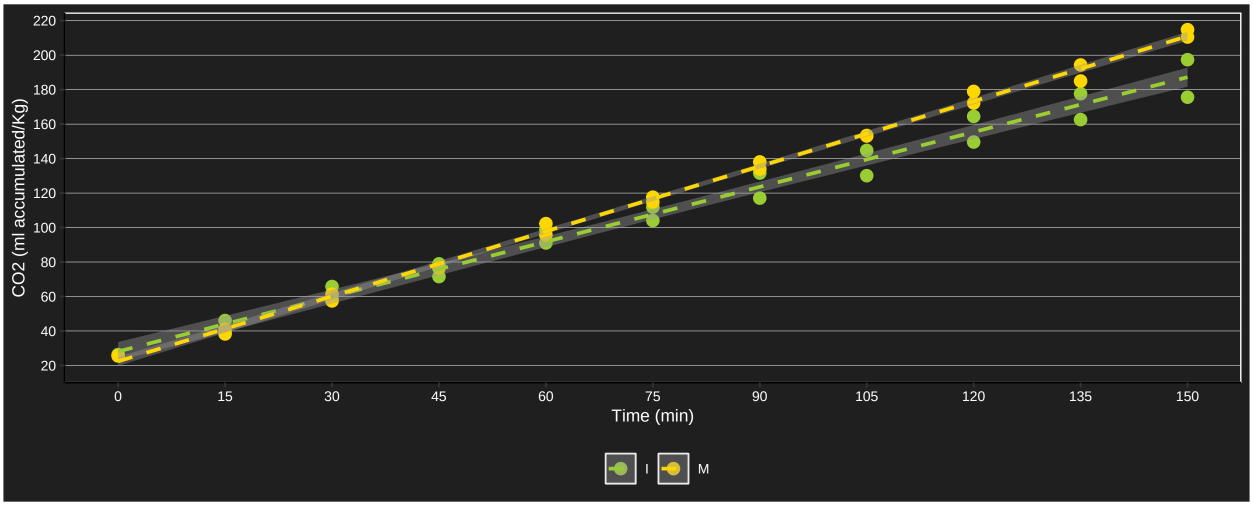
Ensayo 1

Immature and mature ubajay fruits were selected and randomly distributed in 4 jars, 2 immature and 2 mature, then respiration was quantified from accumulated CO2 every 15 minutes for 150 minutes.

