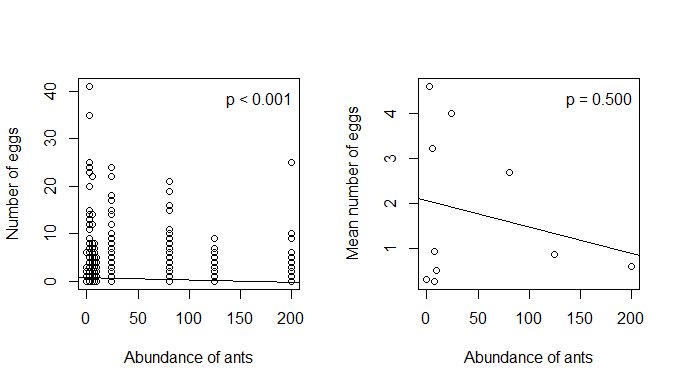
(Dispersion parameter for binomial family taken to be 1)

Null deviance: 26.287 on 18 degrees of freedom

Residual deviance: 22.521 on 17 degrees of freedom

AIC: 26.521

Number of Fisher Scoring iterations: 4



There is a slightly negative relationship between interaction intensity measured as number of eggs and ant abundance.

* Butterflies can cause declines on ant populations due to its parasitic effect, as they are fed by the colony.

Analysis of Gentiana data (2011)

Removed populations with LokalID = Mar001, Sve001, Sve005 and Sve011 because there is no information on fruits and seeds.

**1. Relations between fitness components and reproductive traits - Differences in selection gradients among populations**

Both measures of phenology (phen\_index and most\_adv) are strongly correlated (r = 0.82), so we have to choose one to include in the models.

In this year we should be cautious about using number of seeds as a fitness measure, because only one fruit was collected from each individual (in most of the cases), so the count of seeds depends on if this fruit was or not predated. Therefore, I think this will not give an accurate measure of the actual number of seeds per plant. We should maybe avoid using number of seeds and just keep number of intact fruits as a fitness measure for both years (as it also gives better results in 2010).

Response: n\_intact\_fruits

Sum Sq Df F value Pr(>F)

phen\_index 6.0 1 2.4571 0.1171974

n\_fl 158.9 1 64.9050 1.566e-15 \*\*\*

n\_shoots 0.2 1 0.0914 0.7624052

h\_shoot 0.9 1 0.3840 0.5355609

phen\_index:LokalID 61.0 15 1.6616 0.0522906 .

n\_fl:LokalID 91.7 15 2.4966 0.0012009 \*\*

n\_shoots:LokalID 26.7 15 0.7274 0.7584049

h\_shoot:LokalID 95.0 15 2.5876 0.0007627 \*\*\*

Residuals 3751.2 1532

Response: n\_intact\_fruits

Sum Sq Df F value Pr(>F)

most\_adv 1.2 1 0.4708 0.4927240

n\_fl 119.2 1 48.7982 4.215e-12 \*\*\*

n\_shoots 0.2 1 0.0643 0.7999103

h\_shoot 1.1 1 0.4530 0.5009989

most\_adv:LokalID 71.5 15 1.9510 0.0155600 \*

n\_fl:LokalID 102.1 15 2.7845 0.0002795 \*\*\*

n\_shoots:LokalID 25.1 15 0.6843 0.8022097

h\_shoot:LokalID 84.7 15 2.3107 0.0029717 \*\*

Residuals 3746.2 1533

Response: n\_seeds

Sum Sq Df F value Pr(>F)

phen\_index 4.419 1 2.4228 0.121872

n\_fl 15.549 1 8.5253 0.004092 \*\*

n\_shoots 0.418 1 0.2289 0.633082

h\_shoot 6.954 1 3.8128 0.052886 . Estimate: -0.14749

phen\_index:LokalID 32.182 15 1.1763 0.297147

n\_fl:LokalID 95.787 15 3.5013 4.386e-05 \*\*\*

n\_shoots:LokalID 25.861 15 0.9453 0.516326

h\_shoot:LokalID 37.390 15 1.3667 0.172137

Residuals 251.689 138

Response: n\_seeds

Sum Sq Df F value Pr(>F)

