



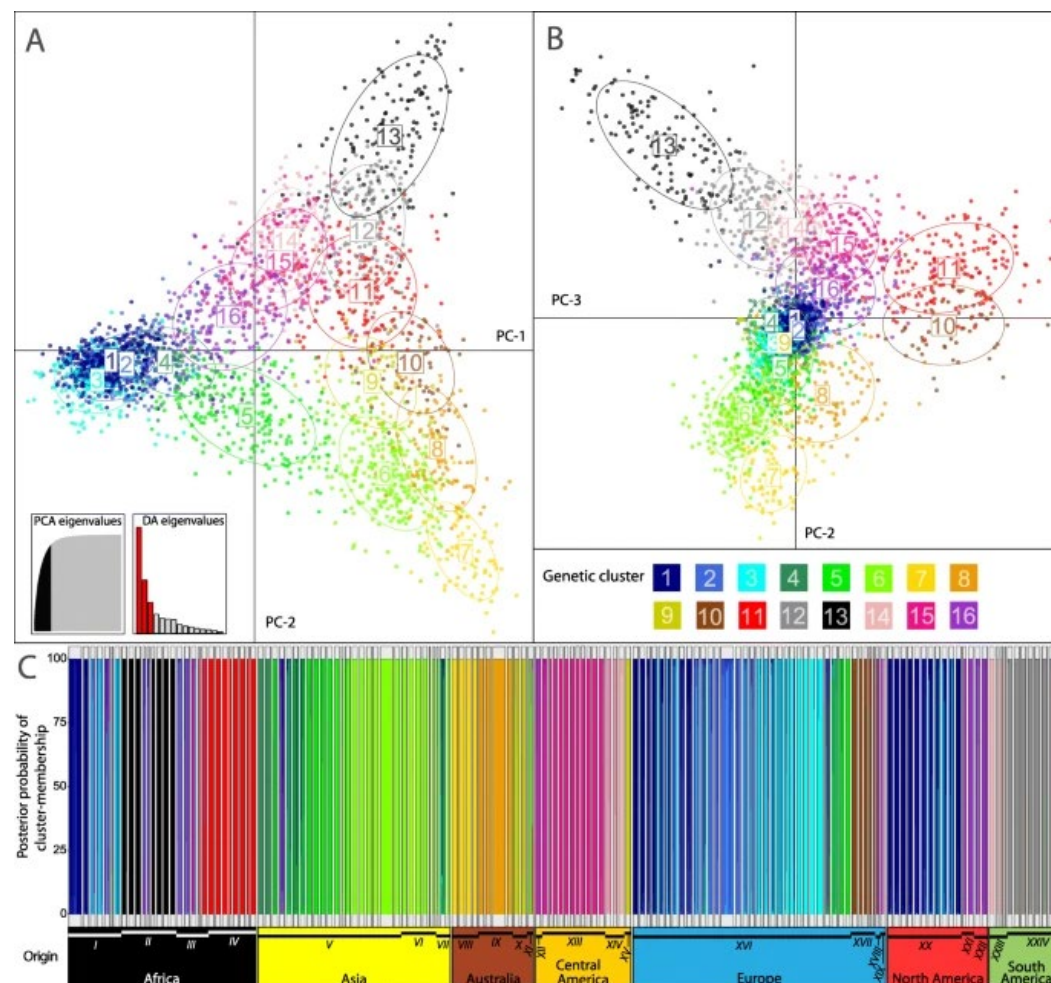
Exploring shifts in the microbial community when rearing different BSF genetic lines in a single production facility



