



Investigation of Intestine Bacterial Abundance Change and Mortality Rate of Waxworms (*Galleria mellonella*. L) after Consuming Polystyrene

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Introduction

I. Motivation

Plastic pollution is a severe issue, and biodegradation is considered a potential solution. It is known that certain microorganisms, such as the intestine bacteria of waxworms (*Galleria mellonella*. L) can degrade polystyrene (PS).

Known facts

- Waxworms have the ability to degrade PS.
- Waxworms' mortality rate increases after they degrade PS.
- Waxworms exhibit an increase in intestinal bacterial abundance after consuming PS.

II. Purpose

- To investigate the mortality rate of the waxworms after their plastic consumption under different temperature settings.
- To discuss the correlation between the changes in intestine bacterial number of the waxworms and the increased mortality rate after plastic consumption.
- To understand the growth cycle of the waxworms in different temperatures.



Fig 1: Waxworms (*Galleria mellonella*, L)

III. Experimental Species

Waxworm is the larval stage of the greater wax moth. Since the intestine bacteria species of the waxworms increase rather than decrease after consuming polystyrene (PS) (Jiang S, et al, 2021), it was chosen as the experimental subject.

The optimal temperature range for waxworm to grow is between 29°C and 35°C, and temperatures between 10°C and 16°C can affect its development. Therefore, 30°C and 15°C were determined to be the temperatures for two different experiment settings.

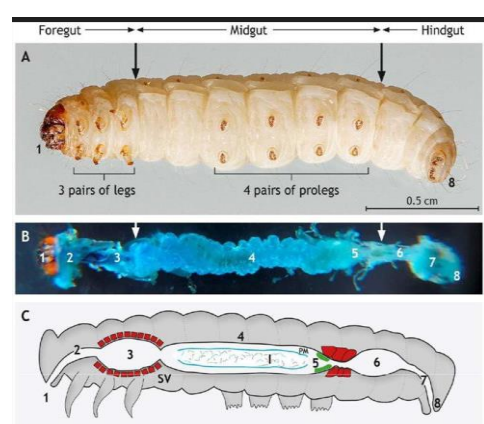


Fig 2: The intestine of the waxworm (Philipp-Albert Sanger, et al. (2022))

