

Capsicum annuum
Solanaceae
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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	<i>F</i>	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

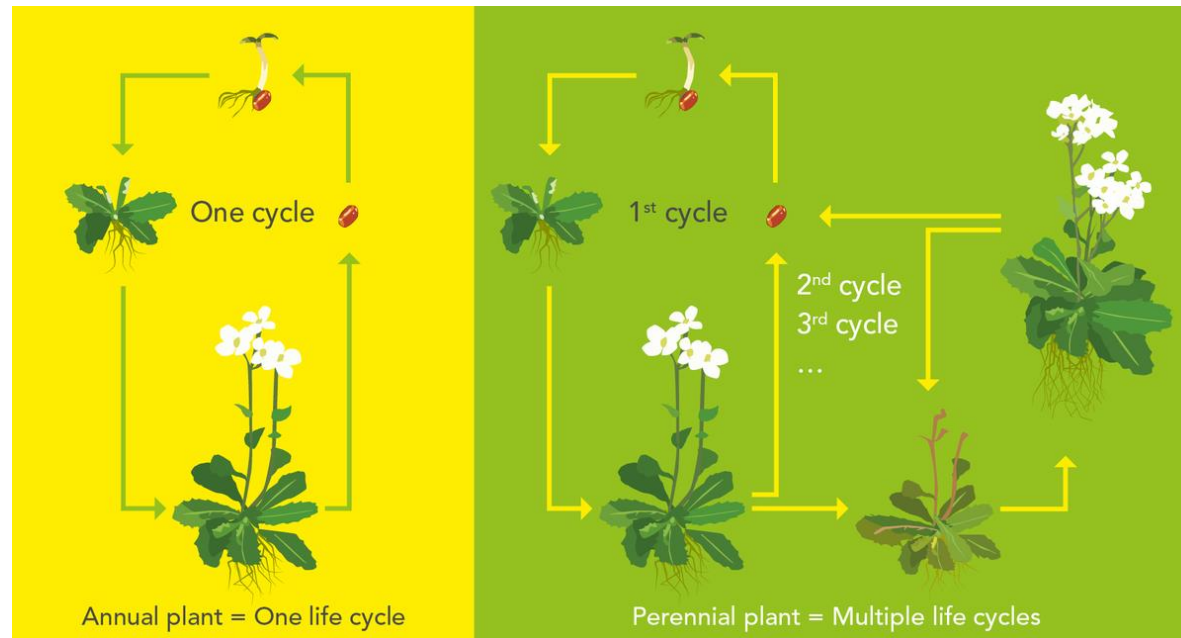
Pinus Phylum



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 there 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

The screenshot shows the Kew Botanical Garden c-value Database website. At the top, the Kew logo (ROYAL BOTANIC GARDENS) is on the left, and a navigation bar on the right contains links: About Kew, Kew videos, Scientific Research & Data, Business & Venue Hire, Ask Kew, and a shopping cart icon. Below this is a green navigation bar with links: Visit Kew Gardens, Visit Wakehurst, Plants & Fungi, Science & Conservation, Collections, Learn, Support Kew, News, and Shop. The main content area has a breadcrumb trail: Where am I? > Home > Kew Databases > Plant DNA C-values. The title is "Plant DNA C-values Database" with a subtitle "(release 6.0, December 2012)" and authors "MD Bennett and IJ Leitch". A "News" section states: "Release of new data for over 1400 species not previously listed. More details". Below this is a row of six categories, each with a title and an image: "Plant C-values" (a purple circle with the word "VALUE" in white), "Angiosperm C-values" (a dandelion seed head), "Gymnosperm C-values" (two tree trunks), "Pteridophyte C-values" (a fern frond), "Bryophyte C-values" (a moss plant), and "Algal C-values" (a green algal colony). At the bottom, a paragraph explains: "The DNA amount in the unreplicated gametic nucleus of an organism is referred to as its C-value, irrespective of the ploidy level of the taxon. The Plant DNA C-values Database currently contains data for". On the right side of the page, there is a sidebar titled "Plant C-values" with a list of links: Home, Introduction, Search, Plant C-values, Angiosperm C-values, Gymnosperm C-values, Pteridophyte C-values, Bryophyte C-values, Algal C-values, Search help, Submit a new C-value, Updates and releases, Contacts, and Links to DNA amounts.

