

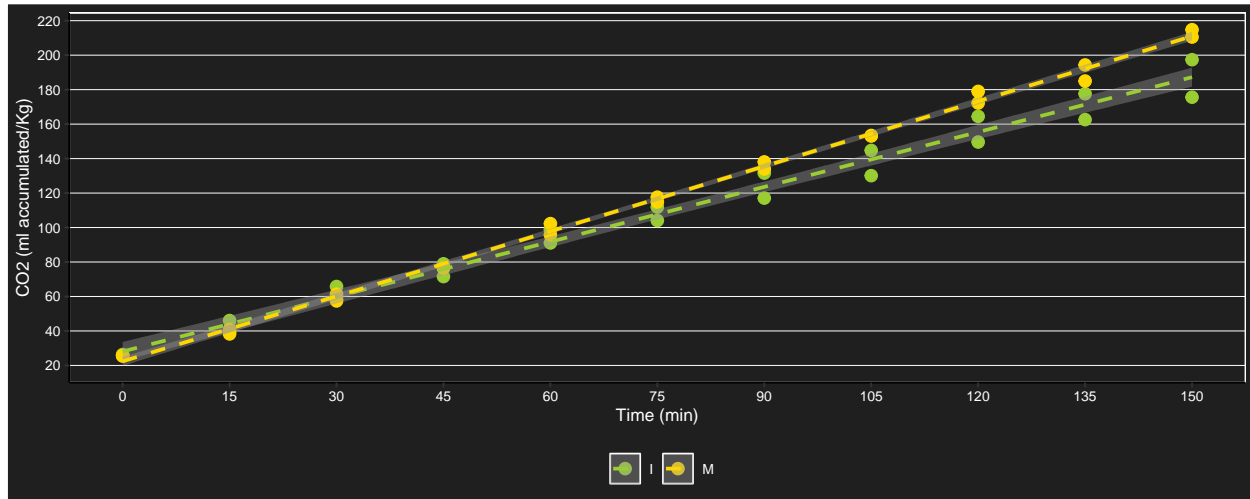
Ensayo 1

Respiración acumulada en frutos I y M



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



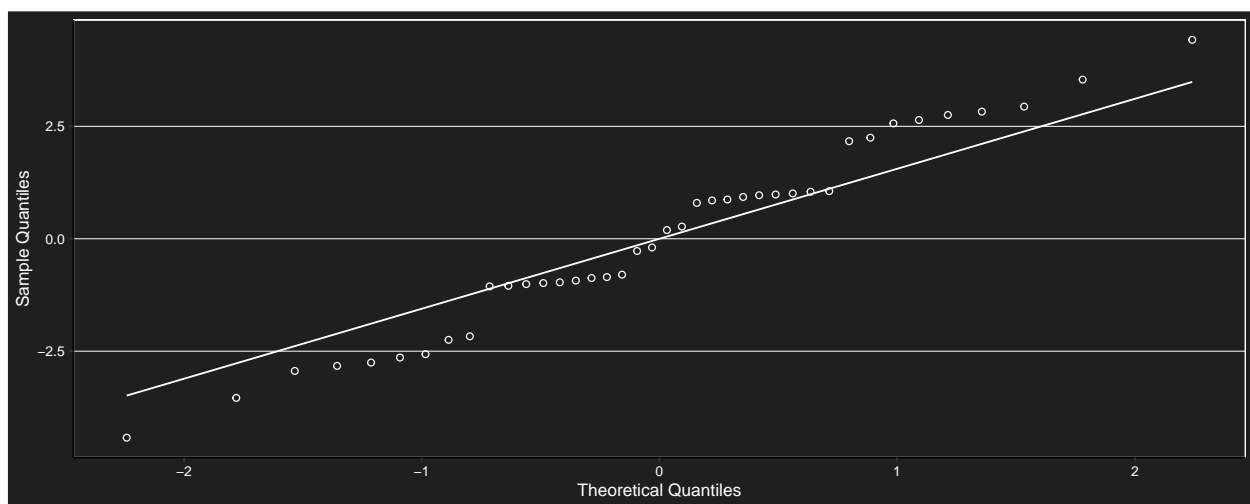
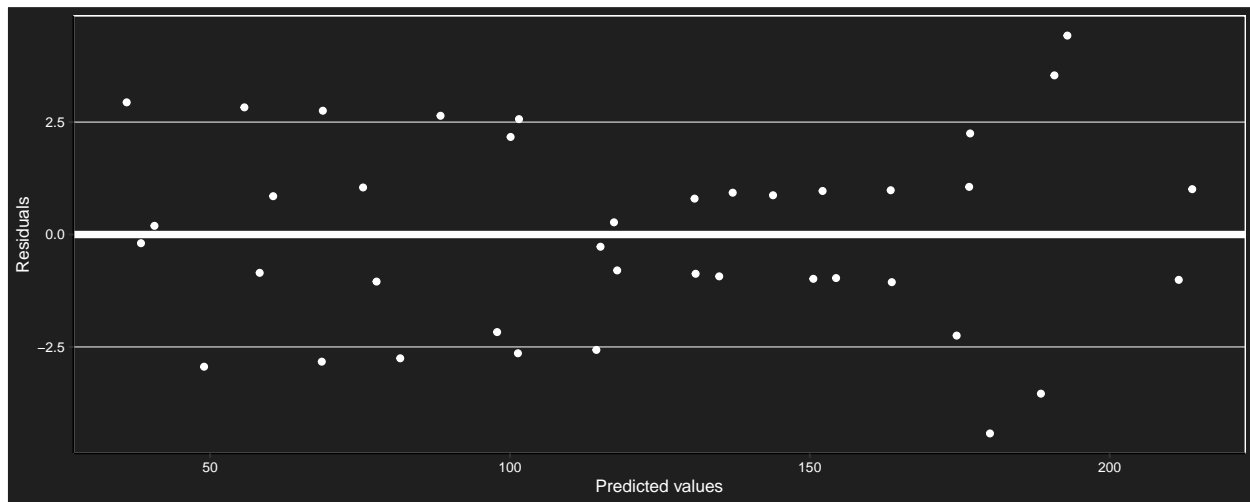
Covariance matrix