Procedure

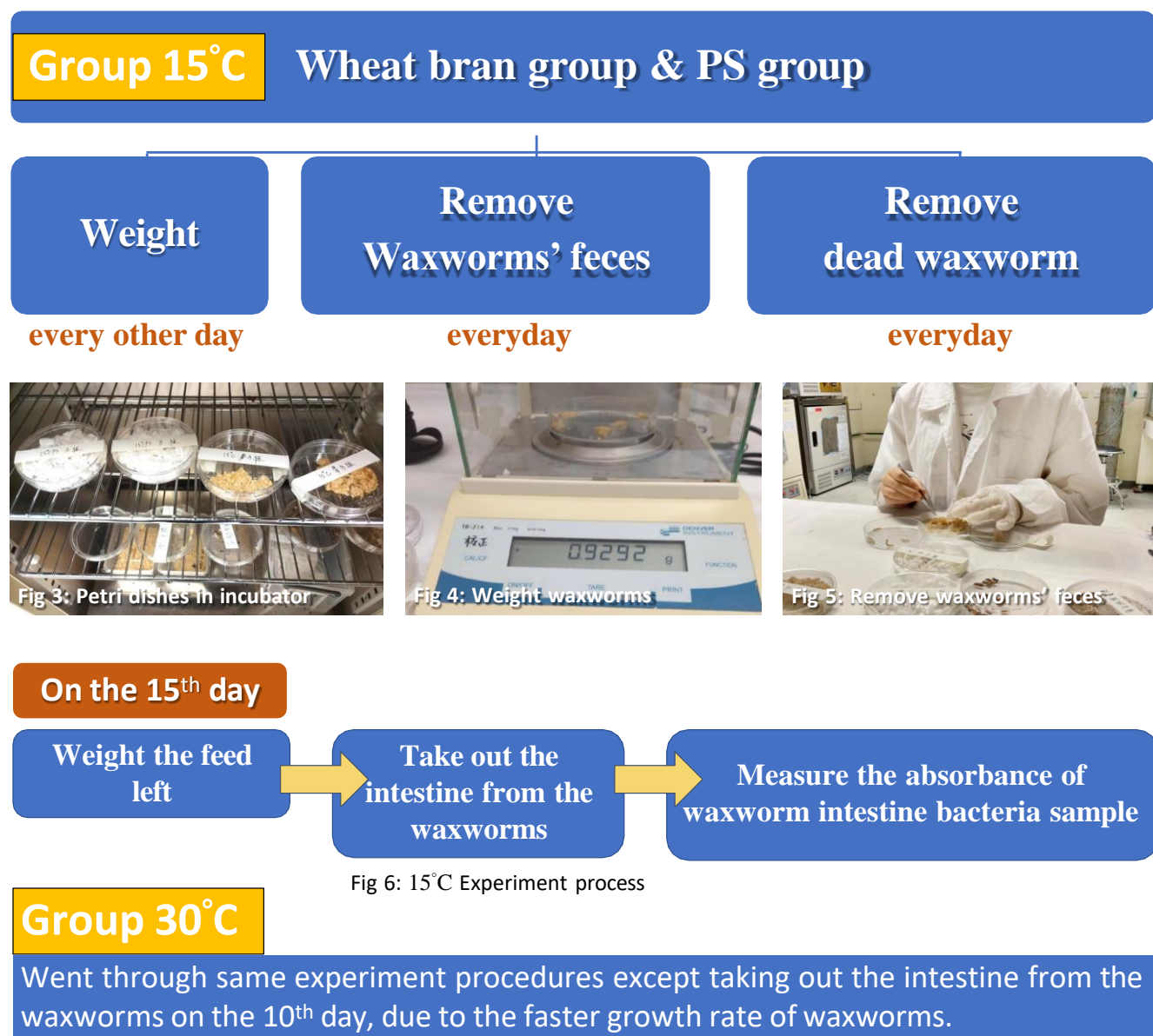


Fig 6: 15°C Experiment process

Results and Discussion

I. Average mortality rate in different temperatures

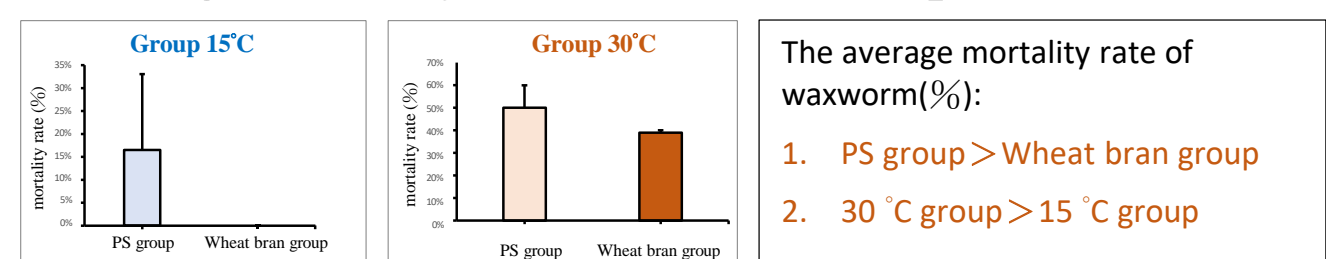


Fig 7: Waxworm's average mortality rate (%)

II. The average absorbance values of intestine bacteria in different temperatures

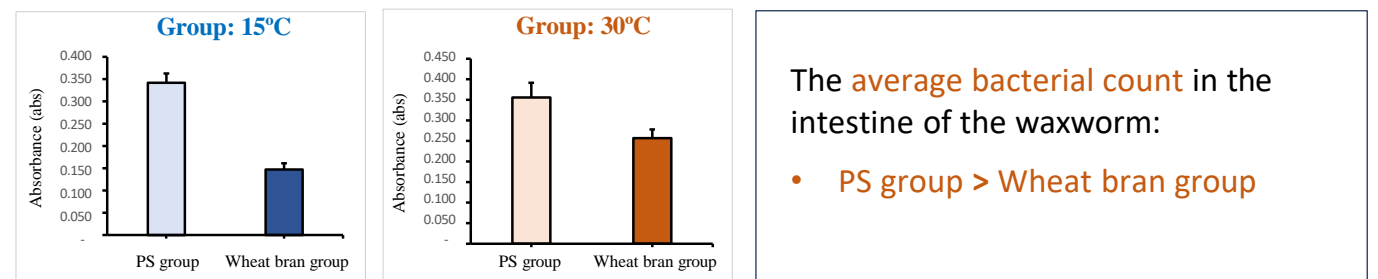


Fig 8: The average absorbance values of intestine bacterial at different temperatures

