Genome Size and Life Style of Solanaceae

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Life Style in Solanaceae

Annual – only lives one season

Not Annual – lives more than one season. (biannual, perennial)

Previous work with genome size

Hordeum Phylum

Table 2

Three-Way Analysis of Variance with Covariate (ANCOVA) for the Contribution of Factors to the Measured Genome Size of the *Hordeum* Accessions.

Source	*F*	Significance
Karyotype	39.255	.000
Life form	150.234	.000
Climate	0.859	.527
Species' ages	0.271	.603

NOTE.—Tests of between-subjects effects. Dependent variable is genome size.

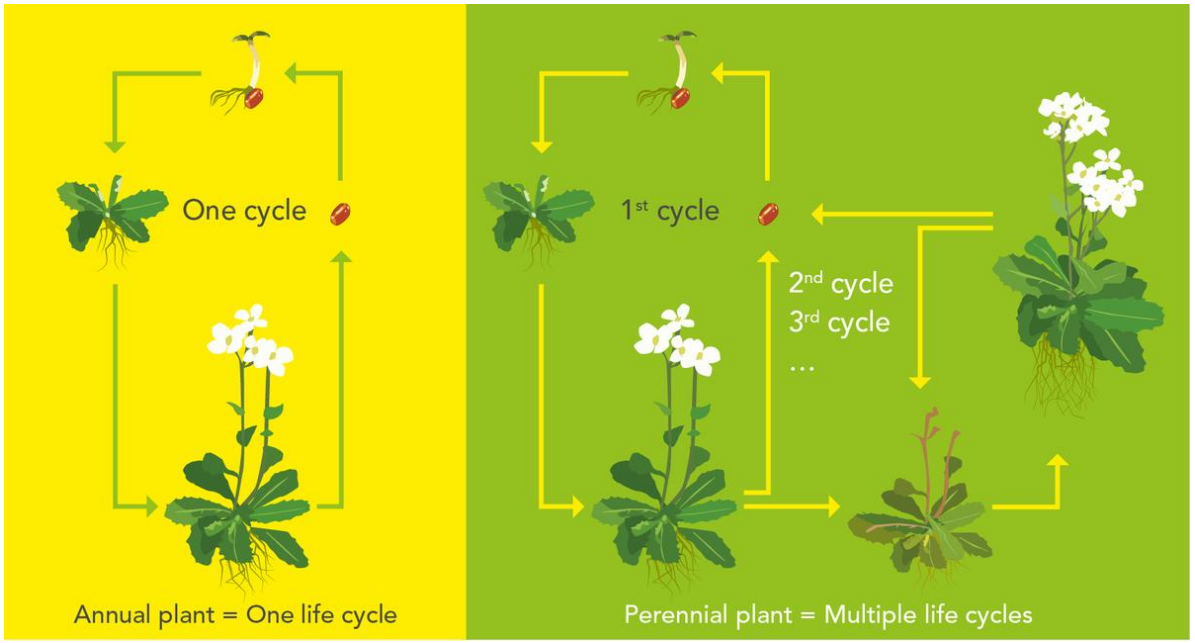
Jakob, S.S., A. Meister, F. R. Blattner. (2004). *The Considerable Genome Size Variation of Hordeum Species (Poaceae) Is Linked to Phylogeny, Life Form, Ecology, and Speciation Rates*. Molecular Biology and Evolution, Volume 21, Issue 5, 1 May 2004, Pages 860–869

Pinus Phylum

Eva Grotkopp, Marcel Rejmánek, Michael J. Sanderson, Thomas L. Rost, and P. Soltis Evolution Aug 2004 : Vol. 58, Issue 8, pg(s) 1705- 1729 https://doi.org/10.1554/03-545

Does annual plants have a smaller genome?

I hypothesis that ***annual plants*** on average, have a ***smaller genome*** due to the fact that they have a fast reproduction rate. I expect ***perennial plants*** have a ***large genome*** for since the is less pressure for fast growth and requires more adaptively throughout its life.