Jeroen De Smet

IJdema F., Broeckx L., Frooninckx L., Van Miert S., **De Smet J.**

Genetic diversity of the BSF population

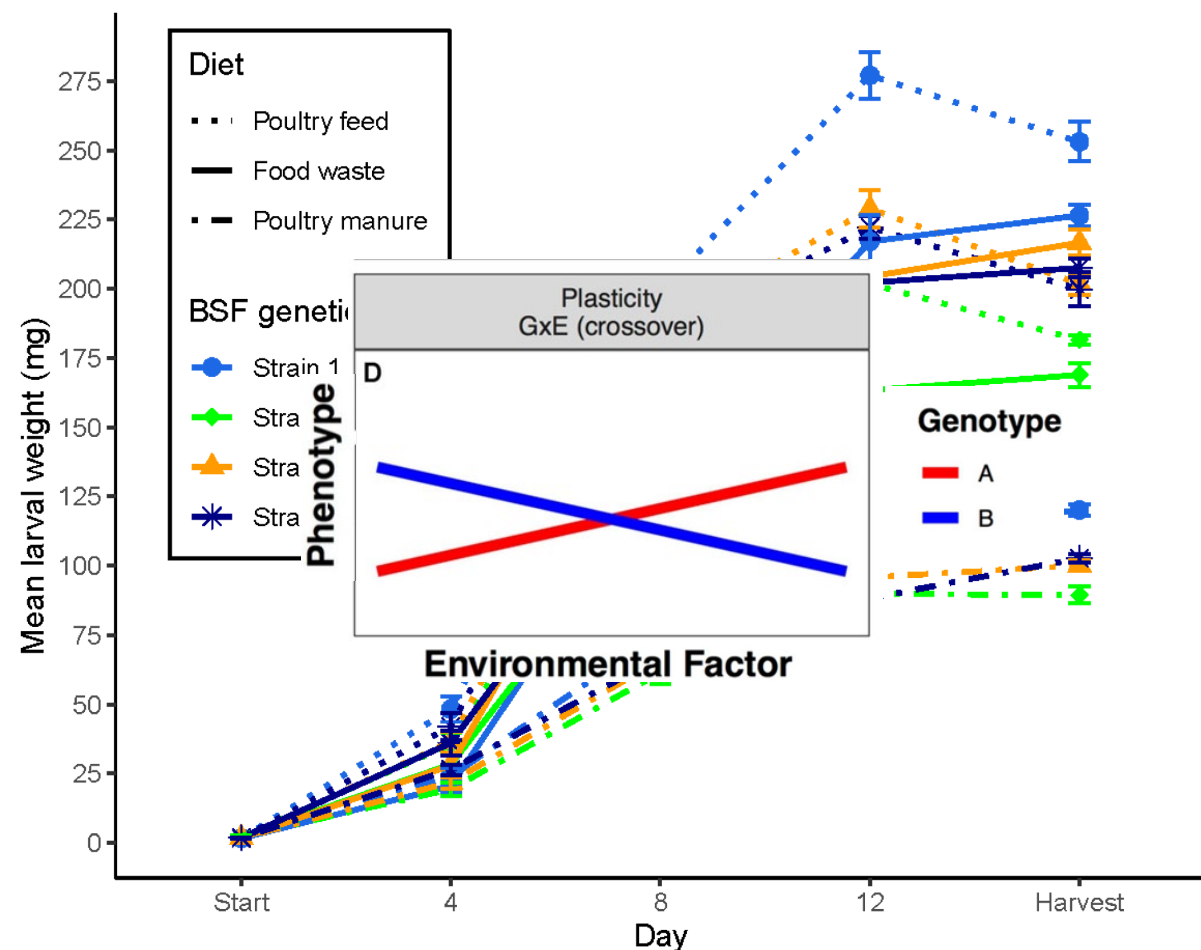


Kaya et al, 2021



Vast genetic diversity of BSF

Exploiting the available genetic diversity for industry



Sandrock et al, 2021



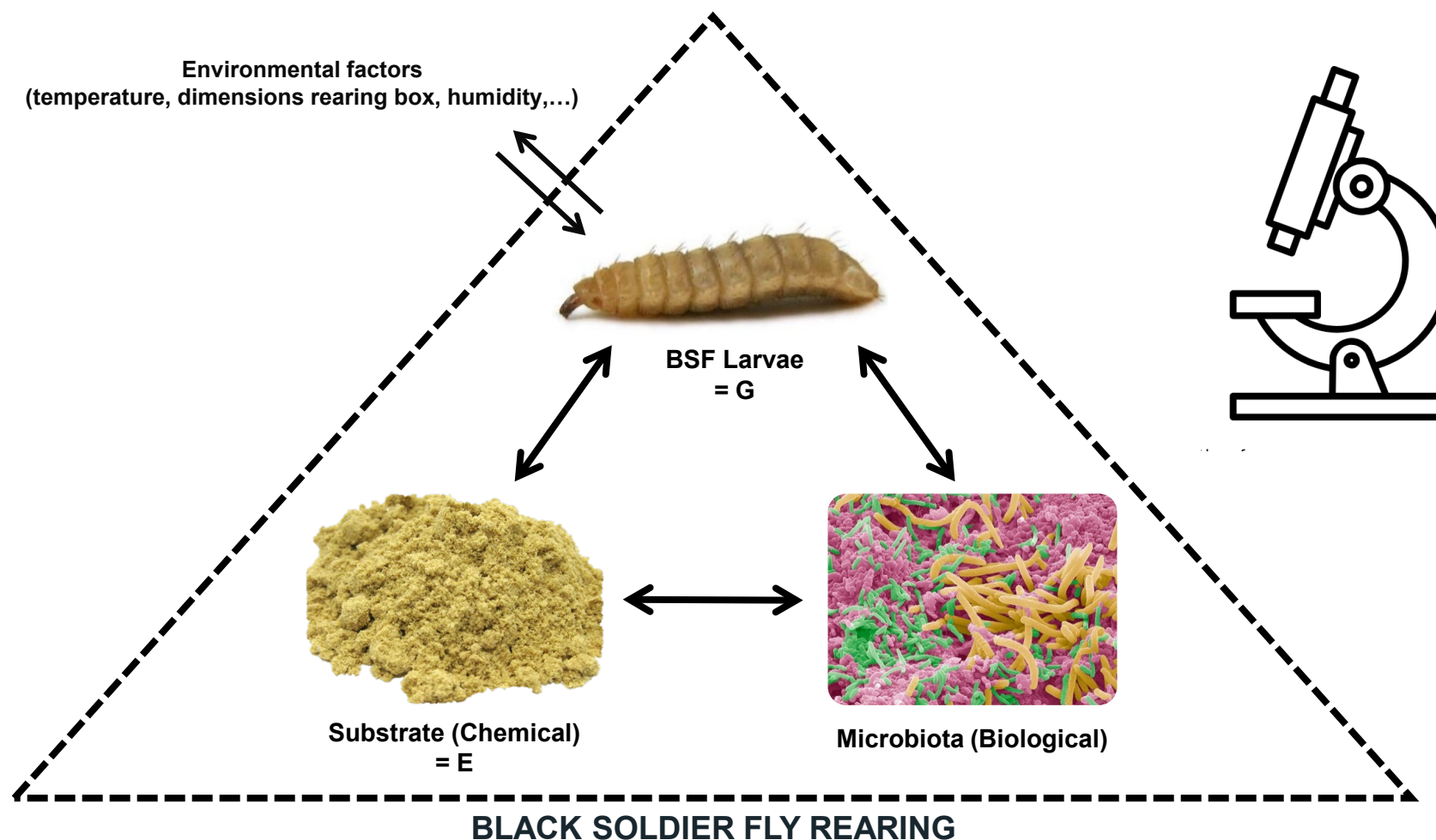
Larval performance and body composition was influenced by diet, BSF genetic variation AND interaction effects between the two

= GxE effects



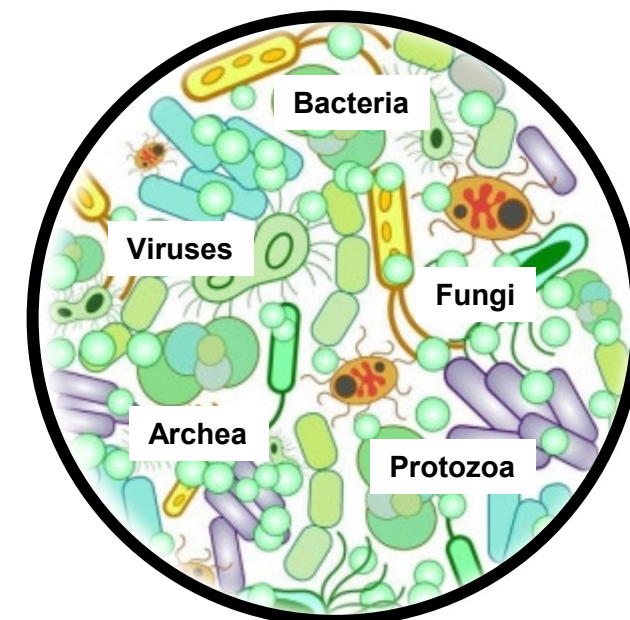
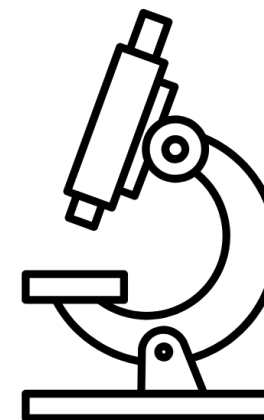
!!! Complicates selections programmes

The BSF microbiota, a complicating factor

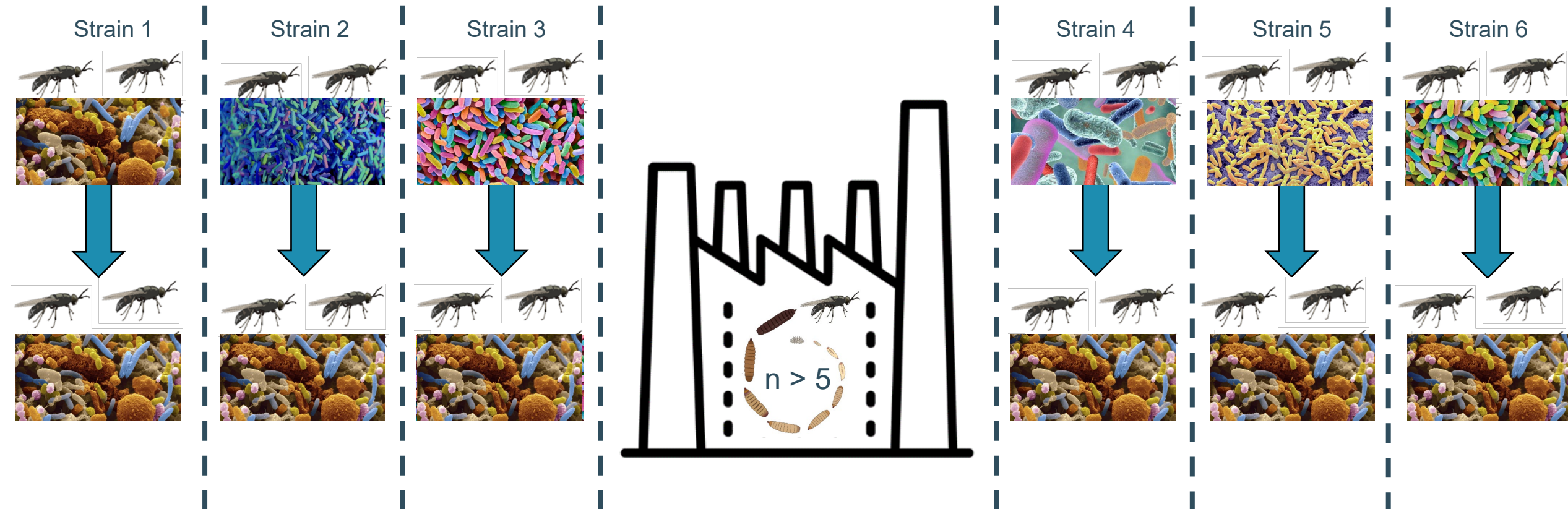


Dynamic composition, depends on:

- Diet
- Gut region
- Rearing facility
- Genotype
- ...



Can we “nulify” the microbiota’s role for selection?

