

Appendix

Table 1: Structure of Data

```
'data.frame': 75 obs. of 4 variables:
 $ Potato : Factor w/ 2 levels "Species1","Species2": 1 1 1 1 1 1 1 1 1 1 ...
 $ Regime : Factor w/ 2 levels "Cold","RoomTemp": 2 2 2 2 2 2 2 2 2 2 ...
 $ Temp : Factor w/ 2 levels "-4 Degrees","-8 Degrees": 1 1 1 1 1 2 2 2 2 2 ...
 $ Leakage: num 2.25 4.34 4.25 6.14 2.38 16.3 5.24 3.25 0.88 3.98 ...
```

Table 2: Summary of Cell Means

	Potato	Regime	Temp	n	mean	var	sd
1	Species1	Cold	-4 Degrees	12	2.339167	7.477954	2.734585
2	Species1	Cold	-8 Degrees	13	10.982308	59.946369	7.742504
3	Species1	RoomTemp	-4 Degrees	5	3.872000	2.590670	1.609556
4	Species1	RoomTemp	-8 Degrees	5	5.930000	36.125100	6.010416
5	Species2	Cold	-4 Degrees	7	2.418571	2.756281	1.660205
6	Species2	Cold	-8 Degrees	7	9.808571	14.554281	3.815007
7	Species2	RoomTemp	-4 Degrees	13	22.380000	164.466950	12.824467
8	Species2	RoomTemp	-8 Degrees	13	32.320769	168.266924	12.971774

Plot 1: Comparing Variances Across Groups

Ion leakage by species, regime, and temperature

Grand mean depicted by grey dashed line, cell means by red dashed line

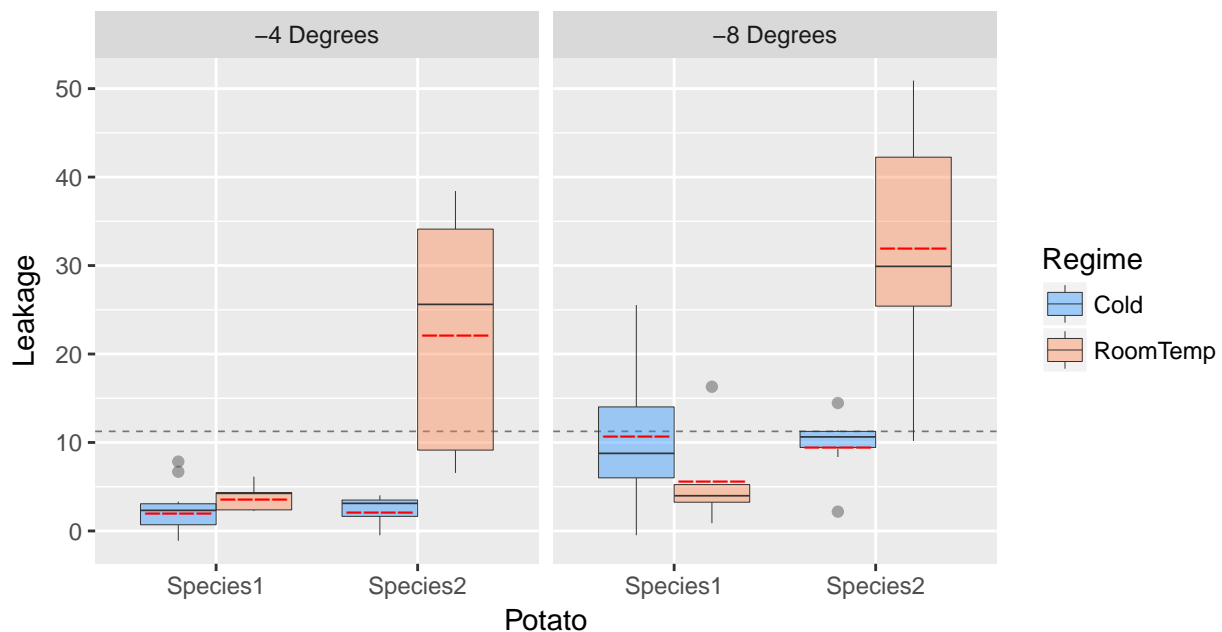


Table 3: Fitting Full 3-Way Interaction Model

Type III ANOVA Table: Full Model

	Sum Sq	Df	F value	Pr(>F)
(Intercept)	8110.74	1	107.54	0.0000
Potato	1919.18	1	25.45	0.0000
Regime	1517.70	1	20.12	0.0000
Temp	785.93	1	10.42	0.0019
Potato:Regime	2115.75	1	28.05	0.0000
Potato:Temp	43.96	1	0.58	0.4479
Regime:Temp	16.28	1	0.22	0.6437
Potato:Regime:Temp	83.48	1	1.11	0.2965
Residuals	5053.15	67		

