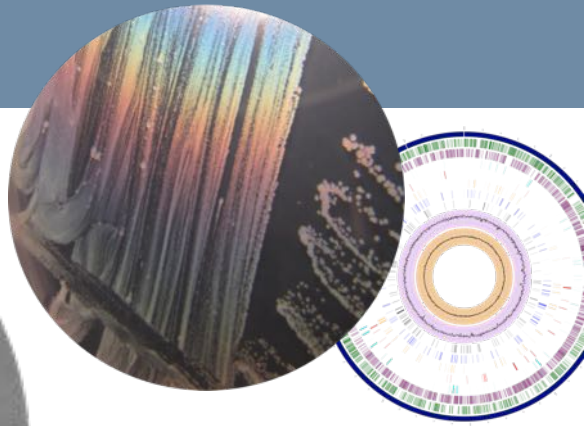
Insect-Bacteria-Plant Interactions: Microbiomes of Russian wheat aphid contain bacteria that increase virulence to wheat



Emily Luna

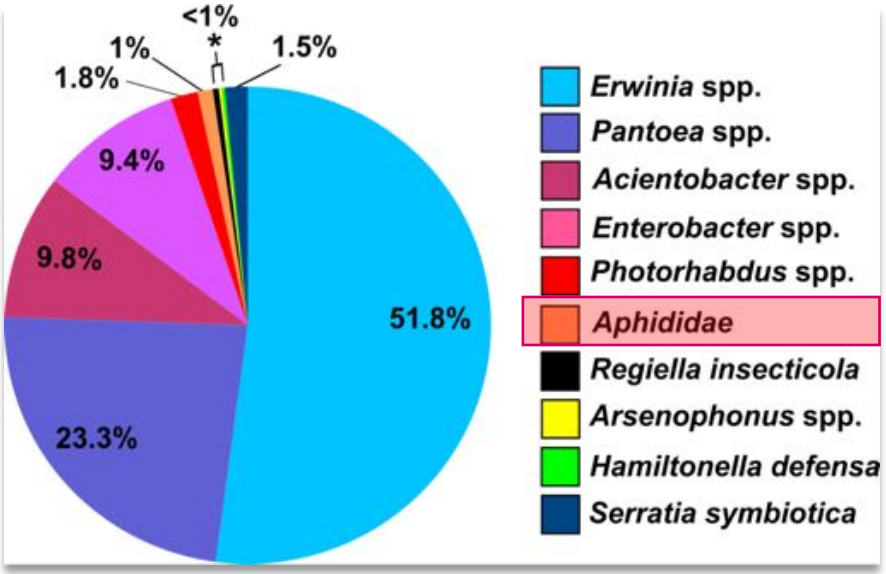
Colorado State University

PAG-San Diego
January, 2019

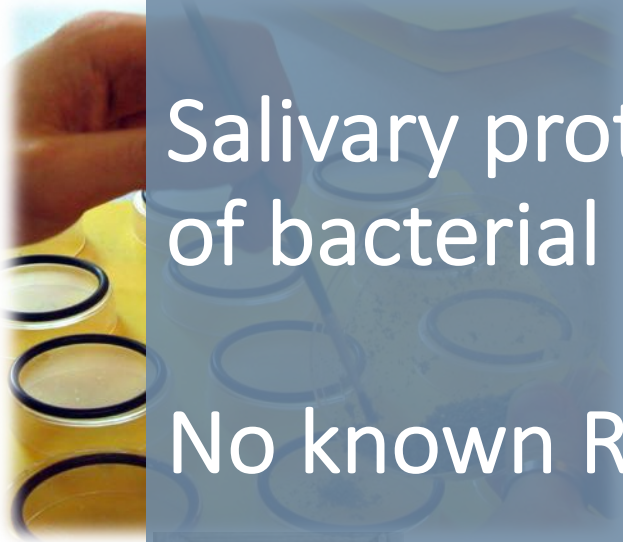
Do **bacteria** associated with Russian wheat **aphids** (RWA) enhance aphid virulence to **plants?**