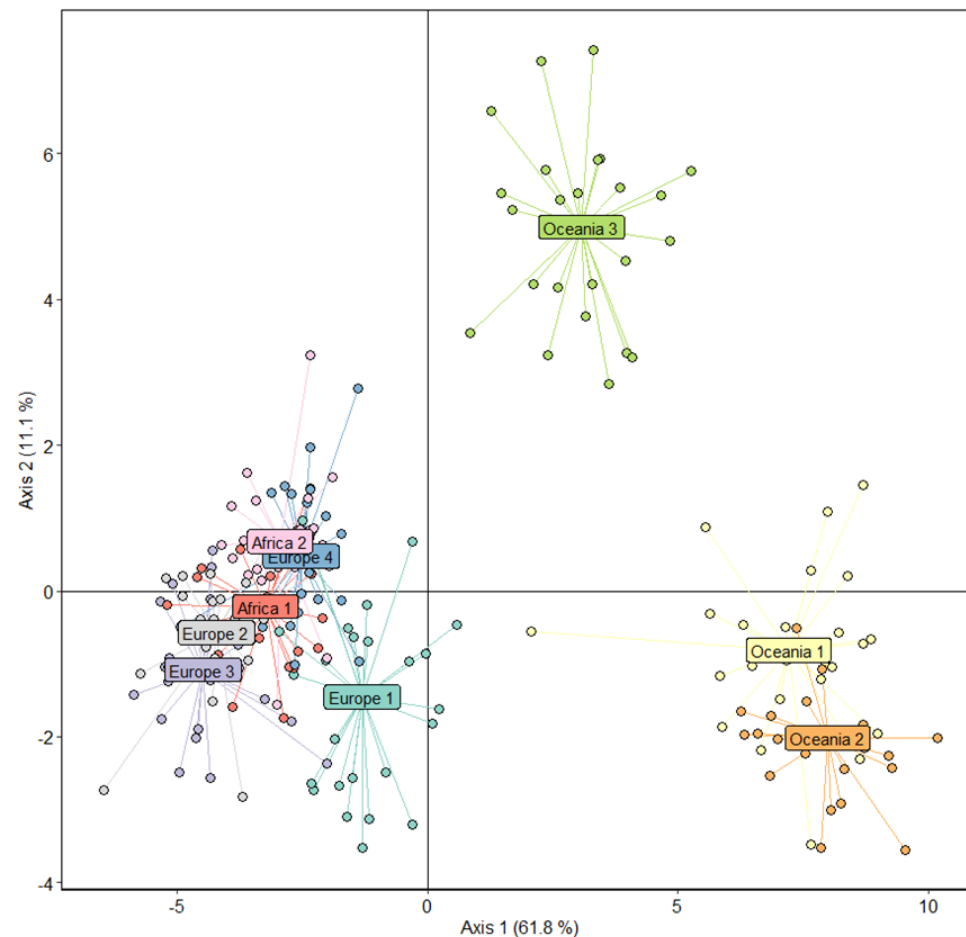


Step 1: Gathering strains & Genotyping

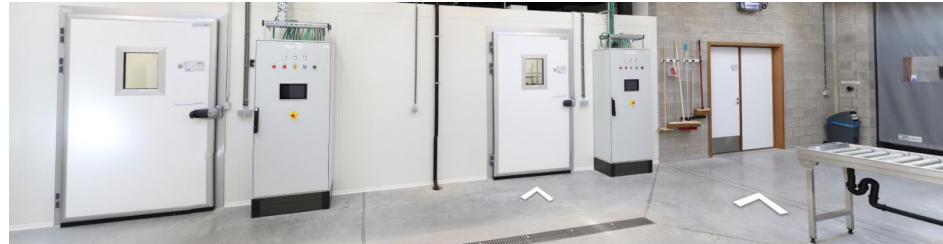


Strain	Status
Oceania 1	Domesticated
Oceania 2	Domesticated
Oceania 3	Wild
Africa 1	Domesticated
Africa 2	Domesticated
Europe 1	Domesticated
Europe 2	In-house
Europe 3	Domesticated
Europe 4	Domesticated
Europe 5	Wild x Dom.

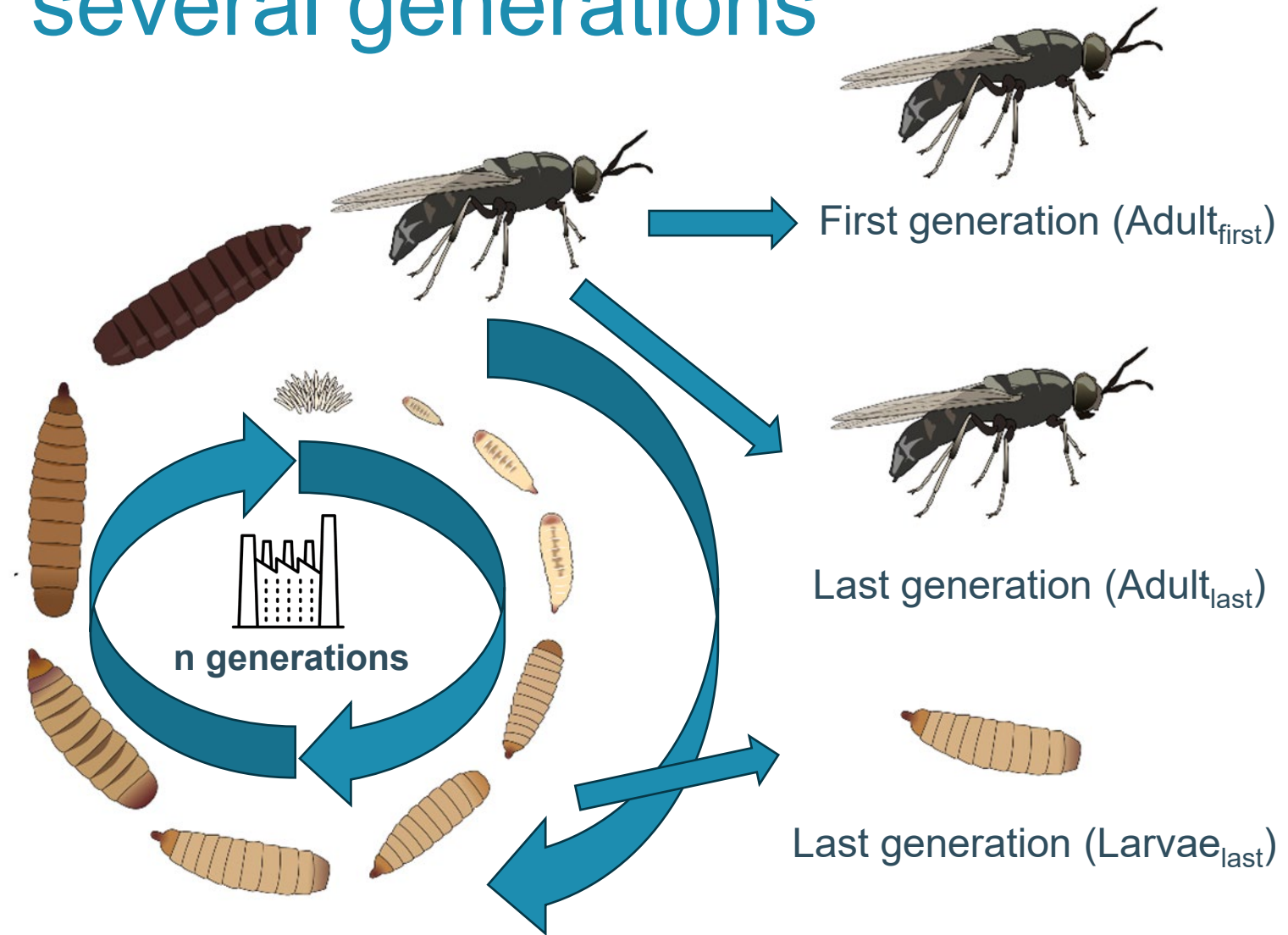
Discriminant analysis of principal components



Step 2: Rearing for several generations



Received strain were introduced
in rearing system of Insect Pilot
Plant



Step 2: Rearing for several generations

Strain	Status	Adult _{first}	Adult _{last}	Larvae _{last}
Oceania 1	Domesticated	0	11	12
Oceania 2	Domesticated	1	9	10
Oceania 3	Wild	0	11	12
Africa 1	Domesticated	0	7	8
Africa 2	Domesticated	0	6	7
Europe 1	Domesticated	0	8	9
Europe 2	In-house	0	10	11
Europe 3	Domesticated	0	11	12
Europe 4	Domesticated	0	8	9
Europe 5	Wild x Dom.	2	5	6



First generation (Adult_{first})



