

Short Paper

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Abstract

This is the abstract.

It consists of two paragraphs.

Methods

All analysis were carried away with the R Statistical Software (R Core Team 2016), all meta-analyses were made on the metafor package (Viechtbauer 2010). Our estimations were based on the use of random/mixed-effects models form of meta-analyses, which provide an unconditional inference about a larger set of studies from which the k studies included in the meta-analysis are assumed to be a random sample (L. V. Hedges and Vevea 1998). This estimations do not assume that this larger set consists only of studies that have actually been conducted, but instead envision a hypothetical population of studies that comprises studies that have been conducted, that could have been conducted, or that may be conducted in the future (L. V. Hedges and Vevea 1998).

We used the *escalc* function of the metafor package to estimate the effect size estimates (Viechtbauer 2010), we used the *standardized mean difference with heteroscedastic population variances in the two groups* (SDMH) as our estimator for effect size (Bonett 2009), the metafor package also corrects the slight positive bias of the estimation following (Wasserman, Hedges, and Olkin 1988). To be extra conservative we used the unbiased estimates of the sampling variances. In all cases the residual heterogeneity estimator was Hedges.

Since we used mixed effect models we used the The Knapp and Hartung adjustment (**Knapp and Hartung, 2003**) to test the individual coefficients of the model.

Test for (Residual) Heterogeneity

For each model we tested for residual heterogeneity, if we used models without moderators, then the Cochran's Q-test (Cochran 1954) was used to test whether the variability in the observed effect sizes or outcomes is larger than would be expected based on sampling variability alone. *A significant test suggests that the true effects or outcomes are heterogeneous.* When moderators were included in the models the Q_E-test for residual heterogeneity was used, this tests whether the variability in the observed effect sizes or outcomes not accounted for by the moderators included in the model is larger than would be expected based on sampling variability alone. When using moderators to explain more variability a pseudo R squared was computed following (Raudenbush 2009).

Results

As we can see in figure 1, the most common type of performance measured in studies was abundance, with 101 estimations, followed by reproduction with 44 estimation, behavior with 23, and finally survival and condition with 16 each.

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Table 1: effect size of the Standardized mean difference for each type of estimation of performance, it's standard error and p-value

estimate	ci.ub	ci.lb	group	p	n	I2	pvalCT
-0.776	-0.378	-1.175	Abundance	0.000	131	88.894	0
-2.232	3.012	-7.476	Behavior	0.404	29	99.895	0
-8.131	-2.544	-13.718	Survival	0.004	28	99.667	0
0.203	14.647	-14.240	Reproduction	0.978	90	99.997	0
-1.903	-0.892	-2.915	Condition	0.000	40	99.247	0

Overall effect size

As we can see in table 1 and figure 2, all estimations of the effects are negative. However, only abundance, survival and condition have significative negative effects. Survival has the highest effect size, with a mean difference estimation of -8.13

Estimations using moderators:

Abundance models without concentrations

Comparison of models without concentrations

Table 2: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Order+Functional group+Treatment Type	0.000	0.28	131	572.304	0.000	0.327
y~ Order+Functional group+Treatment Type+Neonic	0.000	0.29	131	573.175	0.871	0.211
y~ Functional group+Treatment Type+Neonic+Nesting Area	0.008	0.14	131	575.871	3.567	0.055
y~ Functional group+Treatment Type+Nesting Area	0.012	0.12	131	576.083	3.779	0.049
y~ Order+Treatment Type	0.002	0.21	131	576.675	4.371	0.037
y~ Treatment Type+Neonic+Nesting Area	0.031	0.08	131	576.910	4.606	0.033
y~ Treatment Type+Nesting Area	0.044	0.07	131	577.291	4.987	0.027

Abundance and concentration (Kg/Ha) for Powder/granular treatment models

Comparison of models with concentrations [Kg/Ha]

Table 3: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Nesting Area+Concentration [Kg/Ha]	0.063	0.16	50	196.298	0.000	0.610
y~ Order+Concentration [Kg/Ha]	0.021	0.32	50	198.905	2.606	0.166
y~ Order+Functional group+Concentration [Kg/Ha]	0.010	0.41	50	200.352	4.054	0.080
y~ Concentration [Kg/Ha]	0.717	0.00	50	200.388	4.090	0.079

Abundance and concentration (g/Kg) models with seed treatment

Comparison of models [g/Kg]

Table 4: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Concentration [g/Kg]	0.110	0.09	53	181.555	0.000	0.303
y~ Functional group+Concentration [g/Kg]	0.102	0.11	53	181.685	0.131	0.284
y~ Functional group+Nesting Area+Concentration [g/Kg]	0.087	0.14	53	181.854	0.299	0.261
y~ Nesting Area+Concentration [g/Kg]	0.228	0.08	53	183.579	2.024	0.110