Methods

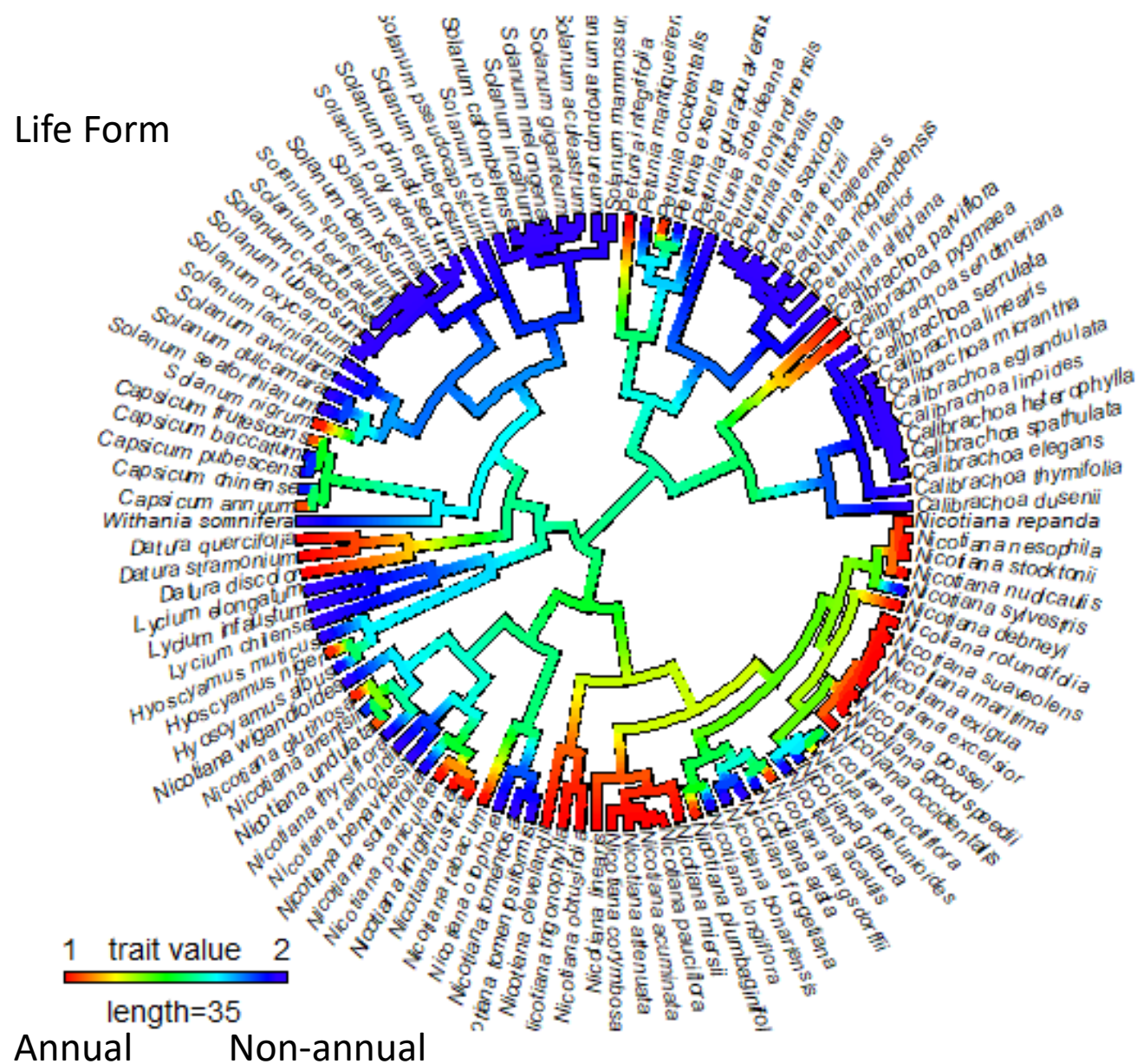
- PhyloAnova
 - Reasoning: To test if the means of “annual” and “non-annual” are different
 - Different Models:
 - chromosome number \sim life form
 - genome size \sim chromosome number
 - genome size \sim life form
 - Genome size \sim chromosome number + life form

