Stingless bee abundance and efficiency in Australian crop systems

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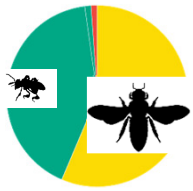
Stingless bee abundance and efficiency in crops:

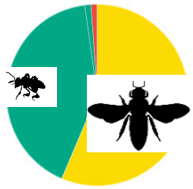
1.



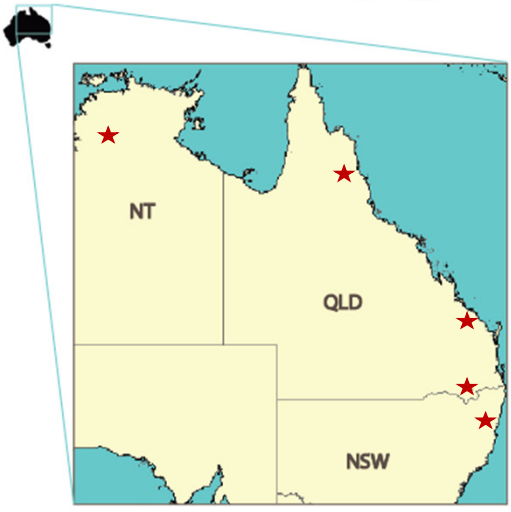
2.

3.

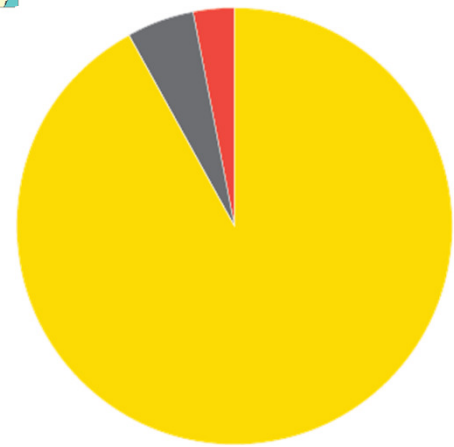
Stingless bee abundance and efficiency in crops:

1. 

Crops Studied Across Australia



Apple
Stanthorpe, QLD 2017



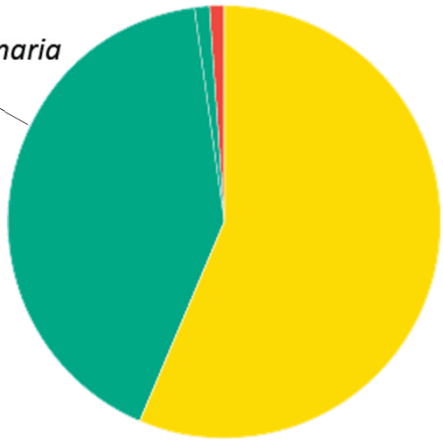
Apis mellifera

Lucillia spp.
Syrphidae

Other flower visitors

Blueberry
Coff's Harbour, NSW 2016 & 2017

Tetragonula carbonaria



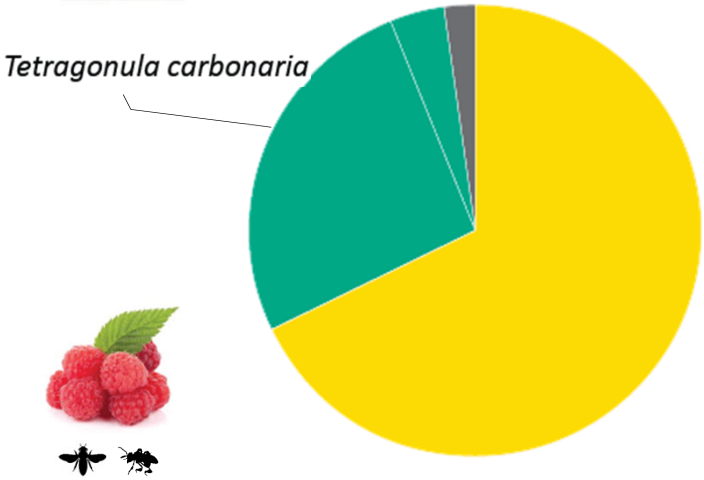
Apis mellifera

Tetragonula carbonaria
Xylocopa bombylans and others
Barunsapis spp.

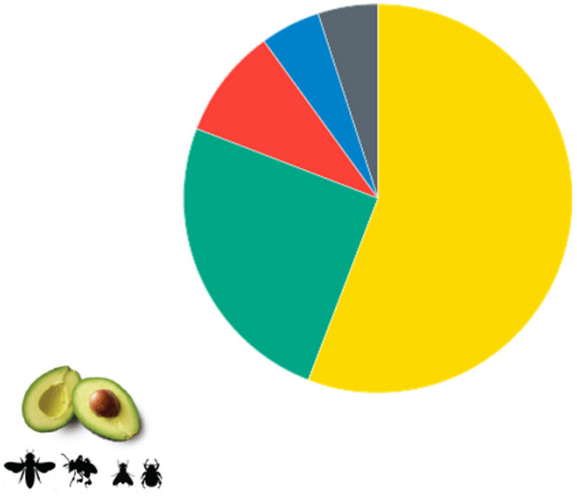
Austrosyrphus spp.
Exoneura bicolor

Other flower visitors

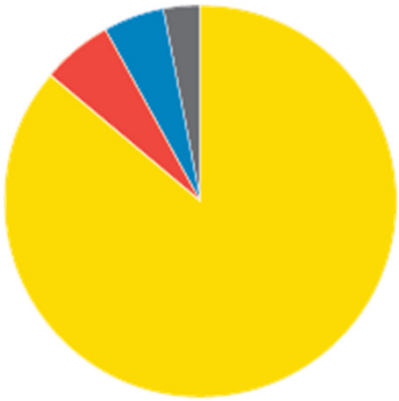
Raspberry
Coff's Harbour, NSW 2017



Avocado
Bundaberg, QLD



Macadamia
Bundaberg, QLD



Apis mellifera

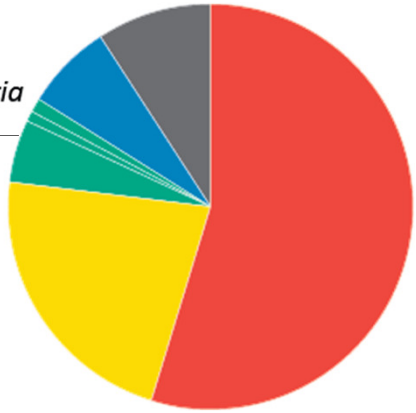
Stomorhina discolor
Chrysomya spp.
Syphidae spp.

Cantharid spp.
Coccinella spp.

