

Supplementary Material

Nutrition induced direct fitness for workers in a primitively eusocial wasp

Jithu U. Krishnan, Anindita Brahma, Sayali K. Chavan and Raghavendra Gadagkar

Tables

Table S1. Characteristics of all parent nests transplanted inside the walk-in cages. Number of cells, eggs, larvae, pupae and adults were calculated on the day of transplantation of the respective parent nests.

Nest ID	Nest type	Date of transplantation	Number of cells	Number of eggs	Number of larvae	Number of pupae	Number of females	Date of nest abandonment
W10	Test	21/02/2018	173	58	75	54	38	18/04/2018
W11	Control	21/02/2018	148	20	70	60	46	22/06/2018
W12	Control	20/03/2018	212	21	82	43	32	03/07/2018
W13	Test	20/03/2018	237	17	116	51	41	12/06/2018
W14	Test	20/03/2018	176	39	88	37	40	07/06/2018
W15	Control	20/03/2018	204	26	84	45	57	20/06/2018
W16	Control	27/02/2019	217	72	101	30	34	22/06/2019
W17	Test	27/02/2019	255	63	130	42	31	13/05/2019
W18	Control	27/02/2019	219	66	94	39	48	24/06/2019
W19	Test	27/02/2019	246	41	114	46	32	18/05/2019
W20	Test	22/02/2019	182	44	109	27	44	10/04/2019
W21	Control	22/02/2019	224	78	90	39	39	03/07/2019

Table S2. Parameter estimates of the models fitted with nest type and year of experiment as fixed effects.

Response variable	Predictor variable	Estimate	Standard error	t-value	p-value
Average per-capita food consumption	Nest type	0.21	0.03	6.79	< 0.0001
	Year	0.01	0.03	0.28	0.79
Parent colony period	Nest type	-43.33	8.89	-4.86	0.0009
	Year	-1.02e-14	8.89	0	1.0
Total number of queen turnovers	Nest type	5.67	0.83	6.76	<0.0001
	Year	0.67	0.83	0.79	0.48
Per-capita queen turnover	Nest type	0.08	0.01	9.57	<0.0001
	Year	0.02	0.01	1.83	0.1
Total number of new nests initiated	Nest type	3.33	0.72	4.63	0.001
	Year	-0.67	0.72	-0.93	0.38
Per-capita nest initiation	Nest type	0.05	0.01	4.79	0.009
	Year	-0.01	0.01	-0.64	0.54

Table S3. Parameter estimates of models fitted with average per-capita food consumption (APFC) and year of experiment as fixed effects.

Response variable	Predictor variable	Estimate	Standard error	t-value	p-value
Parent colony period	APFC	-166.342	51.51	-3.23	0.01
	Year	1.39	11.55	0.12	0.91
Total number of queen turnovers	APFC	20.02	6.36	3.15	0.01
	Year	0.49	1.43	0.35	0.73
Per-capita queen turnover	APFC	0.32	0.06	5.27	0.0005
	Year	0.01	0.01	0.91	0.39
Total number of new nests initiated	APFC	13.47	3.84	3.51	0.007
	Year	-0.78	0.86	-0.91	0.39
Per-capita nest initiation	APFC	0.23	0.04	5.48	0.0004
	Year	-0.009	0.009	-0.91	0.39
Frequency of dominance behaviour	APFC	4.71	1.25	3.76	0.02

R-codes

```
library(lme4)
library(scales)
library(ggplot2)

#data
excess_feeding <- read.csv(file = "excess_feeding_both_years.csv",
                          header = TRUE)
#read data for only year 1 (2018)
excess_feeding_year_1 <- read.csv(file = "excess_feeding_year_1.csv", header = TRUE)

#model_1A for Figure 1A: nest_type v/s apfc (average per-capita food consumption)
model_1A <- lm(apfc ~ nest_type + year, data = excess_feeding)
summary(model_1A)

#model_1B for Figure 1B: nest_type v/s pcd (parent colony duration)
model_1B <- lm(pcd ~ nest_type + year, data = excess_feeding)
summary(model_1B)

#model_1C for Figure 1C: nest_type v/s nqt (number of queen turnovers)
model_1C <- lm(nqt ~ nest_type + year, data = excess_feeding)
summary(model_1C)

#model_1D for Figure 1D: nest_type v/s pcqt (per-capita queen turnover)
model_1D <- lm(pcqt ~ nest_type + year, data = excess_feeding)
summary(model_1D)

#model_1E for Figure 1E: nest_type v/s nnf (number of nest foundation)
model_1E <- lm(nnf ~ nest_type + year, data = excess_feeding)
summary(model_1E)

#model_1F for Figure 1F: nest_type v/s pcnf (per-capita new nest foundation)
model_1F <- lm(pcnf ~ nest_type + year, data = excess_feeding)
summary(model_1F)

#using average per-capita food consumption (apfc) as the predictor variable
#model_2A for Figure 2A: apfc v/s pcd (parent colony duration)
```

```
model_2A <- lm(pcd ~ apfc + year, data = excess_feeding)
summary(model_2A)
```

```
#model_2B for Figure 2B : apfc v/s nqt (number of queen turnovers)
model_2B <- lm(nqt ~ apfc + year, data = excess_feeding)
summary(model_2B)
```

```
#model_2C : apfc v/s pcqt (per-capita queen turnover)
model_2C <- lm(pcqt ~ apfc + year, data = excess_feeding)
summary(model_2C)
```

```
#model_2D for Figure 2D: apfc v/s nnf (number of nest foundation)
model_2D <- lm(nnf ~ apfc + year, data = excess_feeding)
summary(model_2D)
```

```
#model_2E for Figure 2E: apcc v/s pcnf (per-capita nest foundation)
model_2E <- lm(pcnf ~ apcc + year, data = excess_feeding)
summary(model_2E)
```

```
# model_2F for Figure 2F: apcc v/s db (frequency per-hour of dominance behaviour)
##using excess_feeding_year_1 as dataset
model_2F <- lm(db ~ apcc, data = excess_feeding_year_1)
summary(model_2F)
```