Results

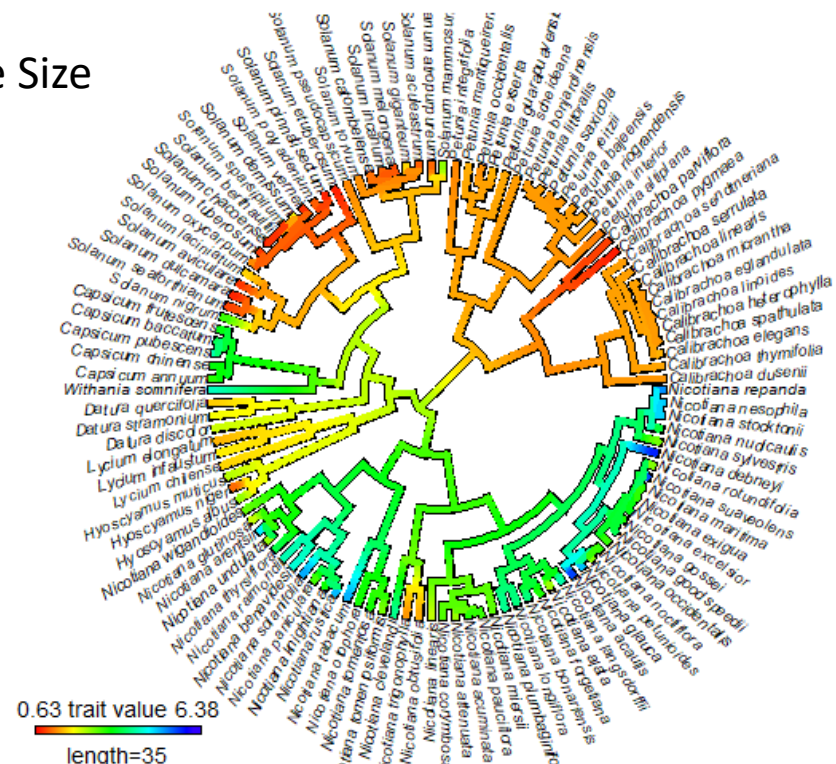
Model	LnLike Value	AIC Values	P-value	Residual standard error
chromosome number ~ life form	-451.334	908.6679	0.0092	13.13198
Genome size ~ chromosome number	-197.1063	400.2127	1.00E-04	1.317146
<i>Genome size ~ life form</i>	<i>-194.8883</i>	<i>395.7765</i>	<i>2.00E-04</i>	<i>1.330237</i>
Genome size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