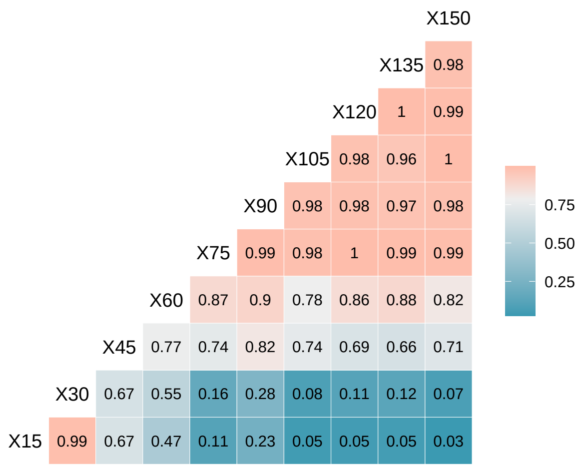
CO2 acumulation



Descriptive table

```
## # A tibble: 20 x 7
## # Groups:   time_min [10]
##    time_min matu  carbon_ac_n carbon_ac_Mean carbon_ac_sd carbon_ac_min
##    <fct>    <fct>       <int>          <dbl>        <dbl>         <dbl>
##  1 15       I               2           42.5        4.97           39.0
##  2 15       M               2           39.6        1.86           38.3
##  3 30       I               2           62.2        5.13           58.5
##  4 30       M               2           59.4        2.79           57.4
##  5 45       I               2           75.2        5.23           71.5
##  6 45       M               2           76.6        0.110          76.6
##  7 60       I               2           94.9        5.39           91.1
##  8 60       M               2           99.0        4.66           95.7
##  9 75       I               2          108.         5.50          104.
## 10 75       M               2          116.         1.97          115.
## 11 90       I               2          124.        10.3           117.
## 12 90       M               2          136.         2.91          134.
## 13 105      I               2          137.        10.4           130.
## 14 105      M               2          153.         0.221         153.
## 15 120      I               2          157.        10.5           150.
## 16 120      M               2          176.         4.77          172.
## 17 135      I               2          170.        10.6           163.
## 18 135      M               2          190.         6.59          185.
## 19 150      I               2          186.        15.4           176.
## 20 150      M               2          213.         3.02          211.
## # i 1 more variable: carbon_ac_max <dbl>
```