Luna et al. 2018. *Phytobiomes*

Leon van Eck

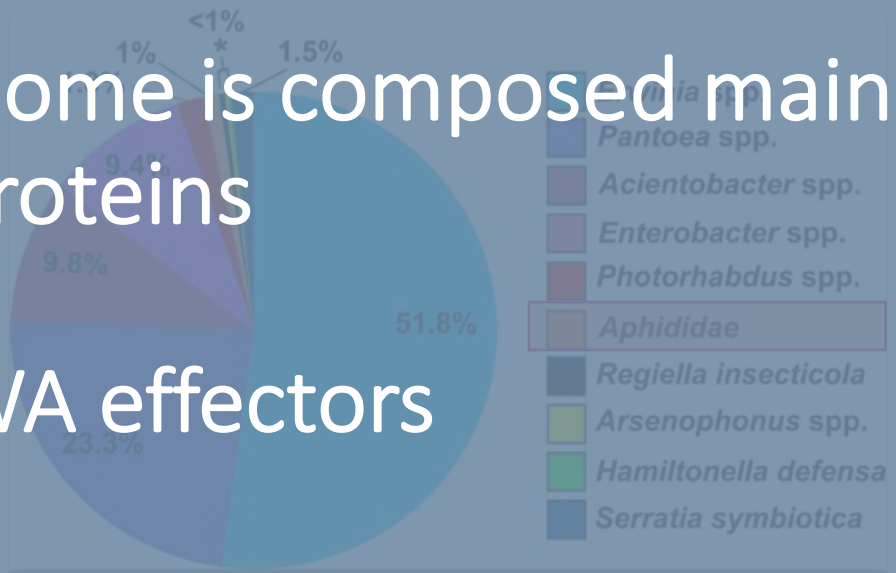


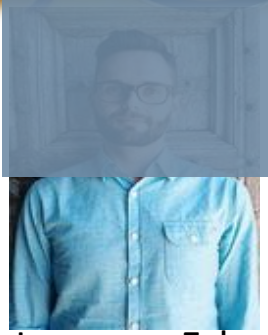
Luna et al. 2018



Salivary proteome is composed mainly of bacterial proteins

No known RWA effectors

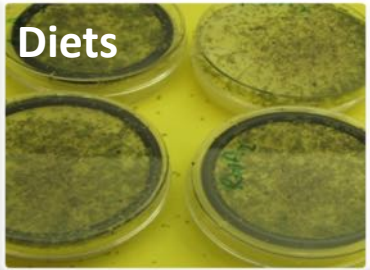


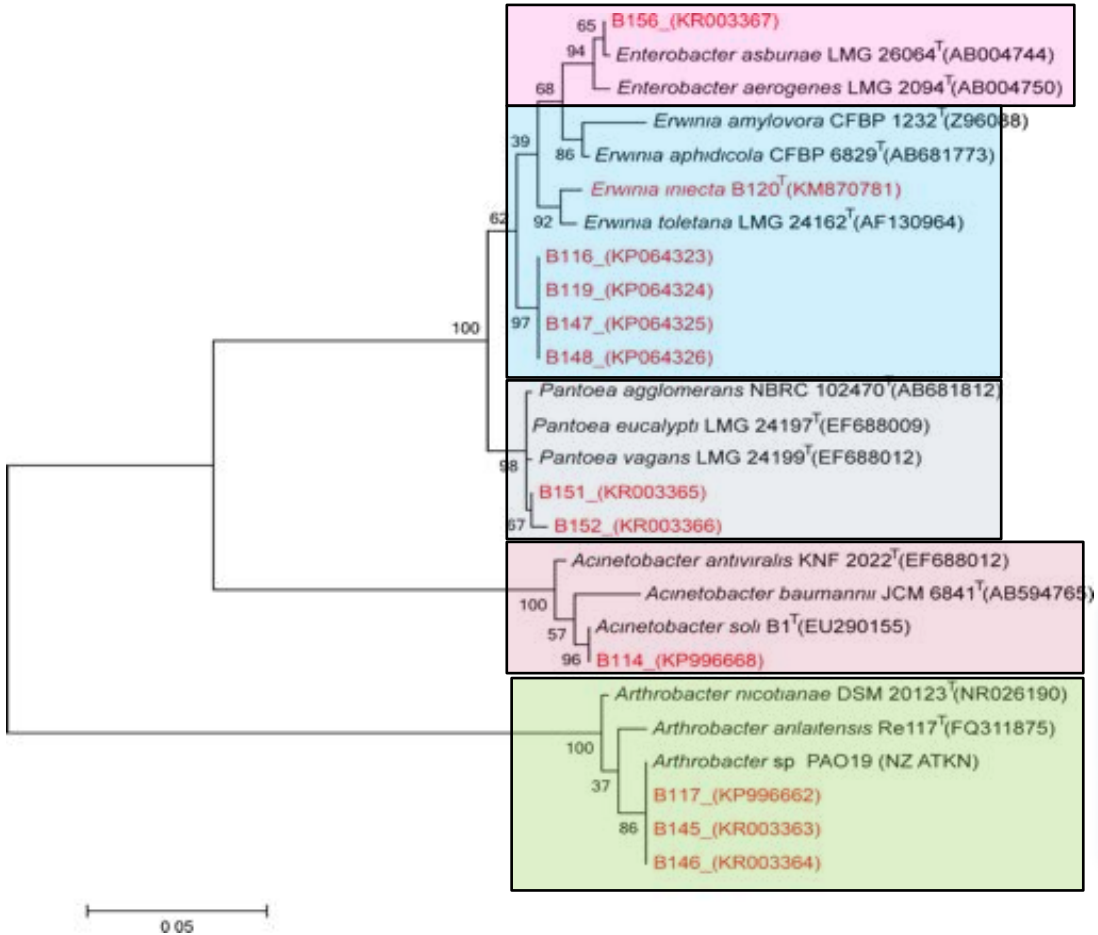


Leon van Eck

Luna et al. 2018

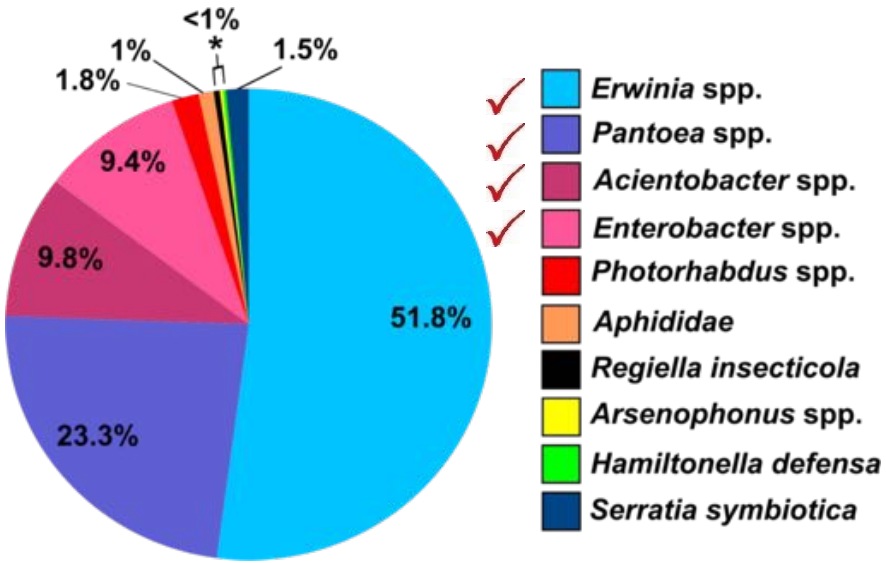
Which bacteria are present in the system?

