

# *Pemphigus betae* influences arthropod co-occurrence patterns

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July 17, 2012

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# 1 Questions for Art

1. Send me P. betae matrices?

# 2 Tasks

1. Add in 2009
  - together
2. Get distance data between networks and correlate with treatment effects
3. Break out by genotype
4. Compare (co-occurrence and networks) excluded and control
  - (a) with/without pb
  - (b) lumping years
  - (c) excluding outbreak species
5. Co-occurrence and networks at the whole data scale

### 3 Do arthropod co-occurrence patterns shift in response to a keystone species removal and does this depend on genotype?

## 4 2008

### 4.1 Compositional Differences from *P. betae* Exclusion

Call:

```
adonis(formula = com ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)	
g	9	3.9502	0.43891	4.1310	0.25205	0.001	***
tree:trt	40	8.5346	0.21337	2.0082	0.54457	0.001	***
Residuals	30	3.1874	0.10625		0.20338		
Total	79	15.6722			1.00000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = com.rsm ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	3.8160	0.42400	2.3743	0.19792	0.001 ***
tree:trt	40	10.1069	0.25267	1.4149	0.52421	0.001 ***
Residuals	30	5.3572	0.17857		0.27786	
Total	79	19.2801			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = com.rst ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	4.2684	0.47427	1.9143	0.16715	0.001 ***
tree:trt	40	13.8349	0.34587	1.3961	0.54178	0.001 ***
Residuals	30	7.4325	0.24775		0.29106	
Total	79	25.5358			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = com[, -1] ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
--	----	-----------	---------	---------	----	--------

g	9	3.7806	0.42006	3.7258	0.25459	0.001	***
tree:trt	40	7.6866	0.19216	1.7044	0.51763	0.001	***
Residuals	30	3.3823	0.11274		0.22777		
Total	79	14.8495			1.00000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = com.rsm[, -1] ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	3.7866	0.42074	2.3063	0.19620	0.001 ***
tree:trt	40	10.0404	0.25101	1.3759	0.52023	0.001 ***
Residuals	30	5.4729	0.18243		0.28357	
Total	79	19.3000			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = com.rst[, -1] ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	4.2200	0.46889	1.8372	0.16402	0.001 ***