Correlations over time



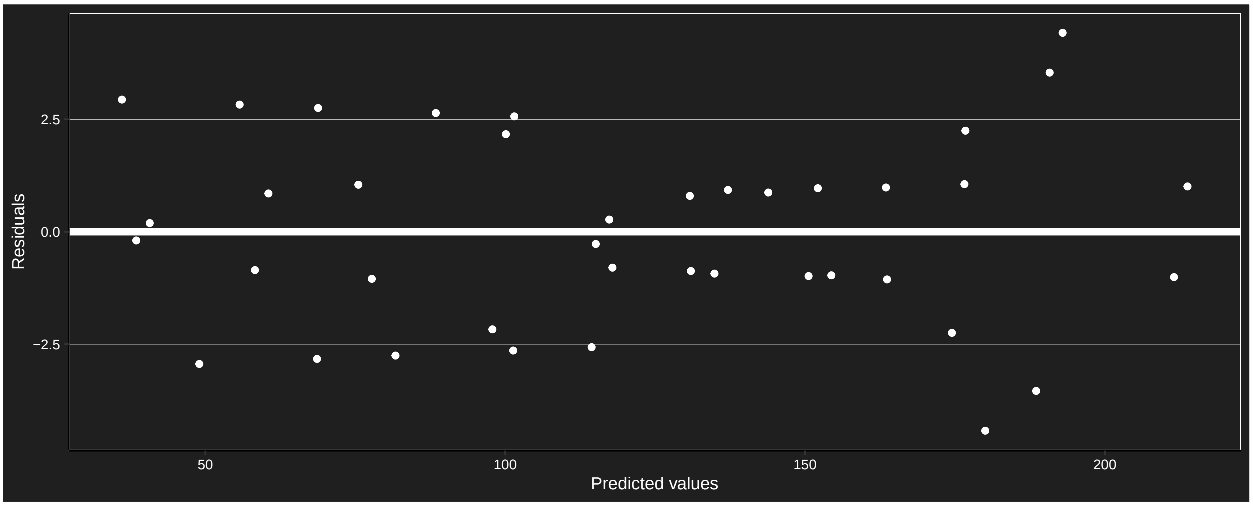
Covariance matrix

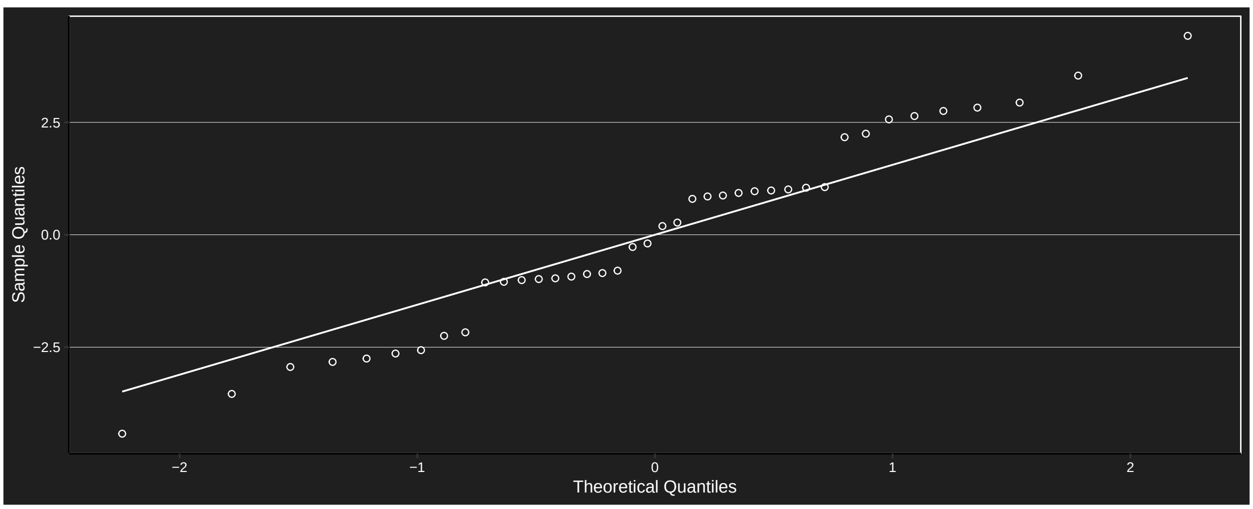
```
##         15    30    45    60     75     90    105    120    135    150
## 15   12.28 12.95  7.38  7.79   2.21   7.31   1.73   2.14   2.50   1.66
## 30   12.95 13.93  7.77  9.75   3.59   9.42   3.25   5.23   6.22   4.90
## 45    7.38  7.77  9.77 11.46  13.46  23.37  25.37  27.07  27.76  38.97
## 60    7.79  9.75 11.46 22.55  24.26  38.94  40.66  51.74  56.09  68.14
## 75    2.21  3.59 13.46 24.26  34.14  52.90  62.77  73.57  77.63 102.21
## 90    7.31  9.42 23.37 38.94  52.90  83.40  97.35 112.92 118.82 157.38
## 105   1.73  3.25 25.37 40.66  62.77  97.35 119.47 134.76 140.36 191.45
## 120   2.14  5.23 27.07 51.74  73.57 112.92 134.76 159.43 168.68 220.61
## 135   2.50  6.22 27.76 56.09  77.63 118.82 140.36 168.68 179.37 231.42
## 150   1.66  4.90 38.97 68.14 102.21 157.38 191.45 220.61 231.42 309.86
```

Marginal model with first-order autoregressive structure

```
## gls(model = (carbon_ac) ~ time_min * matu + basal, data = resp2w,
##     correlation = corAR1(form = ~1 | rep))
```

Assumptions






```
##
##  Shapiro-Wilk normality test
##
## data:  e
## W = 0.97616, p-value = 0.5498
```

Model coefficients

```
##       (Intercept)        time_min30        time_min45        time_min60
##     -1088.3098591        19.6250543        32.7084238        52.3334782
##         time_min75        time_min90       time_min105       time_min120
##        65.4168477        81.7897236        94.8730931       114.4981474
##        time_min135       time_min150             matuM             basal
##       127.5815169       143.9543928        24.0203019        43.2170578
##  time_min30:matuM  time_min45:matuM  time_min60:matuM  time_min75:matuM
```

```
##         0.1712202         4.3272497         7.0553453        11.2113748
##  time_min90:matuM time_min105:matuM time_min120:matuM time_min135:matuM
##        14.6347734        18.7908030        21.5188986        22.4853372
## time_min150:matuM
##        29.0983267
```

Anova

```
## Denom. DF: 19
##               numDF   F-value p-value
## (Intercept)       1 12422.598  <.0001
## time_min          9   497.680  <.0001
## matu              1    23.524  0.0001
## basal             1    18.306  0.0004
## time_min:matu     9     4.645  0.0024
```