Other flower visitors

Mango
Bundaberg, QLD 2016 & 2017

Tetragonula carbonaria



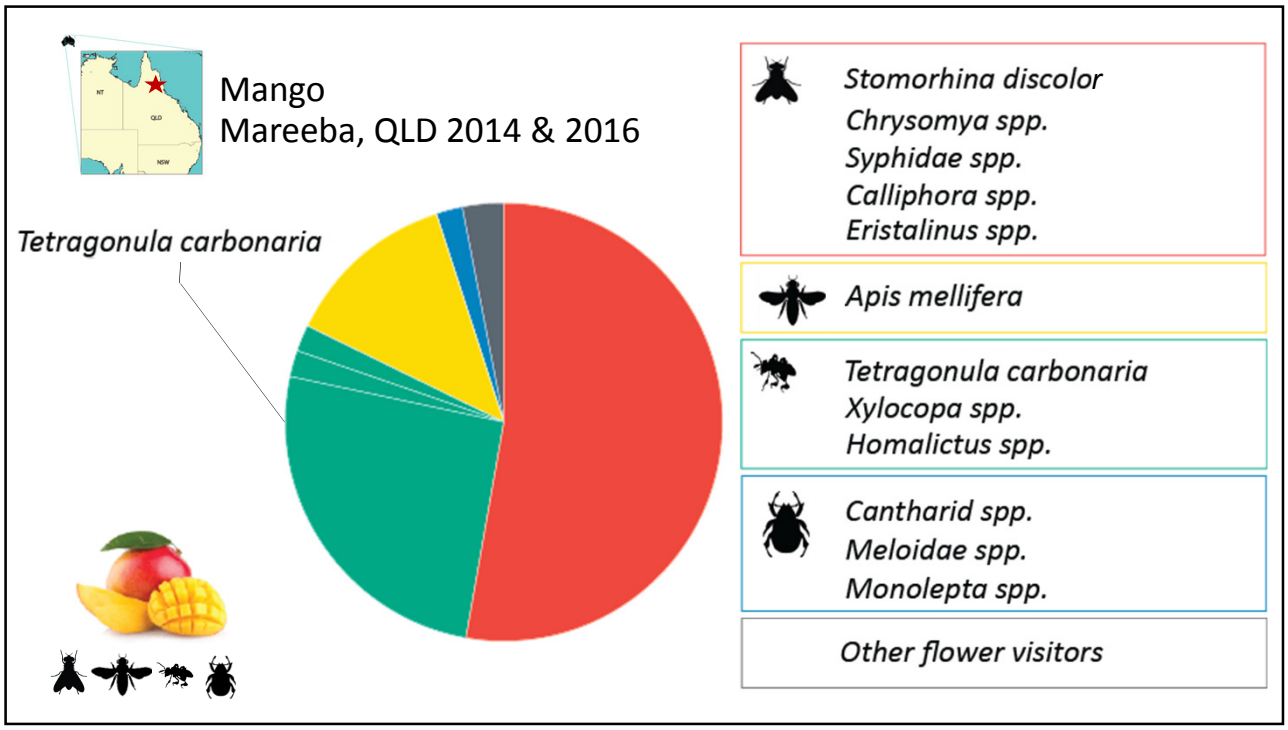
Stomorhina discolor
Chrysomya spp.
Syphidae spp.
Calliphora spp.
Eristalinus spp.

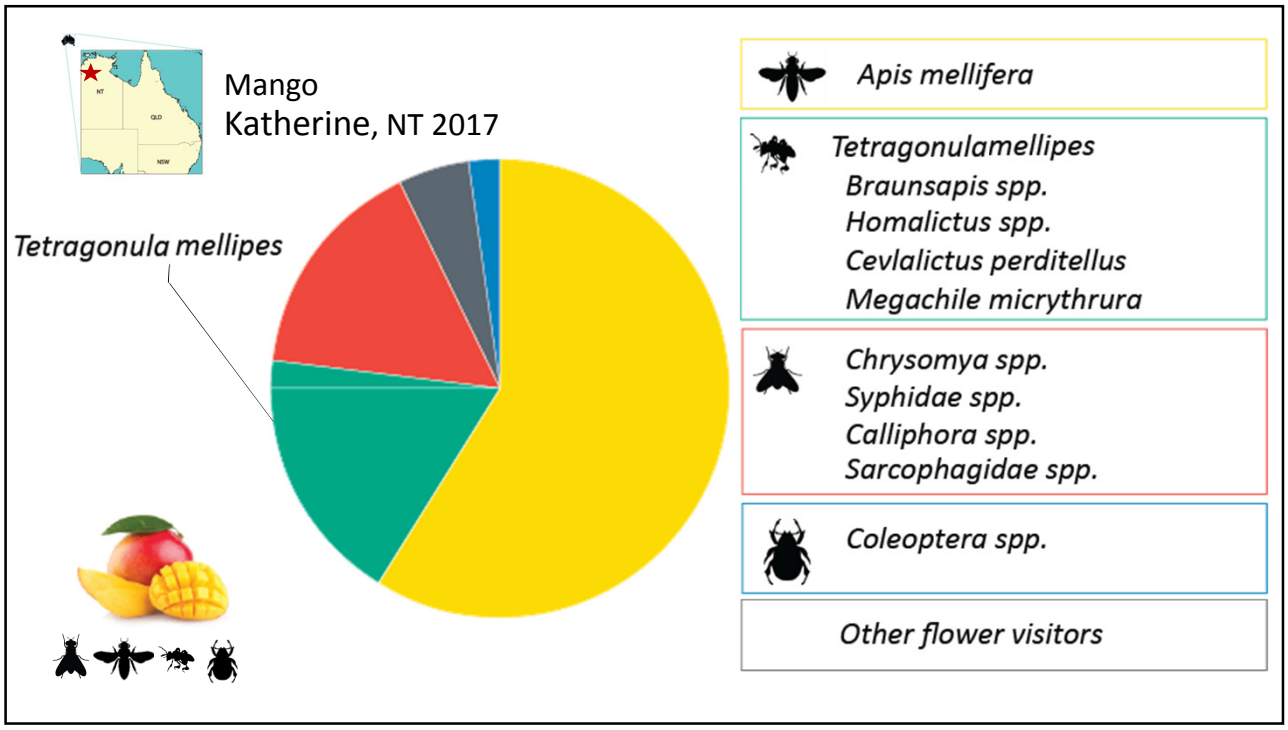
Apis mellifera

Tetragonula carbonaria
Xylocopa spp.
Homalictus spp.

Cantharid spp.
Meloidae spp.
Monolepta spp.