Phylogeny

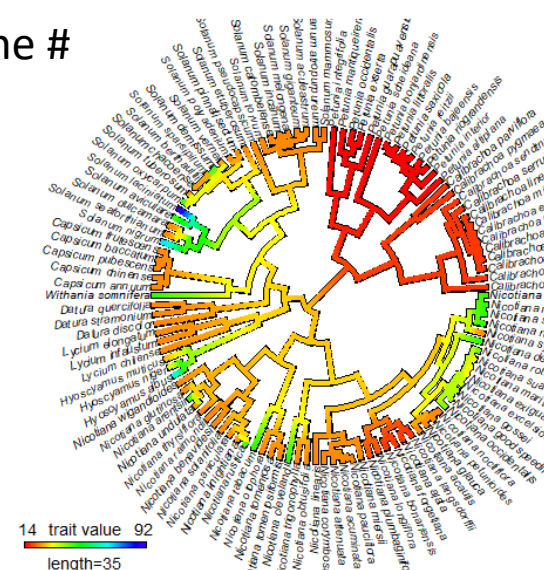
Life Form



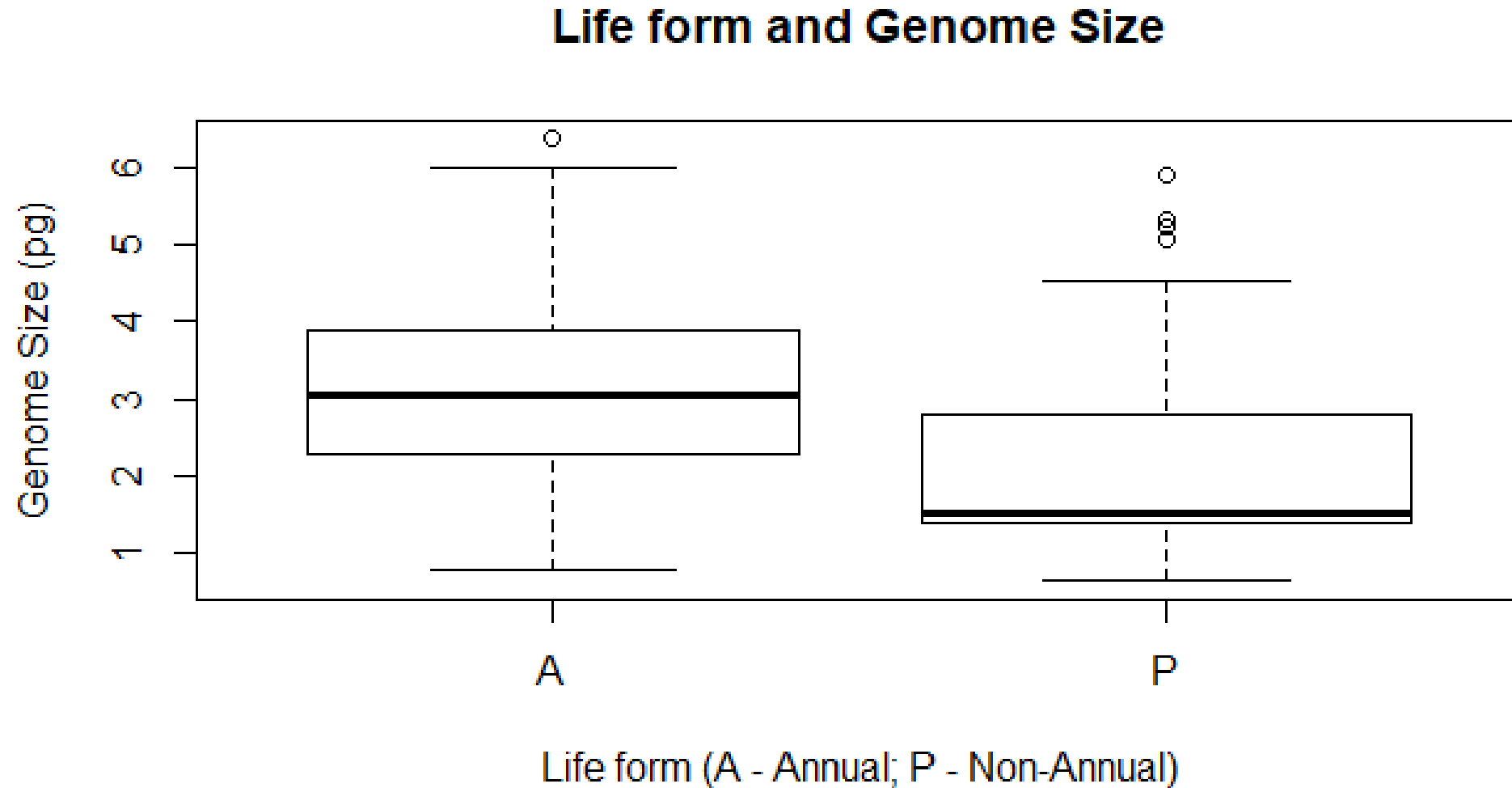