Plot 2: Diagnostics of Full Model

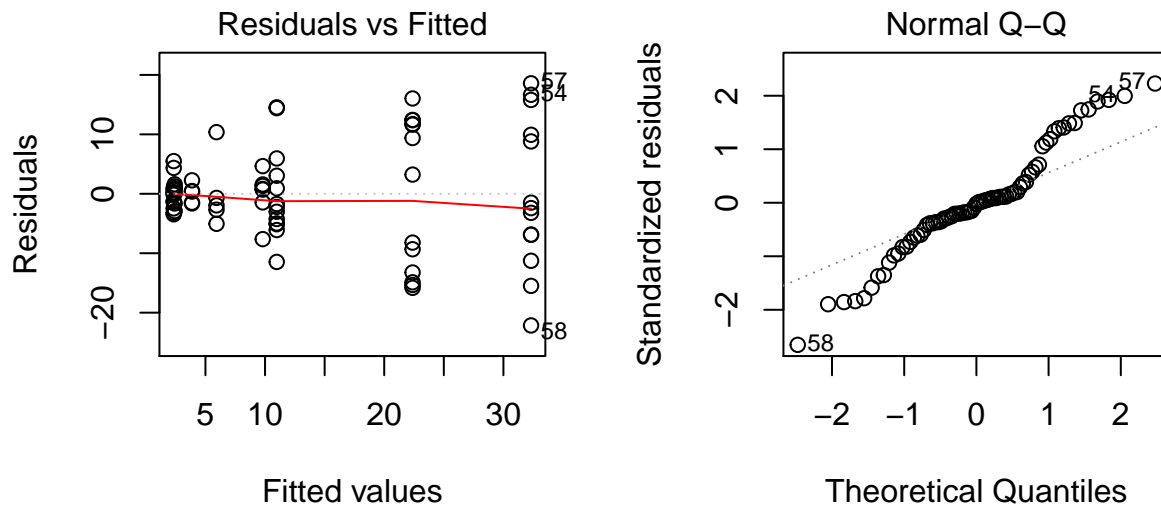


Table 4: Tests for Normality, Constant Variance and Outliers

Levene's Test for Homogeneity of Variance (center = median)

	Df	F value	Pr(>F)
group	7	7.1323	2.307e-06 ***
	67		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Shapiro-Wilk normality test

data: resid

W = 0.96425, p-value = 0.03256

No Studentized residuals with Bonferonni $p < 0.05$
Largest |rstudent|:
rstudent unadjusted p-value Bonferonni p
58 -2.785452 0.0069699 0.52274

Plot 3: Boxcox Transformation

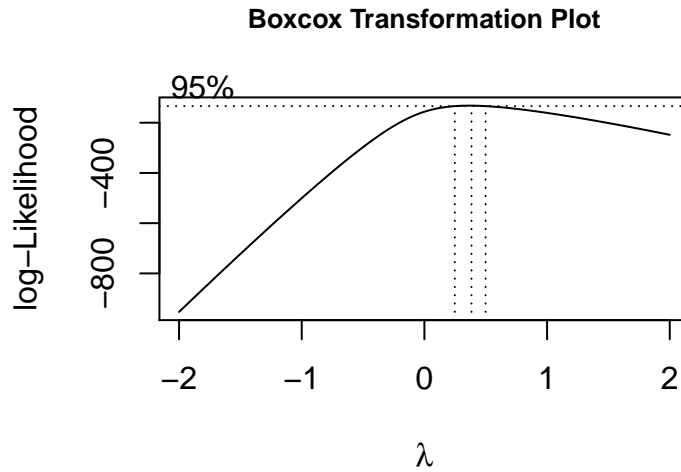


Table 5: Fitting Full 3-Way Interaction Model (Transformed Response)

Type III ANOVA Table: Transformed Model

	Sum Sq	Df	F value	Pr(>F)
(Intercept)	276.36	1	1196.24	0.0000
Potato	6.42	1	27.77	0.0000
Regime	5.00	1	21.65	0.0000
Temp	4.22	1	18.27	0.0001
Potato:Regime	5.31	1	22.99	0.0000
Potato:Temp	0.03	1	0.14	0.7143
Regime:Temp	1.01	1	4.35	0.0408
Potato:Regime:Temp	0.16	1	0.69	0.4097
Residuals	15.48	67		

Plot 4: Diagnostics of Transformed Response Model

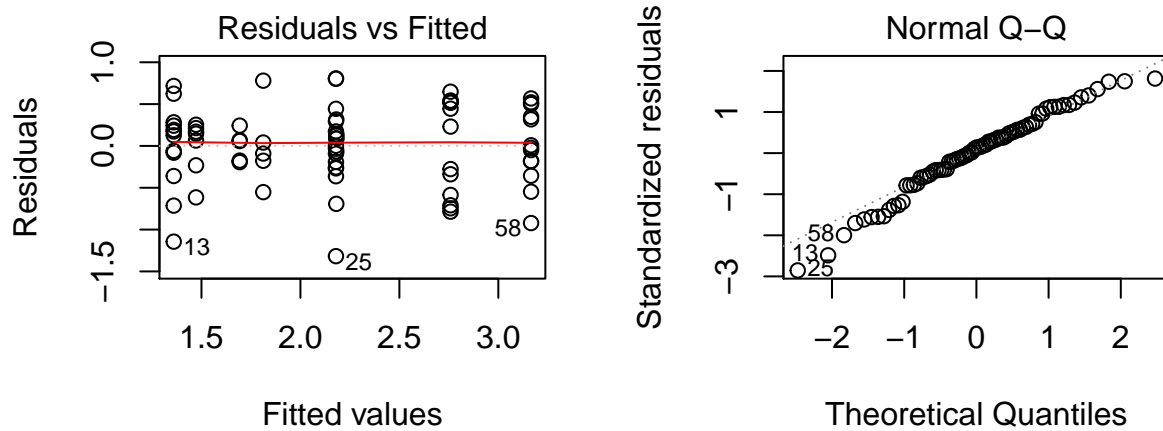


Table 6: Tests for Normality, Constant Variance and Outliers in Transformed Model

Levene's Test for Homogeneity of Variance (center = median)