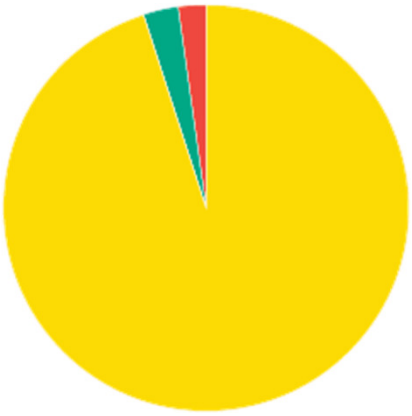
Other flower visitors


Mango
Mareeba, QLD 2014 & 2016
Tetragonula carbonaria
Stomorhina discolor
Chrysomya spp.
Syphidae spp.
Calliphora spp.
Eristalinus spp.
Apis mellifera
Tetragonula carbonaria
Xylocopa spp.
Homalictus spp.
Cantharid spp.
Meloidae spp.
Monolepta spp.
Other flower visitors


Mango
Katherine, NT 2017
Tetragonula mellipes
Apis mellifera
Tetragonulamellipes
Braunsapis spp.
Homalictus spp.
Cevlalictus perditellus
Megachile micrythrura
Chrysomya spp.
Syphidae spp.
Calliphora spp.
Sarcophagidae spp.
Coleoptera spp.
Other flower visitors

Watermelon
Katherine, NT 2017

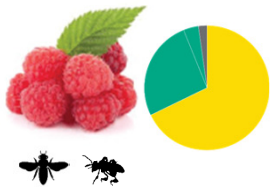
NEWSFLASH! We will be doing Riverina melons this summer so contact us if you want us to work on your property!!!

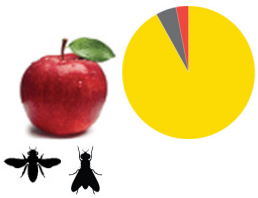


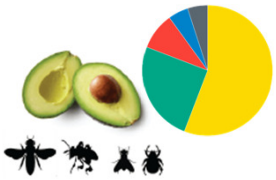
Apis mellifera

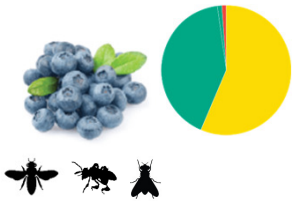
Tetragonula spp.
Homalictus spp.

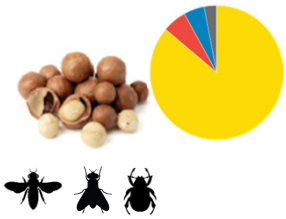
Syphidae spp.

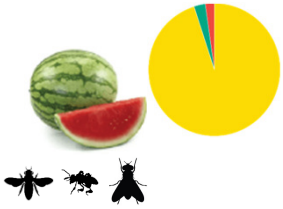


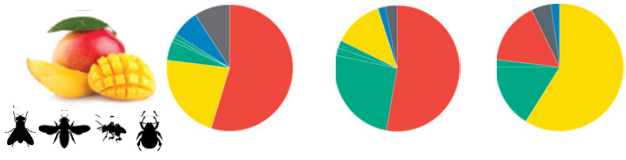


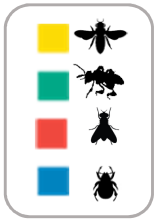








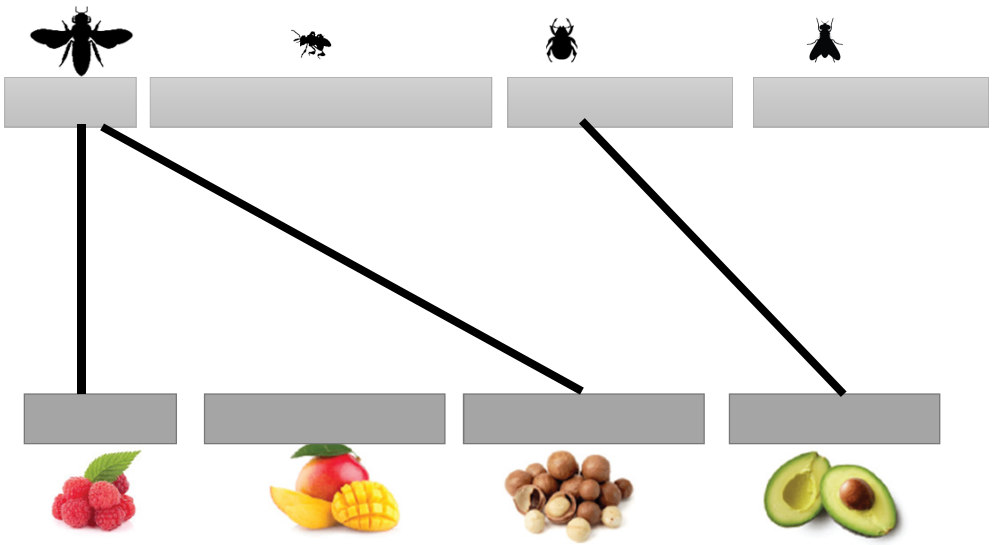




Managed and Wild Bees Found in Our Focal Crops

	Bundaberg, QLD	Coff's Harbour, QLD		Katherine, NT		Mareeba, QLD	Stanthorpe, QLD
Apis cerana						✓	
Apis mellifera	✓	✓	✓	✓	✓	✓	✓
Braunsapis spp.				✓			
Ceylalictus perditellus				✓			
Homalictus spp	✓		✓	✓	✓	✓	
Hylaeus spp						✓	
Lasioglossum spp.							✓
Megachile micerythrura				✓			
Tetragonula spp	✓	✓	✓	✓	✓	✓	
Xylocopa spp	✓					✓	
Unknown Small Native Bees	✓					✓	

