Can fecundity and emergence rate of bean beetles be predicted by the metabolic theory of ecology?

Background

No matter the shape it takes, a life form can only be considered so if it has a metabolism. This seemingly endless ecological diversity can, however, be explained in terms of how body size, temperature and chemical kinetics affect metabolism. By quantifying these variables, a so-called metabolic theory of ecology (MTE) can be established. Two most prominent variations of it are found in *Gilloly et al. (2001)* and *Arroyo et al.(2022)*. If such theory is true, it could predict how the metabolic rate controls the outcome of virtually all ecological processes.

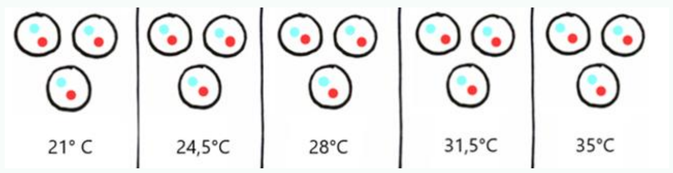
Research Goal

- Observe fecundity and emergence of bean beetle larvae
- Examine whether the rates correspond to either models of the MTE

Our hypothesis: Both rates will follow the MTE

Materials & Methods

- 2 beetles (F/M) + 135 beans in each petri dish
- 3 petri dishes in each temperature



- We analyzed the results by running an AIC analysis and comparing the models *MTE, Gilloly et a.(2001)* and *Arroyo et al.(2022)*.

Results

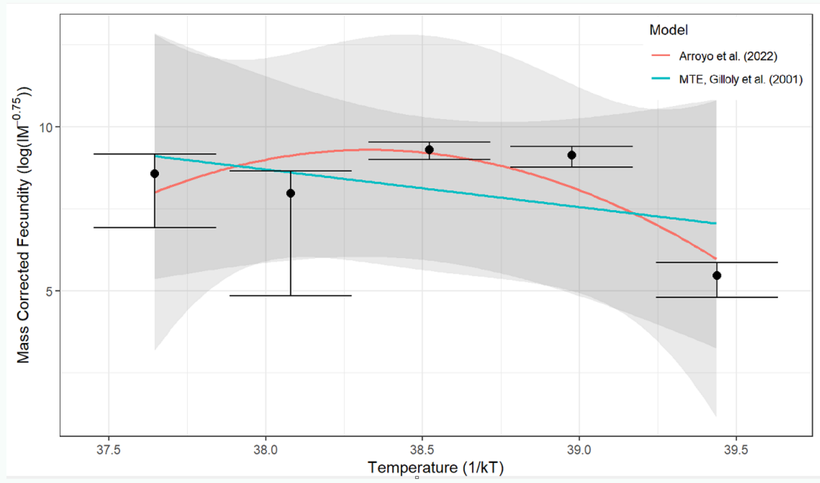


Figure 1: Shows fecundity from egglaying rates, in comparison to the models.

Table 1: Statistical variables from analysis our own data using the Arroyo model

	Estimate	Std.Error	t value	Pr(>|t|)
Intercept	-5354.79	8828.06	-0.61	0.65
log(x)	2032.57	3336.89	0.61	0.65
x	-53.53	87.11	-0.61	0.65

Table 2: Statistical variables from analysis of collective dataset using the Arroyo model

	Estimate	Std.Error	t value	Pr(>|t|)
Intercept	-24464.42	5890.14	-4.15	0.053
log(x)	9256.17	2221.43	4.17	0.053
x	-242.12	57.64	-4.20	0.052

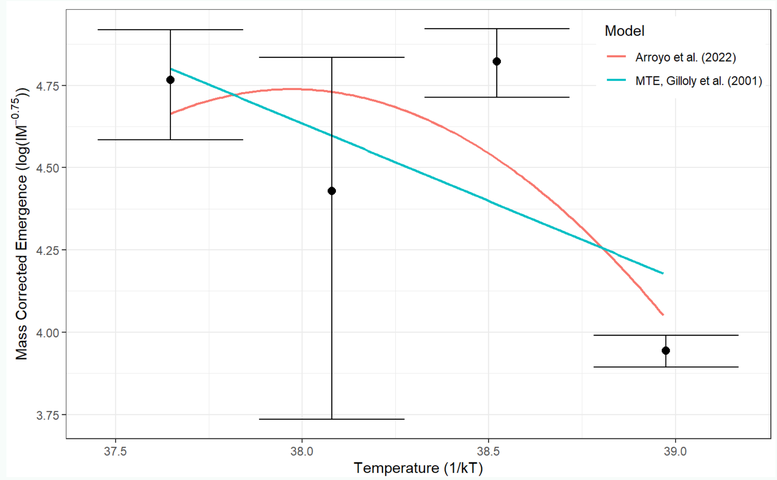


Figure 2: Emergence rates from our own data

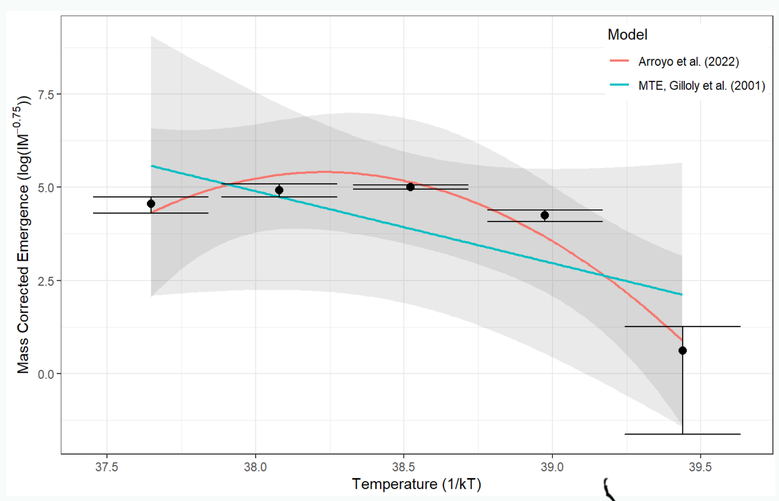


Figure 3: Emergence rates from the collective dataset

Discussion and Conclusion

- Our results show that the fecundity follows the Arroyo model, while the emergence rate does not
- Emergence rate data follows the models, but only when included in a larger dataset
- Our experiment had a limited sized data set, hence yielding inconclusive results
- Our findings show that fecundity and emergence rate can be predicted by the MTE.

Sources