	Df	F value	Pr(>F)
group	7	1.2802	0.2736
	67		

Shapiro-Wilk normality test

data: resid.t

W = 0.97444, p-value = 0.1331

No Studentized residuals with Bonferonni $p < 0.05$

Largest |rstudent|:

	rstudent	unadjusted p-value	Bonferonni p
25	-3.021974	0.003572	0.2679

Plot 5: Boxcox Transformation (post transformation)

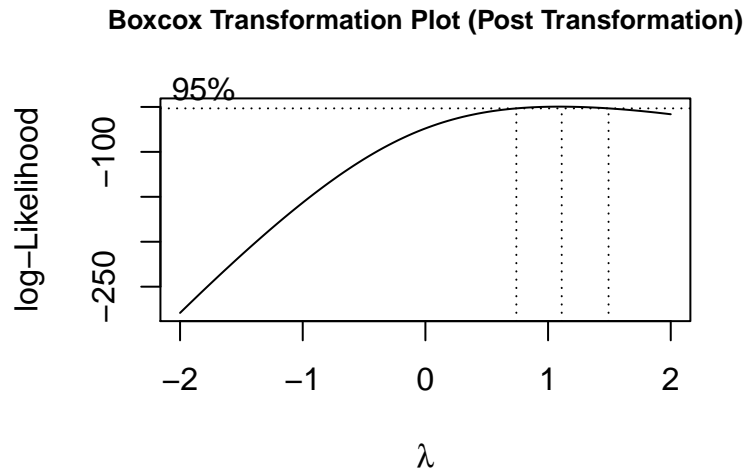


Table 7: Summary of Transformed Cell Means

	Potato	Regime	Temp	n	mean	var	sd
1	Species1	Cold	-4 Degrees	12	1.359857	0.28034267	0.5294740
2	Species1	Cold	-8 Degrees	13	2.179621	0.30506291	0.5523250
3	Species1	RoomTemp	-4 Degrees	5	1.693184	0.03381407	0.1838860
4	Species1	RoomTemp	-8 Degrees	5	1.812235	0.23872098	0.4885908
5	Species2	Cold	-4 Degrees	7	1.472462	0.09936032	0.3152147
6	Species2	Cold	-8 Degrees	7	2.181223	0.10572116	0.3251479
7	Species2	RoomTemp	-4 Degrees	13	2.758669	0.33355499	0.5775422
8	Species2	RoomTemp	-8 Degrees	13	3.165403	0.20091742	0.4482381

Plot 6: Profile Plots (before reduction of model)