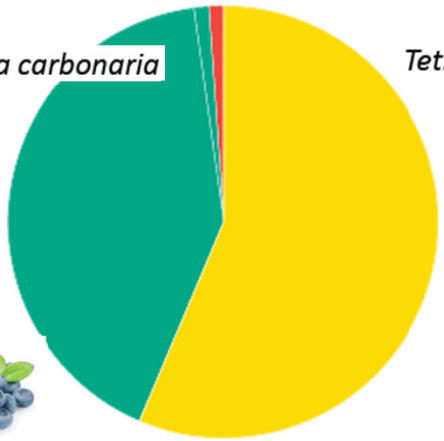
Pollinators



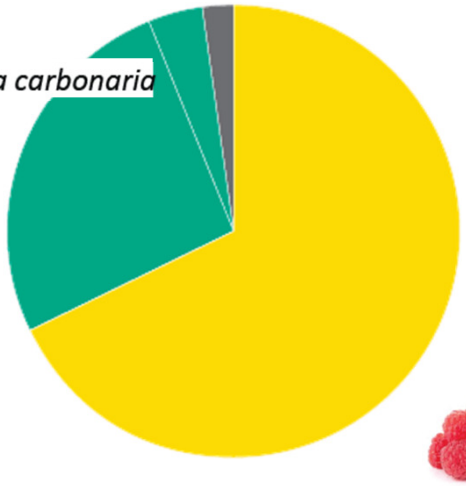
Plants visited by pollinators

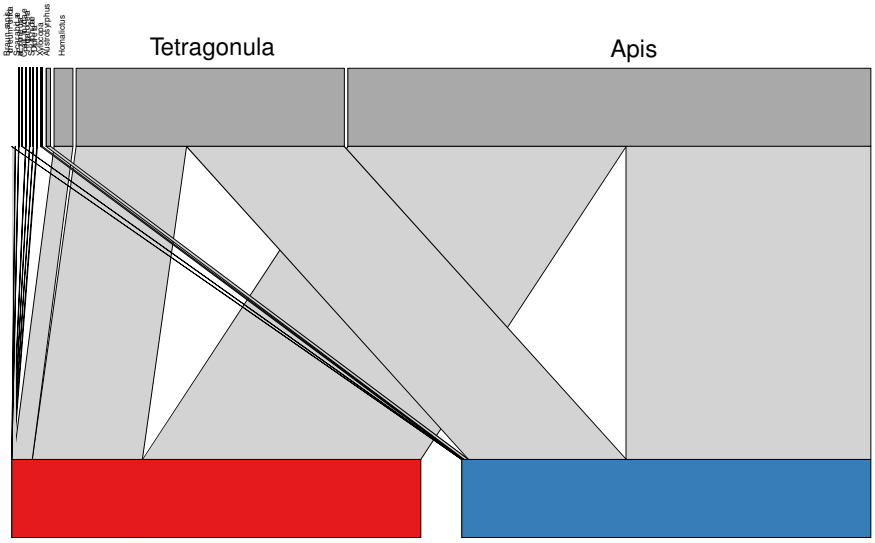
Blueberry and raspberry
Coff's Harbour, NSW 2016 & 2017

Tetragonula carbonaria

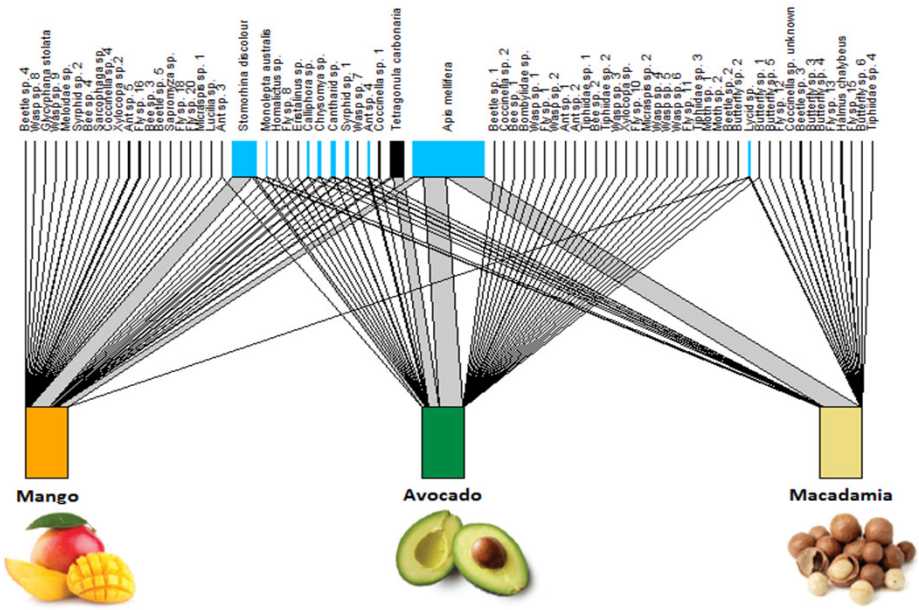


Tetragonula carbonaria





Willcox et al. (in prep.) Identifying keystone crop pollinators across co-flowering horticultural crops



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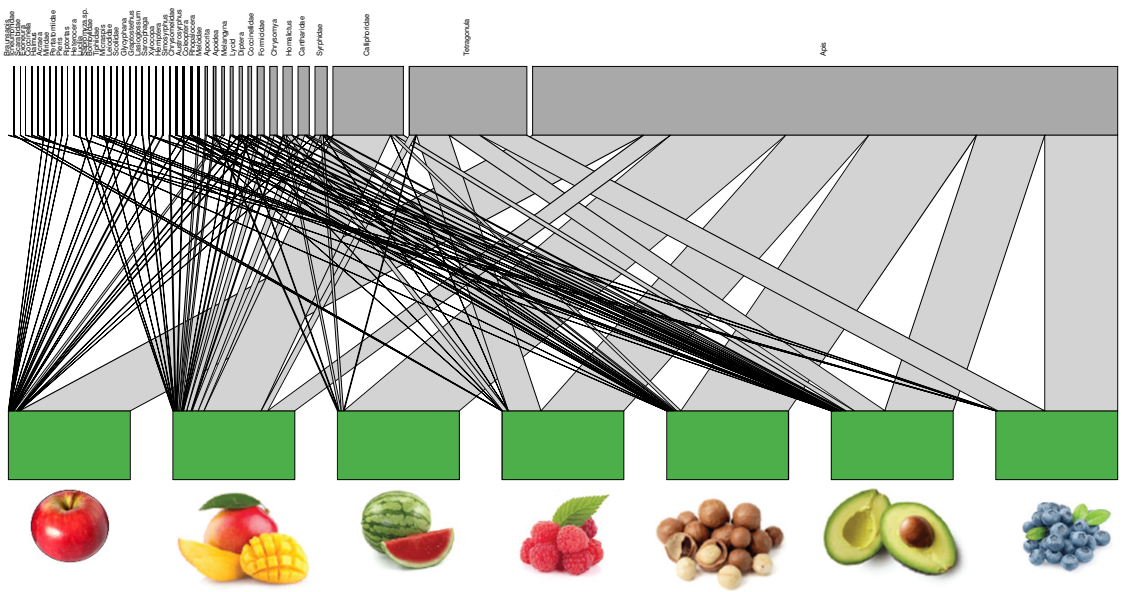