Genome Size



Chromosome #



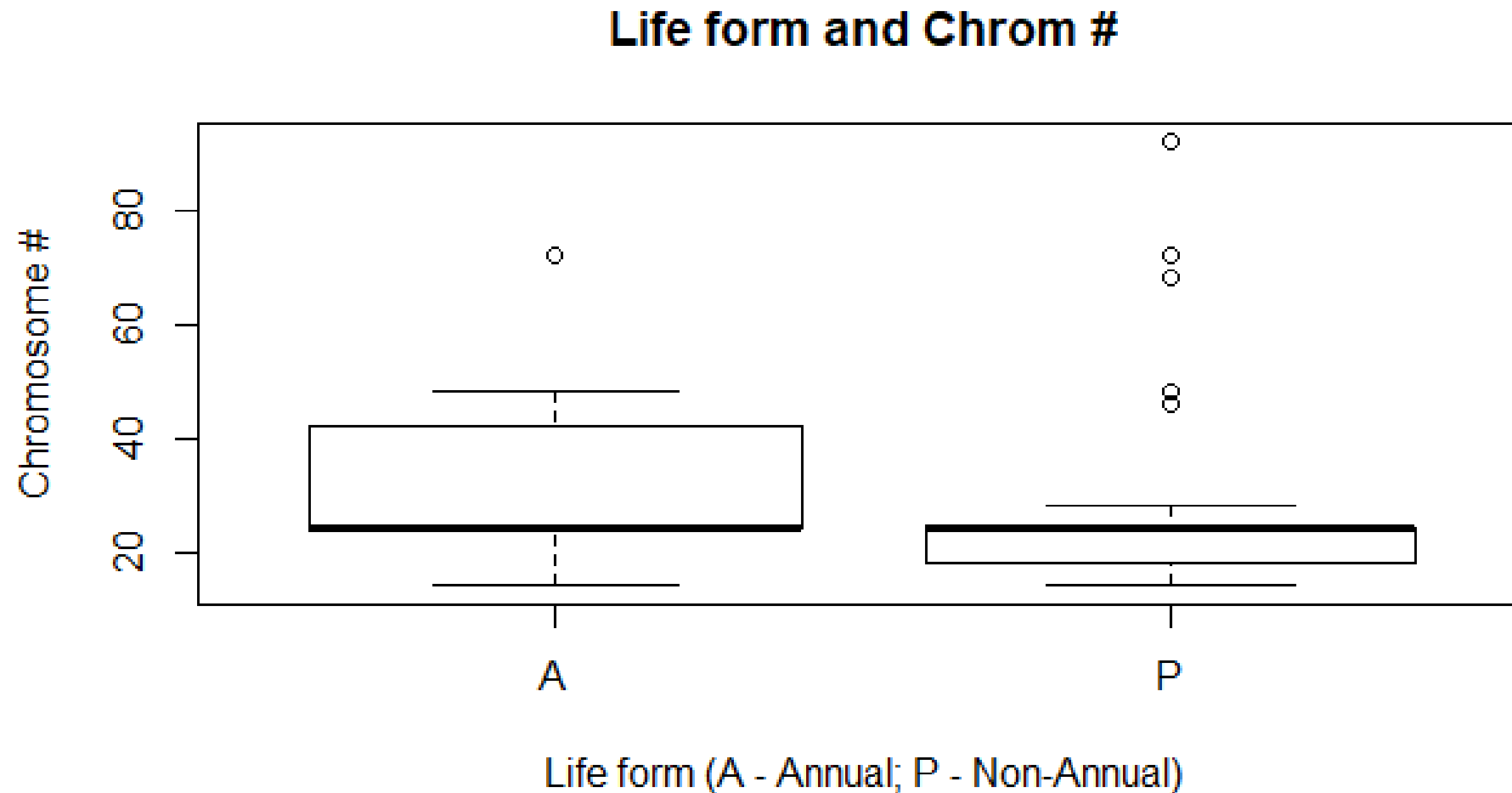
But.... How does size relate to life form?