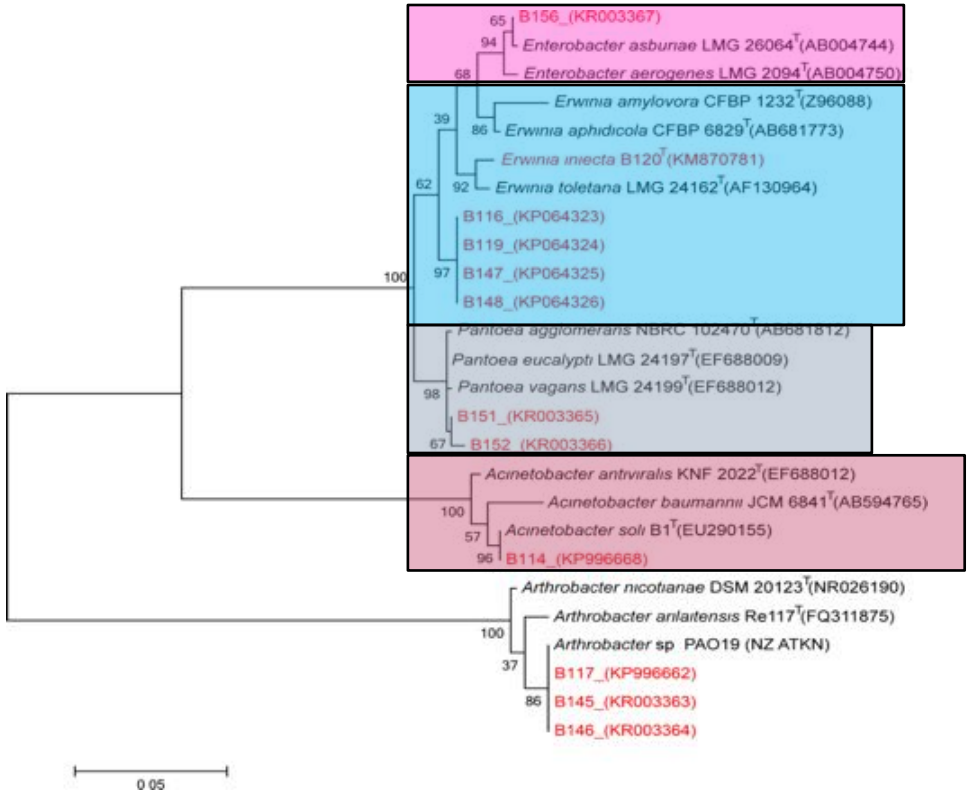


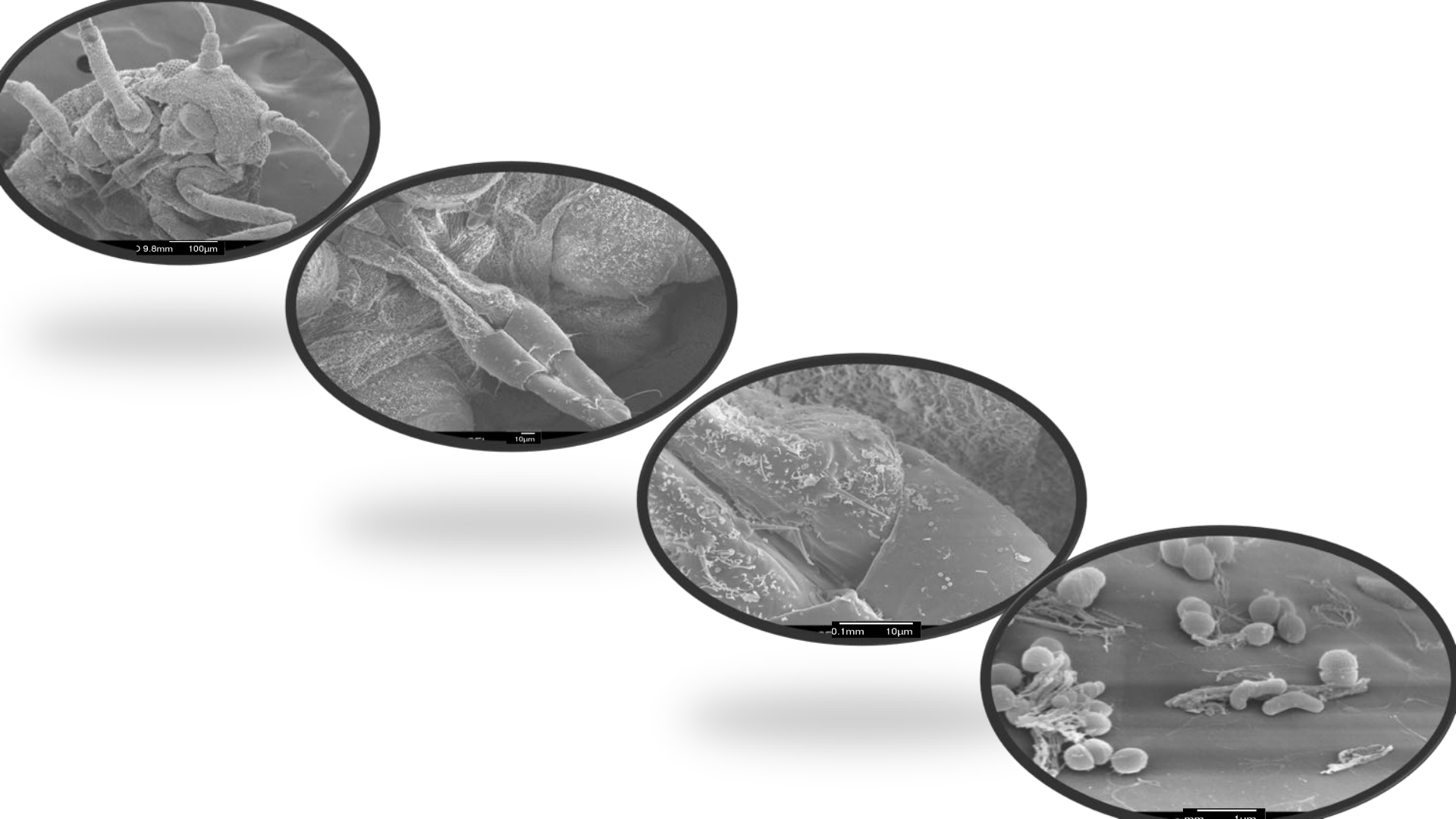


Tony Campillo

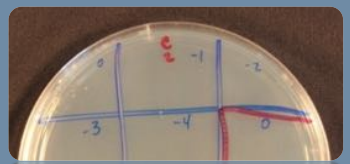
Isolated bacteria recapitulates proteins found in RWA saliva