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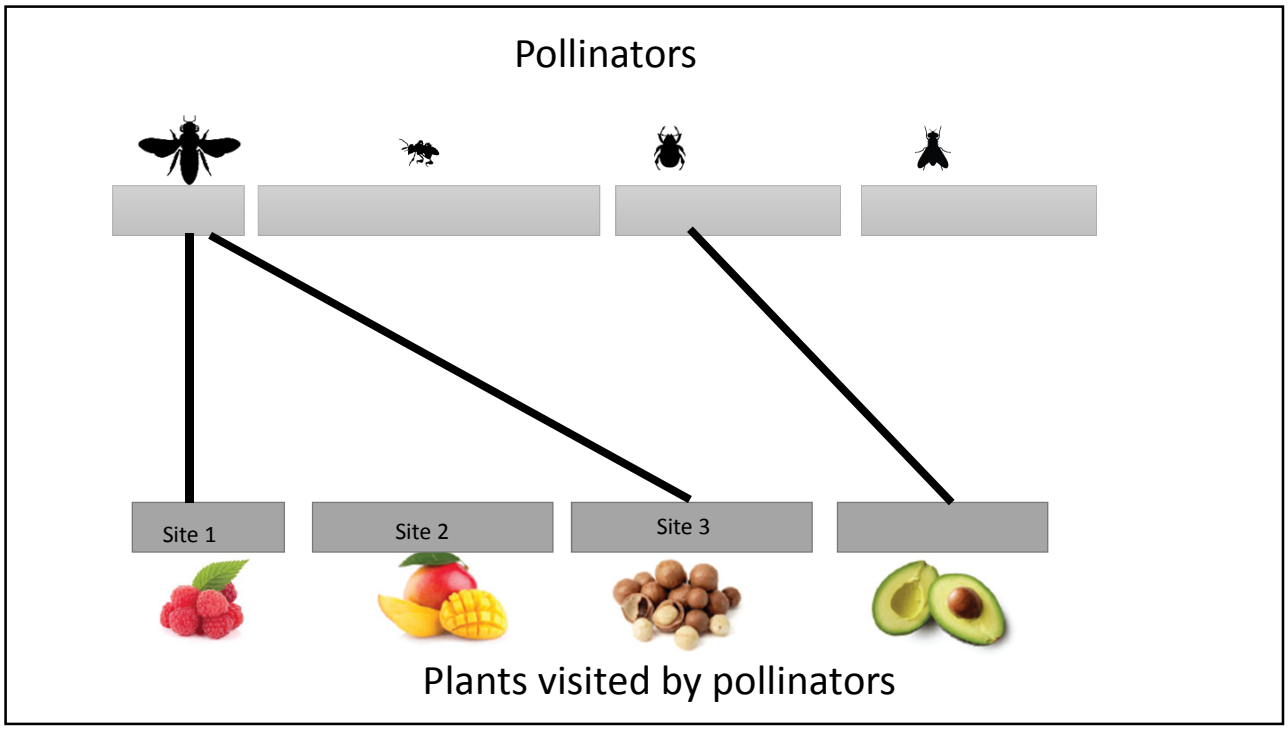
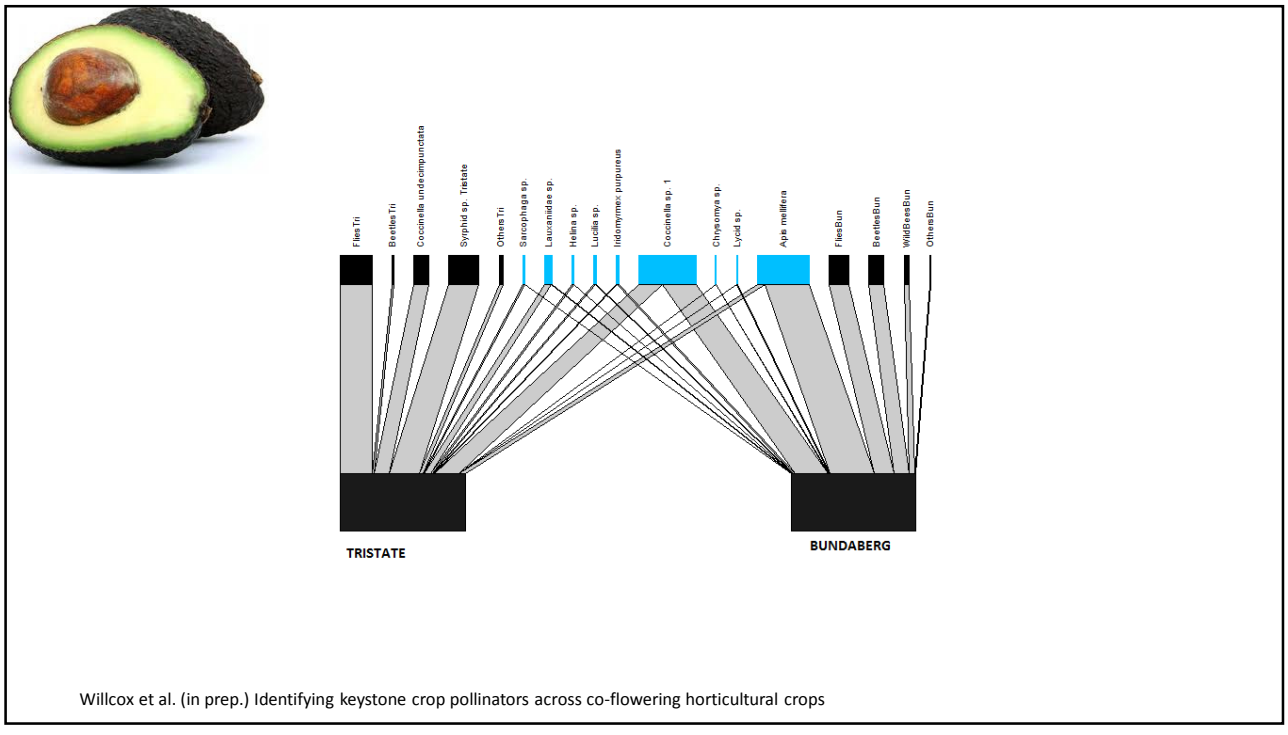
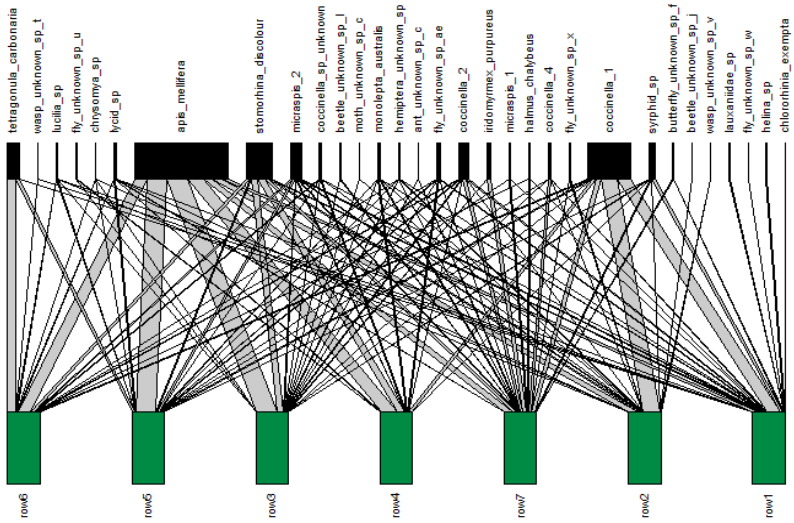