most\_adv 1.076 1 0.5538 0.458031

n\_fl 10.666 1 5.4876 0.020582 \*

n\_shoots 0.167 1 0.0860 0.769764

h\_shoot 6.174 1 3.1762 0.076919 . Estimate: -0.157656

most\_adv:LokalID 18.981 15 0.6510 0.827671

n\_fl:LokalID 76.179 15 2.6128 0.001726 \*\*

n\_shoots:LokalID 24.218 15 0.8307 0.642290

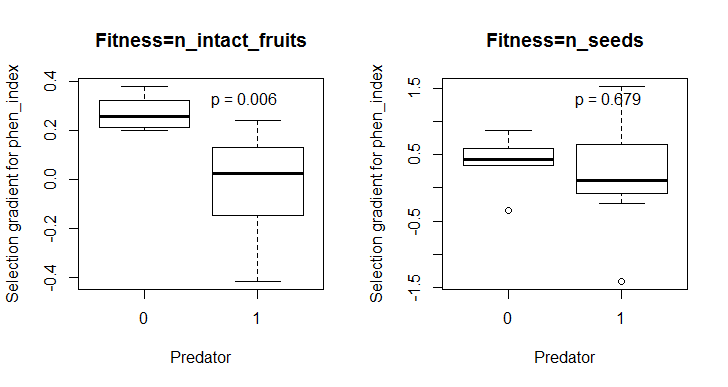
h\_shoot:LokalID 41.041 15 1.4076 0.151743

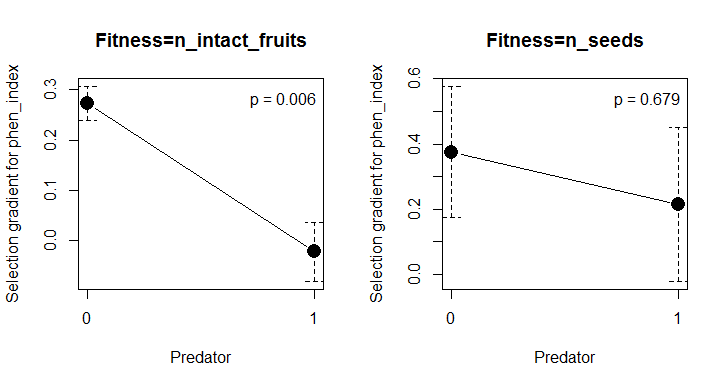
Residuals 268.233 138

There are differences in selection gradients for flower number between populations, either using number of fruits or number of seeds as fitness measures. Using number of fruits, there are differences in the selection gradient for phenology (when using phen\_index the interaction is marginally significant) and shoot height. Using number of seeds, the selection for lower shoots is constant between populations (although the effect is marginally significant).

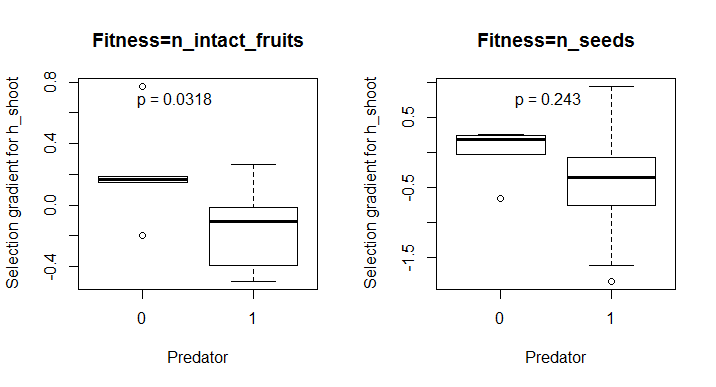
A) Using phen\_index as a measure of phenology