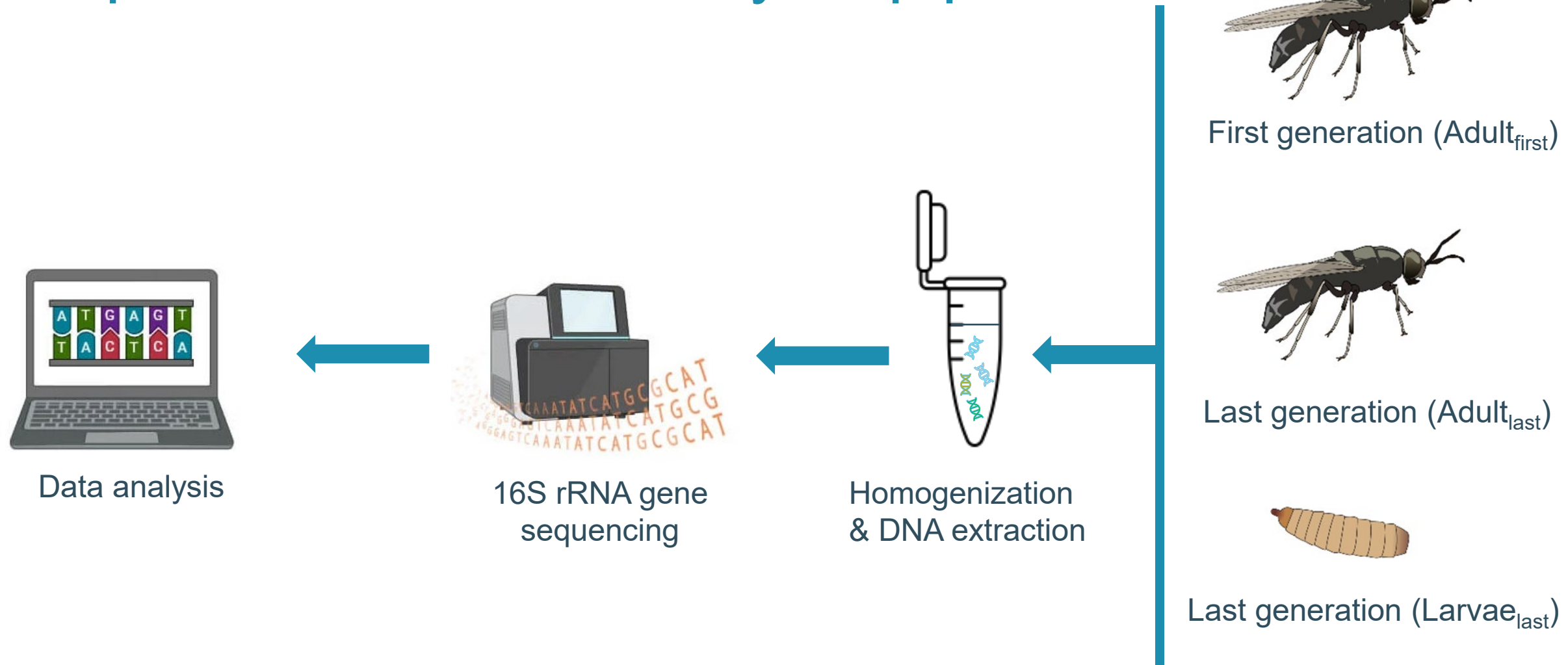
Last generation (Adult_{last})



Last generation (Larvae_{last})



Step 3: Microbiome analysis pipeline

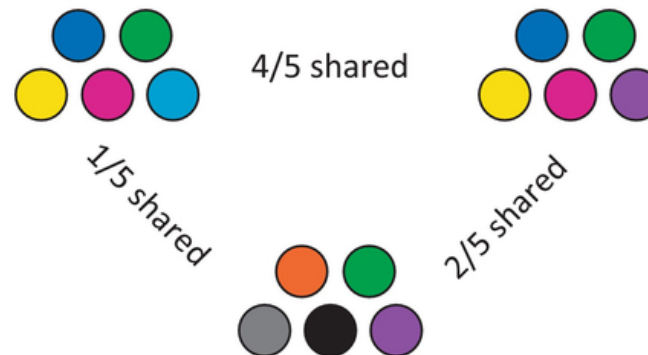


How to define diversity in microbiomes?