Approach

Data: Kew Botanical Garden c-value Database: http://data.kew.org/cvalues/

Tree Dataset: 114 taxa

Methods

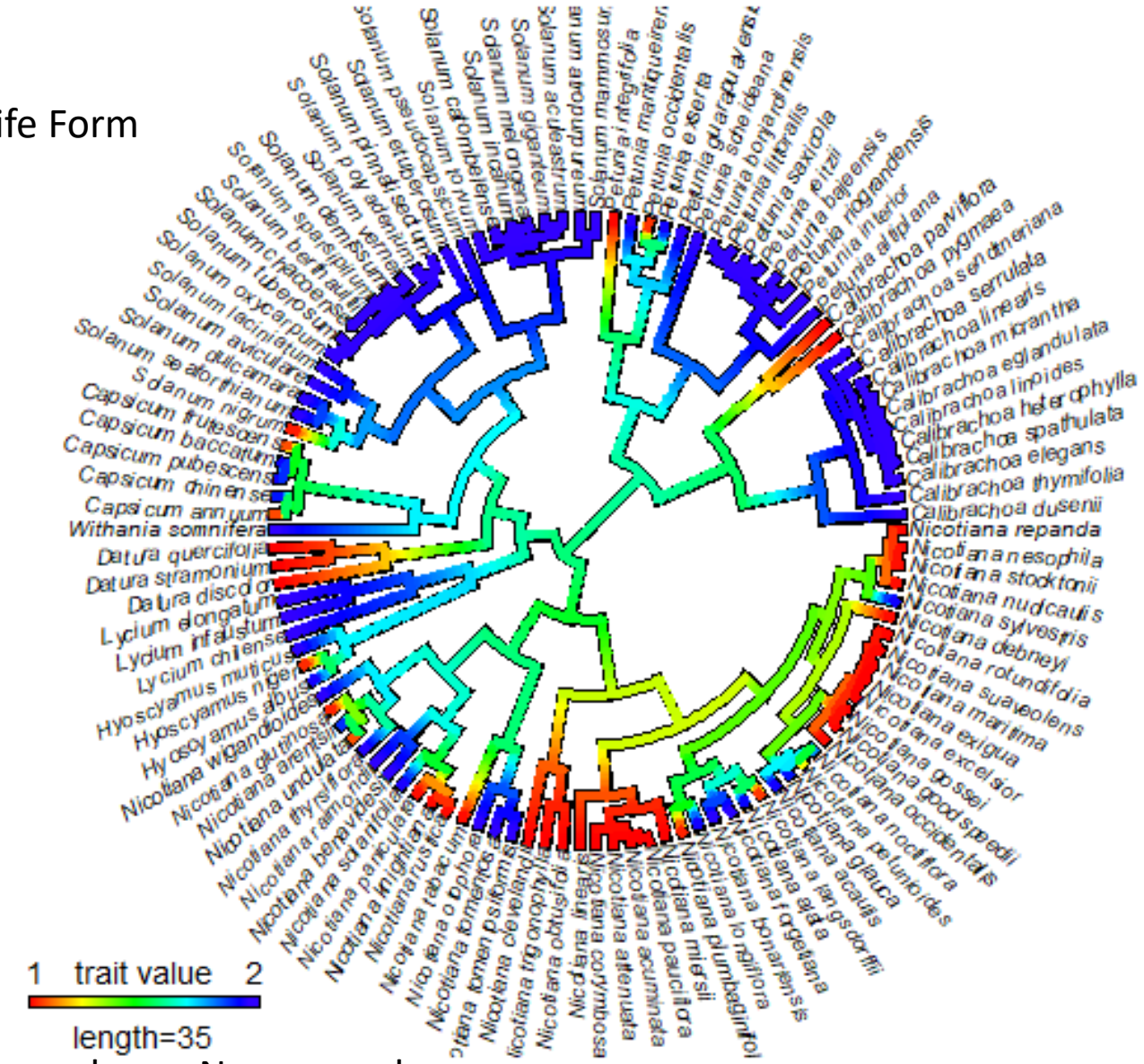
- PhyloAnova
  - Reasoning: To test of the means of “annual” and “non-annual” are different
  - Different Models:
    - chromosome number ~ life form
    - genome size ~ chromosome number
    - genome size ~ life form
    - Genome size ~ chromosome number + life form