Behaviour

Behaviour without concentration

Model Comparison behaviour without concentration

Table 5: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Study Type	0.450	0	29	241.727	0.000	0.197
y~ Neonc	0.525	0	29	241.913	0.186	0.180
y~ Order	0.742	0	29	242.245	0.518	0.152
y~ Nesting Area	0.532	0	29	243.781	2.054	0.071
y~ Neonc+Study Type	0.752	0	29	244.555	2.828	0.048
y~ Order+Study Type	0.759	0	29	244.580	2.853	0.047
y~ Order+Neonic	0.822	0	29	244.761	3.034	0.043
y~ Treatment Type	0.831	0	29	244.788	3.061	0.043

Table 6: Best model for behaviour

estimate	ci.ub	ci.lb	group	p	n
-2.232	3.012	-7.476	Null	0.404	29
-3.960	2.965	-10.884	lab	0.262	17
4.132	14.844	-6.580	semi-field	0.450	12

Reproduction

Reproduction without concentration

Model Comparison reproduction without concentration

Table 7: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Order	0.225	0.15	90	973.543	0.000	0.601
y~ Order+Nesting Area	0.339	0.14	90	976.635	3.092	0.128
y~ Order+Treatment Type	0.398	0.20	90	977.007	3.464	0.106
y~ Order+Functional group	0.381	0.14	90	978.523	4.981	0.050

Table 8: Best model for reproduction

estimate	ci.ub	ci.lb	group	p	n
0.203	14.647	-14.240	Null	0.978	90
-15.520	12.645	-43.685	Coleoptera	0.280	20
13.334	54.197	-27.528	Haplotaxida	0.522	18
60.687	111.203	10.171	Hemiptera	0.019	10
13.880	48.201	-20.441	Hymenoptera	0.428	41
10.289	138.997	-118.419	Neuroptera	0.875	1

Reproduction and concentration [ppb]

Model Comparison reproduction with concentration [ppb]

Table 9: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc
y~ Order+Neonic+Study Type+Concentration [ppb]	0	0.58	59	285.57
y~ Order+Neonic+Treatment Type+Study Type+Concentration [ppb]	0	0.60	59	286.23
y~ Order+Nesting Area+Neonic+Concentration [ppb]	0	0.56	59	287.36
y~ Order+Nesting Area+Neonic+Study Type+Concentration [ppb]	0	0.58	59	288.03
y~ Order+Nesting Area+Neonic+Treatment Type+Concentration [ppb]	0	0.57	59	288.16
y~ Functional group+Neonic+Study Type+Concentration [ppb]	0	0.58	59	288.89
y~ Order+Functional group+Neonic+Study Type+Concentration [ppb]	0	0.58	59	288.89
y~ Order+Nesting Area+Neonic+Treatment Type+Study Type+Concentration [ppb]	0	0.59	59	288.93
y~ Order+Functional group+Nesting Area+Neonic+Concentration [ppb]	0	0.56	59	289.36
y~ Functional group+Nesting Area+Neonic+Concentration [ppb]	0	0.56	59	289.36
y~ Order+Neonic+Concentration [ppb]	0	0.54	59	289.73
y~ Order+Functional group+Neonic+Treatment Type+Study Type+Concentration [ppb]	0	0.59	59	289.76
y~ Functional group+Neonic+Treatment Type+Study Type+Concentration [ppb]	0	0.59	59	289.76
y~ Order+Neonic+Treatment Type+Concentration [ppb]	0	0.55	59	290.17

Condition

Model Comparison reproduction without concentration

Table 10: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Study Type	0	0.43	40	194.858	0.000	0.244
y~ Nesting Area+Study Type	0	0.43	40	194.858	0.000	0.244
y~ Treatment Type+Study Type	0	0.45	40	197.506	2.648	0.065
y~ Nesting Area+Treatment Type+Study Type	0	0.45	40	197.506	2.648	0.065
y~ Functional group+Study Type	0	0.42	40	197.703	2.845	0.059
y~ Functional group+Nesting Area+Study Type	0	0.42	40	197.703	2.845	0.059
y~ Nesting Area+Neonic+Study Type	0	0.44	40	198.128	3.270	0.048
y~ Neonic+Study Type	0	0.44	40	198.128	3.270	0.048

Condition with concentration [ppb]

Model Comparison reproduction with concentration ppb

Table 11: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	W
y~ Nesting Area+Study Type+Concentration [ppb]	0	0.45	34	169.738	0.000	0
y~ Study Type+Concentration [ppb]	0	0.45	34	169.738	0.000	0
y~ Nesting Area+Neonic+Concentration [ppb]	0	0.43	34	172.040	2.302	0
y~ Functional group+Nesting Area+Study Type+Concentration [ppb]	0	0.43	34	172.853	3.115	0
y~ Functional group+Study Type+Concentration [ppb]	0	0.43	34	172.853	3.115	0
y~ Neonic+Study Type+Concentration [ppb]	0	0.45	34	173.679	3.941	0
y~ Nesting Area+Neonic+Study Type+Concentration [ppb]	0	0.45	34	173.679	3.941	0

