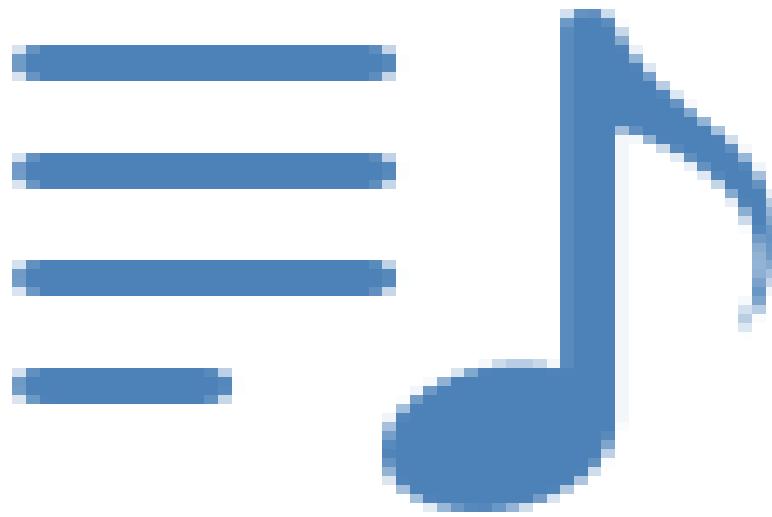


Symbiosis



http://www.youtube.com/watch?v=_dzWBEAhAY8

Brian O'Meara
EEB464 Fall 2018

Definitions of symbiosis

Understanding how and why symbioses can change through time

Making inferences about biology from graphs

Symbiosis = close, often long-lasting (for at least one partner) associations between organisms.

Symbiosis

Symbiosis

Mutualism

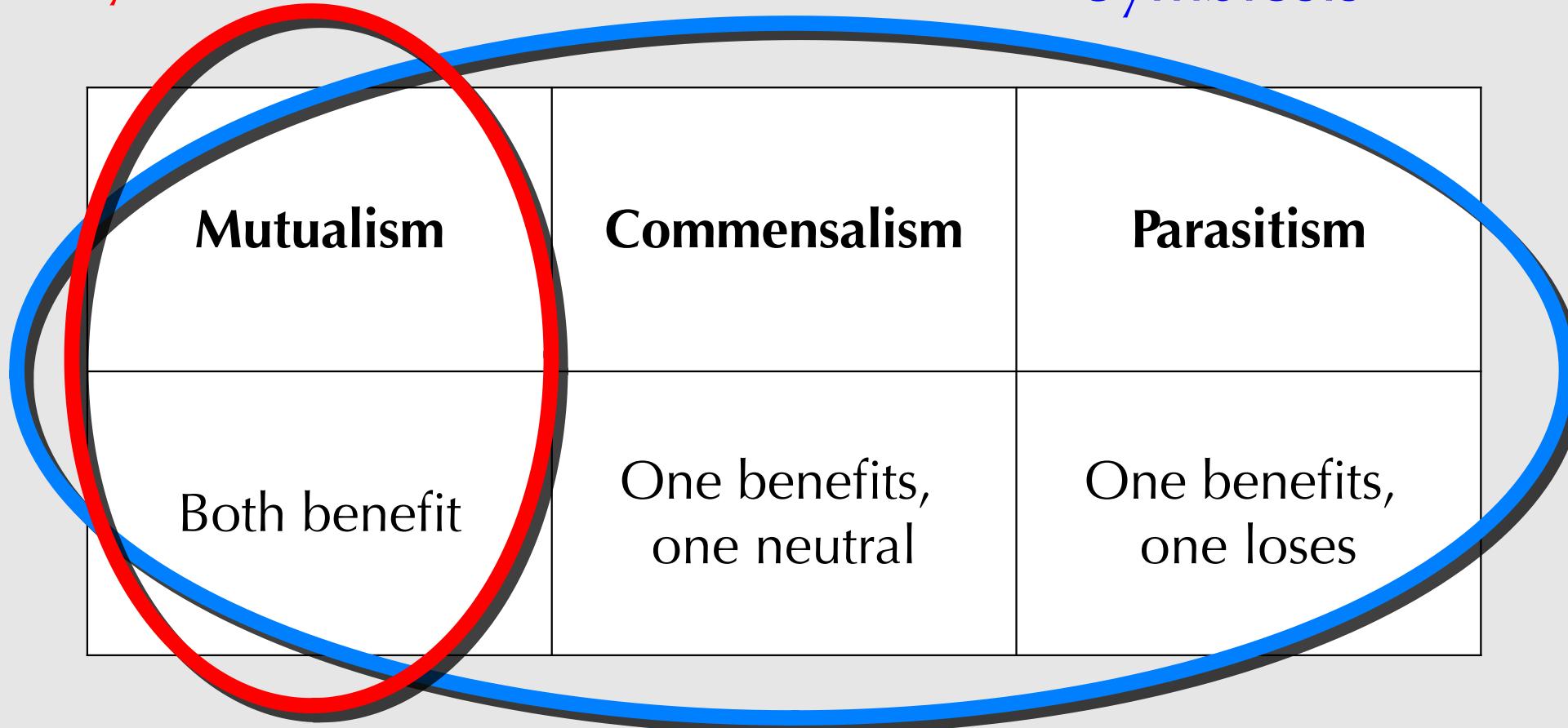
Commensalism

Parasitism

Both benefit

One benefits,
one neutral

One benefits,
one loses



Mutualism	Commensalism	Parasitism
Both benefit	One benefits, one neutral	One benefits, one loses