Pollinators
Site 1
Site 2
Site 3
Plants visited by pollinators

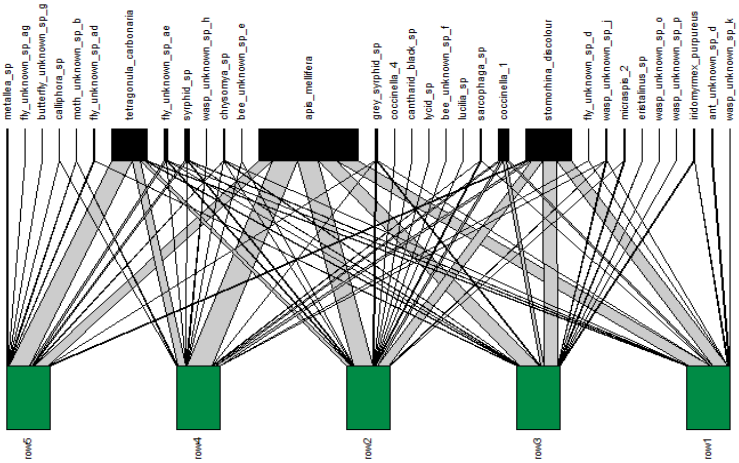

Flies Tri
Beetles Tri
Coccinella undecimpunctata
Syrphid sp. Tristate
Others Tri
Sarcophaga sp.
Laucanidae sp.
Helina sp.
Lucilia sp.
Iridomyrmex purpureus
Coccinella sp. 1
Chrysomya sp.
Lycid sp.
Apis mellifera
Flies Bun
Beetles Bun
Wild Bees Bun
Others Bun
TRISTATE
BUNDABERG
Willcox et al. (in prep.) Identifying keystone crop pollinators across co-flowering horticultural crops

Bundaberg: Visitation only



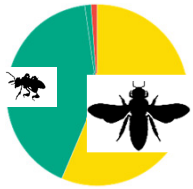
Willcox et al. (in prep.) Identifying keystone crop pollinators across co-flowering horticultural crops

Avocado 2017 Bundaberg: Visitation only



Willcox et al. (in prep.) Identifying keystone crop pollinators across co-flowering horticultural crops

Stingless bee abundance and efficiency in crops:

1. 


2. 

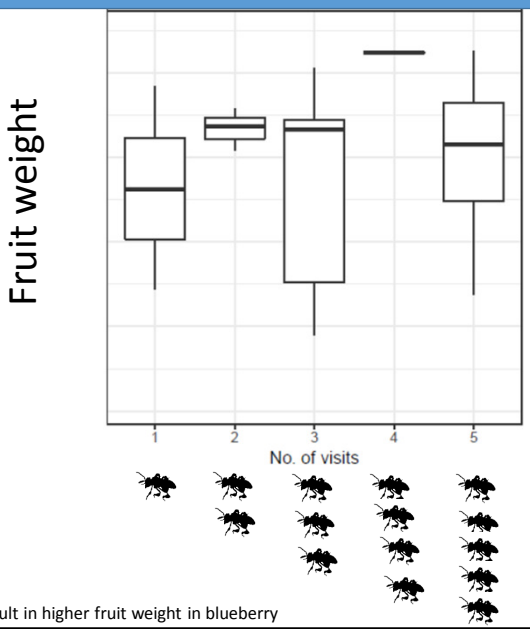
The number of visits is important!

- Too few visits = crumbly fruit

2. Pollinator efficiency

Vis1

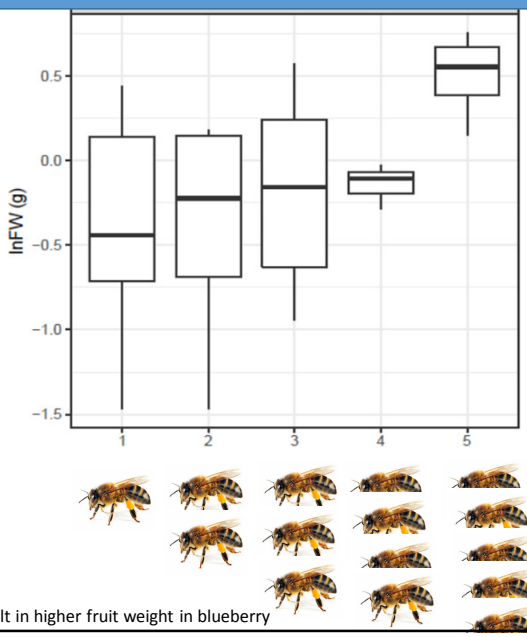
Stingless bees alone



Kendall et al. (in prep.) Mixed pollinator visits result in higher fruit weight in blueberry

Honey bees alone

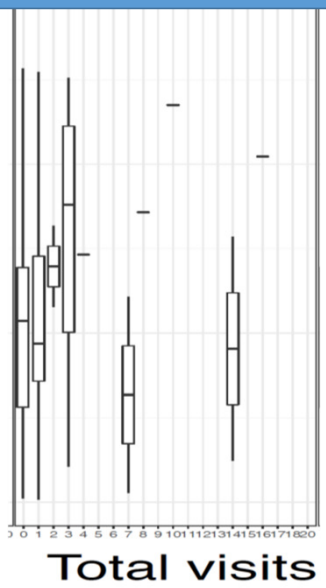
Fruit weight



Kendall et al. (in prep.) Mixed pollinator visits result in higher fruit weight in blueberry

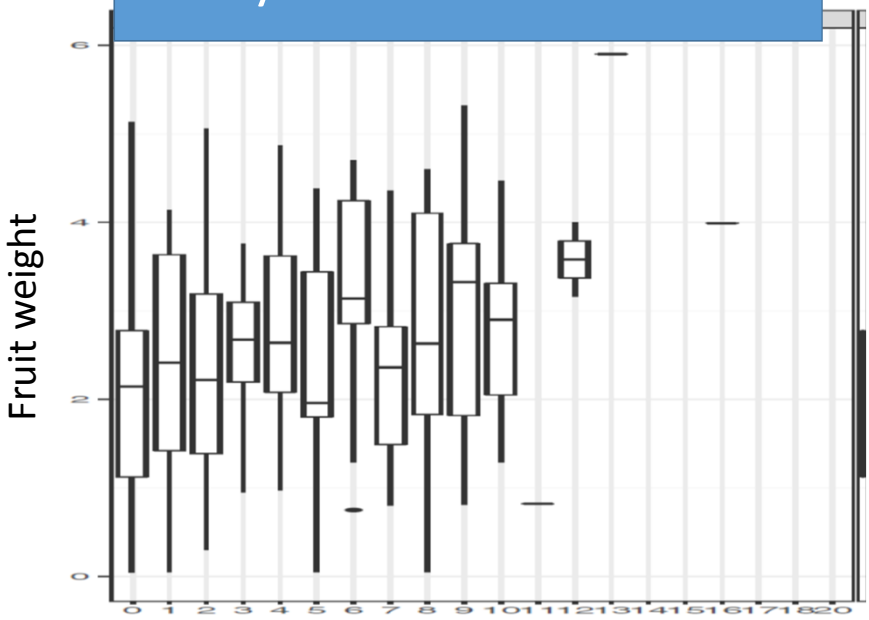
Stingless bees alone

Weight



Hall et al. (in prep.) Multiple pollinator visits are required for commercial raspberry production

Honey bees alone



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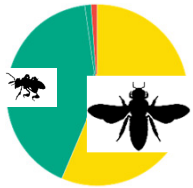
Stingless bee abundance and efficiency in crops:

1. 