Survival

Model Comparison Survival without concentration

Table 12: Comparison of models taking into account p value, Pseudo R squared and AICc

model	pvalue	R_squared	n	AICc	deltaAICc	Weight
y~ Treatment Type	0.044	0.37	28	219.242	0.000	0.147
y~ Nesting Area+Treatment Type	0.044	0.37	28	219.242	0.000	0.147
y~ Nesting Area+Study Type	0.055	0.40	28	219.251	0.009	0.146
y~ Nesting Area	0.052	0.18	28	220.075	0.833	0.097
y~ Nesting Area+Neonic	0.082	0.25	28	221.561	2.319	0.046
y~ Functional group+Study Type	0.073	0.40	28	222.049	2.806	0.036
y~ Functional group+Nesting Area+Study Type	0.073	0.40	28	222.049	2.806	0.036
y~ Functional group+Treatment Type	0.065	0.36	28	222.381	3.139	0.031
y~ Functional group+Nesting Area+Treatment Type	0.065	0.36	28	222.381	3.139	0.031
y~ Order	0.152	0.28	28	222.418	3.175	0.030
y~ Order+Functional group	0.114	0.31	28	222.868	3.625	0.024
y~ Order+Nesting Area	0.114	0.31	28	222.868	3.625	0.024
y~ Order+Functional group+Nesting Area	0.114	0.31	28	222.868	3.625	0.024
y~ Order+Neonic	0.093	0.38	28	223.049	3.807	0.022
y~ Neonic	0.148	0.14	28	223.381	4.138	0.019
y~ Functional group	0.157	0.15	28	223.381	4.138	0.019
y~ Functional group+Nesting Area	0.157	0.15	28	223.381	4.138	0.019
y~ Neonic+Treatment Type	0.087	0.35	28	223.572	4.329	0.017
y~ Nesting Area+Neonic+Treatment Type	0.087	0.35	28	223.572	4.329	0.017

Table 13: Best model for survival

estimate	ci.ub	ci.lb	group	p	n
-2.057	11.106	-15.220	foliar	0.759	3
0.105	15.536	-15.327	lab compound	0.989	8
-17.331	-1.233	-33.429	powder/granular	0.035	8
0.682	19.294	-17.929	seed treatment	0.943	3

estimate	ci.ub	ci.lb	group	p	n
-7.322	8.831	-23.475	soil treatment	0.374	6
-8.131	-2.544	-13.718	Null	0.004	28

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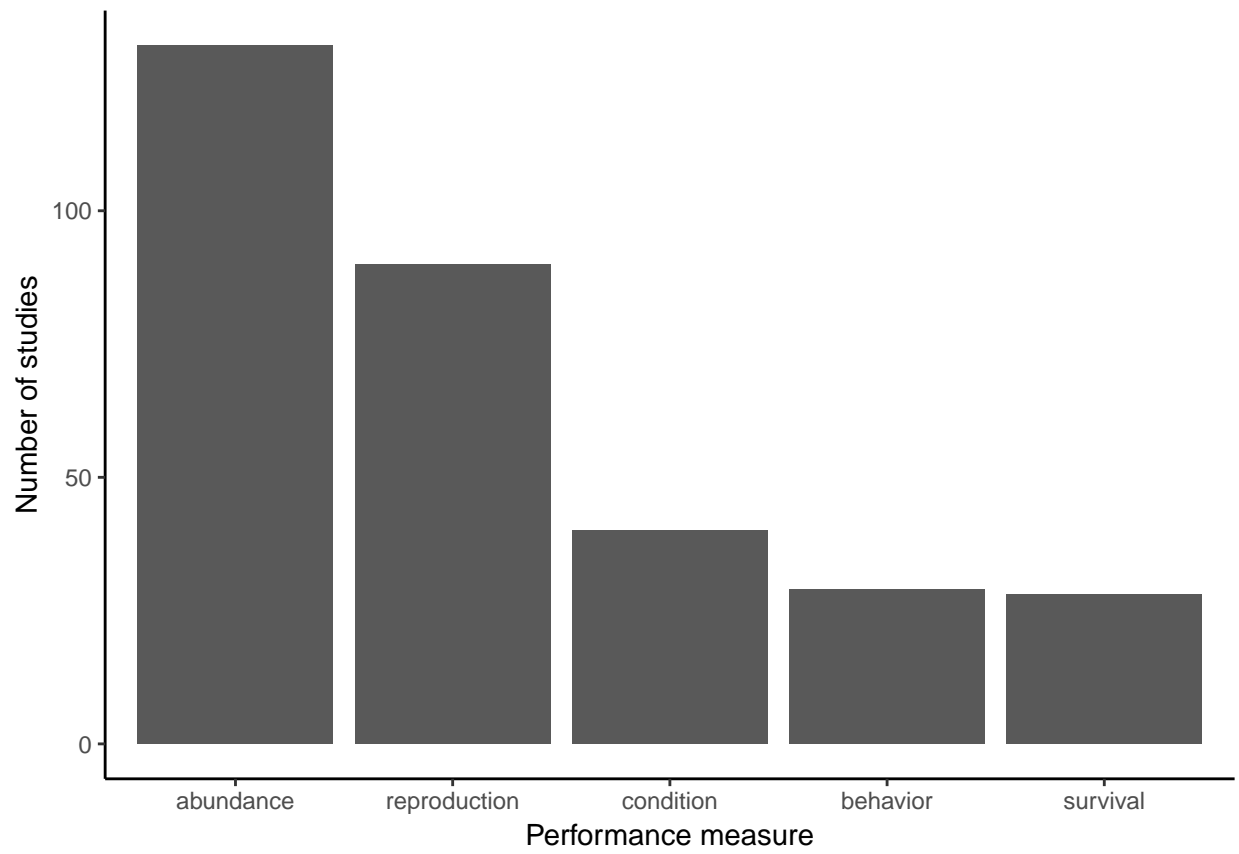


