The Influence of a Natural Diet and Microbiota Community on the Metabolic Phenotype of *Drosophila melanogaster*

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Introduction

- Obesity is an increasing pandemic that contributes to physical and mental health losses
- Symbiotic microbiota influence the development of life history traits and metabolic phenotype
- This study developed a novel methodology for experimenting with natural diet and microbial communities in the controlled lab environment
- We evaluated the influence of the natural diet as well as environmental and transgenerationally transferred microbiota communities on *Drosophila melanogaster* larvae life history traits and metabolic phenotypes

Materials and Methods

- Peaches were left outside for six days to acquire natural microbiota
- Standard lab food was prepared based on molasses and corn meal
- Embryos subjected to sterilization (S) or non-sterilization treatments (NS)
- 50 first instar larvae were placed in individual vials of each diet
- Ten wildtype genetic lines were assayed independently
- Third instar larvae were collected and used for 16S v4 sequencing and metabolic assays

Embryos	Lab food	Peach	Autoclaved Peach
Sterilized	S	S	S
Non-sterilized	NS	NS	NS

16S rRNA Sequencing

Metabolic Assays

Results

- On a natural diet, the presence of environmental microbiota increased survival, weight, and decreased triglyceride levels (Fig. 1: A, B, C)
- In addition, the presence of environmental microbiota increased the development rate, decreased glucose and protein levels (data not shown)
- Parental microbiota had a significant effect on all phenotypes with an autoclaved peach diet, and on development time and weight on for peach diet (Fig. 1: A, B, C)
- Parental microbiota had no significant effect on any phenotypes on a regular diet (Fig. 1: A, B, C)
- Sterilized larvae formed distinct microbial communities on each diet (Fig. 2: A)
- Non sterilized larvae formed a distinct microbial community on a peach diet (Fig.2: B)
- At the level of 10 most abundant microbial genera, regular diet was defined by the increased abundance of *Lactobacillus*, peach diet by *Leuconostoc*, and autoclaved peach diet was differentiated primarily by abundance of *Wolbachia* (Fig. 2 : A, B)
- The effects that microbial abundance, at the level of individual taxa, produced on larval phenotypes varied with the diet and treatment (Fig. 3: A, B)
- Genotype produced a significant effect on five (out of six) larval phenotypes and on the abundance of seven (out of 10) most abundant symbiotic microbial genera (data not shown)

Conclusions

- Frozen fermented peach food provided nutritional conditions (high in sugars and low in protein) similar to the natural ones and preserved key microbial taxa necessary for survival and development of *Drosophila* larvae.
- Interactive effects between diet and treatment played a significant role in the formation of a microbial community, and larval phenotypes
- The effect that individual microbial taxa produced on the host may significantly vary with changing environmental variables

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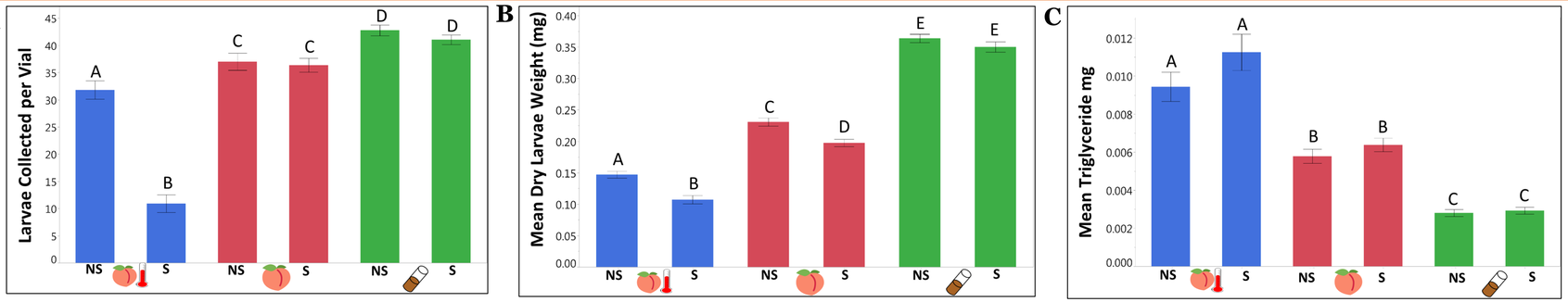

Figure 1: The influence of diets and parental microbiota on 1) survival 2) weight 3) mg of triglyceride per mg of dry larvae weight. Bars labeled with different letters are significantly different to each other.