Alpha diversity: biodiversity within a sample



Beta diversity: similarity between samples



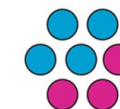
Thackray VG, 2018

α -diversity

Alpha diversity: biodiversity within a sample

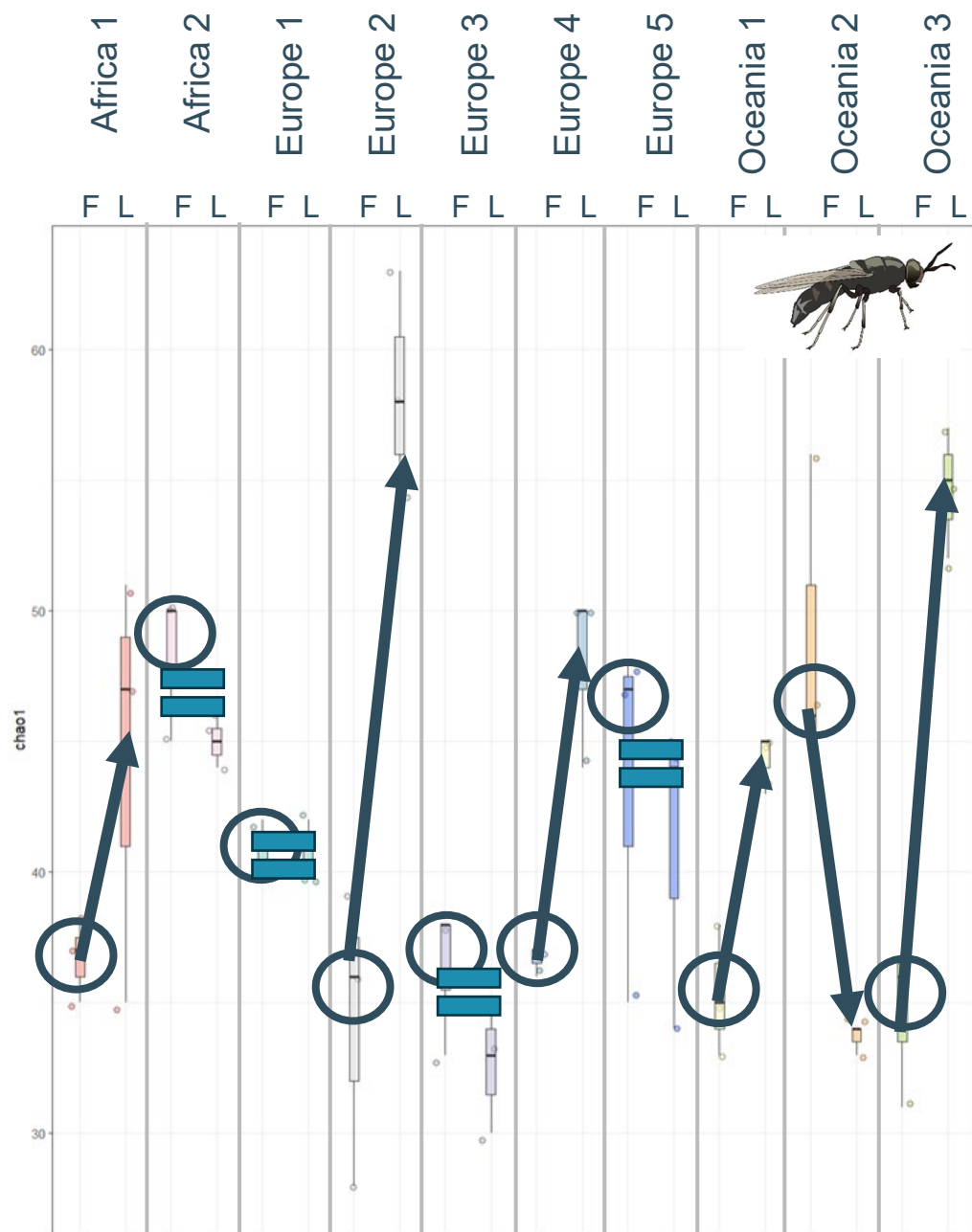


High alpha diversity



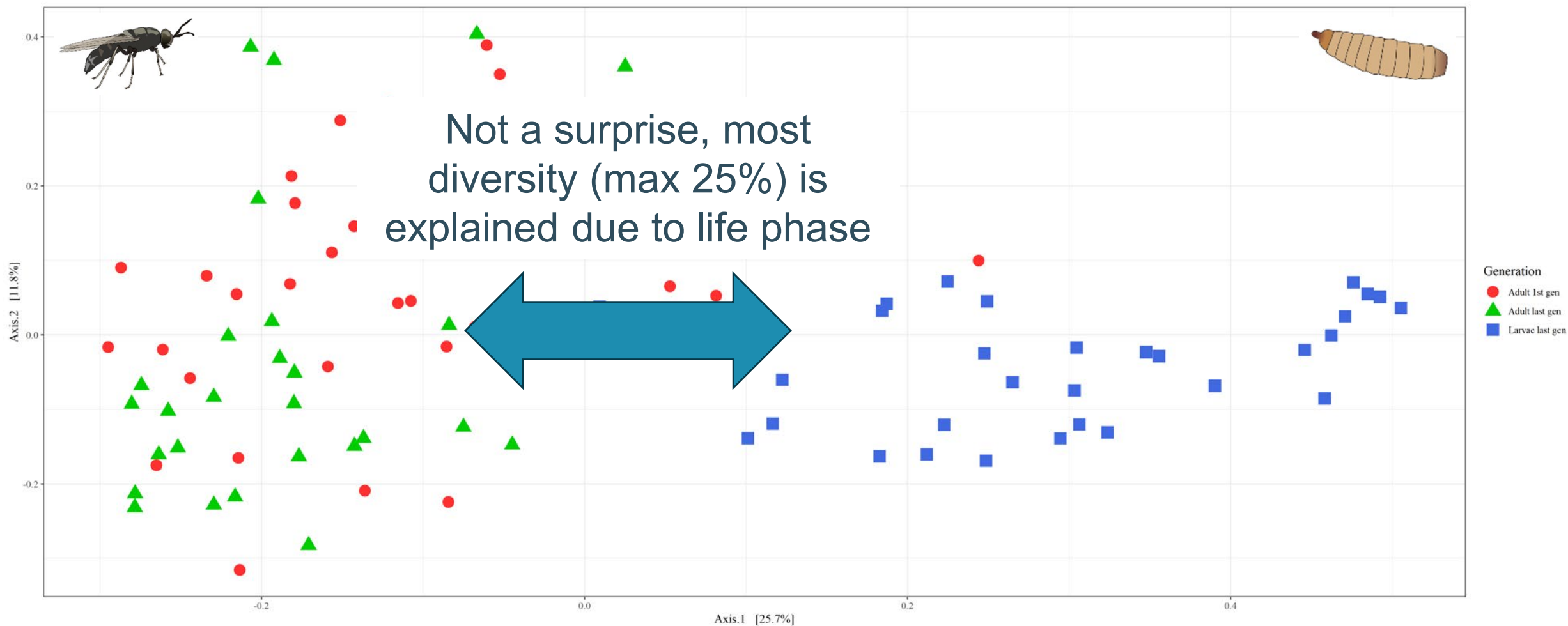
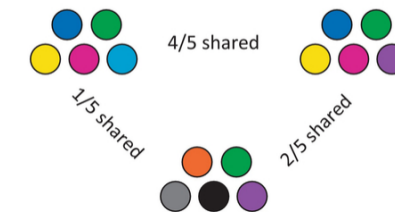
Low alpha diversity

Varying effects between strains, BUT no clear link with genetic diversity



β-diversity

Beta diversity: similarity between samples



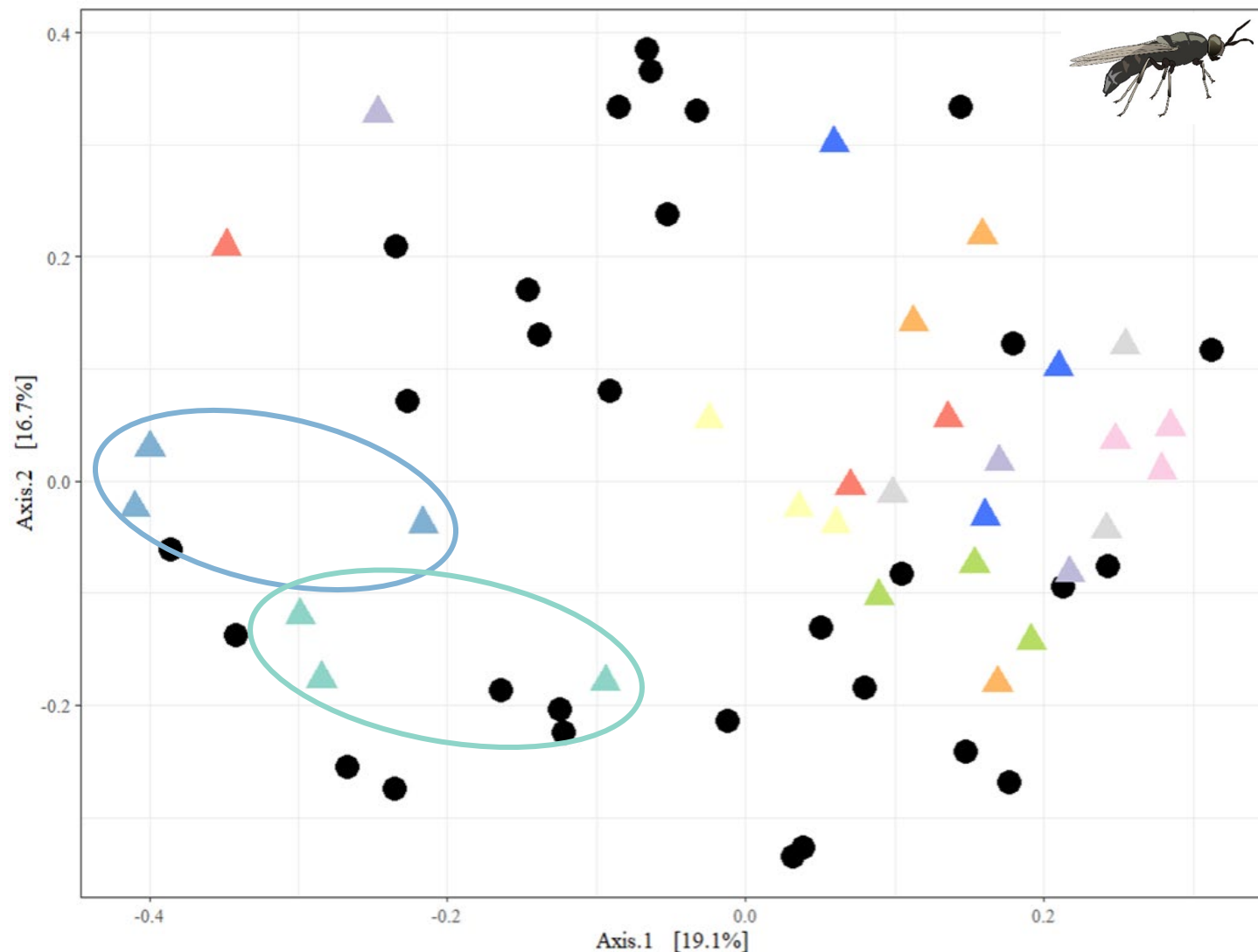
β-diversity

PERMANOVA

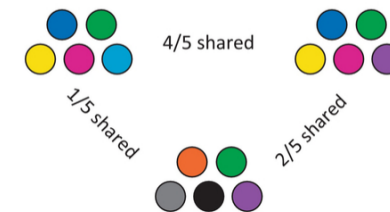
Strain
($p = 0.0001$)

Generation
($p = 0.2728$)

Strain x Generation
($p = 0.0001$)