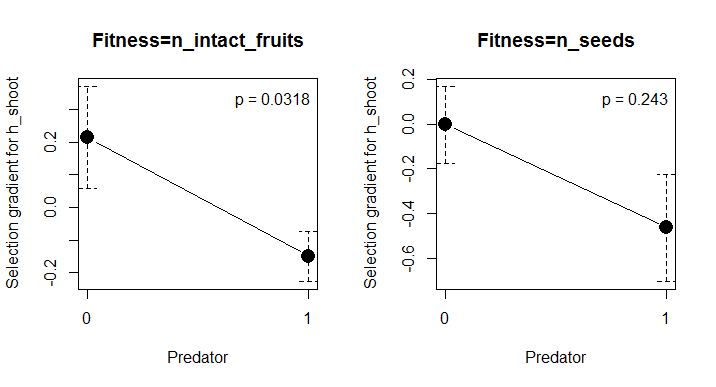
**2. Differences in selection gradients between populations with/without predator**





The selection gradients for phenology were different between populations with and without predator when fitness was measured as the number of intact fruits. In populations where the predator is absent there was selection for earlier flowering (higher phen\_index), while in populations where the predator was present there was selection for later flowering (lower phen\_index). There were no differences in selection gradients for phenology when fitness was measured as the number of seeds.





The selection gradients for shoot height were also different between populations with and without predator when fitness was measured as the number of intact fruits. In populations where the predator is absent there was selection for higher shoots, while in populations where the predator was present there was selection for lower shoots. Again, there were no differences when fitness was measured as the number of seeds.

There were not differences in selection gradients for the other traits (flower and shoot number) between populations with and without predator.

**3. Variation in selection gradients with predation intensity**



The selection gradient for flower number is now only marginally related to interaction intensity measured as mean number of eggs per population when considering n\_intact\_fruits as a fitness measure. Populations with higher intensity of predation (higher number of eggs) show selection for lower number of flowers. There is, however, no relation between intensity of predation (measured as mean number of eggs) and selection gradients for phenology, height or number of shoots.

In this year, the relation between intensity of predation measured as mean number of aborted flowers, fruits and buds per population and selection gradient for phenology is not significant. Intensity of predation measured as mean number of predated flowers, fruits and buds did not either show any significant relationship with any of the selection gradients for traits.

**4. Effects of traits on interaction intensity**

Response: n\_eggs

Sum Sq Df F value Pr(>F)

phen\_index 490.9 1 57.5277 7.578e-14 \*\*\*

n\_fl 1114.2 1 130.5807 < 2.2e-16 \*\*\*

n\_shoots 9.9 1 1.1620 0.2813

h\_shoot 1.6 1 0.1922 0.6612

LokalID 2576.0 9 33.5433 < 2.2e-16 \*\*\*

phen\_index:LokalID 797.9 9 10.3902 1.854e-15 \*\*\*

n\_fl:LokalID 1163.1 9 15.1453 < 2.2e-16 \*\*\*

n\_shoots:LokalID 74.5 9 0.9700 0.4633

h\_shoot:LokalID 48.6 9 0.6326 0.7698

Residuals 8567.1 1004

Response: n\_pred\_all

Sum Sq Df F value Pr(>F)

phen\_index 45.46 1 48.0075 7.417e-12 \*\*\* Estimate: 0.23519

n\_fl 387.08 1 408.7827 < 2.2e-16 \*\*\*

n\_shoots 1.36 1 1.4343 0.231328

h\_shoot 8.68 1 9.1689 0.002522 \*\* Estimate: 0.12758

LokalID 163.09 10 17.2228 < 2.2e-16 \*\*\*

phen\_index:LokalID 6.35 10 0.6702 0.752829

n\_fl:LokalID 31.06 10 3.2799 0.000341 \*\*\*

n\_shoots:LokalID 11.30 10 1.1936 0.290865

h\_shoot:LokalID 8.32 10 0.8789 0.552519

Residuals 988.58 1044

Response: n\_aborted\_all

Sum Sq Df F value Pr(>F)

phen\_index 25.07 1 57.2266 8.499e-14 \*\*\* Estimate: -0.17248

n\_fl 100.96 1 230.4094 < 2.2e-16 \*\*\*

n\_shoots 0.33 1 0.7609 0.3833

h\_shoot 0.29 1 0.6693 0.4135

LokalID 30.79 10 7.0278 9.547e-11 \*\*\*

phen\_index:LokalID 4.75 10 1.0845 0.3709

n\_fl:LokalID 31.85 10 7.2697 3.478e-11 \*\*\*

n\_shoots:LokalID 6.35 10 1.4491 0.1536

h\_shoot:LokalID 6.88 10 1.5698 0.1104

Residuals 457.44 1044

Selection on phenology and flower number seems to be in part determined by the intensity of predation.