```

tree:trt  40    13.8526 0.34632  1.3569 0.53840  0.001 ***
Residuals 30     7.6567 0.25522          0.29759
Total      79    25.7294          1.00000

```

---

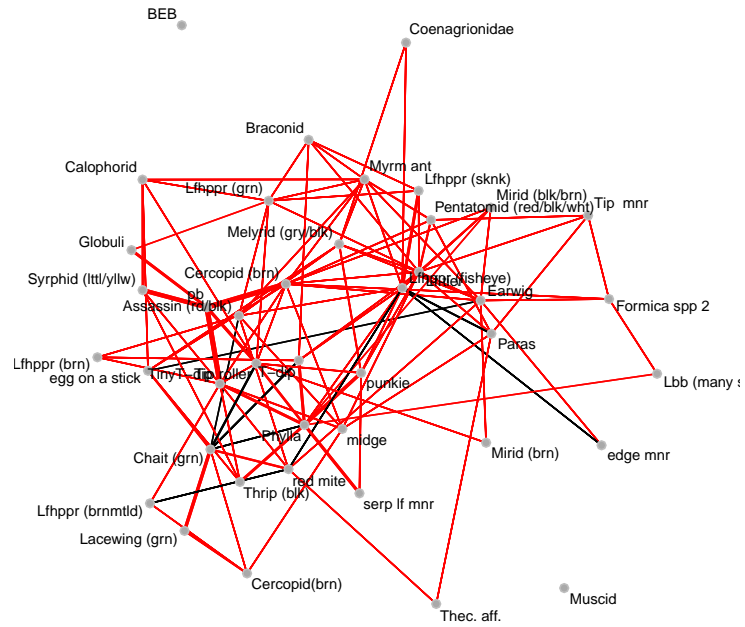
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

	BEB	serp.lf.mnr.	Tip.roller
indval.996	0.09	0.00	0.01
indval.1000	0.18	0.31	0.02
indval.1008	0.26	0.03	0.07
indval.1017	0.02	0.00	0.28
indval.1020	0.08	0.02	0.01
indval.coal.3	0.08	0.02	0.05
indval.HE.10	0.06	0.09	0.01
indval.Rm.2	0.05	0.06	0.08
indval.T.15	0.02	0.00	0.00
indval.WC.5	0.05	0.06	0.21
p	0.04	0.06	0.07

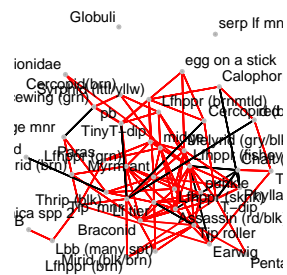
	Lfhppr..fisheye.	midge
indval.996	0.15	0.00
indval.1000	0.02	0.00
indval.1008	0.14	0.02
indval.1017	0.26	0.55
indval.1020	0.01	0.02
indval.coal.3	0.04	0.00
indval.HE.10	0.04	0.00
indval.Rm.2	0.04	0.02
indval.T.15	0.04	0.00
indval.WC.5	0.11	0.00
p	0.01	0.01

## 4.2 Co-occurrence Patterns

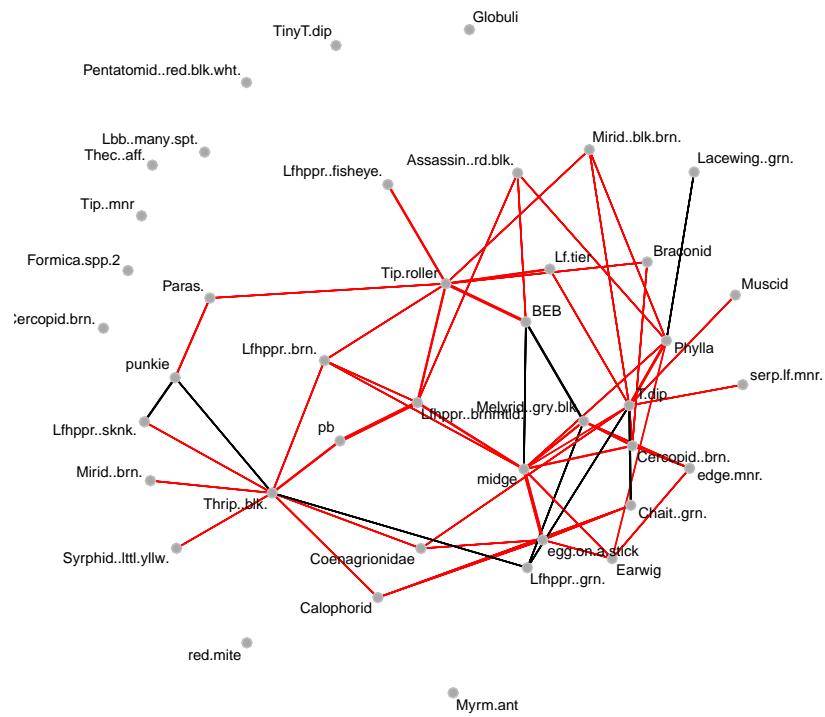
## 4.3 Network Models



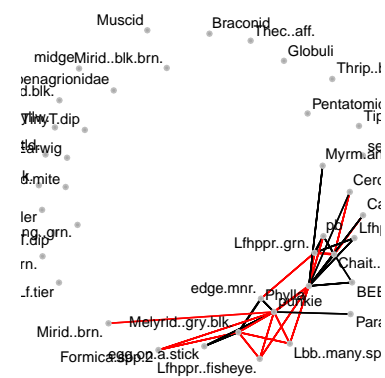




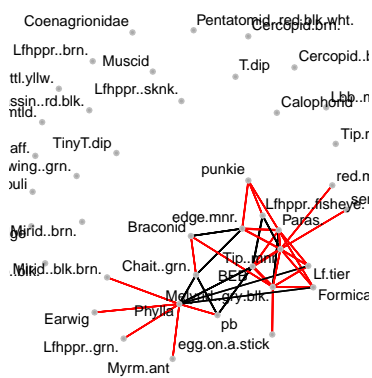
996



1000.1



1000.2



## 5 2009

### 5.1 Compositional Differences from *P. betae* Exclusion

Call:

```
adonis(formula = clarkeAdjust(com) ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	4.8919	0.54355	5.3364	0.26805	0.001 ***
tree:trt	40	10.3022	0.25755	2.5286	0.56451	0.001 ***
Residuals	30	3.0557	0.10186		0.16744	
Total	79	18.2499			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = clarkeAdjust(com.rsm) ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	4.7449	0.52721	2.9847	0.20917	0.001 ***
tree:trt	40	12.6405	0.31601	1.7891	0.55723	0.001 ***
Residuals	30	5.2991	0.17664		0.23360	
Total	79	22.6845			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = clarkeAdjust(com.rst) ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	5.0055	0.55617	2.5423	0.19613	0.001 ***
tree:trt	40	13.9523	0.34881	1.5944	0.54670	0.001 ***
Residuals	30	6.5629	0.21876		0.25716	
Total	79	25.5207			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = clarkeAdjust(com[, -1]) ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	3.7780	0.41978	3.8166	0.22204	0.001 ***
tree:trt	40	9.9378	0.24844	2.2589	0.58405	0.001 ***
Residuals	30	3.2996	0.10999		0.19392	
Total	79	17.0154			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = clarkeAdjust(com.rsm[, -1]) ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	4.7291	0.52546	2.9941	0.20686	0.001 ***
tree:trt	40	12.8674	0.32169	1.8330	0.56284	0.001 ***
Residuals	30	5.2649	0.17550		0.23030	
Total	79	22.8615			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Call:

```
adonis(formula = clarkeAdjust(com.rst[, -1]) ~ tree:trt + g)
```

Terms added sequentially (first to last)

	Df	SumsOfSqs	MeanSqs	F.Model	R2	Pr(>F)
g	9	5.0233	0.55814	2.5712	0.19468	0.001 ***
tree:trt	40	14.2668	0.35667	1.6431	0.55293	0.001 ***
Residuals	30	6.5122	0.21707		0.25239	
Total	79	25.8022			1.00000	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

	Anthocorid	Tip.roller
indval.996	0.00	0.01
indval.1000	0.03	0.15
indval.1008	0.00	0.05
indval.1017	0.38	0.37
indval.1020	0.00	0.01
indval.coal.3	0.00	0.01
indval.HE.10	0.00	0.15
indval.Rm.2	0.10	0.01
indval.T.15	0.03	0.04
indval.WC.5	0.03	0.02
p	0.04	0.00

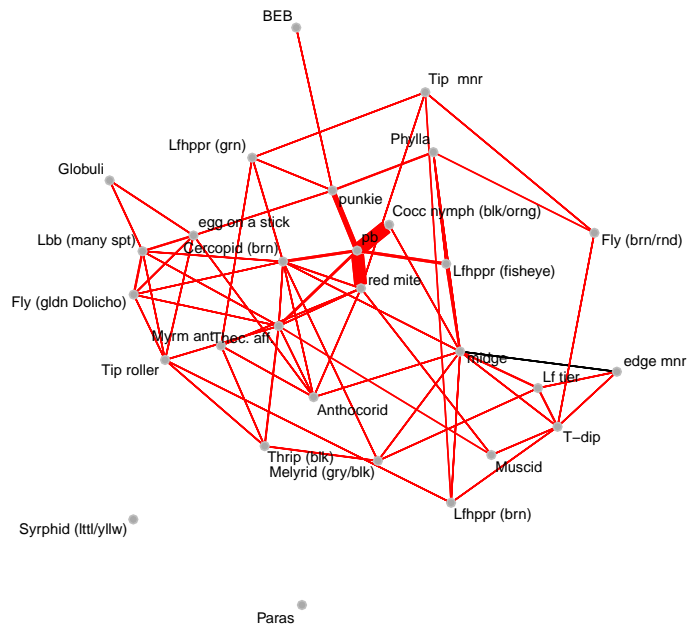
## 5.2 Co-occurrence Patterns

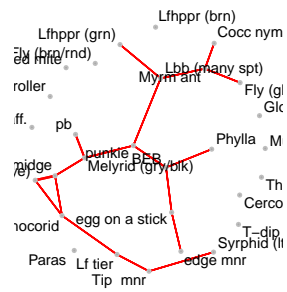
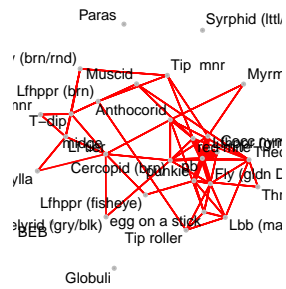
[1] "lasso"