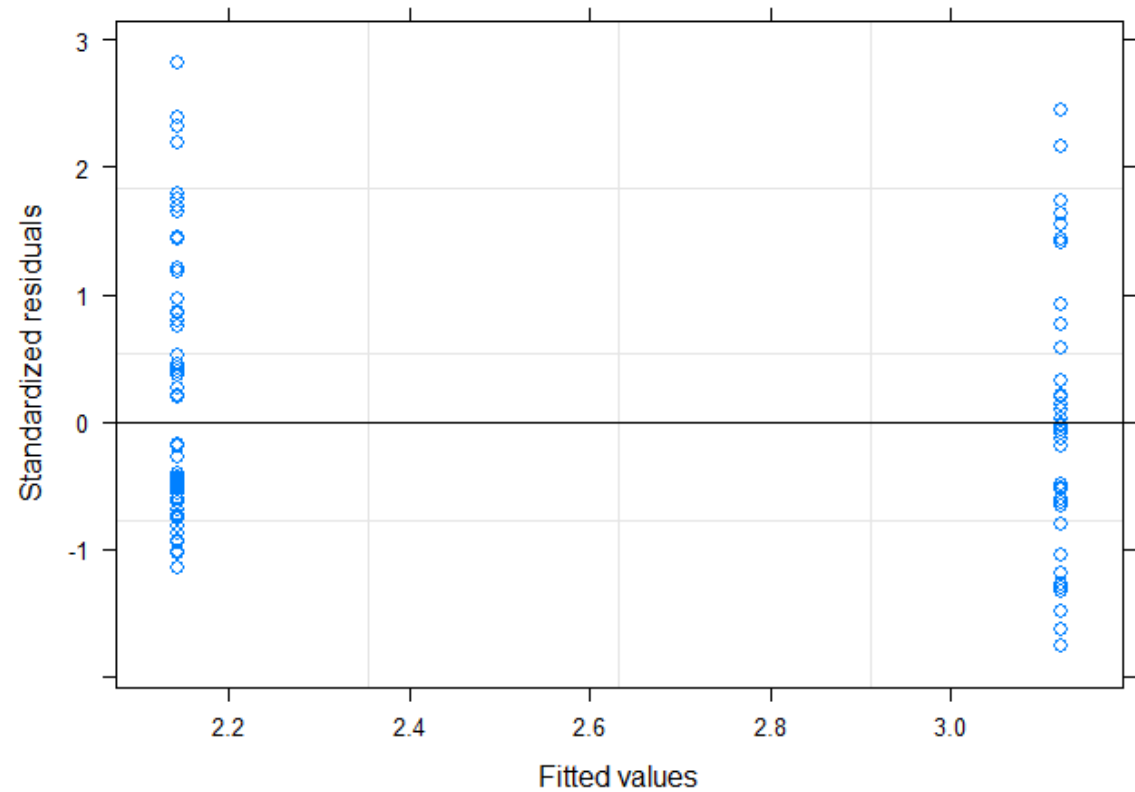
Conclusions

- 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