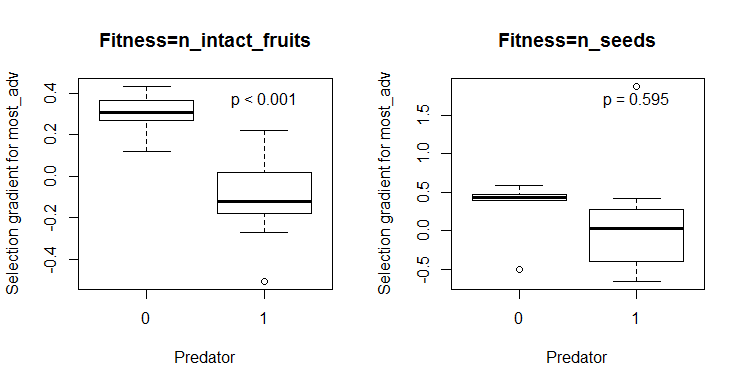
The relationship between the number of eggs and phenology and between number of eggs and flower number varied among populations.

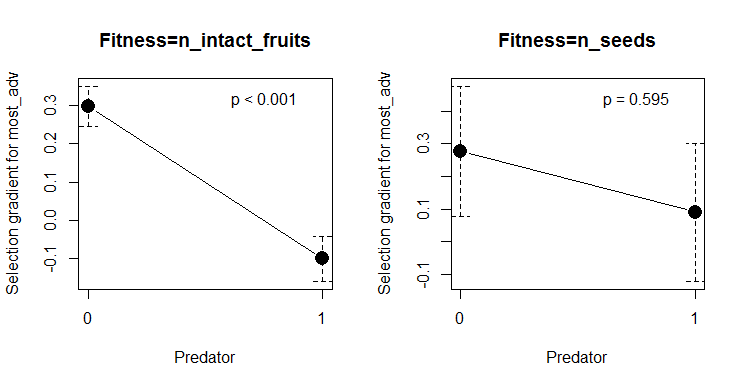
The relationship between the number of predated flowers, fruits and buds and flower number varied between populations. However, the relation between the number of predated flowers, fruits and buds and phenology and shoot height was consistent across populations, with more predation in plants flowering early and with higher shoots.

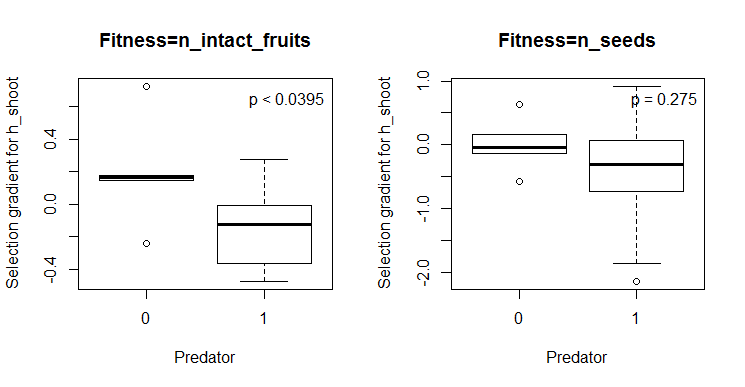
The relationship between number of aborted flowers, fruits and buds and number of flowers varied between populations. The relationship between number of aborted flowers, fruits and buds and phenology was consistent across populations (less abortion in plants flowering early).