Group: 15°C	PS group	Wheat bran group	Group: 30°C	PS group	Wheat bran group
Absorbance (abs)	0.3420	0.1475	0.3555	0.2570	
Bacterial count (amount/ml)	3.420x10 ⁸	1.475x10 ⁸	3.555x10 ⁸	2.570x10 ⁸	

III. The food intake of the waxworm in different temperatures

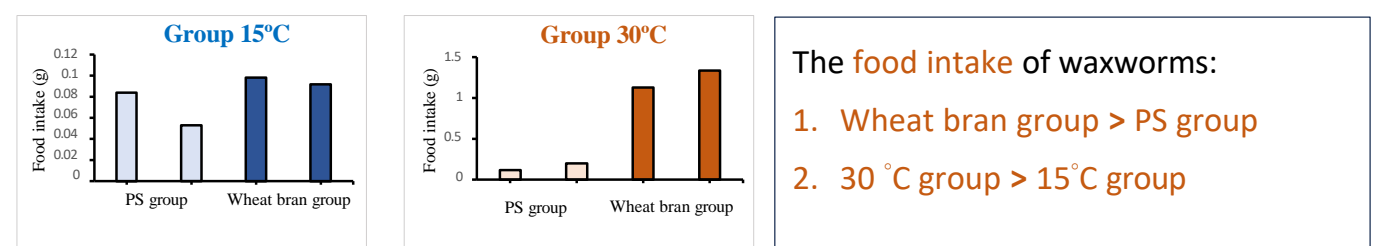


Fig 9: Food intake (g)

IV. Average weight changes of waxworm on the 10th day

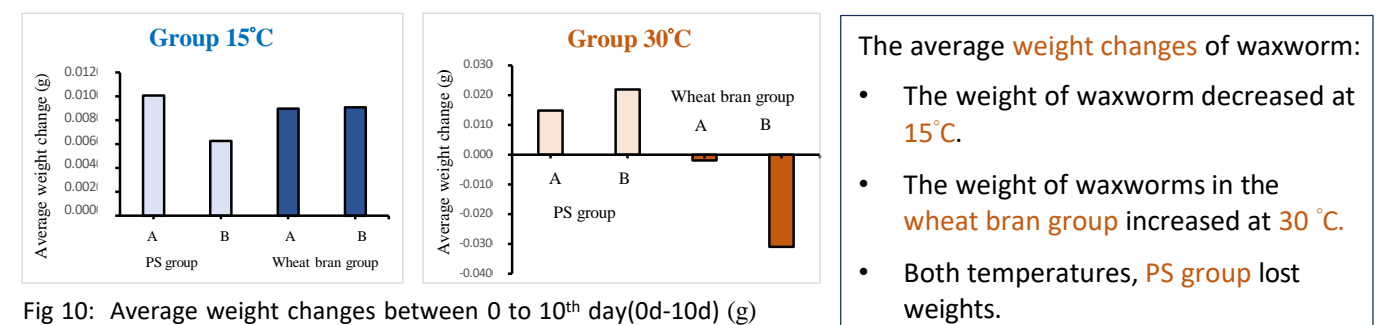


Fig 10: Average weight changes between 0 to 10th day(0d-10d) (g)

	30 °C group	15 °C group
Polystyrene	weight decreased	weight decreased
Wheat Bran Main food source	weight increased	weight decreased

Table 1: Weight changes in different group

Conclusions

This experiment shows a new evidence that the total intestine bacterial count increased when the waxworm consumed PS, suggesting that it might be a contributing factor to the mortality rate.

	30 °C group		15 °C group	
Mortality rate	PS group > Wheat bran group		PS group > Wheat bran group	
Bacterial count	PS group > Wheat bran group		PS group > Wheat bran group	
Food intake	Wheat bran group > PS group		Wheat bran group > PS group	
Weight changes	PS group	Wheat bran group	PS group	Wheat bran group
	↓	↑	↓	↓

Table 2: Comparison between groups

Suggestions

In addition to measuring the bacterial count with spectrophotometer, I also want to use gas chromatography to measure the PS content in waxworm. Moreover, I hope to further investigate the diversity of intestine bacteria by DNA sequencing.

References

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