Figure 1: Number of estimation of effect size within the meta-analyses

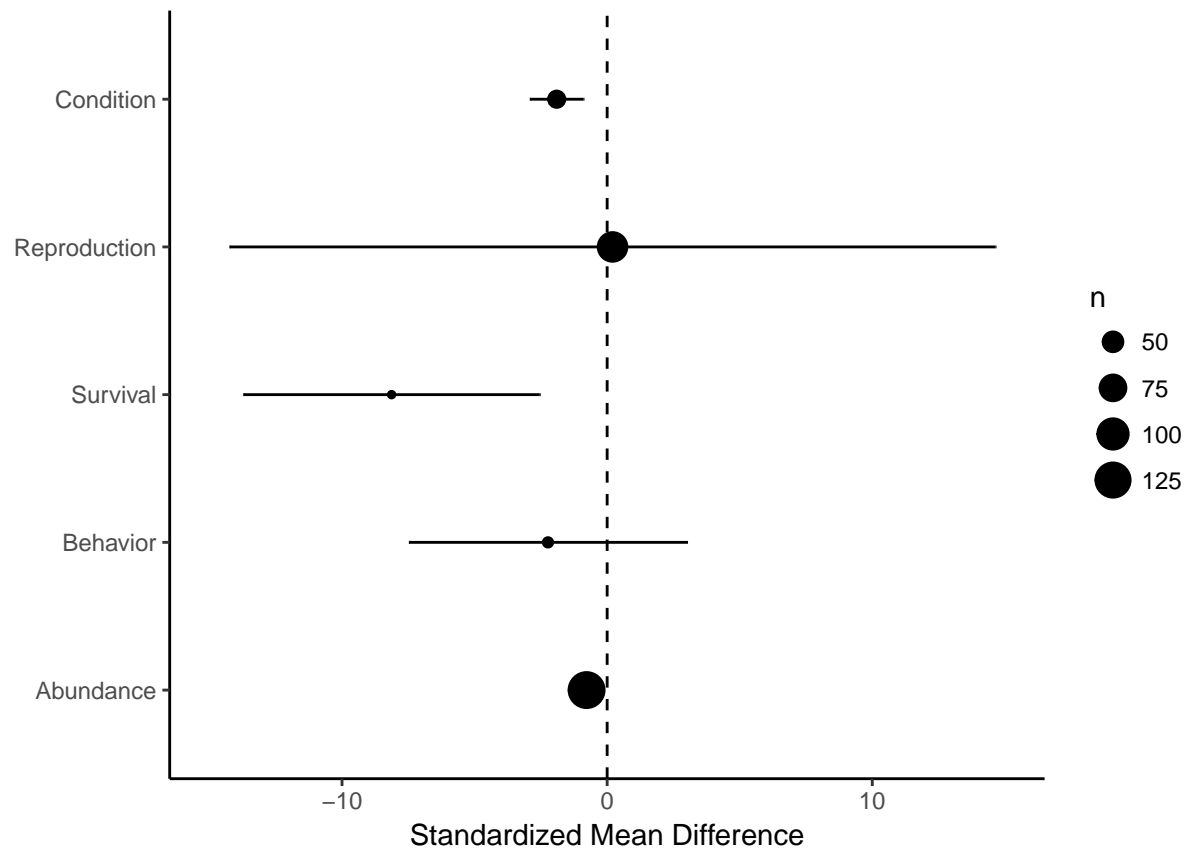


Figure 2: effect size of the Standardized mean difference for each type of estimation of performance and it's standard error