*?

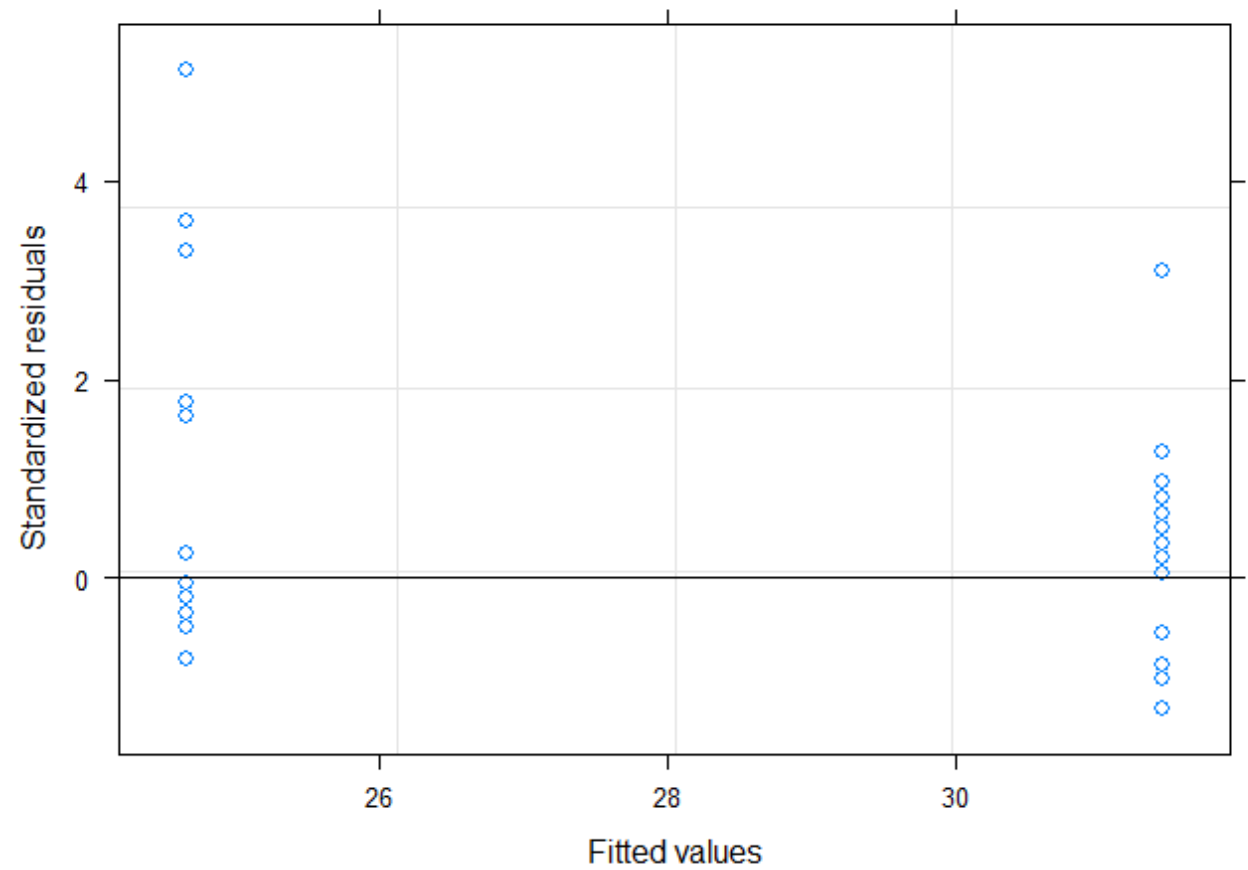
For fun..