Results

Model	**LnLike Value**	**AIC Values**	**P-value**	**Residual standard error**
chromosome number ~ life form	-451.334	908.6679	0.0092	13.13198
Genome size ~ chromosome number	-197.1063	400.2127	1.00E-04	1.317146
Genome size ~ life form	*-194.8883*	*395.7765*	*2.00E-04*	*1.330237*
Genome size ~ chromosome number + life form	-193.1446	394.2892	0.0032 (lf), 0.0010 (ch#)	1.271947

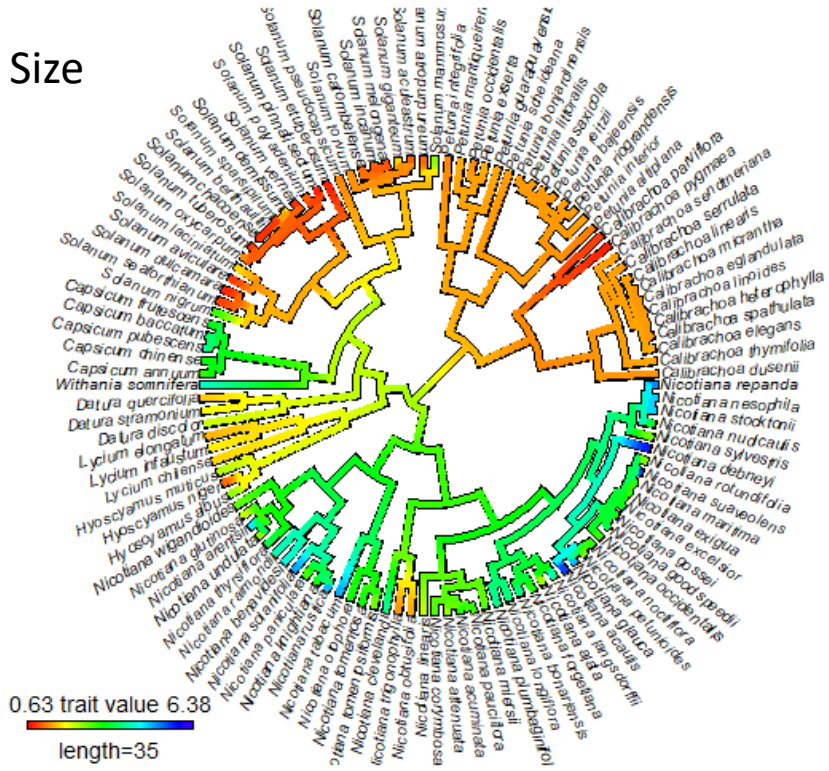
Phylogeny

Life Form