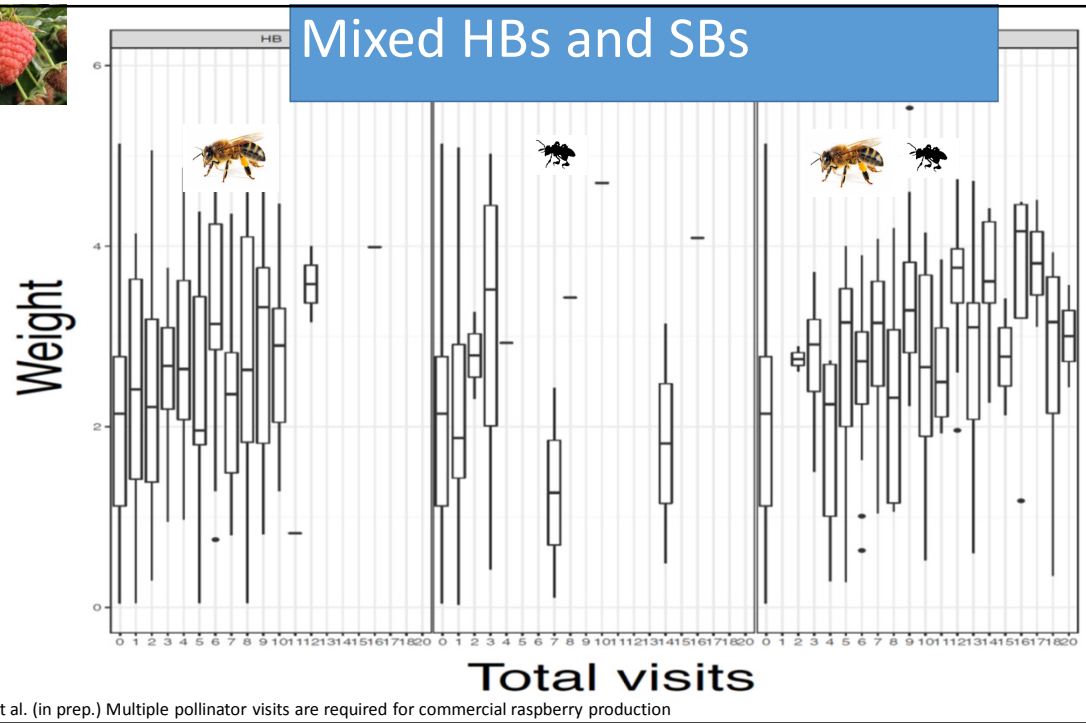

2. Vis1 Vis3 Vis5


3. 

Mixed HBs and SBs

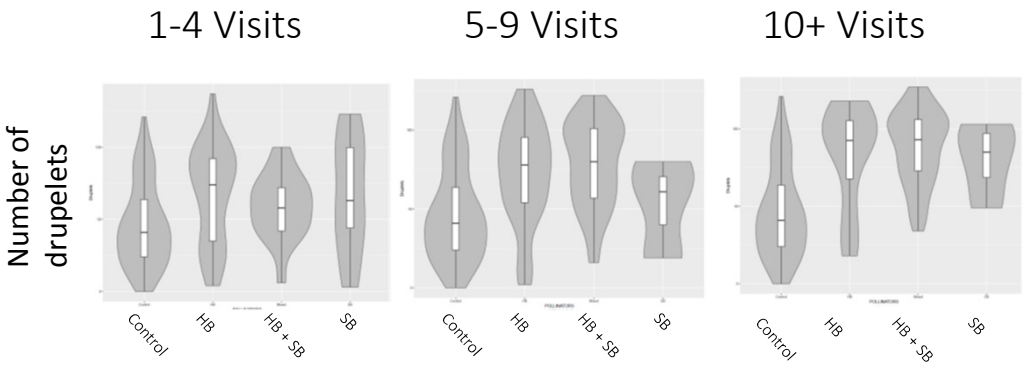
Kendall et al. (in prep.) Mixed pollinator visits result in higher fruit weight in blueberry

Mixed HBs and SBs



Hall et al. (in prep.) Multiple pollinator visits are required for commercial raspberry production

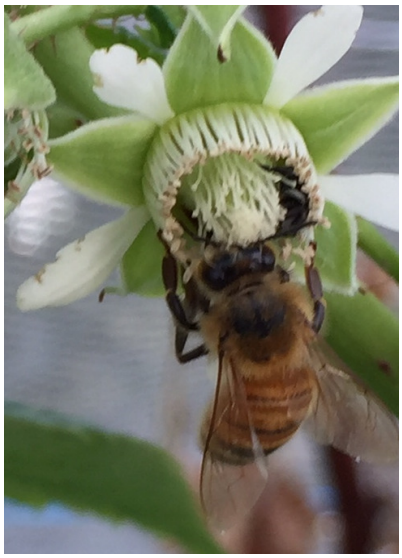
The number of visits is important!



Number of Drupelets; (lots is good!)

Hall et al. (in prep.) Multiple pollinator visits are required for commercial raspberry production

Why is there so much variation? Are mixed visits good?



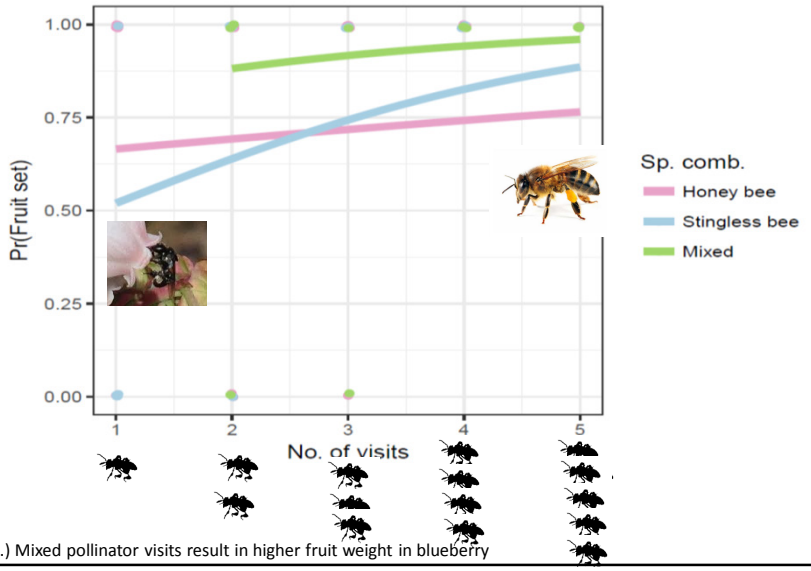
1. Differences in foraging behaviour could mean some visits are good for flower and others not

2. Differences in foraging behaviour could mean more fruit set overall

Pollen collecting behaviour

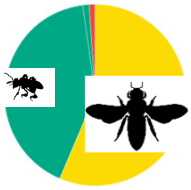
Nectar collecting behaviour

Proportion fruit set after 1-5 visits

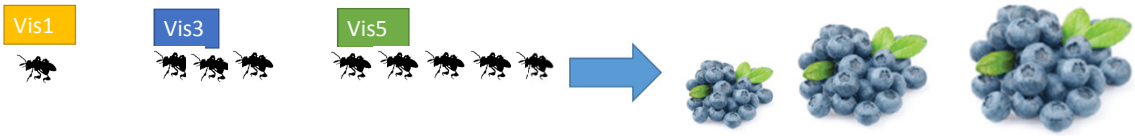


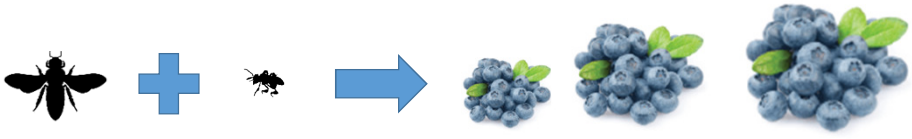
Kendall et al. (in prep.) Mixed pollinator visits result in higher fruit weight in blueberry

Conclusions:

1. 