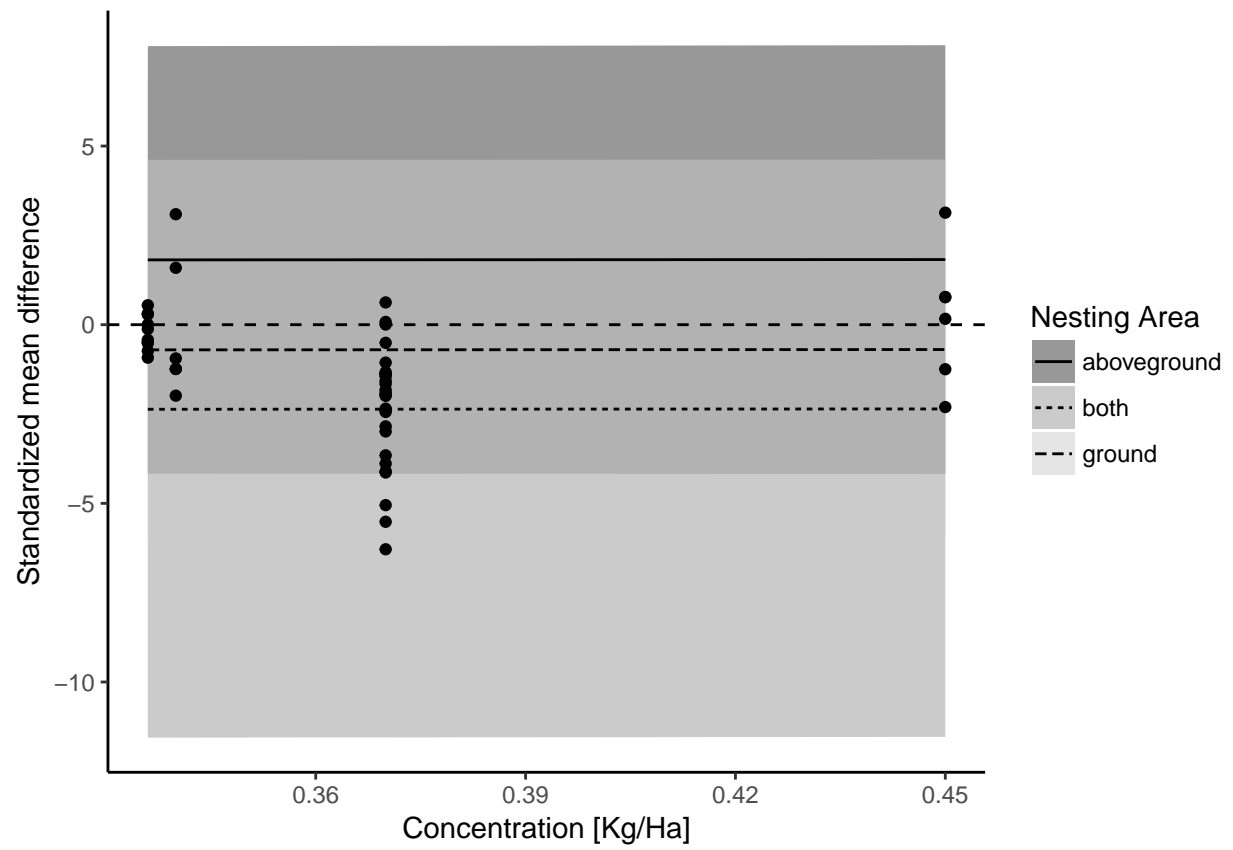


Figure 3: effect size of the Standardized mean difference of abundance for Nesting Area and concentration (Kg/Ha) for powder/granular applications