Simple effects

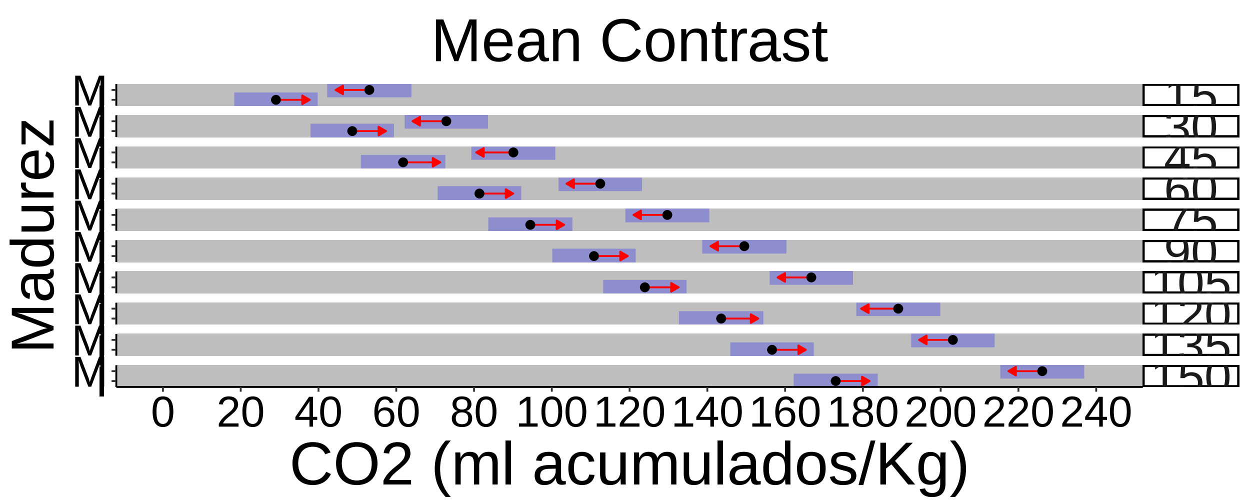
```
## $emmeans
## time_min = 15:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I     29.05593 3.996413 4.38  18.32747  39.78439
##  M     53.07623 3.996413 4.26  42.24267  63.90980
##
## time_min = 30:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I     48.68099 3.996413 4.37  37.94735  59.41462
##  M     72.87251 3.996413 4.38  62.14744  83.59757
##
## time_min = 45:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I     61.76435 3.996413 4.23  50.90664  72.62207
##  M     90.11191 3.996413 4.30  79.31519 100.90863
##
## time_min = 60:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I     81.38941 3.996413 4.35  70.64128  92.13754
##  M    112.46506 3.996413 4.37 101.73142 123.19869
##
## time_min = 75:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I     94.47278 3.996413 4.28  83.65659 105.28897
##  M    129.70446 3.996413 4.31 118.91264 140.49627
##
## time_min = 90:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I    110.84565 3.996413 4.38 100.11719 121.57412
##  M    149.50073 3.996413 4.26 138.66717 160.33429
##
## time_min = 105:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I    123.92902 3.996413 4.37 113.19539 134.66266
```

```
##  M    166.74013 3.996413 4.38 156.01506 177.46520
##
## time_min = 120:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I    143.55408 3.996413 4.23 132.69637 154.41179
##  M    189.09328 3.996413 4.30 178.29656 199.89000
##
## time_min = 135:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I    156.63745 3.996413 4.35 145.88932 167.38558
##  M    203.14309 3.996413 4.37 192.40945 213.87672
##
## time_min = 150:
##  matu    emmean       SE   df  lower.CL  upper.CL
##  I    173.01032 3.996413 4.28 162.19413 183.82652
##  M    226.12895 3.996413 4.31 215.33714 236.92077
##
## Degrees-of-freedom method: satterthwaite
## Results are given on the ( (not the response) scale.
## Confidence level used: 0.95
##
## $contrasts
## time_min = 15:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -24.02030 7.197624 6.29  -3.337  0.0146
##
## time_min = 30:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -24.19152 7.197624 6.30  -3.361  0.0141
##
## time_min = 45:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -28.34755 7.197624 4.51  -3.938  0.0135
##
## time_min = 60:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -31.07565 7.197624 6.28  -4.317  0.0045
##
## time_min = 75:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -35.23168 7.197624 6.24  -4.895  0.0024
##
## time_min = 90:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -38.65508 7.197624 6.29  -5.371  0.0015
##
## time_min = 105:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -42.81110 7.197624 6.30  -5.948  0.0008
##
## time_min = 120:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -45.53920 7.197624 4.51  -6.327  0.0021
##
```