General patterns for each crop do not exist!

2. 

3. 

Questions?

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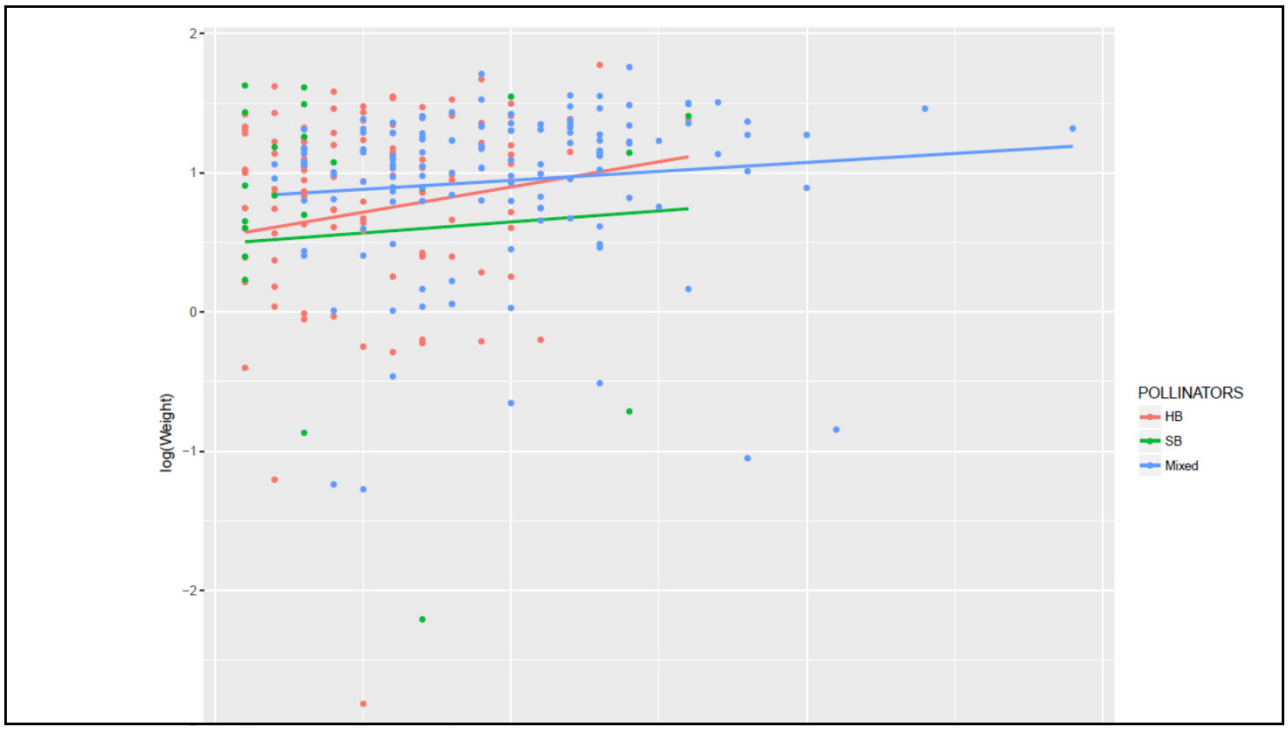
Contributors to our crop pollination work: Bruce White, Carolyn Sonter, Emma Goodwin, Juan Lobaton, Bryony Willcox, Liam Kendall, Manu Saunders, Sarah McDonald, Rob and Raelene Mitchie, Brad Howlett, Lindsey Kirkland, Mark Hall, Jeremy Jones, Tobias Smith, Jamie Stavert and Costa Group.

Vis1

	Avocado Bundaberg 2015	Avocado Bundaberg 2017	Avocado Tristate 2015	Mango Mareeba 2014
Bees				
Apis mellifera	2	2	4	6
Tetragonula carbonaria	–	1	–	1
Flies				
Allograpta sp.	–	–	–	4
Calliphora morphosp. 1	–	–	9	–
Calliphora morphosp. 3	–	–	1	–
Chrysomya morphosp. 1	–	–	–	2
Lucilia morphosp. 1	–	–	5	5
Metallea morphosp. 1	–	–	6	–
Plecia sp.1	–	–	–	10
Stomorhina discolor	3	3	–	3
Stomorhina xanthogaster	–	–	–	7
Syritta sp. 1	–	–	–	8
Syrphid morphosp. 1	–	–	8	–
Tachinid morphosp. 1	–	–	7	–
Thynninae morphosp. 1	–	–	3	–
Others				
Coccinella morphosp. 1	1	–	–	–
Coccinella undecimpunctata	–	–	2	–
Iridomyrmex purpureus	4	–	–	–
Tenebrionid sp. 1	–	–	–	9

Willcox et al. (in prep.) Identifying keystone crop pollinators across co-flowering horticultural crops



Species ranked by abundance for each crop, year and region

	Avocado				Macadamia		Mango				
	Bundaberg			Tristate	Bundaberg		Bundaberg		Mareeba		Katherine
	2015	2016	2017	2015	2015	2016	2016	2017	2014	2016	2017
BEES											
Apis mellifera	1	1	1	4	1	1	2	4	3	5	1
Tetragonula carbonaria	4	2	3				3		1	1	
Tetragonula mellipes											2
FLIES											
Stomorhina discolour	3	3	2		2	2	1	1	2	4	
Chrysomya sp.							5	3		2	3
Syrphid sp.	5			1	4	3					
Lauxaniidae sp.				5							
Calliphora sp.1				3							
Calliphora sp.2											4
Syritta sp.									4		
Plecia sp.									5	3	
Tabanidae sp.			5								
Grey syrphid sp.								2			
Simosyrphus sp.								5			
Sarcophaga sp.											5
BEETLES											
Coccinellid sp.	2	5	4	2	4						
Lycid sp.					4	4					
Monolepta australis					4						
Cantharid sp.		4				5	4				
ANTS AND WASPS											
Ant species 1					3						
Ant species 2					5						

Willcox et al. (in prep.) Identifying keystone crop pollinators across co-flowering horticultural crops