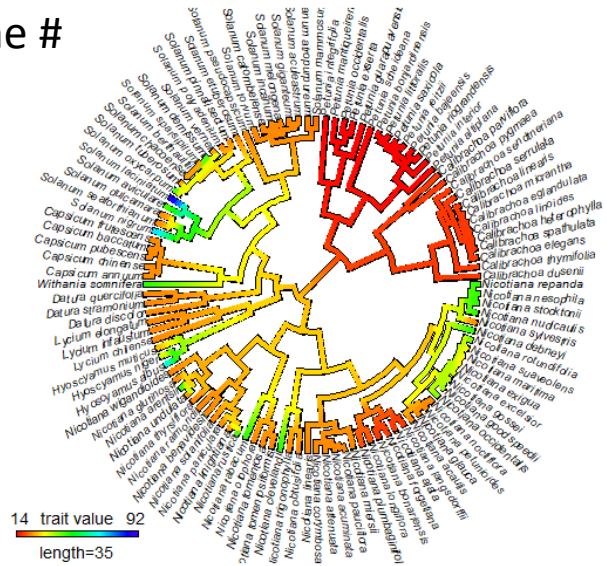


Annual Non-annual

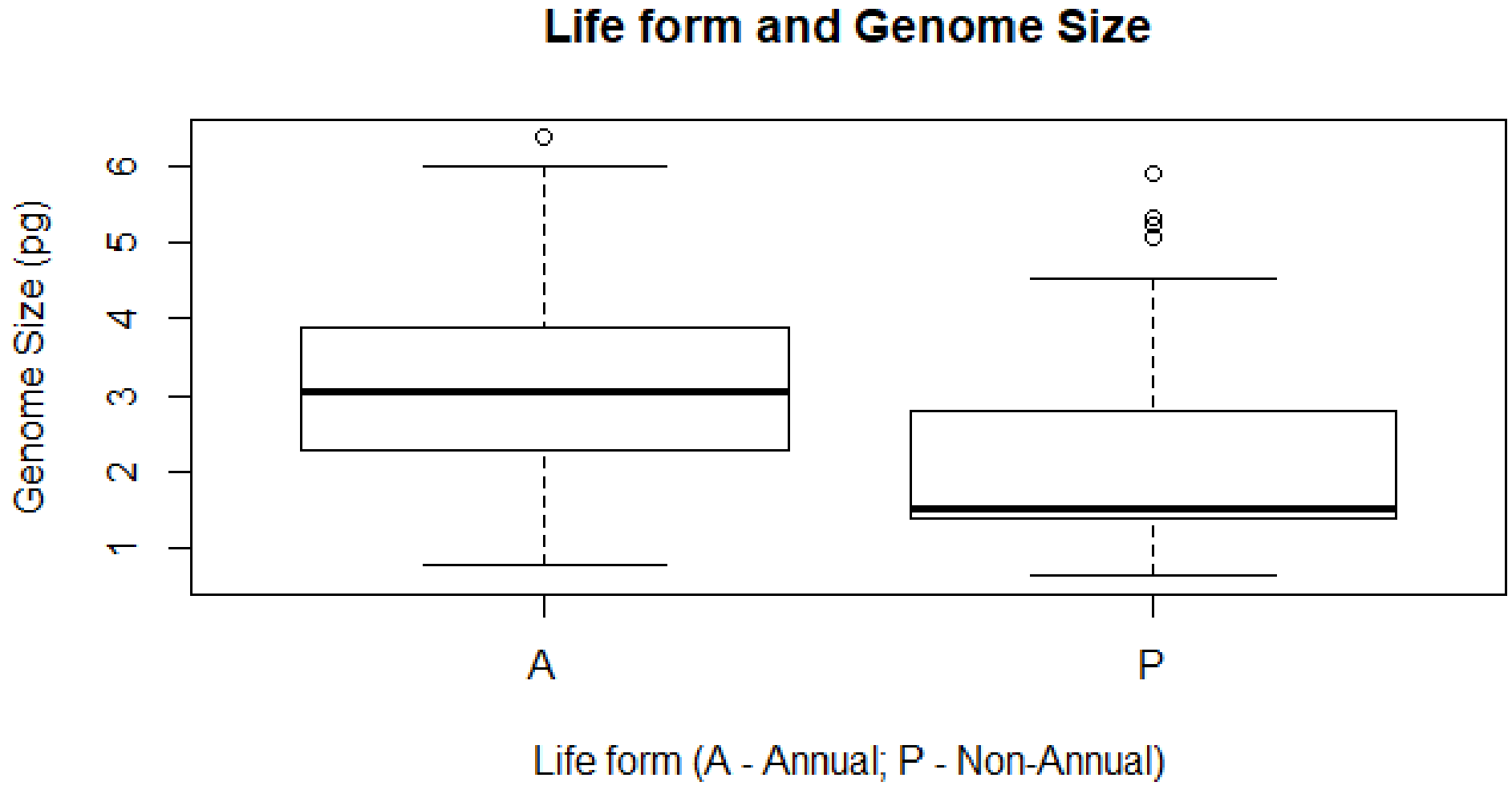
Genome Size



Chromosome #



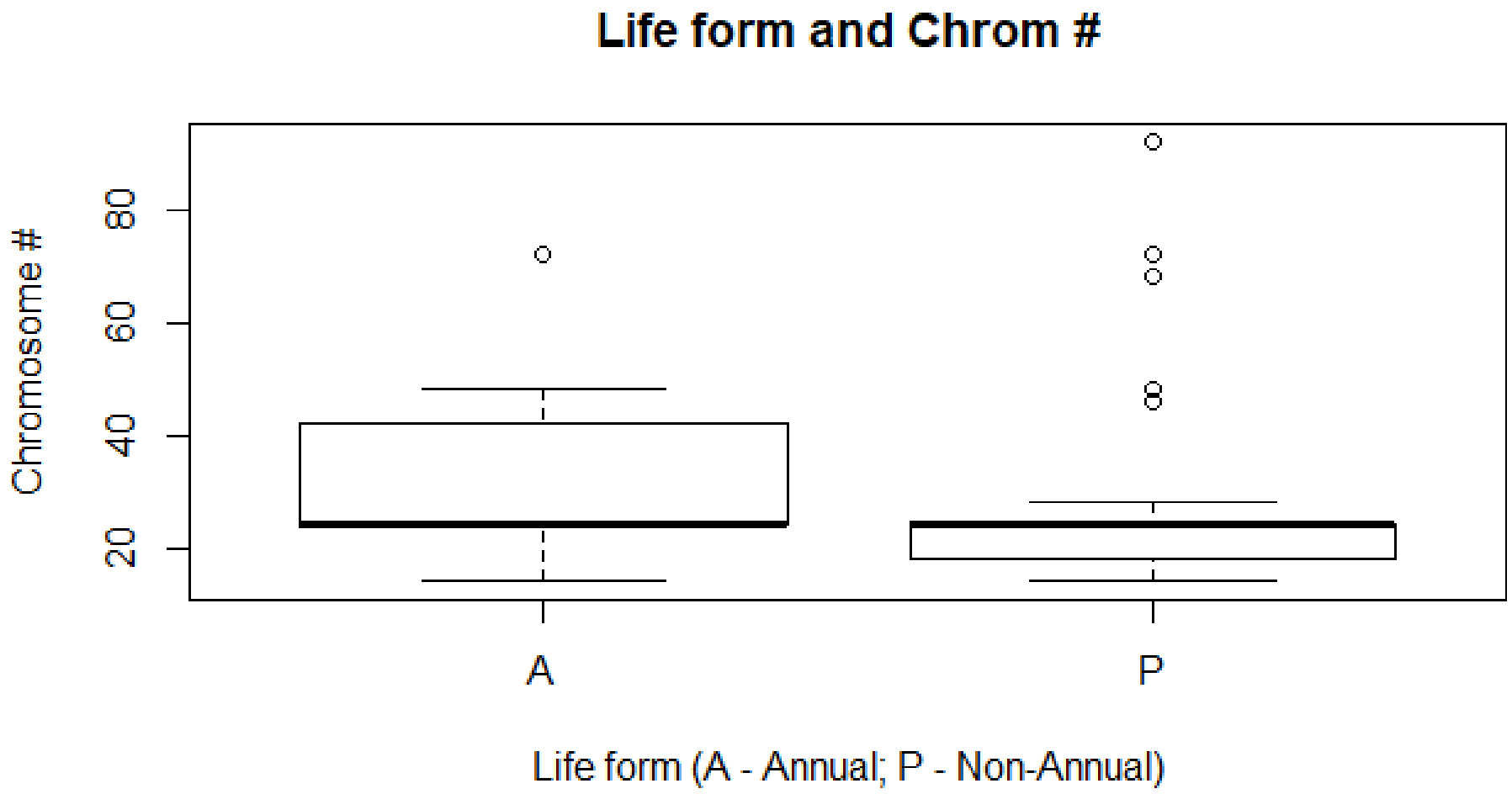
But…. How does size relate to life form?