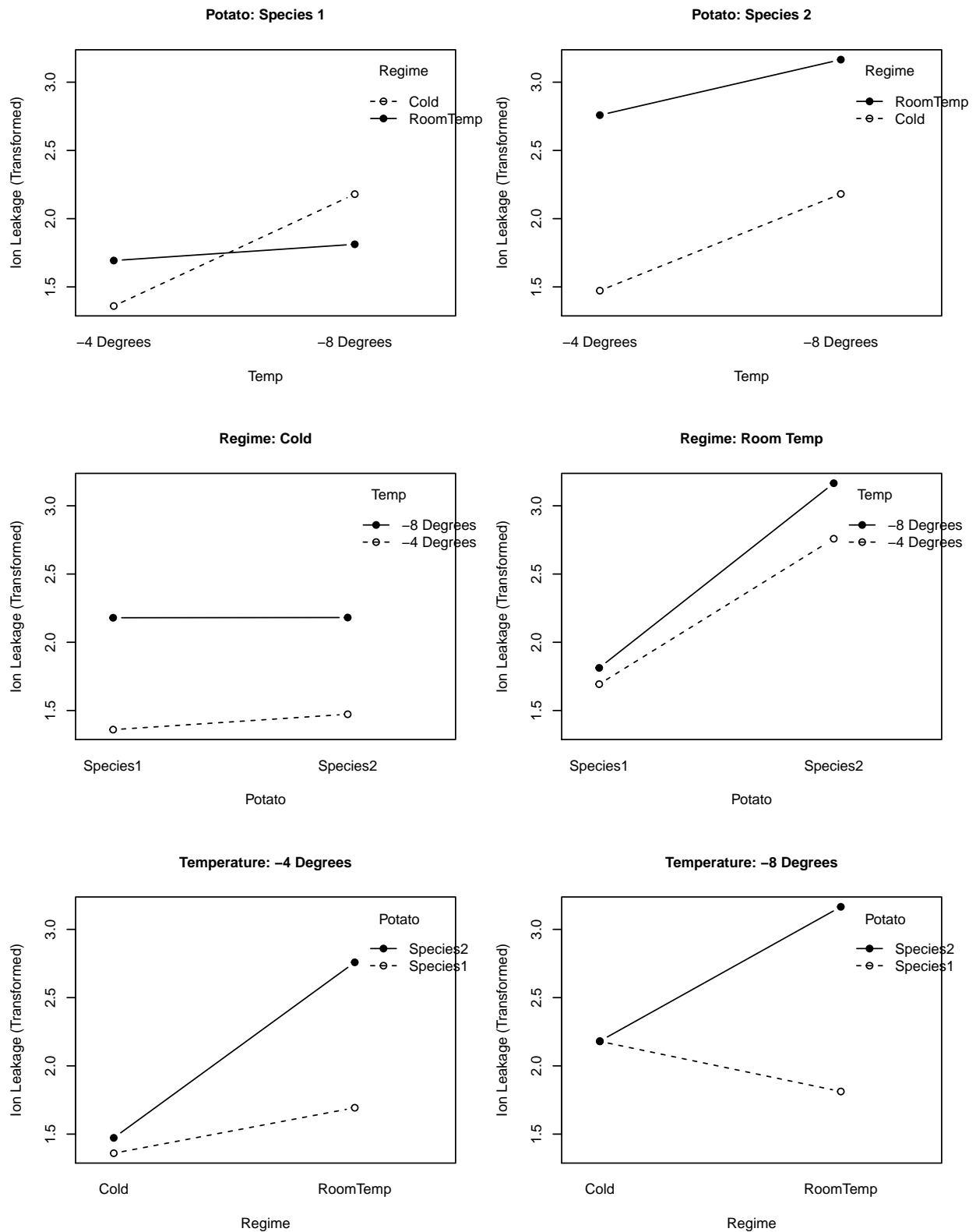


Table 8: Reduced ANOVA Type 3 Model

Type III ANOVA Table: Reduced Model				
	Sum Sq	Df	F value	Pr(>F)
(Intercept)	276.46	1	1202.17	0.0000
Potato	6.40	1	27.85	0.0000
Regime	4.99	1	21.70	0.0000
Temp	5.63	1	24.48	0.0000
Potato:Regime	5.32	1	23.15	0.0000
Potato:Temp	0.02	1	0.08	0.7800
Regime:Temp	0.92	1	4.02	0.0489
Residuals	15.64	68		

Plot7: Plotting Diagnostics of Reduced Model

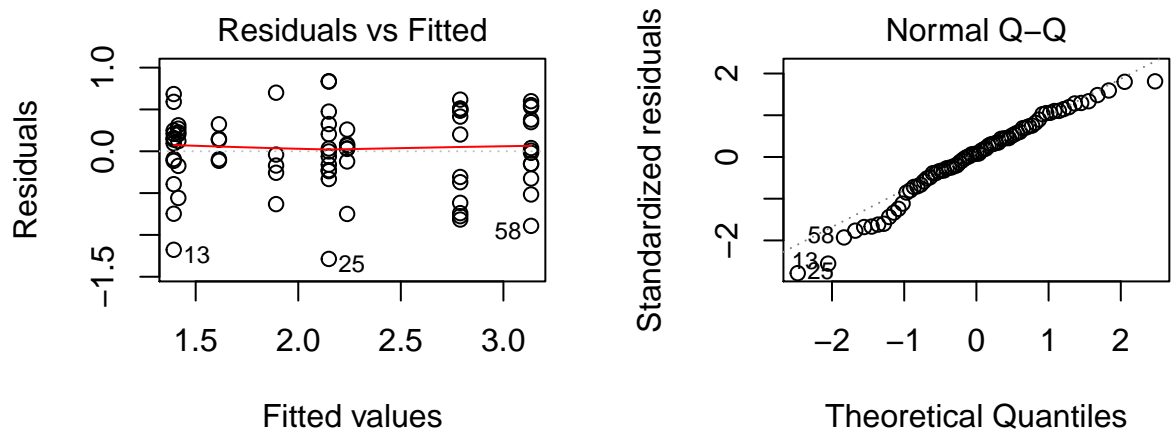


Table 9: Tests for Normality, Constant Variance and Outliers in Reduced Model

Levene's Test for Homogeneity of Variance (center = median)

	Df	F value	Pr(>F)
group	7	1.2802	0.2736
	67		

Shapiro-Wilk normality test

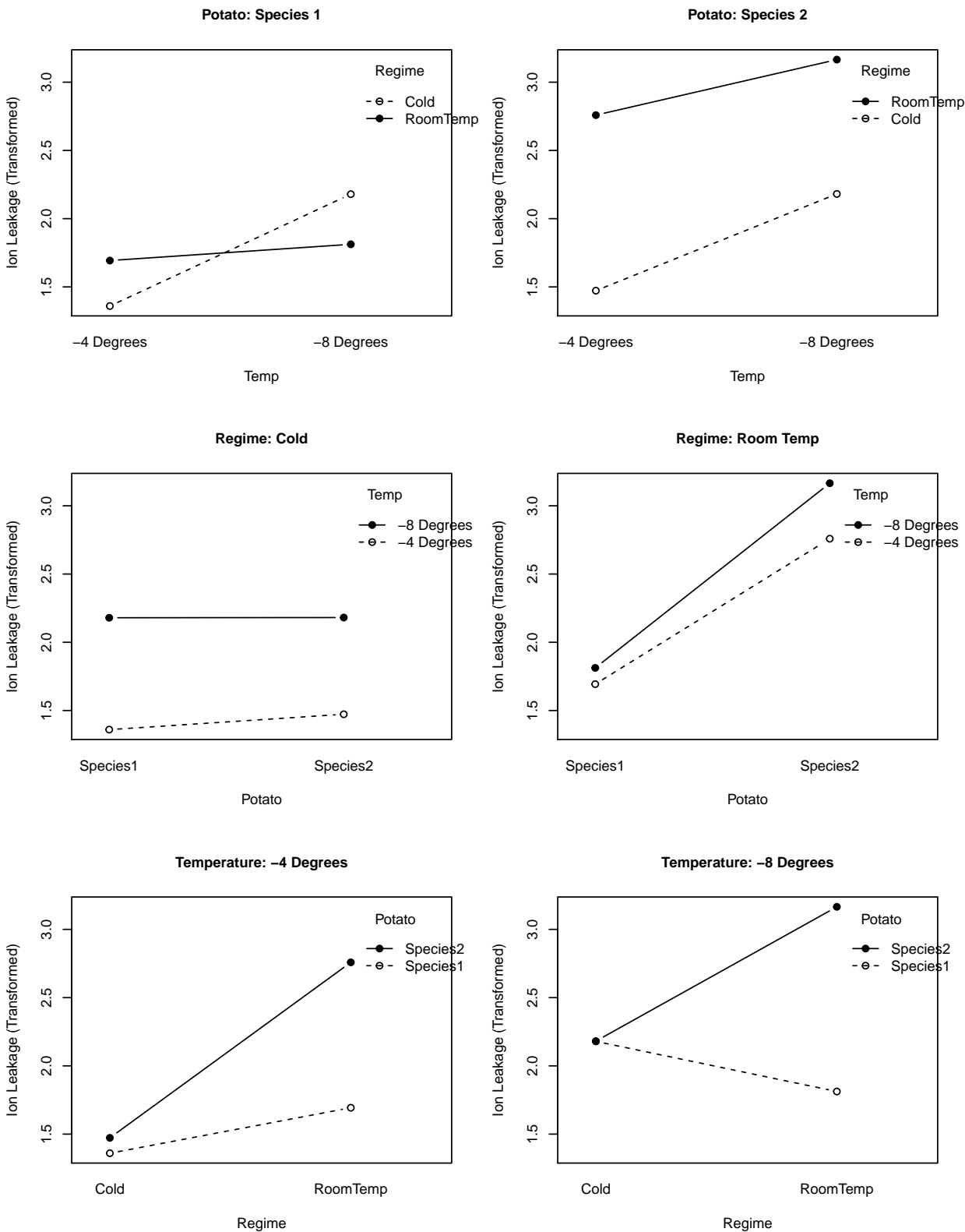
data: resid.t
W = 0.97444, p-value = 0.1331