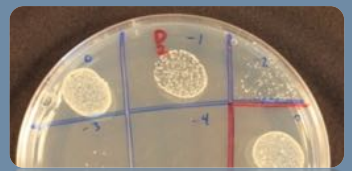



9.8mm 100µm
10µm
0.1mm 10µm

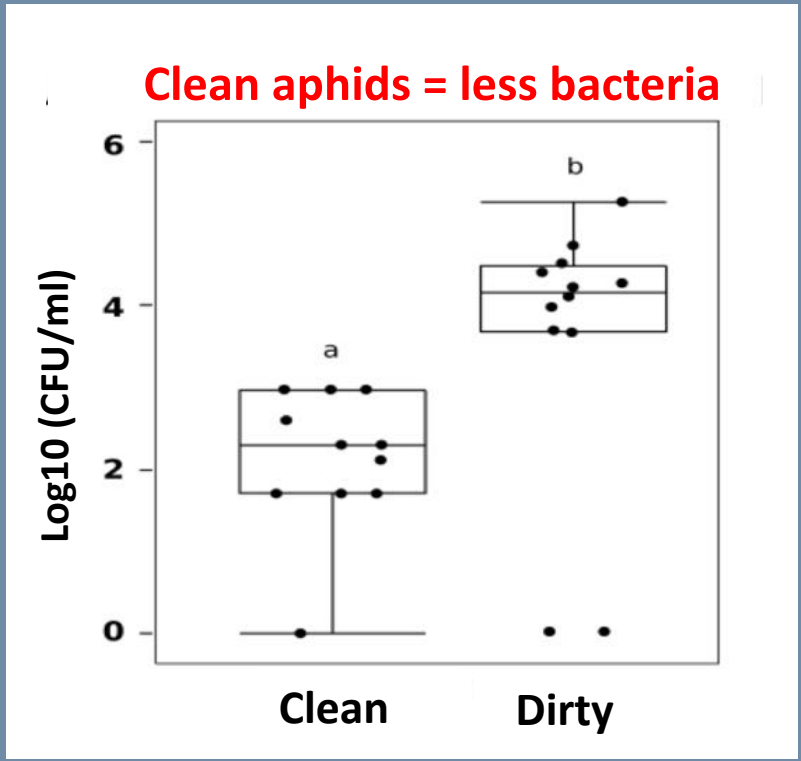
Rearing aphid colonies with less bacteria