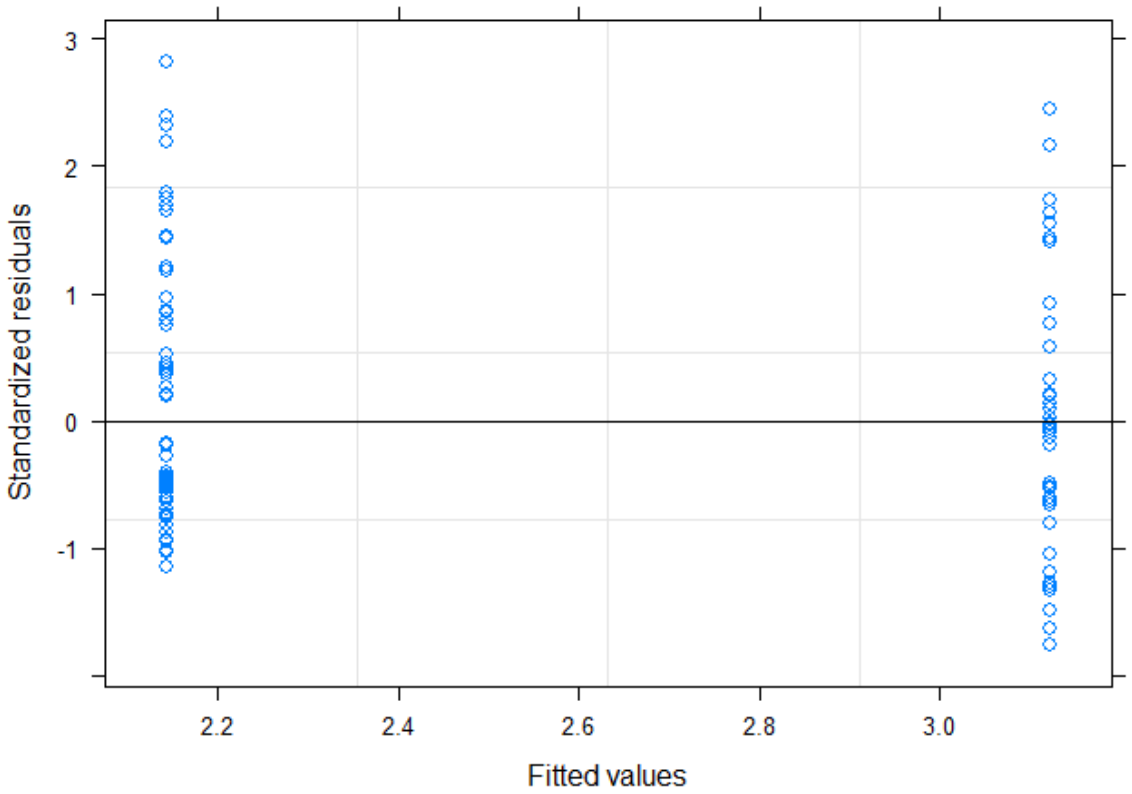
Conclusions

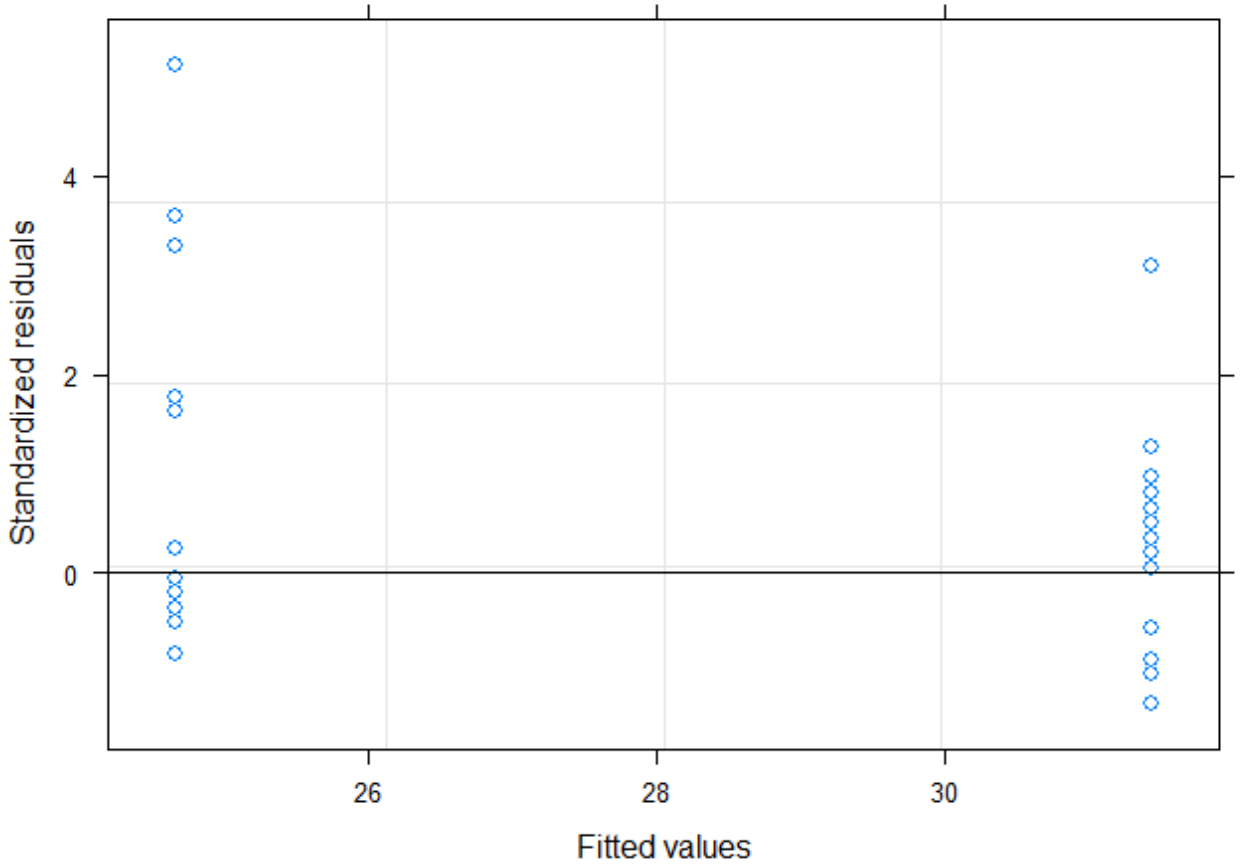
- There is a difference between ***annual plants*** **and** ***perennial plants*** ***genome*** **size**.
  - ***Perennial plants*** seem to have smaller size and range. This could be due to different selection pressure on genome size.
    - Next: Test if perennial plants have BM evolution using an OU model with two different optimums.
  - Could this be due to other factors?
    - Type 1 error. Is genome size stochastic?
    - Would adding more sample show two different means within **perennial plants?**