No Studentized residuals with Bonferonni $p < 0.05$

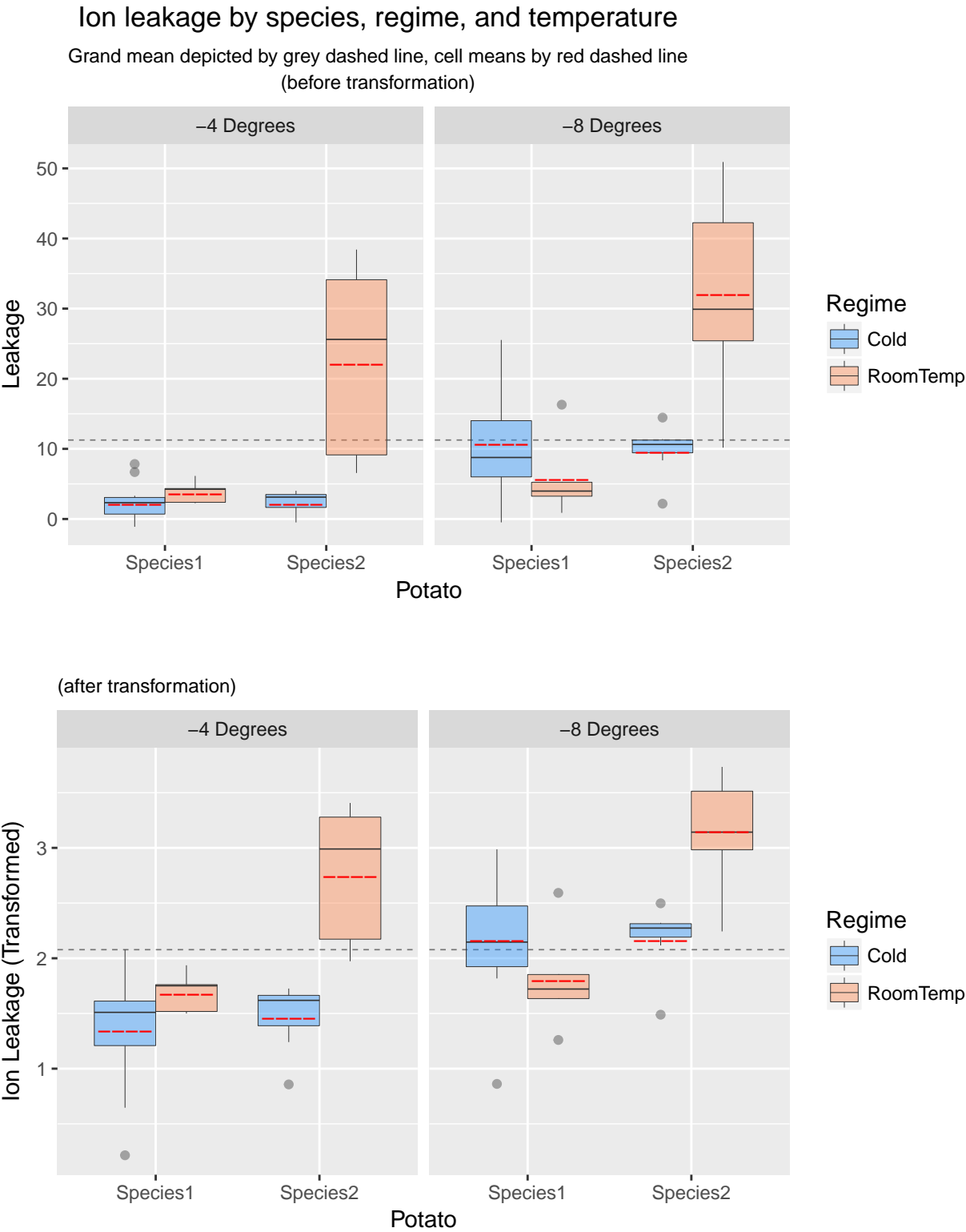
Largest |rstudent|:

	rstudent	unadjusted p-value	Bonferonni p
25	-3.021974	0.003572	0.2679

Plot 8: Profile Plots (after reduction of model)