Clean

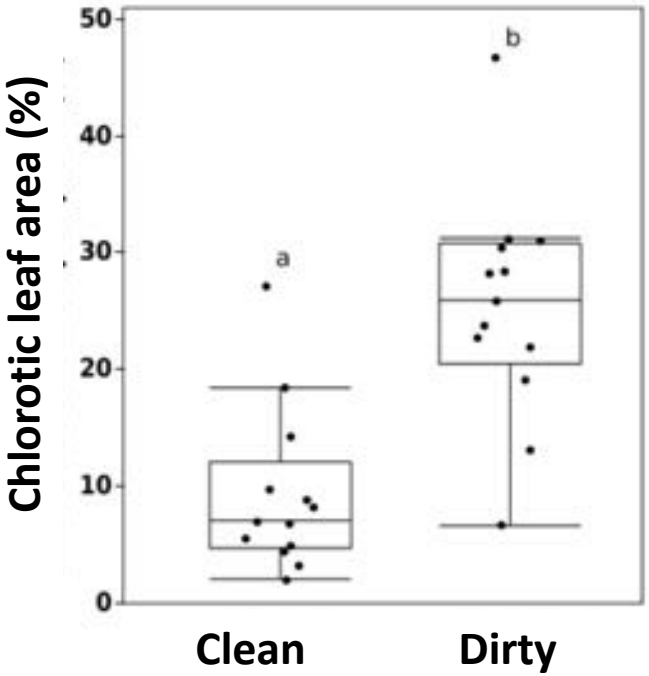


Dirty

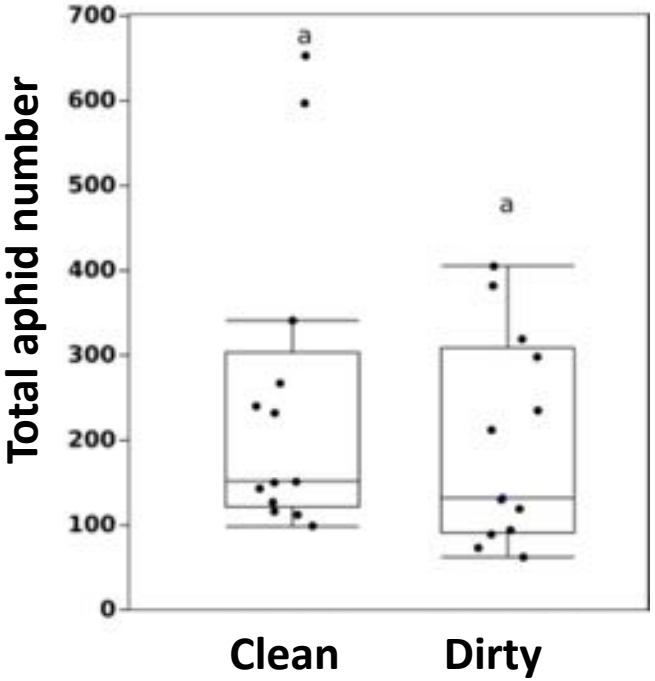


Do bacteria contribute to plant damage?

Clean aphids = less chlorosis



Aphid number is same



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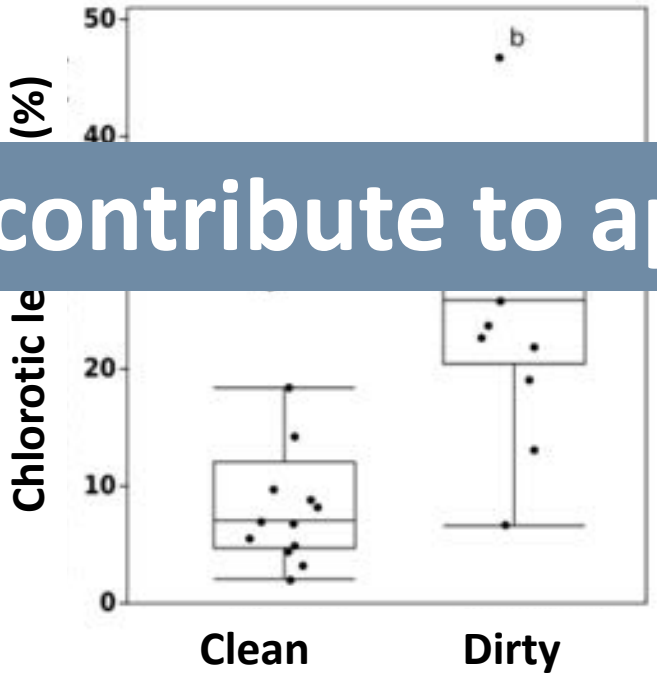
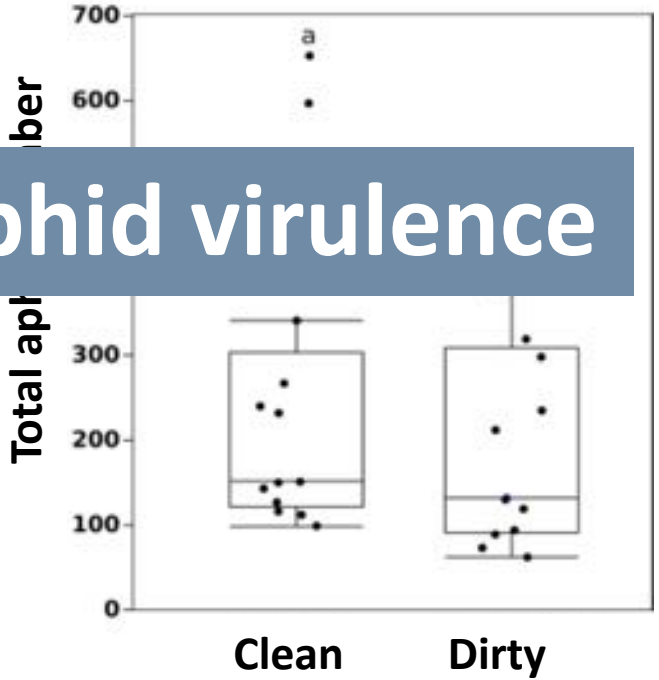
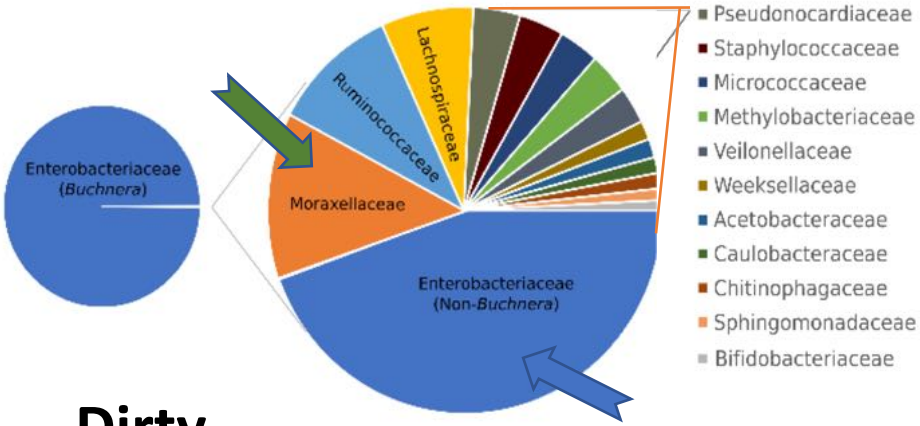