+

0

-

Benefit to less-helped host

Mutualism	Commensalism	Parasitism
Both benefit	One benefits, one neutral	One benefits, one loses

+

0

-

Benefit to less-helped host

+

0

-

Benefit to less-helped host

Duration of interaction for

shorter-lived species

Brief

Life-long

+

0

-

Benefit to less-helped host



Duration of interaction for

shorter-lived species

Brief

Life-long

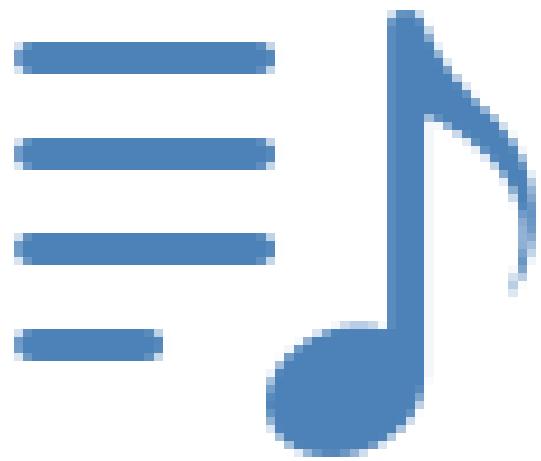
+

0

-

Benefit to less-helped host

remora-shark



Duration of interaction for

shorter-lived species

Brief

Life-long

+

0

-

Benefit to less-helped host

remora-shark

wasp-aphid

Duration of interaction for
shorter-lived species

Brief

Life-long

+

0

-

Benefit to less-helped host

remora-shark

wasp-aphid

predation



Martin Purvis, <http://lepidoptera.butterflyhouse.com.au/lyca/evagor.html>



Merlin Crossley, <http://lepidoptera.butterflyhouse.com.au/lyca/evagor.html>

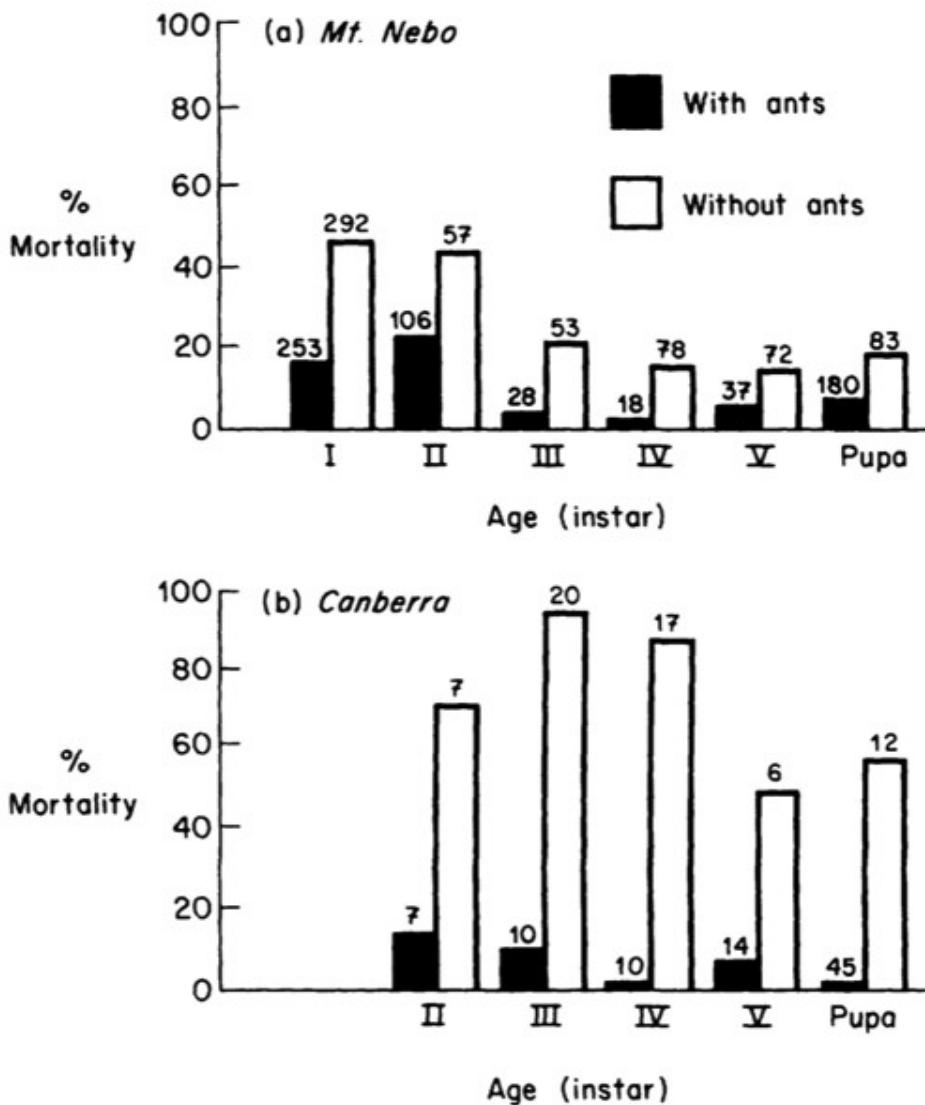


Fig. 1a, b. Age-specific mortality due to predation of larvae and pupae of *Jalmenus evagoras* with and without ants in two field sites: Mt Nebo, Queensland and Canberra, ACT. Sample sizes are given above each bar

- Ant attendance reduces predation on caterpillars/pupae

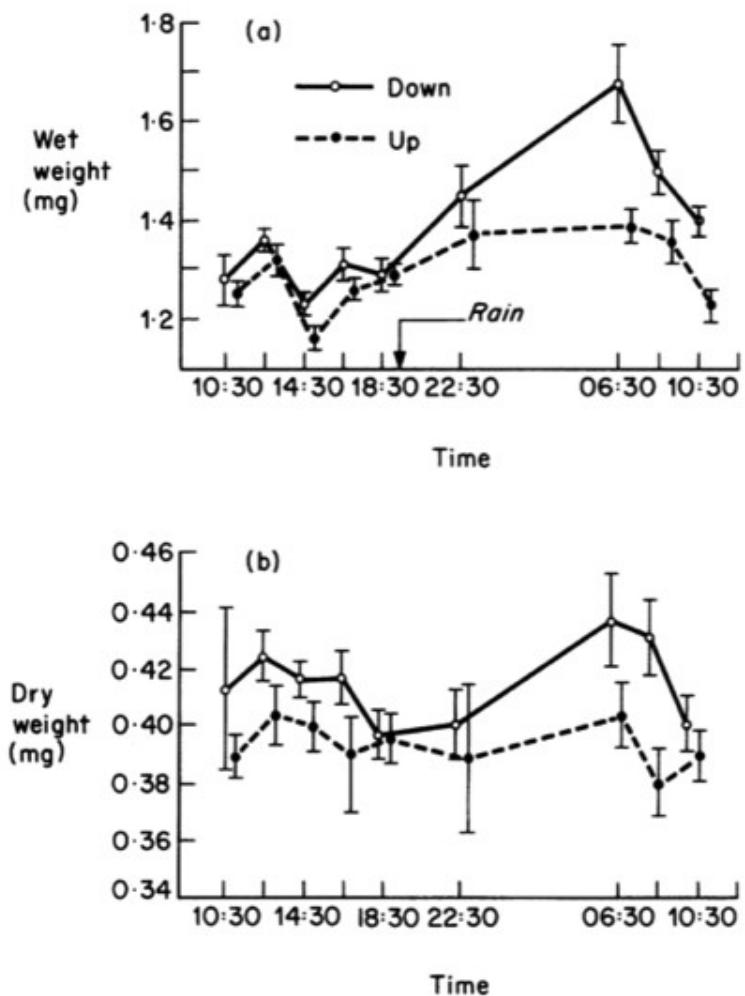