Beta diversity: similarity between samples



Generation

- Adult 1st gen
- ▲ Adult last gen

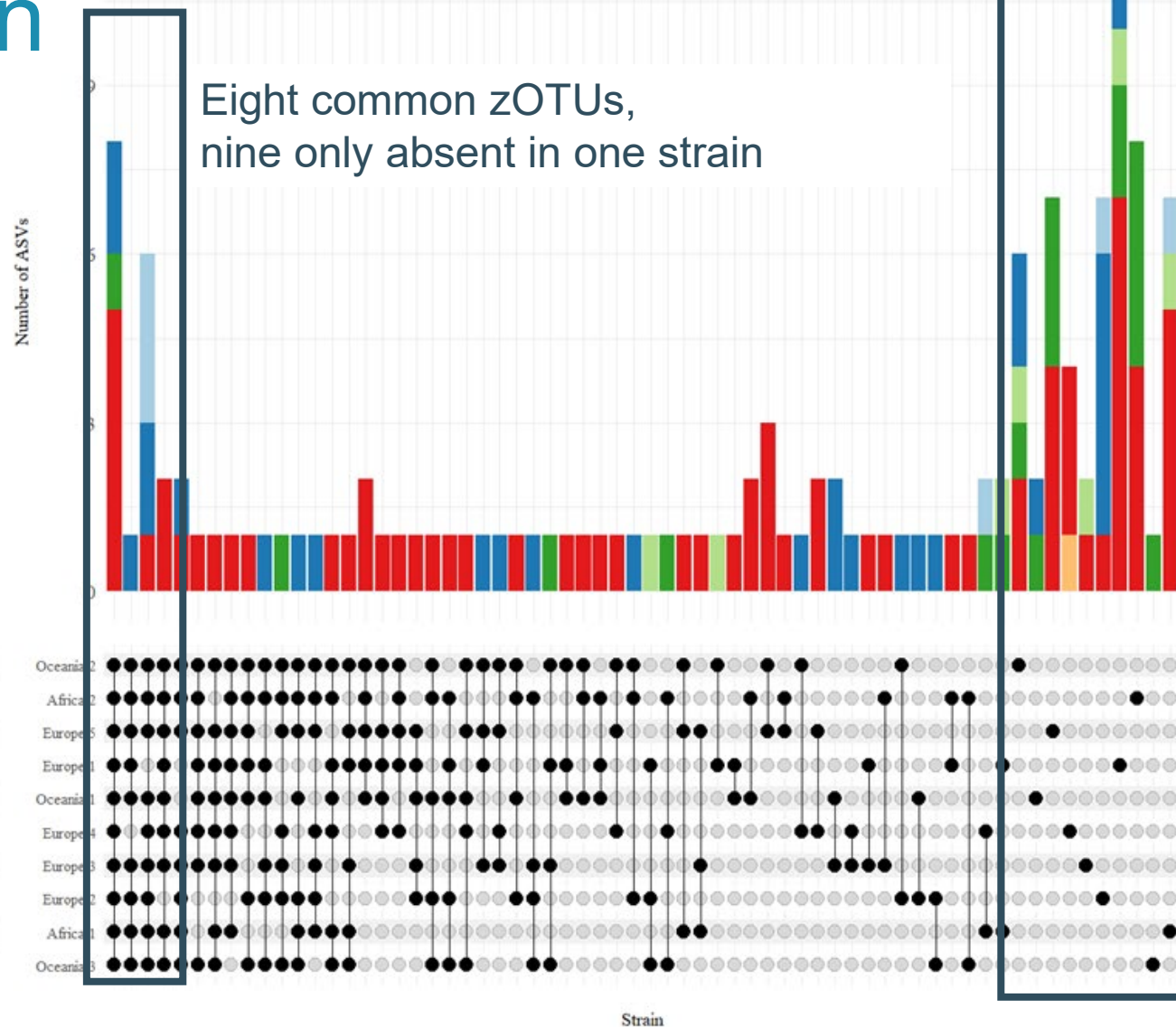
Strains

- Africa 1
- Africa 2
- Europe 1
- Europe 2
- Europe 3
- Europe 4
- Europe 5
- Oceania 1
- Oceania 2
- Oceania 3

Zooming in

Phylum

- Actinomycetota
- Bacillota
- Unidentified bacteria
- Bacteroidota
- Pseudomonadota
- Verrucomicrobiota



First generation (Adult_{first})

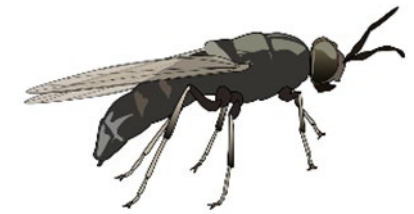
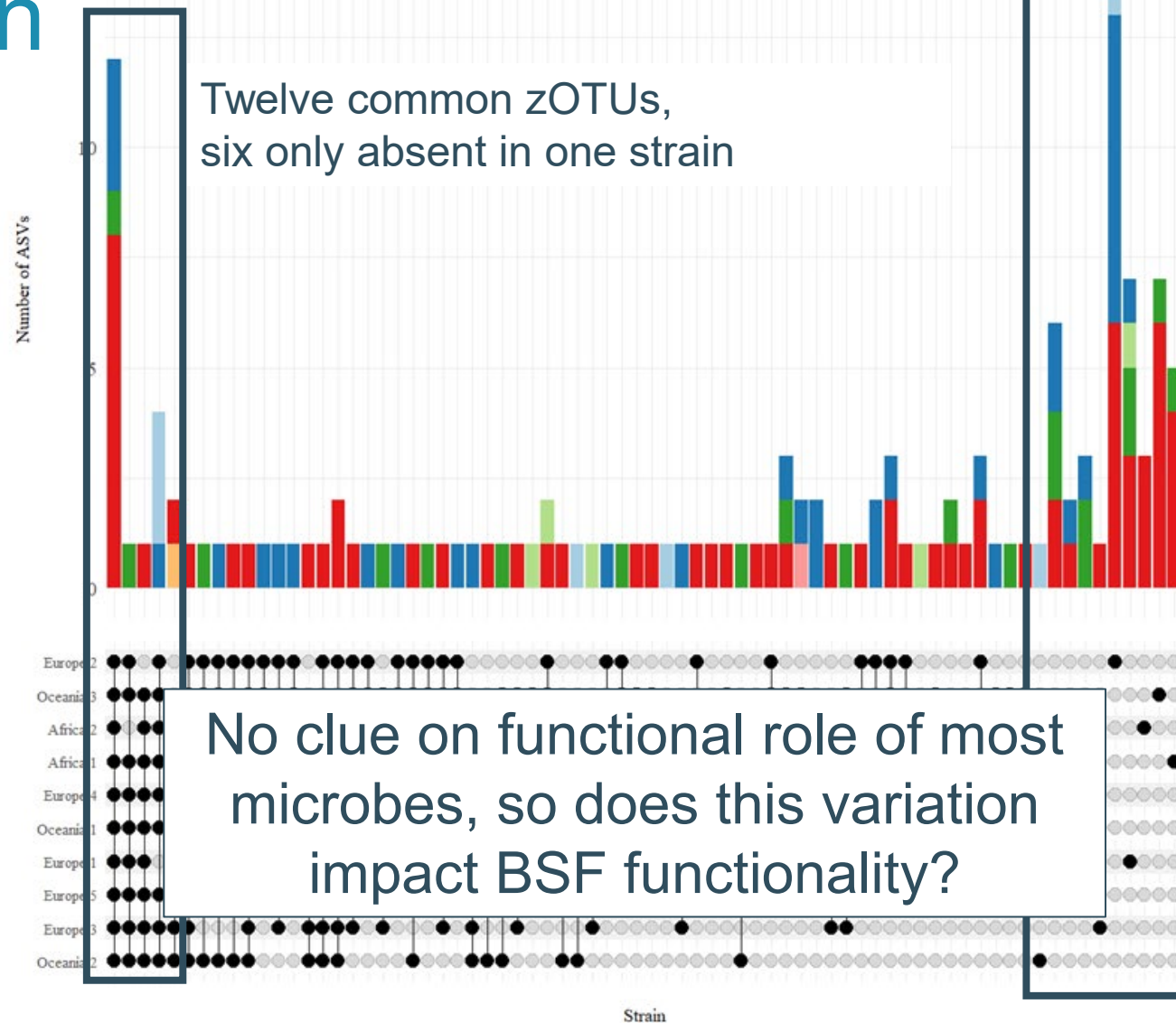
Common zOTUs

- Enterobacteriaceae* sp.
- Providencia* sp.
- Pseudomonas* sp.
- Enterococcus* sp.
- Stenotrophomonas* sp.
- Enterococcus* sp.
- Proteus* sp.
- Sphingobacterium* sp.