Aphid number is same



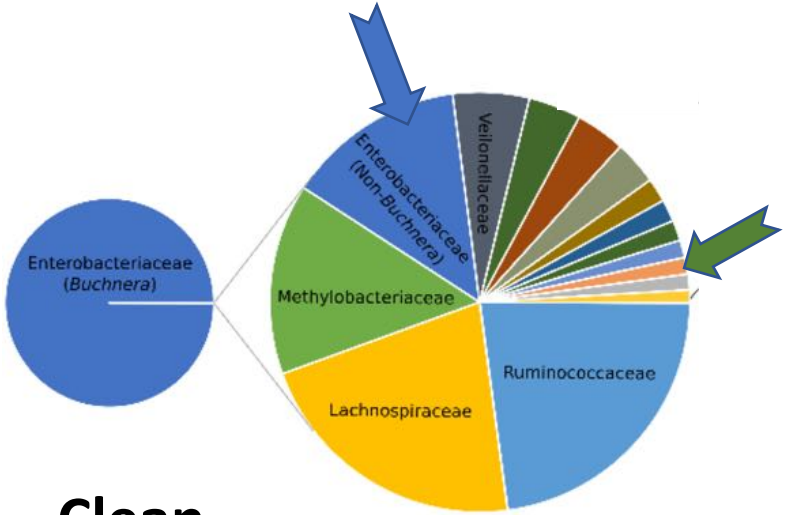
Bacteria contribute to aphid virulence

Dirty aphid microbiome: more diverse and more Enterobacteriacea and Moraxellaceae



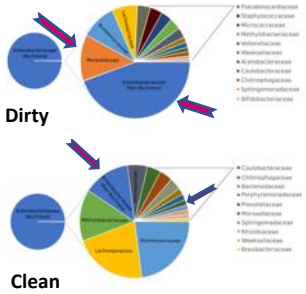
Dirty

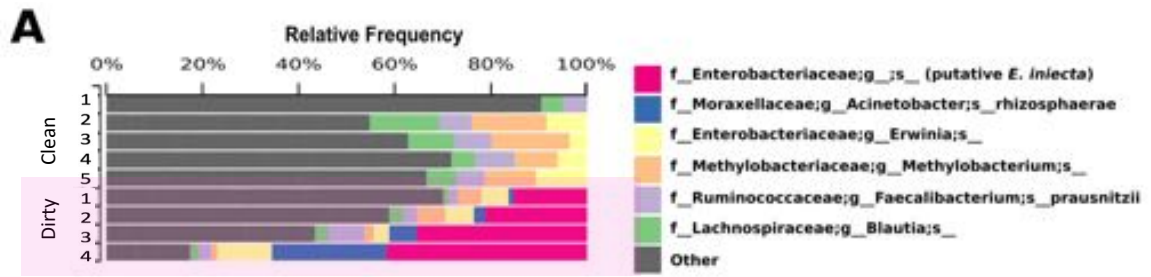
- ***Buchnera* dominates**
- **Dirty aphid microbiome more diverse & enriched in *Enterobacteriaceae* and *Moraxellaceae***

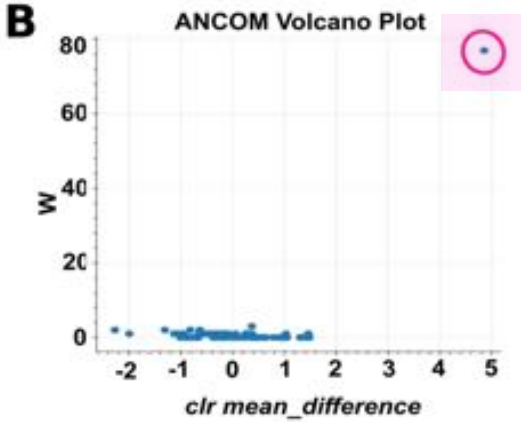


Clean

Dirty aphid microbiome: more diverse and more *Enterobacteriacea* and *Moraxellaceae*