For fun..


Life form and Chrom #
Chromosome #
20
40
60
80
A
P
Life form (A - Annual; P - Non-Annual)

Plotted Fits

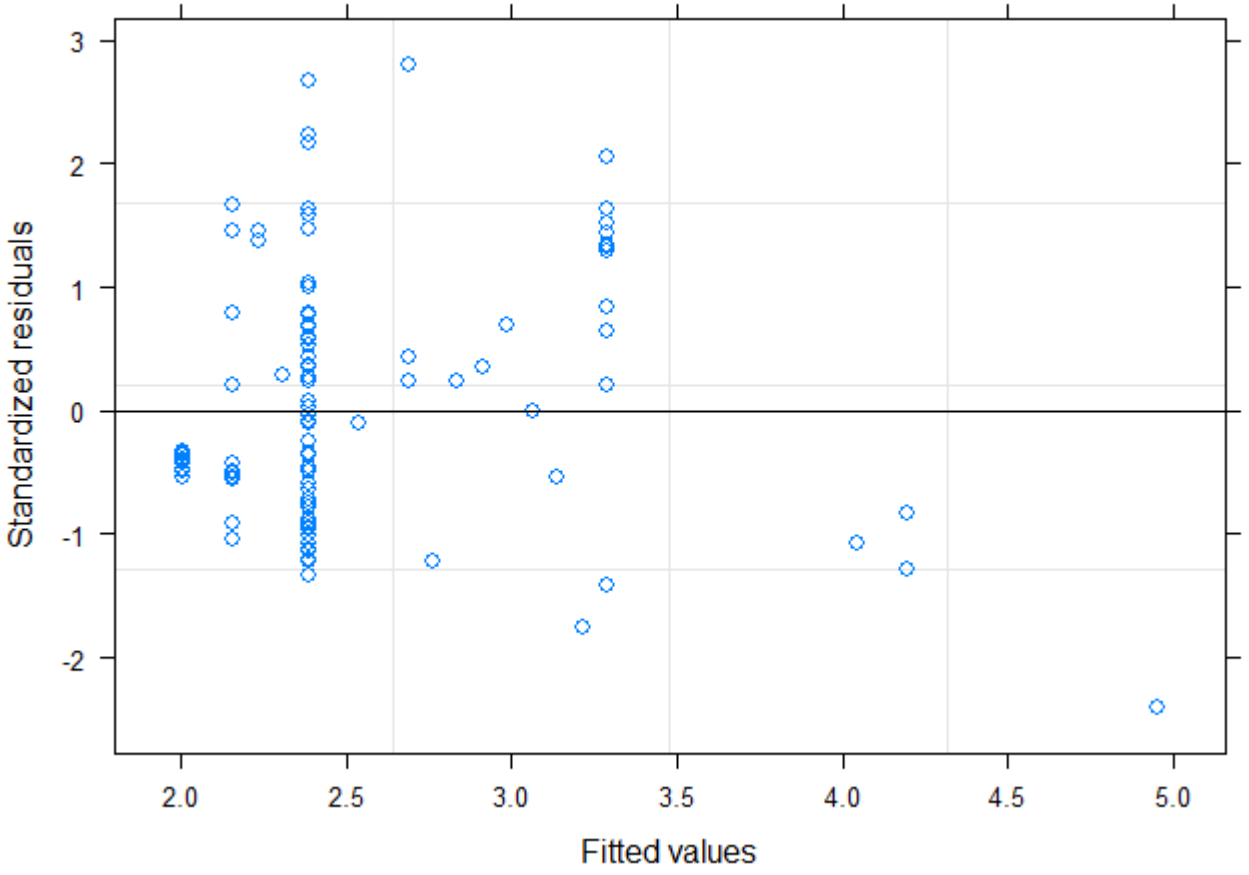




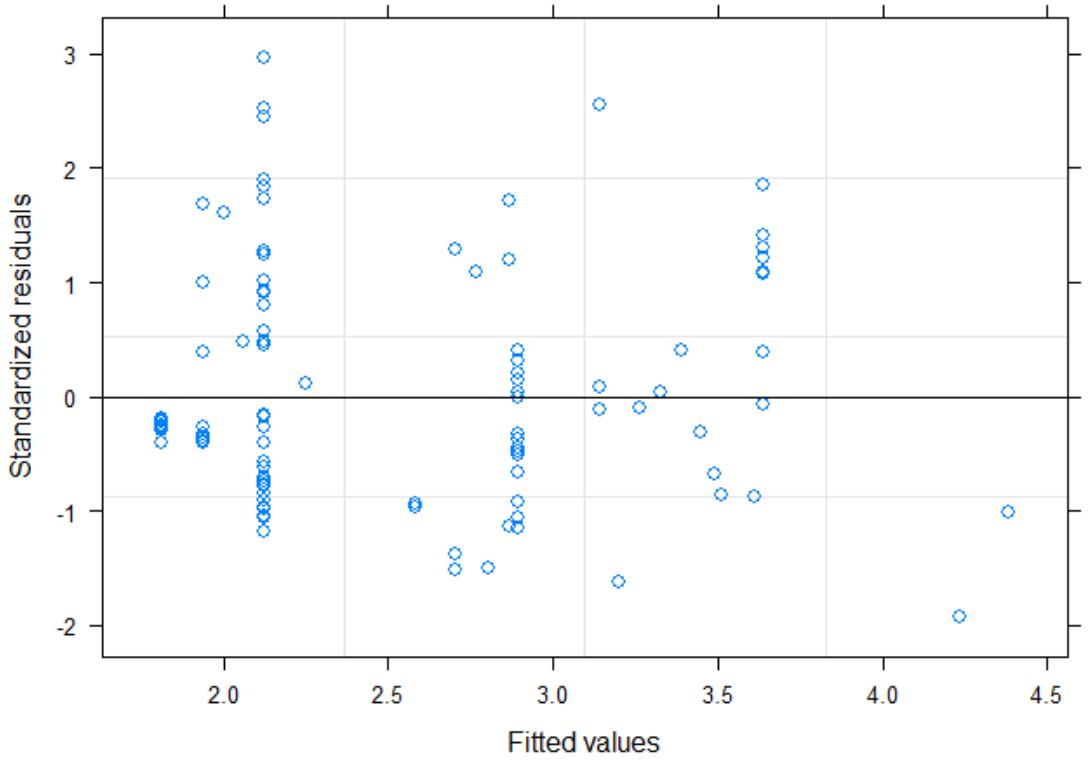
genome size ~ life form

chromosome number ~ life form

Plotted Fit Cont.



Genome size ~ chromosome number



Genome size ~ chromosome number + life form