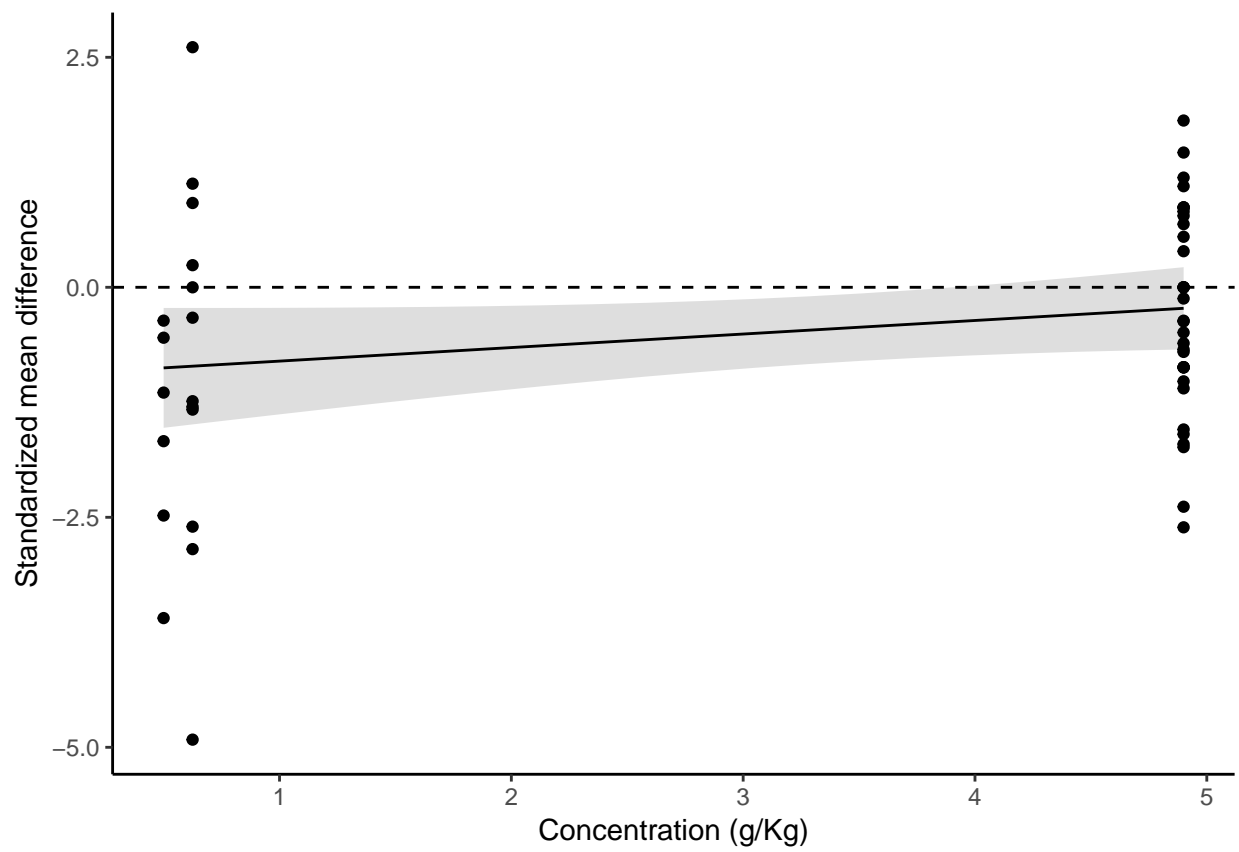


Figure 4: effect size of the Standardized mean difference of abundance and concentration (g/Kg)

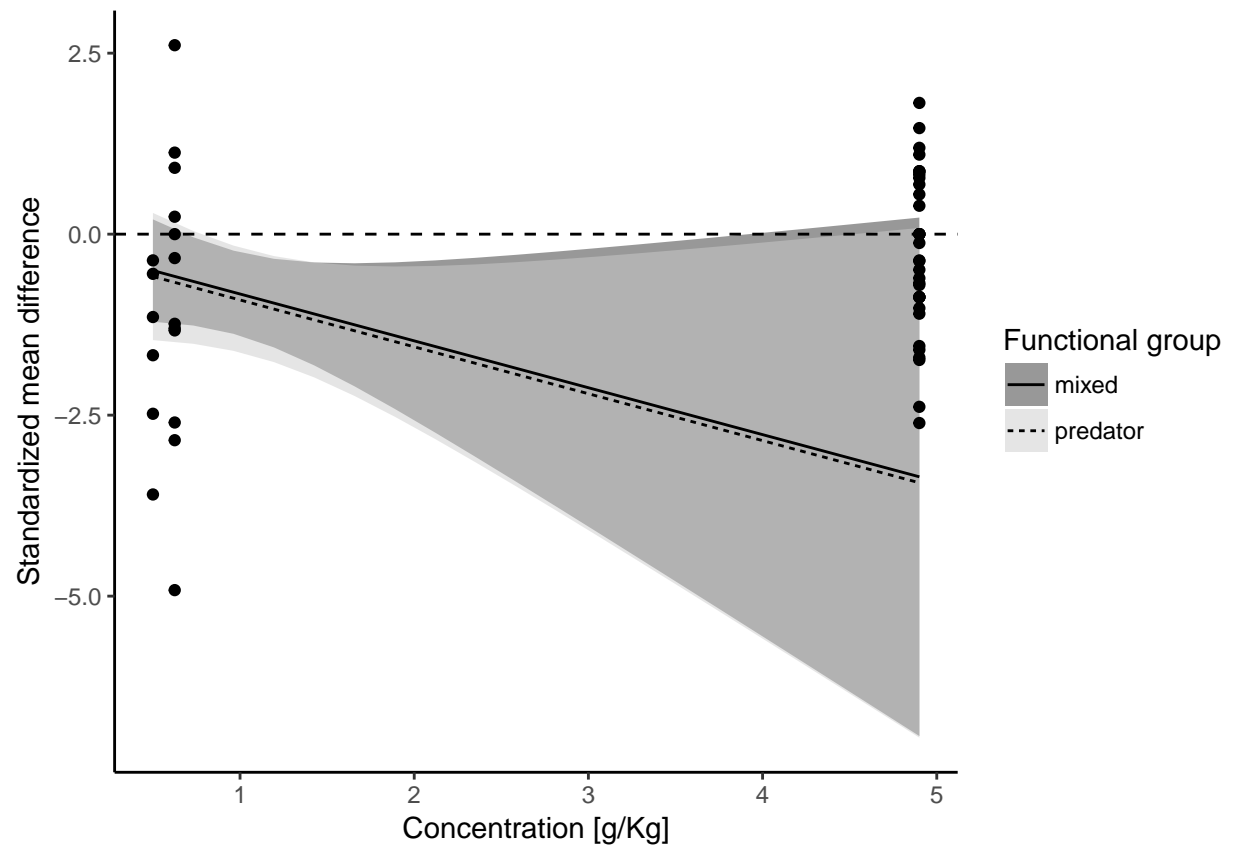


Figure 5: effect size of the Standardized mean difference of abundance and functional group with concentration (g/Kg)