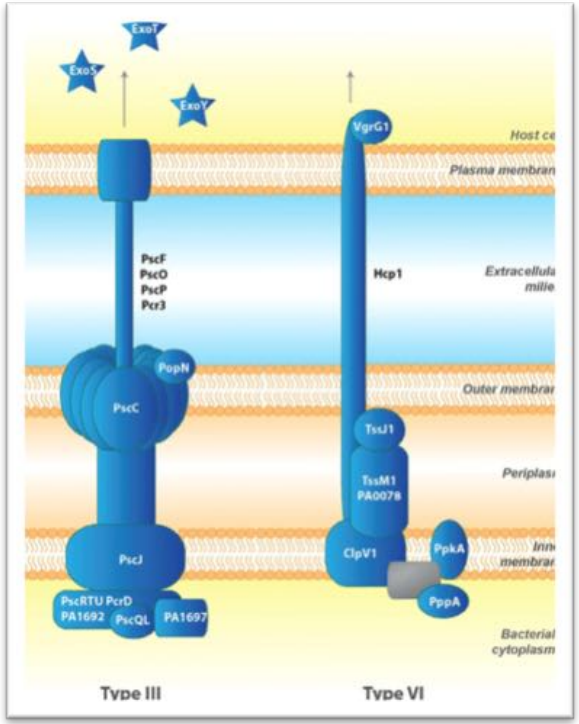






Luna et al. 2018

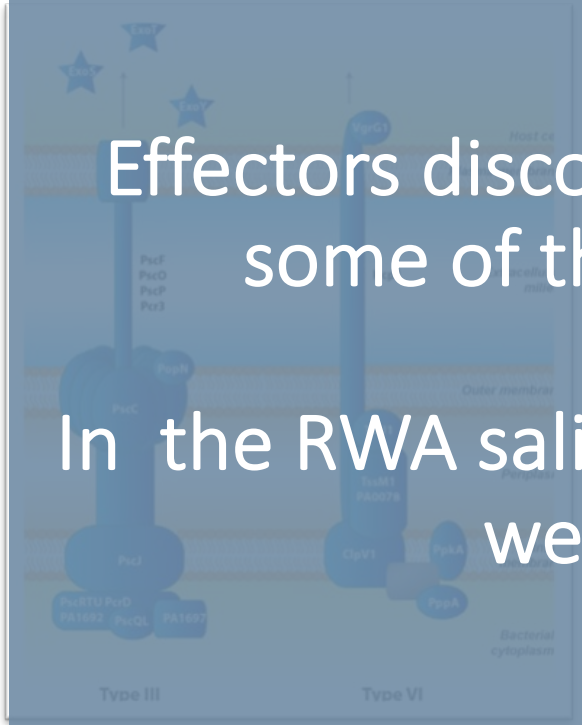
Pacbio SMRT genome sequencing



Damron et al. 2016

	T3SS	T6SS	*Salmonella*-like Effectors (SseCB)	*Erwinia*-like Effectors (DspEF)
*E. iniecta*_B120	+	+	+	+
*Erwinia*_sp._B119	-	+	+	-
*Enterobacter*_sp._M38	-	+	+	-
*Sphingomonas*_sp._M5	-	-	-	-
*Enterobacter*_sp._B156	-	+	+	-
*Pantoea*_sp._B152	+	+	+	-
*Acinetobacter*_sp._B114	+	+	+	-

Pacbio SMRT genome sequencing



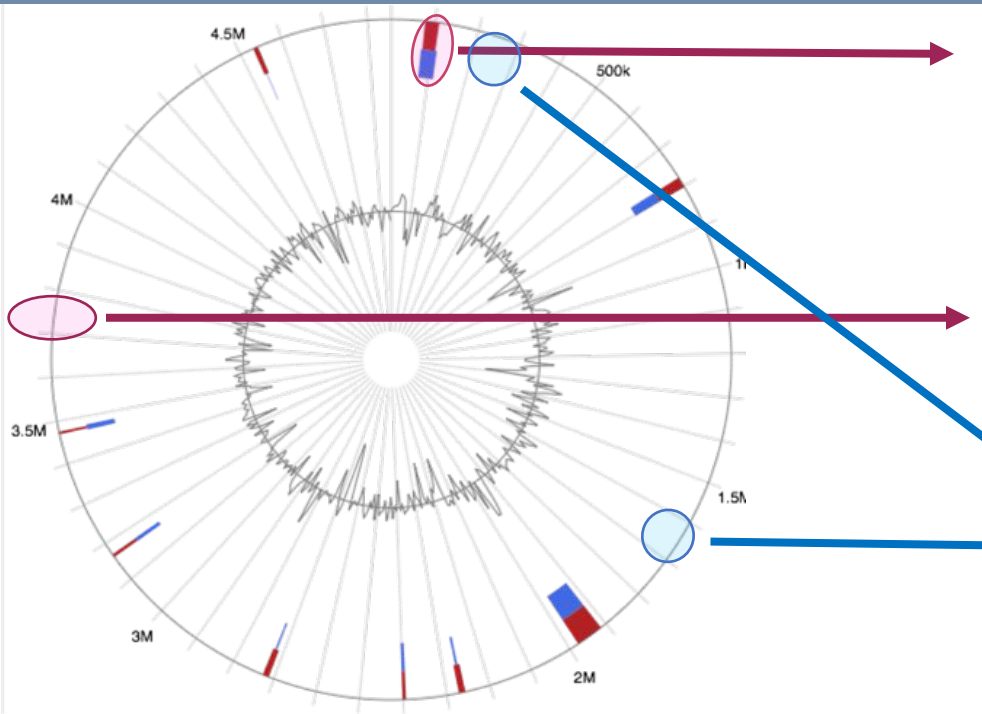
	T3SS	T6SS	*Salmonella*-like Effectors	*Erwinia*-like Effectors
Erwinia_sp._B119	-	+	+	-
Enterobacter_sp._M38	-	+	+	-
Pantoea_sp._B152	+	+	+	-
Acinetobacter_sp._B114	+	+	+	-

Effectors discovered from the RWA saliva match some of those predicted in the genome

In the RWA salivary proteome T6 virulence factors were detected but not T3

Damron et al. 2016

T3SS-associated genes are clustered in GI of *E. iniecta* genome



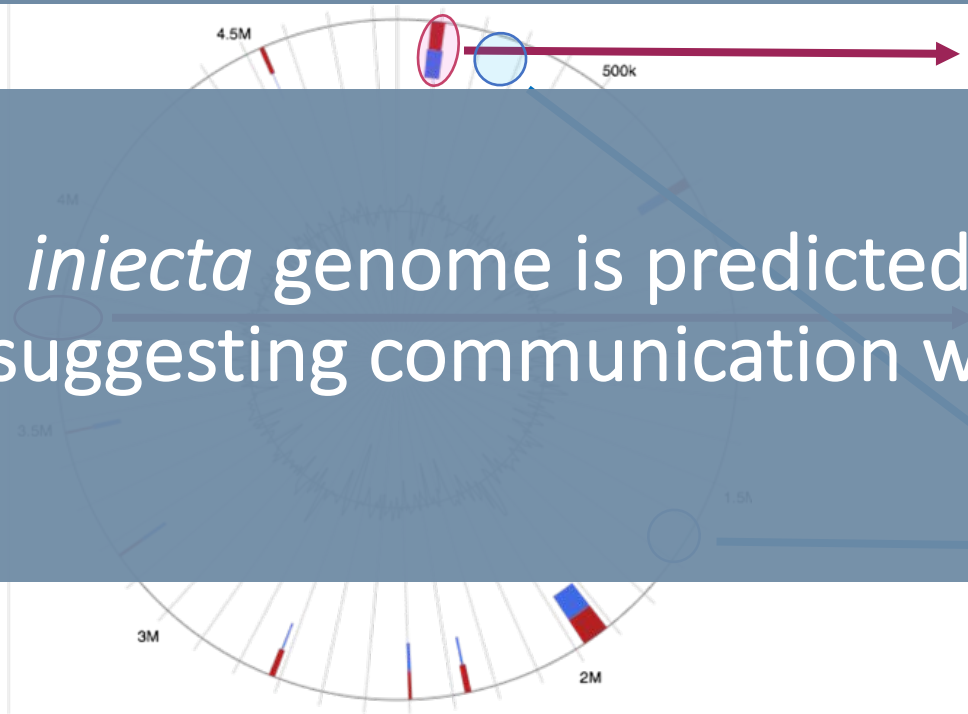
Erwinia-like T3SS-associated proteins/effectors