Plot 9: Comparing Variances Across Groups (before and after transformation)



Plot 10: Pairwise Comparison of Means

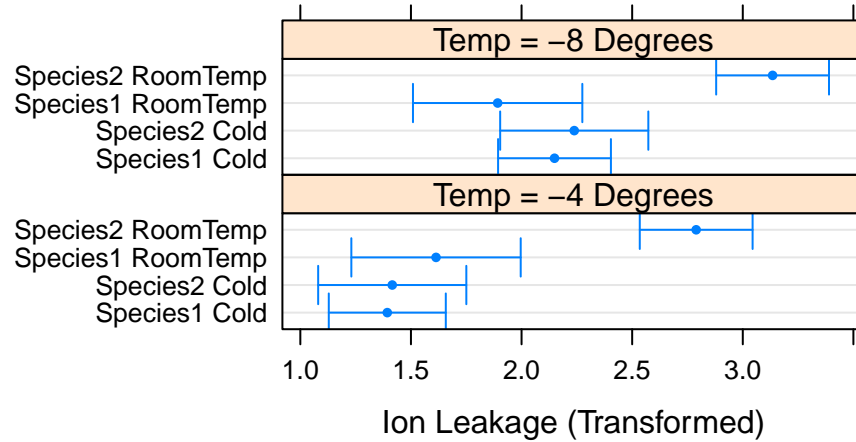
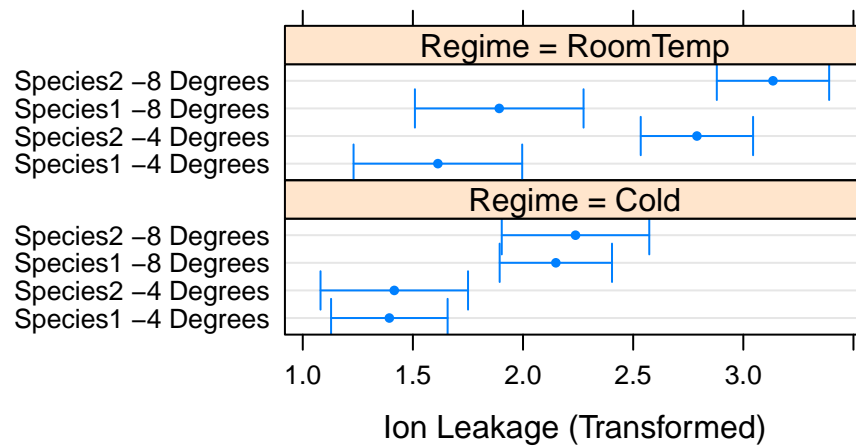
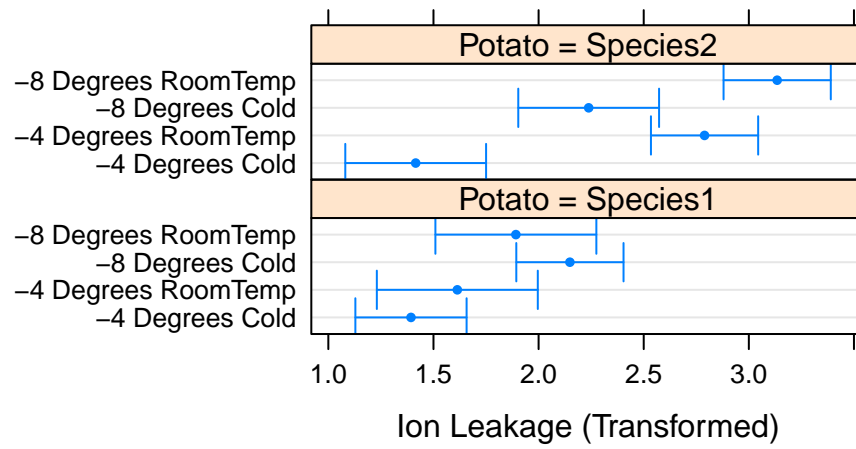


Table 10: Summaries of Significant Contrasts

Potato = S1:

contrast	estimate	SE	df	t.ratio	p.value
4,C - 8,C	-0.7558610	0.1759166	68	-4.297	0.0003
4,C - 4,RT	-0.2203458	0.2160852	68	-1.020	0.7385
4,C - 8,RT	-0.4989006	0.2490518	68	-2.003	0.1970
8,C - 4,RT	0.5355152	0.2453552	68	2.183	0.1385
8,C - 8,RT	0.2569604	0.2145804	68	1.198	0.6305
4,RT - 8,RT	-0.2785549	0.2349160	68	-1.186	0.6379

Potato = S2:

contrast	estimate	SE	df	t.ratio	p.value
4,C - 8,C	-0.8226924	0.2166304	68	-3.798	0.0017
4,C - 4,RT	-1.3738466	0.1985752	68	-6.919	<.0001
4,C - 8,RT	-1.7192328	0.2225813	68	-7.724	<.0001
8,C - 4,RT	-0.5511542	0.2225813	68	-2.476	0.0728
8,C - 8,RT	-0.8965404	0.1985752	68	-4.515	0.0001
4,RT - 8,RT	-0.3453863	0.1730191	68	-1.996	0.1995