Zooming in

Phylum

- Actinomycetota
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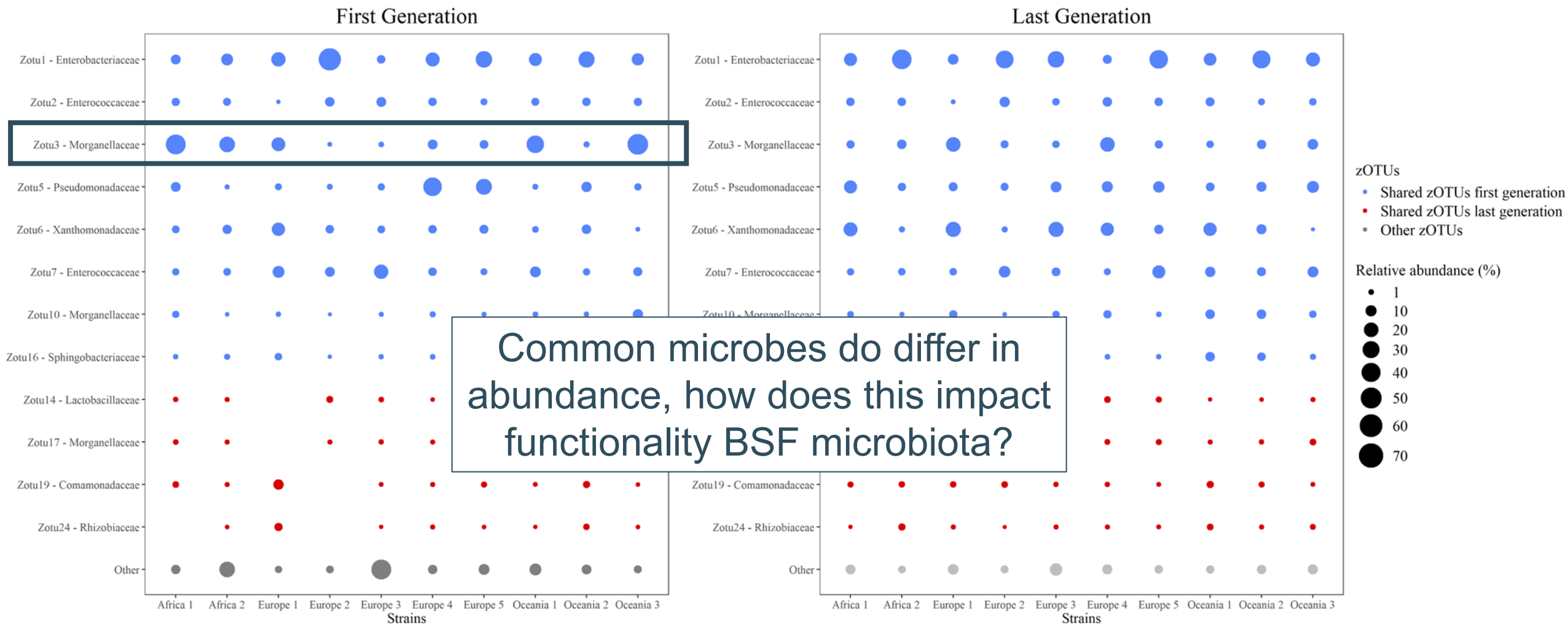


Last generation (Adult_{last})

Common zOTUs

- Enterobacteriaceae* sp.
- Providencia* sp.
- Pseudomonas* sp.
- Enterococcus* sp.
- Stenotrophomonas* sp.
- Enterococcus* sp.
- Proteus* sp.
- Sphingobacterium* sp.
- Delftia* sp.
- Providencia stuarti*
- Lactiplantibacillus* sp.
- Agrobacterium fabrum*

Zooming in





LESSONS LEARNED

- **Some microbes are shared**, and that number slightly increases over generations at one location
- Even **after several generations** on same diet and in same rearing location, **distinction can still be made** between different strains of BSF
 - ➔ Both at larval and adult stage
- **BUT how this affects microbiota functionality** and BSF performance are still **open questions**, requiring much more research
- Going forward, it seems to be important to **take into account the microbiota component** when comparing performances of genetic lines

Acknowledgements

Funding



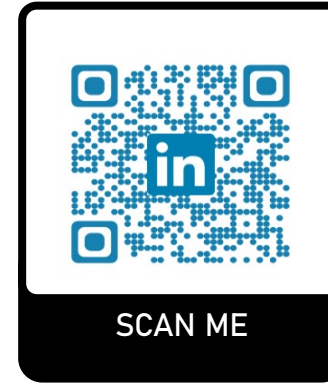
SBO-project Entobiota & Senior postdoctoral fellow grant

Collaborators



CENTRE OF EXPERTISE
Sustainable Biomass and Chemistry
(RADIUS)

Lotte Frooninckx
Laurens Broeckx



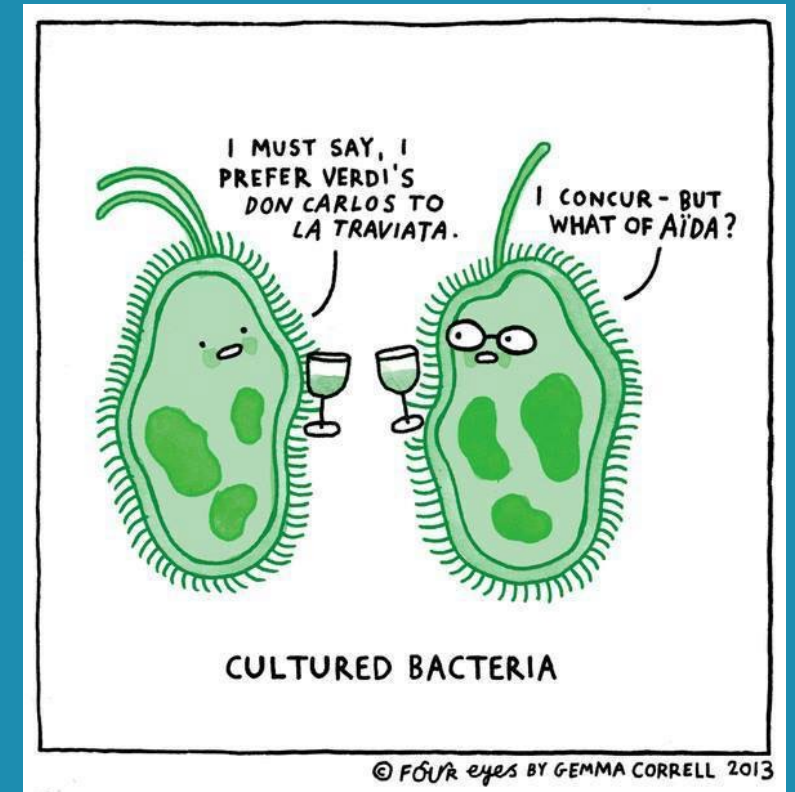
Follow us on LinkedIn for more
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SCAN ME

Thank you for your attention!