Salmonella-like T3SS-associated proteins/effectors

T6SS

IslandViewer4

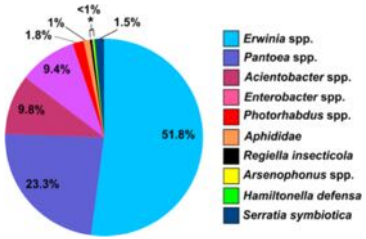
T3SS-associated genes are clustered in GI of *E. iniecta* genome



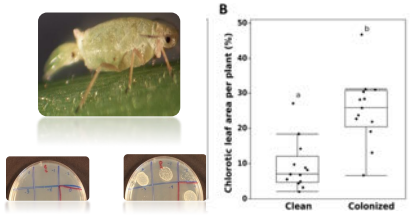
Erwinia-like T3SS-associated proteins/effectors

E. iniecta genome is predicted to harbor two T3SS, suggesting communication with aphid and plant

IslandViewer4

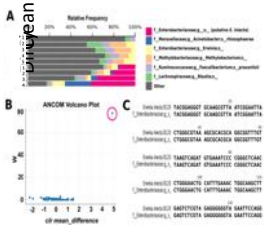


RWA salivary proteome is mostly comprised of bacterial proteins



RWA-associated bacteria contribute to aphid virulence

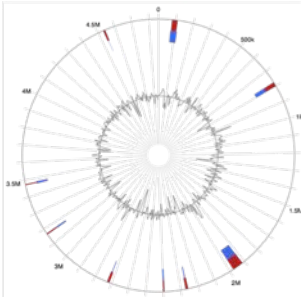
Isolated bacteria are the same genera as detected in proteome



RWA MB is enriched in Enterobacteriaceae and Moraxellaceae

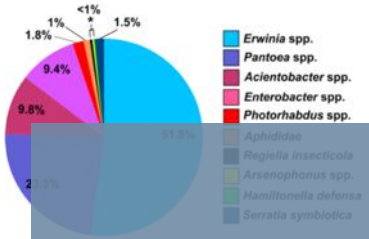
In the clean aphid MB there is an absence of Ei suggesting it is important

Bacteria are present on the aphid stylet



E. iniecta genome shows evidence of T3 and T6 secretion systems.

Two T3 suggesting capable of communicating with plant and animal



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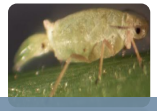
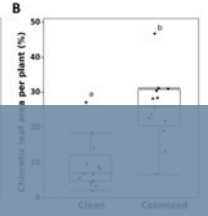
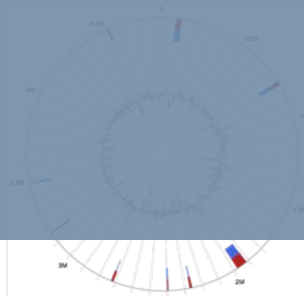




RWA-associated bacteria contribute to aphid virulence

Bacteria are present on the aphid stylet



E. iniecta genome shows evidence of T3 and T6 secretion systems.

Two T3 suggesting capable of communicating with plant and animal

Can we use information gained from phytobiome-related studies to guide breeding programs?

Acknowledgements

Collaborators

Colorado State University
Jan Leach
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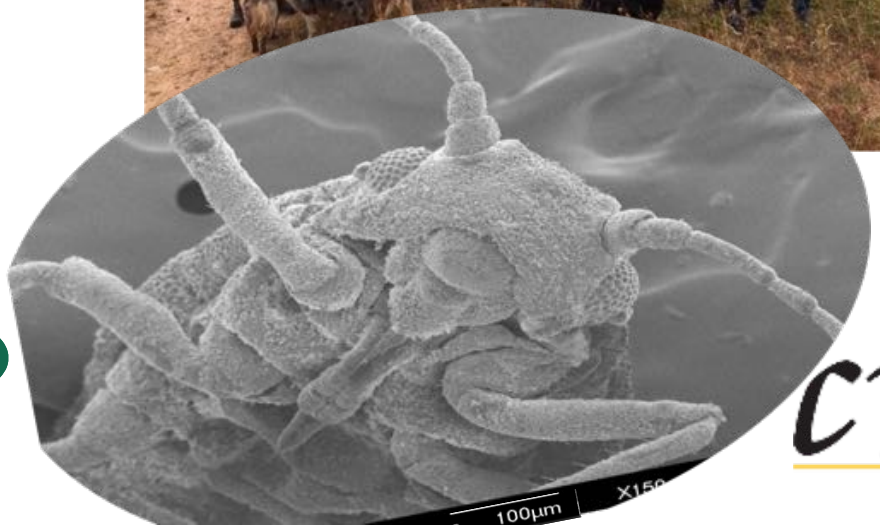
Jeff Rudolph
Terri Randolf
Darren Cockrell
Frank Peairs

Electron Microscopy
Kim Vanderpool



Colorado State University

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