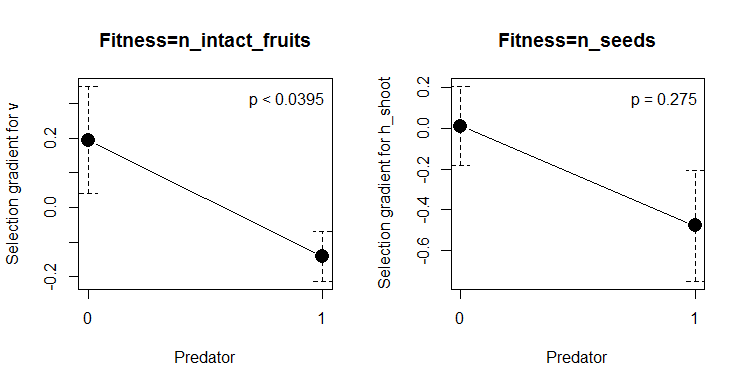
B) Using most\_adv as a measure of phenology

**2. Differences in selection gradients between populations with/without predator**









Same results as with phen\_index.

**3. Variation in selection gradients with predation intensity**

None of the selection gradients were significantly related to any of the measures of predation intensity in this case.

**4. Effects of traits on interaction intensity**

Response: n\_eggs

Sum Sq Df F value Pr(>F)

most\_adv 1089.9 1 39.4100 5.029e-10 \*\*\*

n\_fl 6746.4 1 243.9378 < 2.2e-16 \*\*\*

n\_shoots 2.1 1 0.0749 0.7844

h\_shoot 0.0 1 0.0000 0.9969

LokalID 12722.4 10 46.0021 < 2.2e-16 \*\*\*

most\_adv:LokalID 1213.9 10 4.3893 4.657e-06 \*\*\*

n\_fl:LokalID 9014.3 10 32.5943 < 2.2e-16 \*\*\*

n\_shoots:LokalID 309.3 10 1.1182 0.3448

h\_shoot:LokalID 176.7 10 0.6388 0.7812

Residuals 28873.0 1044

Response: n\_pred\_all

Sum Sq Df F value Pr(>F)

most\_adv 24.86 1 25.9725 4.109e-07 \*\*\* Estimate: 0.20878

n\_fl 267.10 1 279.0652 < 2.2e-16 \*\*\*

n\_shoots 1.04 1 1.0861 0.29758

h\_shoot 8.16 1 8.5240 0.00358 \*\* Estimate: 0.12371

LokalID 163.03 10 17.0341 < 2.2e-16 \*\*\*

most\_adv:LokalID 16.30 10 1.7032 0.07528 .

n\_fl:LokalID 39.78 10 4.1562 1.170e-05 \*\*\*

n\_shoots:LokalID 10.94 10 1.1433 0.32615

h\_shoot:LokalID 7.47 10 0.7801 0.64815

Residuals 999.22 1044

Response: n\_aborted\_all

Sum Sq Df F value Pr(>F)

most\_adv 7.89 1 17.3898 3.297e-05 \*\*\* Estimate: -0.11962

n\_fl 100.50 1 221.6308 < 2.2e-16 \*\*\*

n\_shoots 0.31 1 0.6813 0.4093

h\_shoot 0.25 1 0.5483 0.4592

LokalID 30.80 10 6.7930 2.538e-10 \*\*\*

most\_adv:LokalID 5.99 10 1.3208 0.2140

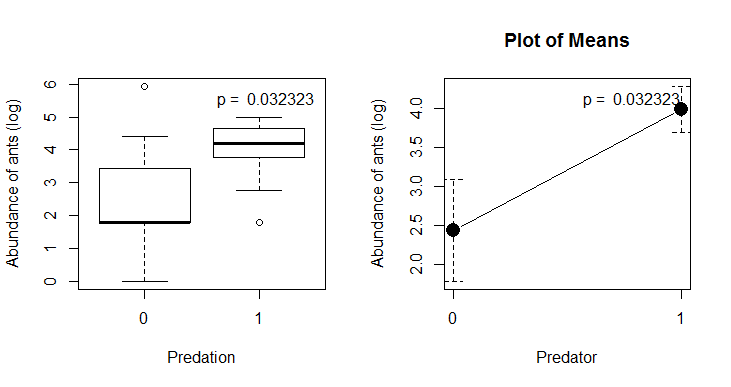
n\_fl:LokalID 33.76 10 7.4445 1.676e-11 \*\*\*