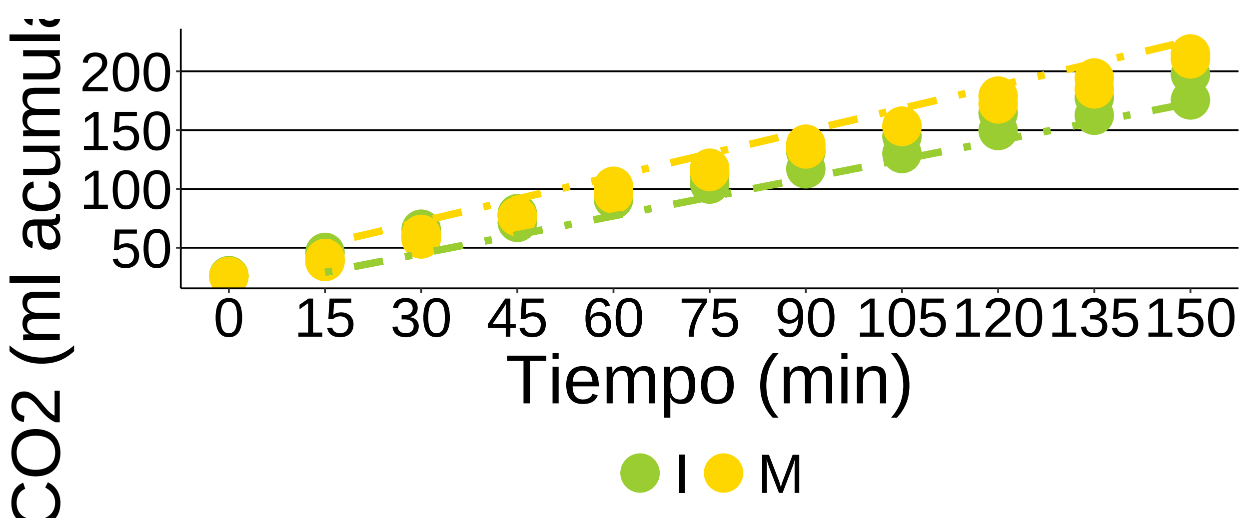
```
## time_min = 135:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -46.50564 7.197624 6.28  -6.461  0.0005
##
## time_min = 150:
##  contrast  estimate       SE   df t.ratio p.value
##  I - M    -53.11863 7.197624 6.24  -7.380  0.0003
##
## Note: contrasts are still on the ( scale
## Degrees-of-freedom method: satterthwaite
```

Statistically significant differences were found in the CO2 respiration rate in each time between immature and mature Hexachlamys edulis fruits.

Comparison chart



Fitted model plot



Respiration. Essay 1 with CO_2 accumulated

CO_2 acumulation

Respiration. Essay 1 with ml CO_2

Boxplot for CO_2 emission for two stages of maturity in time.

CO_2 emission for two stages of maturity in time. Shapes indicate different repetitions.

Correlation between the concentration of CO_2 and O_2 for mature and immature fruits.

O_2 for mature and immature fruits over time.

Model

Assumptions

Assumptions are ok.

Anova

There is no interaction or significant differences.

Conclusion for respiration

There is no convincing evidence in this essay to affirm that the fruit of the ubajay is climacteric.

Análisis de con medidas repetidas en el tiempo