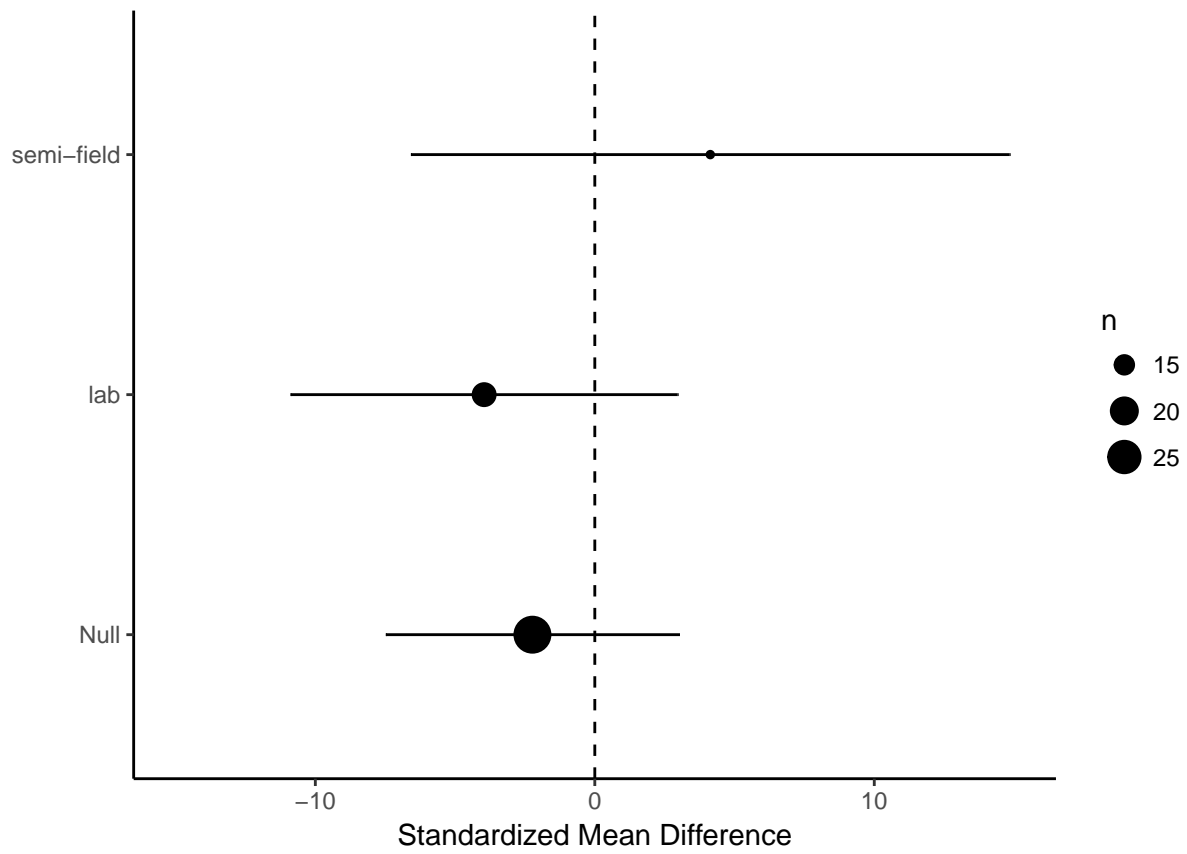


Figure 6: Effect of behaviour by Study type

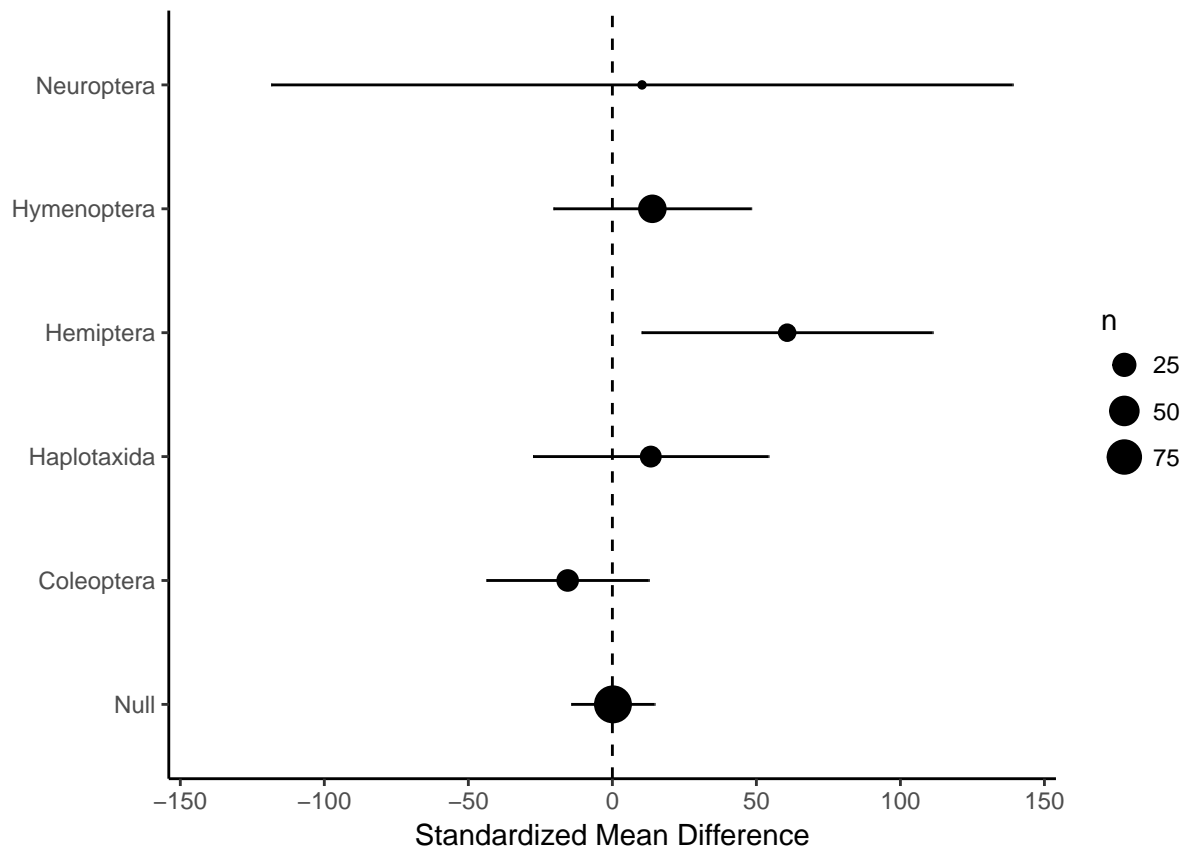