P value adjustment: tukey method for comparing a family of 4 estimates

Regime = C:

contrast	estimate	SE	df	t.ratio	p.value
S1,4 - S2,4	-0.02240959	0.2006208	68	-0.112	0.9995
S1,4 - S1,8	-0.75586103	0.1759166	68	-4.297	0.0003
S1,4 - S2,8	-0.84510201	0.2262776	68	-3.735	0.0021
S2,4 - S1,8	-0.73345144	0.2225813	68	-3.295	0.0083
S2,4 - S2,8	-0.82269242	0.2166304	68	-3.798	0.0017
S1,8 - S2,8	-0.08924098	0.1985752	68	-0.449	0.9695

Regime = RT:

contrast	estimate	SE	df	t.ratio	p.value
S1,4 - S2,4	-1.17591039	0.2145804	68	-5.480	<.0001
S1,4 - S1,8	-0.27855486	0.2349160	68	-1.186	0.6379
S1,4 - S2,8	-1.52129664	0.2453552	68	-6.200	<.0001
S2,4 - S1,8	0.89735553	0.2453552	68	3.657	0.0027
S2,4 - S2,8	-0.34538625	0.1730191	68	-1.996	0.1995
S1,8 - S2,8	-1.24274178	0.2145804	68	-5.791	<.0001

P value adjustment: tukey method for comparing a family of 4 estimates

Temp = 4:

contrast	estimate	SE	df	t.ratio	p.value
C,S1 - RT,S1	-0.22034579	0.2160852	68	-1.020	0.7385
C,S1 - C,S2	-0.02240959	0.2006208	68	-0.112	0.9995
C,S1 - RT,S2	-1.39625617	0.1919488	68	-7.274	<.0001
RT,S1 - C,S2	0.19793620	0.2794548	68	0.708	0.8935
RT,S1 - RT,S2	-1.17591039	0.2145804	68	-5.480	<.0001
C,S2 - RT,S2	-1.37384658	0.1985752	68	-6.919	<.0001

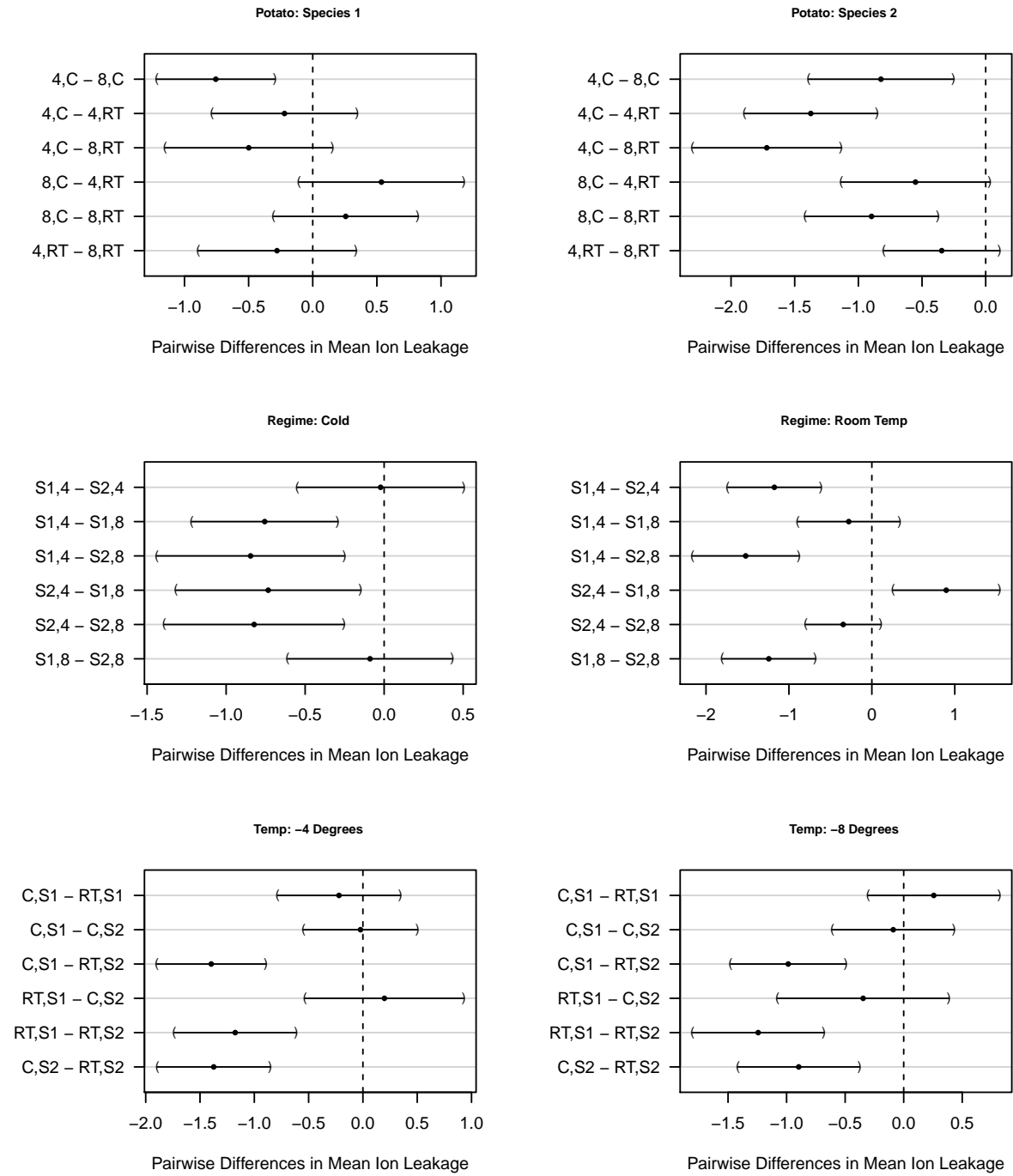
Temp = 8:

contrast	estimate	SE	df	t.ratio	p.value
C,S1 - RT,S1	0.25696038	0.2145804	68	1.198	0.6305
C,S1 - C,S2	-0.08924098	0.1985752	68	-0.449	0.9695