##	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 = 0.9761627, p-value = 0.549824
```

Model coefficients

```
##      (Intercept)      time_min30      time_min45      time_min60
## -1088.309859117    19.625054307    32.708423844    52.333478151
##      time_min75      time_min90      time_min105     time_min120
##   65.416847689    81.789723552    94.873093090    114.498147397
##      time_min135     time_min150      matuM          basal
##  127.581516934    143.954392798    24.020301930    43.217057762
## time_min30:matuM time_min45:matuM time_min60:matuM time_min75:matuM
```

```
##      0.171220178      4.327249699      7.055345302      11.211374823
## time_min90:matuM time_min105:matuM time_min120:matuM time_min135:matuM
##      14.634773444      18.790802965      21.518898568      22.485337162
## time_min150:matuM
##      29.098326710
```

Anova

```
## Denom. DF: 19
##      numDF      F-value p-value
## (Intercept)      1 12422.59816 <.0001
## time_min      9   497.67981 <.0001
## matu      1    23.52445 0.0001
## basal      1    18.30623 0.0004
## time_min:matu      9    4.64451 0.0024
```

Simple effects

```
## $emmeans
## time_min = 15:
## matu      emmean      SE df    lower.CL    upper.CL
## I      29.0559310 3.99641289 4.38  18.3274684  39.7843936
## M      53.0762329 3.99641289 4.26  42.2426703  63.9097956
##
## time_min = 30:
## matu      emmean      SE df    lower.CL    upper.CL
## I      48.6809853 3.99641289 4.37  37.9473496  59.4146210
## M      72.8725074 3.99641289 4.38  62.1474410  83.5975738
##
## time_min = 45:
## matu      emmean      SE df    lower.CL    upper.CL
## I      61.7643548 3.99641289 4.23  50.9066429  72.6220667
## M      90.1119065 3.99641289 4.30  79.3151857 100.9086272
##
## time_min = 60:
## matu      emmean      SE df    lower.CL    upper.CL
## I      81.3894091 3.99641289 4.35  70.6412810  92.1375372
## M     112.4650564 3.99641289 4.37 101.7314207 123.1986921
##
## time_min = 75:
## matu      emmean      SE df    lower.CL    upper.CL
## I      94.4727787 3.99641289 4.28  83.6565866 105.2889707
## M     129.7044554 3.99641289 4.31 118.9126401 140.4962708
##
## time_min = 90:
## matu      emmean      SE df    lower.CL    upper.CL
## I     110.8456545 3.99641289 4.38 100.1171919 121.5741172
## M     149.5007299 3.99641289 4.26 138.6671673 160.3342926
##
## time_min = 105:
## matu      emmean      SE df    lower.CL    upper.CL
## I     123.9290241 3.99641289 4.37 113.1953884 134.6626598
```