Figure 7: Effect of reproduction by order

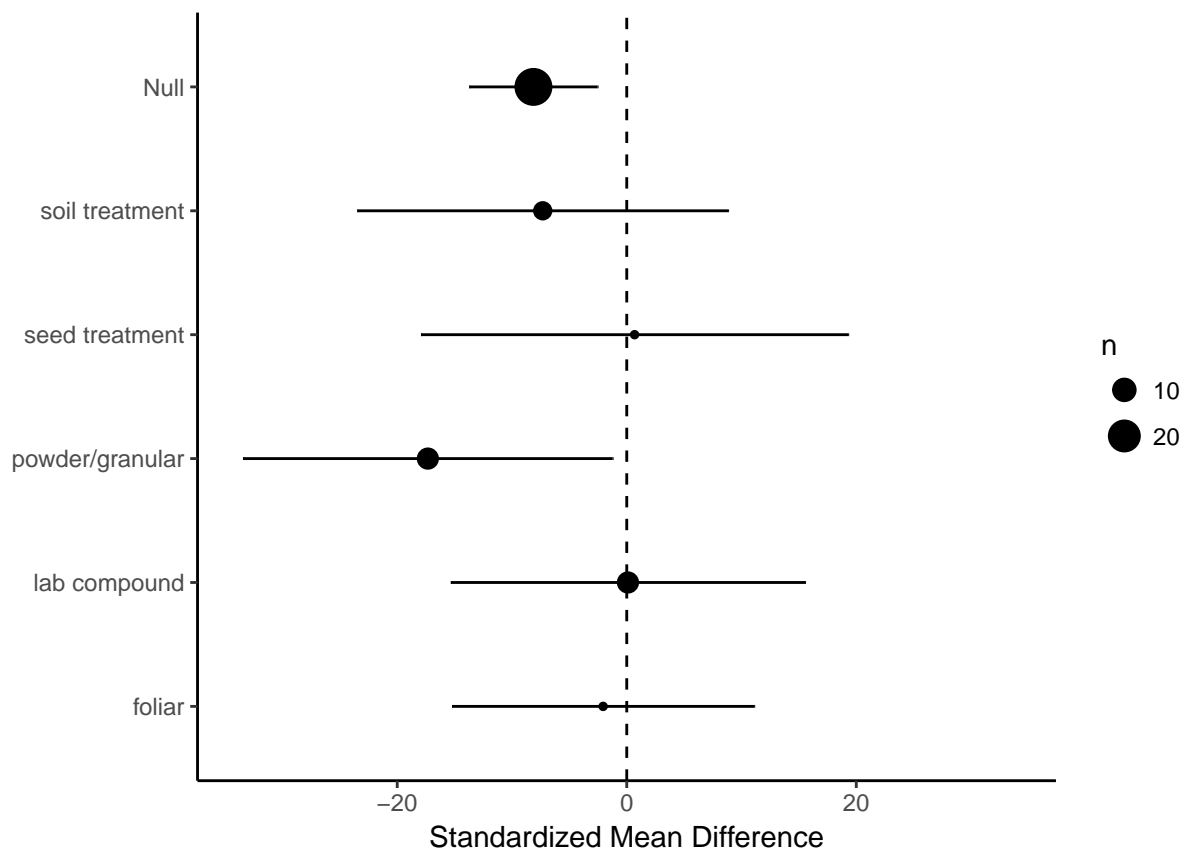


Figure 8: Effect of survival by Treatment type