C,S1 - RT,S2	-0.98578140	0.1880948	68	-5.241	<.0001
RT,S1 - C,S2	-0.34620136	0.2794548	68	-1.239	0.6046
RT,S1 - RT,S2	-1.24274178	0.2145804	68	-5.791	<.0001
C,S2 - RT,S2	-0.89654042	0.1985752	68	-4.515	0.0001

P value adjustment: tukey method for comparing a family of 4 estimates

Plot 11: Pairwise Differences of Ion Leakage



Pairwise differences across Potato Species Cells

The mean ion leakage of potato species 2 acclimatized to cold weather and later subjected to -4 degree temperatures was significantly **lower** than those acclimatized to room temperature and later subjected to -8 degree temperatures.

- Estimated difference: -5.081 ($p < 0.001$)

The mean ion leakage of potato species 2 subjected to -4 degree temperatures and acclimatized to cold weather was significantly **lower** than those acclimatized to room temperature.

- Estimated difference: -2.593 ($p < 0.001$)

The mean ion leakage of potato species 2 subjected to -8 degree temperatures and acclimatized to cold weather was significantly **lower** than those acclimatized to room temperature.

- Estimated difference: -0.041 ($p < 0.001$)
 - This suggests that the mean ion leakage of potatoes species 2 acclimatized to cold weather was significantly **lower** than those acclimatized to room temperature, regardless of the temperature they were later subjected to. (I.e., **main effect of regime on ion leakage within Potato=Species 2 cell.**)
-

Pairwise differences across Regime Cells

The mean ion leakage of potato species 1 acclimatized to cold weather and subjected to -4 degree temperatures was significantly **lower** than potato species 2 which were also acclimatized to cold weather but later subjected to -8 degree temperatures.

- Estimated difference: -0.604 ($p = 0.002$)

The mean ion leakage of potato species 1 acclimatized to cold weather and subjected to -8 degree temperatures was significantly **higher** than potato species 2 which were also acclimatized to cold weather but subjected to -4 degree temperatures.

- Estimated difference: -0.395 ($p = 0.008$)

The mean ion leakage of potato species 1 acclimatized to room temperature and subjected to -4 degree temperatures was significantly **lower** than potato species 2 which were also acclimatized to room temperature but later subjected to -8 degree temperatures.

- Estimated difference: -3.521 ($p < 0.001$)

The mean ion leakage of potato species 1 acclimatized to room temperature and subjected to -8 degree temperatures was significantly **lower** than potato species 2 which were also acclimatized to room temperature but later subjected to -4 degree temperatures.

- Estimated difference: -0.723 ($p = 0.003$)

The mean ion leakage of potatoes acclimatized to room temperature and subjected to -4 degree temperatures was significantly **lower** in potato species 1 than potato species 2.

- Estimated difference: -1.626 ($p < .001$)

The mean ion leakage of potatoes acclimatized to room temperature and subjected to -8 degree temperatures was significantly **lower** in potato species 1 than potato species 2.

- Estimated difference: -1.919 ($p < .001$)
- This suggests that the mean ion leakage of potatoes acclimatized to room temperature was significantly **lower** among potato species 1 than potato species 2, regardless of the temperature they were later subjected to. (I.e., **main effect of species on ion leakage within Regime=Room Temp cell.**)

The mean ion leakage of potato species 1 acclimatized to cold weather and later subjected to -4 degree temperatures was significantly **lower** than those subjected to -8 degree temperatures.

- Estimated difference: -0.432 ($p < 0.001$)

The mean ion leakage of potato species 2 acclimatized to cold weather and later subjected to -4 degree temperatures was significantly **lower** than those subjected to -8 degree temperatures.

- Estimated difference: -0.557 ($p = 0.002$)
 - This suggests that the mean ion leakage of potatoes acclimatized to cold weather and subjected to -4 degree temperatures was significantly **lower** than those subjected to -8 degree temperatures, regardless of species. (I.e., **main effect of temperature on ion leakage within Regime=Cold cell.**)
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Pairwise differences across Temperature Treatment Cells

- The mean ion leakage of potato species 1 subjected to -4 degree temperatures and acclimatized to cold weather was significantly **lower** than potato species 2 which were also subjected to -4 degree temperatures but acclimatized to room temperature.
- Estimated difference: -2.722 ($p < .001$)

The mean ion leakage of potato species 1 subjected to -8 degree temperatures and acclimatized to cold weather was significantly **lower** than potato species 2 which were also subjected to -8 degree temperatures but acclimatized to room temperature.

- Estimated difference: -0.958 ($p < .001$)
- This suggests that the mean ion leakage of potato species 1 acclimatized to cold weather was significantly **lower** than potato species 2 which were acclimatized to room temperature, regardless of the temperature they were later subjected to. (I.e., **two-way interaction effect of species and regime on ion leakage.**)