```

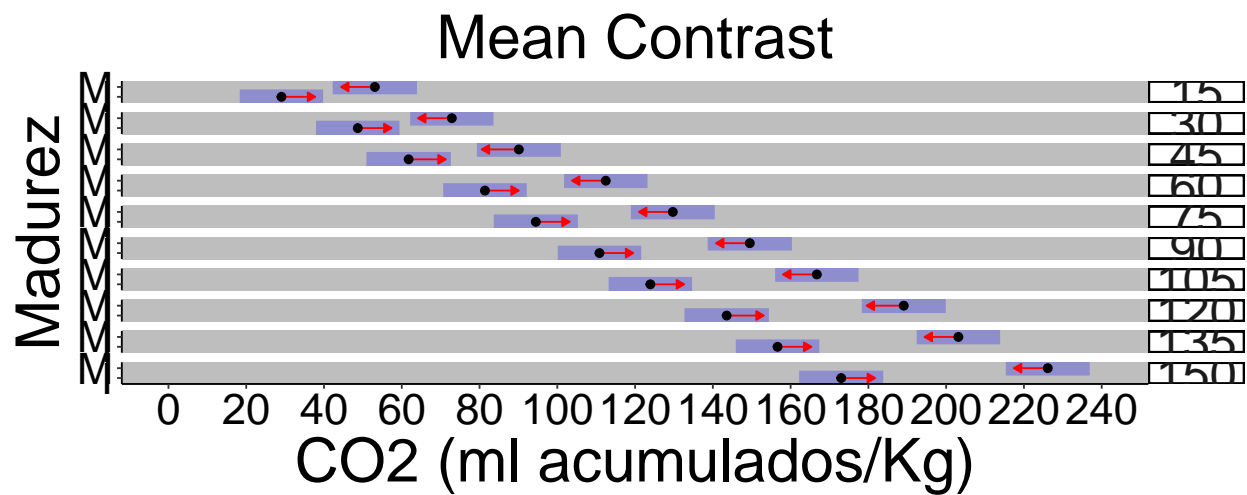
## M      166.7401290 3.99641289 4.38 156.0150626 177.4651953
##
## time_min = 120:
##   matu      emmean      SE    df    lower.CL    upper.CL
## I      143.5540784 3.99641289 4.23 132.6963665 154.4117903
## M      189.0932789 3.99641289 4.30 178.2965581 199.8899996
##
## time_min = 135:
##   matu      emmean      SE    df    lower.CL    upper.CL
## I      156.6374479 3.99641289 4.35 145.8893198 167.3855760
## M      203.1430870 3.99641289 4.37 192.4094513 213.8767227
##
## time_min = 150:
##   matu      emmean      SE    df    lower.CL    upper.CL
## I      173.0103238 3.99641289 4.28 162.1941317 183.8265159
## M      226.1289524 3.99641289 4.31 215.3371371 236.9207678
##
## 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      -24.0203019 7.19762359 6.29  -3.337  0.0146
##
## time_min = 30:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -24.1915221 7.19762359 6.30  -3.361  0.0141
##
## time_min = 45:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -28.3475516 7.19762359 4.51  -3.938  0.0135
##
## time_min = 60:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -31.0756472 7.19762359 6.28  -4.317  0.0045
##
## time_min = 75:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -35.2316768 7.19762359 6.24  -4.895  0.0024
##
## time_min = 90:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -38.6550754 7.19762359 6.29  -5.371  0.0015
##
## time_min = 105:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -42.8111049 7.19762359 6.30  -5.948  0.0008
##
## time_min = 120:
##   contrast      estimate      SE    df t.ratio p.value
## I - M      -45.5392005 7.19762359 4.51  -6.327  0.0021
##

```

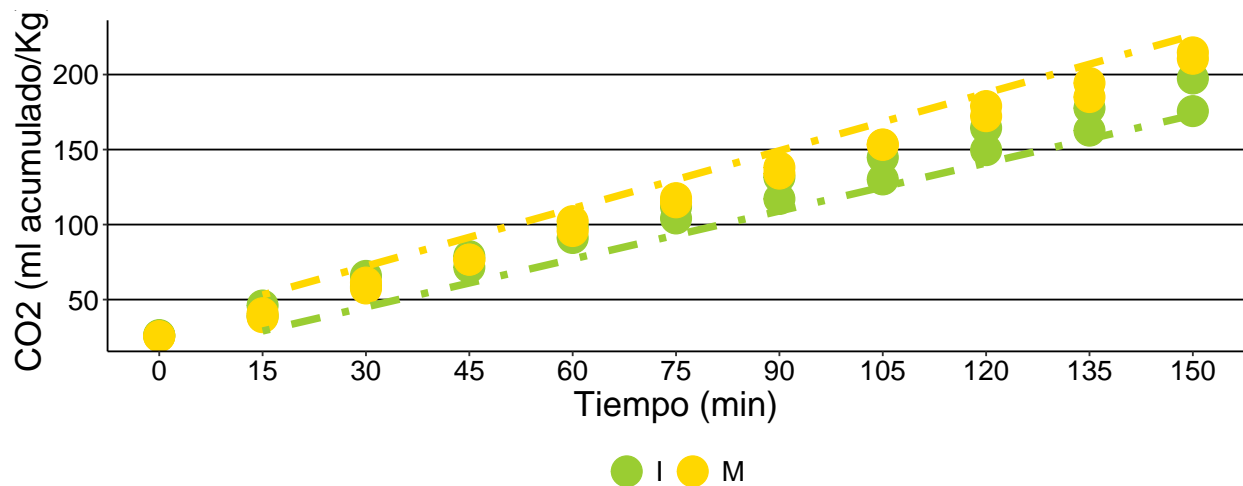
```
## time_min = 135:
## contrast      estimate      SE    df t.ratio p.value
## I - M        -46.5056391  7.19762359  6.28  -6.461  0.0005
##
## time_min = 150:
## contrast      estimate      SE    df t.ratio p.value
## I - M        -53.1186286  7.19762359  6.24  -7.380  0.0003
##
## Note: contrasts 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 CO₂ accumulated

CO₂ accumulation

Respiration. Essay 1 with ml CO₂

Boxplot for CO₂ emission for two stages of maturity in time.

CO₂ emission for two stages of maturity in time. Shapes indicate different repetitions.

Correlation between the concentration of CO₂ and O₂ for mature and immature fruits.

O₂ 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