n\_shoots:LokalID 6.80 10 1.4995 0.1341

h\_shoot:LokalID 6.75 10 1.4891 0.1379

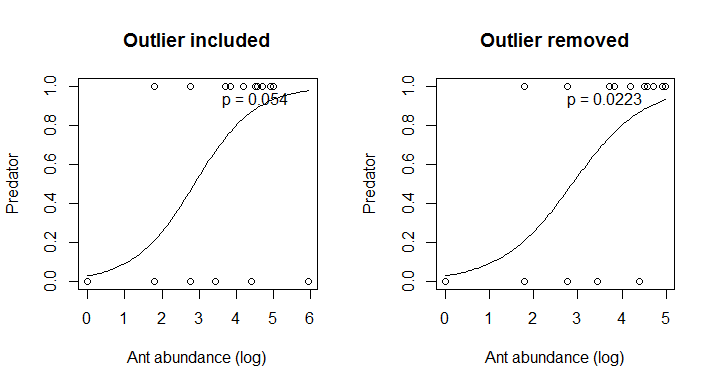
Residuals 473.39 1044

**5. Ants 🡨HERE!**



Abundance of ants in both years is strongly correlated. The population Mar001 is still an outlier, with no butterflies but with high number of ants (this population was removed from previous analyses because there were no data on fruits and seeds, but kept here). But in this case the differences between populations with and without predator in ant abundance are significant (using the log of abundance).

If we see it the other way round with a logistic regression, ant abundance has a marginal positive effect on the presence of the butterfly. If we remove the outlier, the effect is fully significant.



Outlier included:

Call:

glm(formula = pred ~ logants, family = binomial, data = ants)

Deviance Residuals:

Min 1Q Median 3Q Max

-2.1189 -0.8306 0.6591 0.8631 1.5696

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -2.1944 1.3638 -1.609 0.108

logants 0.7298 0.3787 1.927 0.054 .

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 27.526 on 19 degrees of freedom

Residual deviance: 22.499 on 18 degrees of freedom

AIC: 26.499

Number of Fisher Scoring iterations: 4

Outlier removed:

Call:

glm(formula = pred ~ logants, family = binomial, data = ants\_sub)

Deviance Residuals:

Min 1Q Median 3Q Max

-2.0123 -0.6817 0.3924 0.6648 1.7740

Coefficients:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -3.5609 1.8337 -1.942 0.0522 .

logants 1.2388 0.5422 2.285 0.0223 \*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

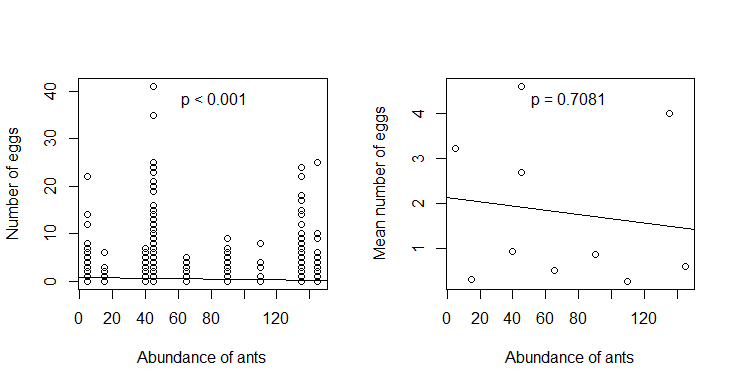
(Dispersion parameter for binomial family taken to be 1)

Null deviance: 25.864 on 18 degrees of freedom

Residual deviance: 16.685 on 17 degrees of freedom

AIC: 20.685

Number of Fisher Scoring iterations: 5



The negative relationship between interaction intensity measured as number of eggs and ant abundance still appears in this year.