	Lf.tier
indval.996	0.00
indval.1000	0.07
indval.1008	0.02
indval.1017	0.41
indval.1020	0.00
indval.coal.3	0.00
indval.HE.10	0.00
indval.Rm.2	0.00
indval.T.15	0.00
indval.WC.5	0.02
p	0.04

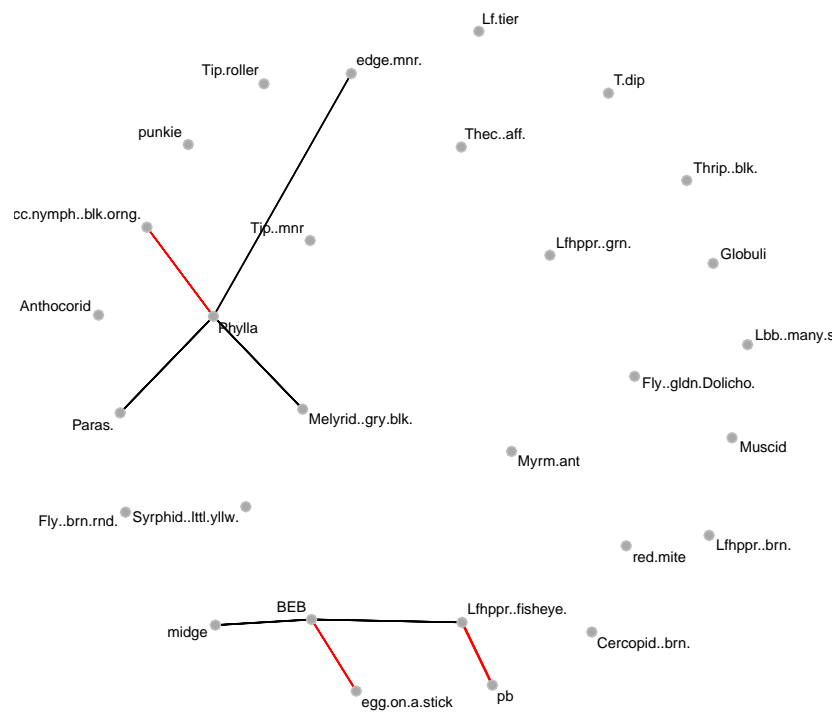


## 5.3 Network Models



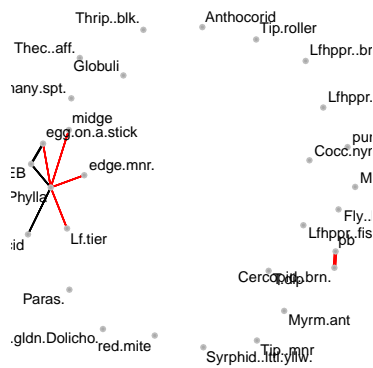
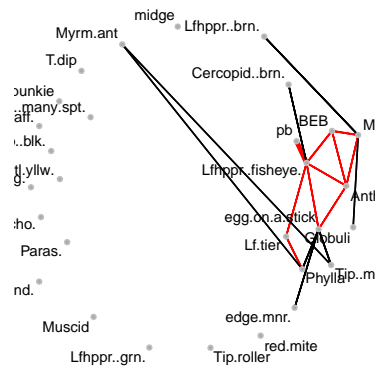


996



1000.1

1000.2



## 6 Look at correlation between 2008 and 2009

Mantel statistic based on Pearson's product-moment correlation

Call:

```
mantel(xdis = d08, ydis = d09)
```

Mantel statistic r: 0.3363

Significance: 0.001

Empirical upper confidence limits of r:

90%	95%	97.5%	99%
0.0519	0.0667	0.0779	0.0926

Based on 999 permutations

## References

- [1] M.B. Araújo, A. Rozenfeld, C. Rahbek, and P.A. Marquet. Using species co-occurrence networks to assess the impacts of climate change. *Ecography*, 34:897–908, 2011.