Plotted Fits

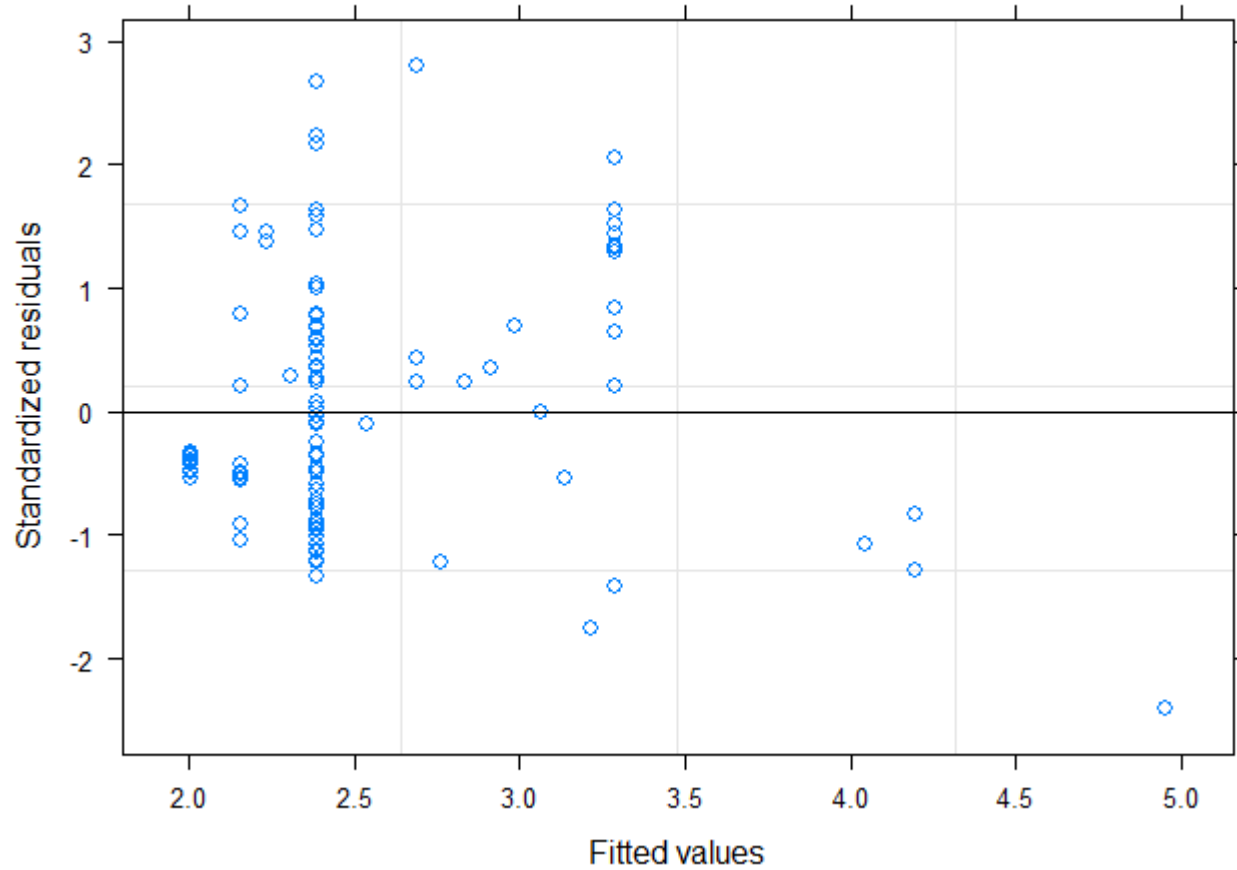


genome size ~ life form

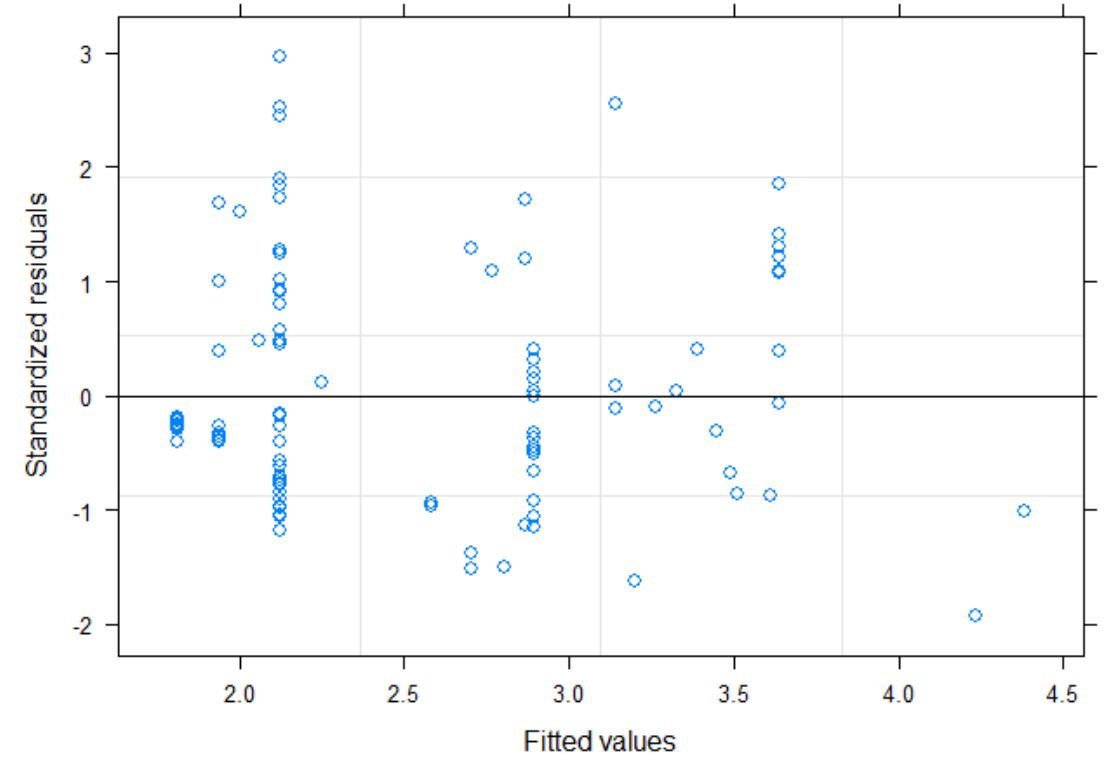


chromosome number ~ life form

Plotted Fit Cont.



Genome size \sim chromosome number



Genome size \sim chromosome number +
life form