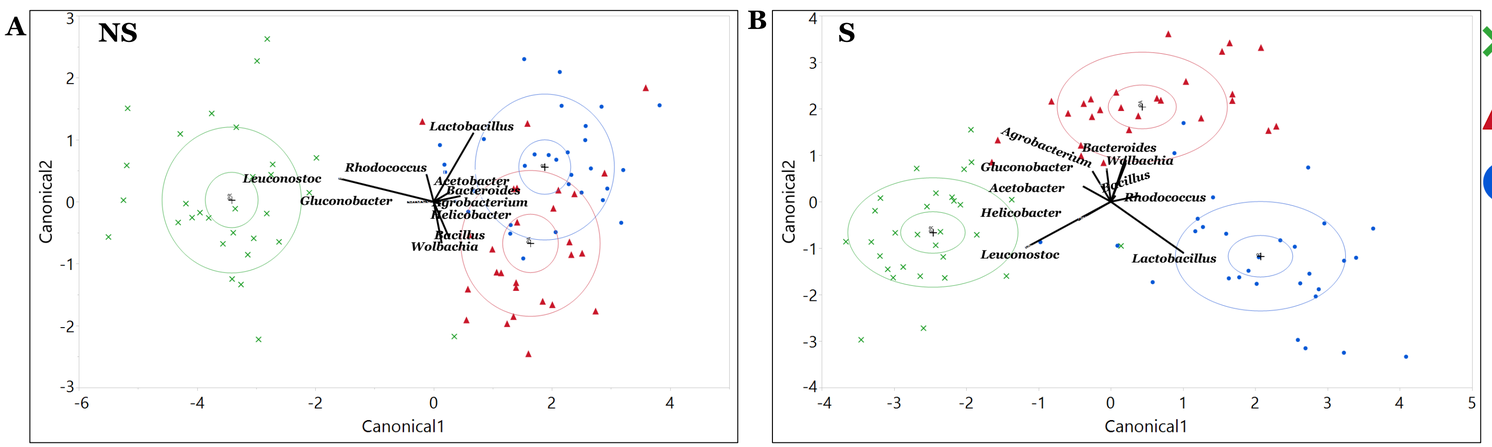

Figure 2: Discriminant analysis of 10 most abundant symbiotic microbiota genera found in 1) Non sterilized and 2) Sterilized larvae

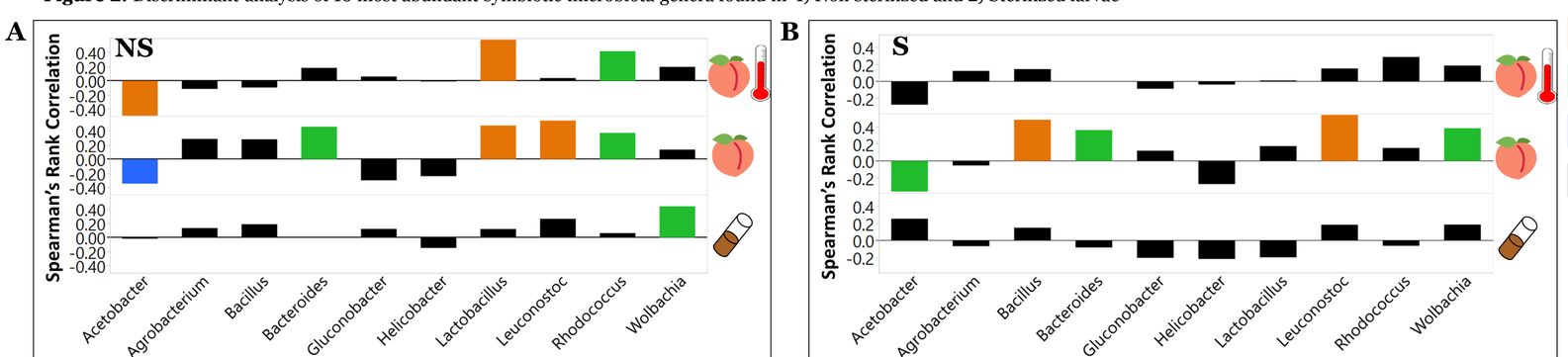

Figure 3: Discriminant analysis of 10 most abundant symbiotic microbiota genera found in 1) Non sterilized and 2) Sterilized larvae