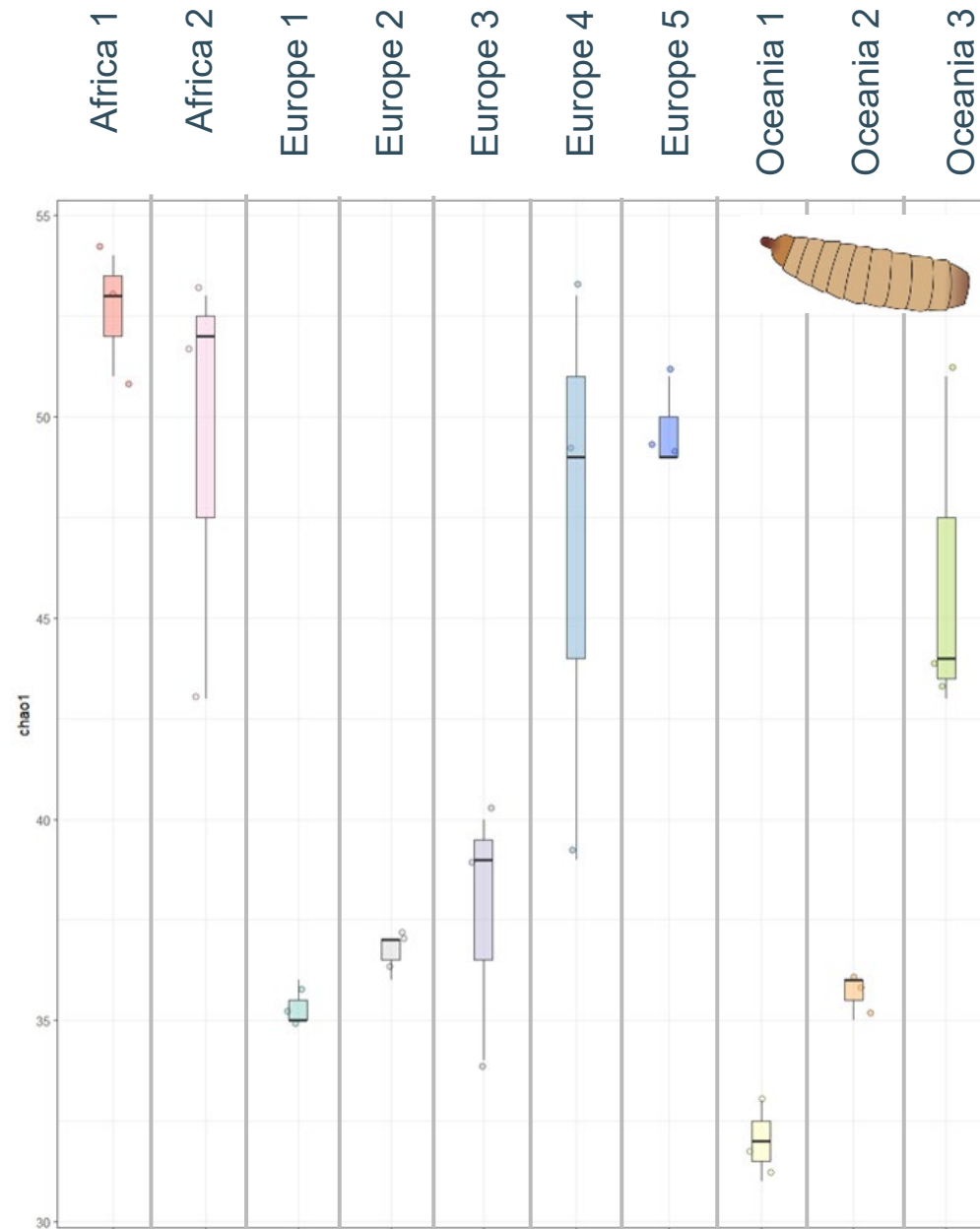


Contact

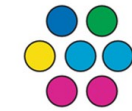
jeroen.desmet@kuleuven.be

α -diversity

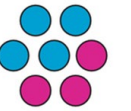
Not same diversity in all larval samples



Alpha diversity: biodiversity within a sample



High alpha diversity

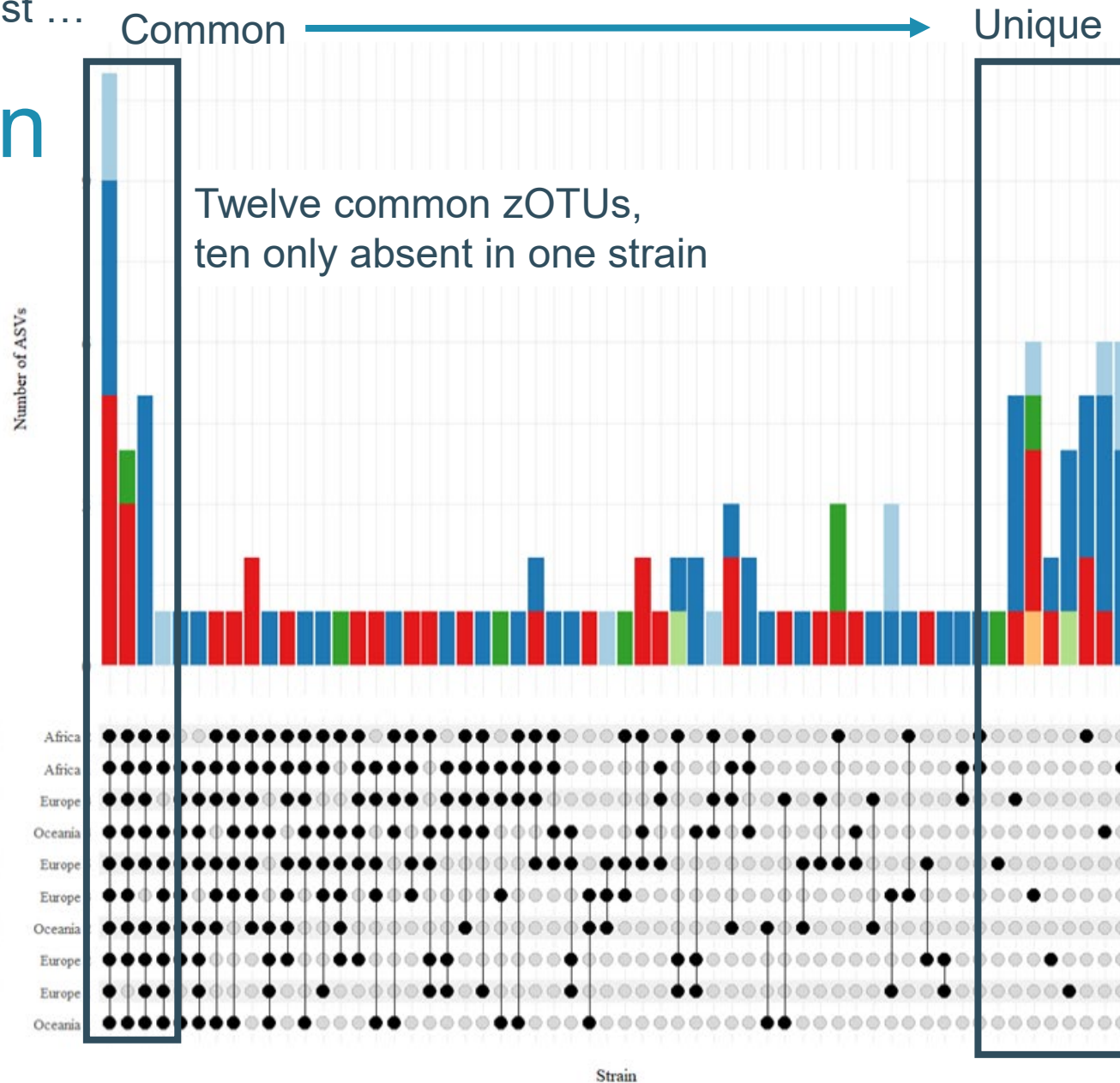
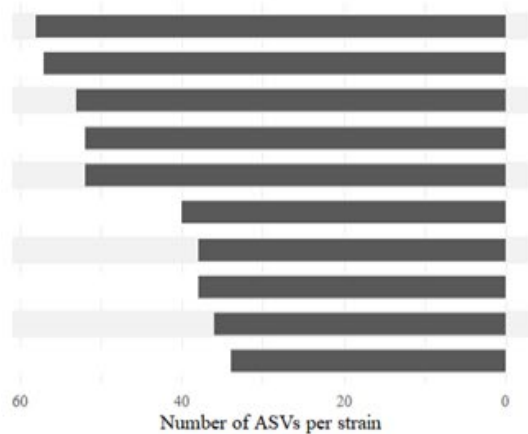


Low alpha diversity

Zooming in

Phylum

- Actinomycetota
- Bacillota
- Unidentified bacteria
- Bacteroidota
- Pseudomonadota
- Verrucomicrobiota



Last generation (Larvae_{last})

Common
<i>Enterococcus</i> sp.
<i>Corynebacterium</i> sp.
Enterobacteriaceae sp.
<i>Enterococcus</i> sp.
<i>Corynebacterium</i> sp.
<i>Weissella paramesenteroides</i>
<i>Providencia stuarti</i>
<i>Providencia</i> sp.
<i>Latilactobacillus</i> sp.
<i>Proteus</i> sp.
Enterobacteriaceae sp.