Fig. 3a, b. Differences in (a) wet weights and (b) dry weights of ants foraging on a tree containing 62 juveniles of *Jalmenus evagoras* over a 24 h period. "Up" weights are means for ants travelling up the tree and "down" weights are means for ants travelling back down again. Bars represent standard errors; sample sizes are over 20 in all time zones, except 22:30, when they are both 7

- Ant attendance reduces predation on caterpillars/pupae
- Ants heavier after leaving the caterpillars/pupae

Table 5. Pupal and adult weight and size of *J. evagoras* reared with and without attendant ants. The effects of sex have been removed from the ANOVA

	With ants			Without ants			$F_{1,136} = 9.32***$
	Mean	SE	n	Mean	SE	n	
Pupal weight (mg)^a							
males	123.94	4.64	40	132.60	5.78	37	
females	133.05	4.31	40	164.87	10.93	22	
Adult weight (mg)^b							
males	35.88	2.92	12	48.95	2.77	35	
females	59.84	4.56	16	80.69	7.43	22	
Forewing length (mm)	18.91	0.25	79	19.48	0.24	59	
Body length (mm)	14.44	0.16	79	15.19	0.18	59	
Silk produced to attach pupa	2.40	0.13	77	2.12	0.17	59	
							$F_{1,133} = 1.57$

* $P < 0.07$; *** $P < 0.005$

^a Interaction with sex; $F_{1,135} = 3.64$, $P < 0.07$

^b Interaction with sex; $F_{1,81} = 0.55$, ns

- Ant attendance reduces predation on caterpillars/pupae
- Ants heavier after leaving the caterpillars/pupae
- Adults reared with ants smaller than ones reared without ants

Duration of interaction for
shorter-lived species

Brief

Life-long

+

0

-

Benefit to less-helped host

ant-butterfly
(x-axis butterfly)

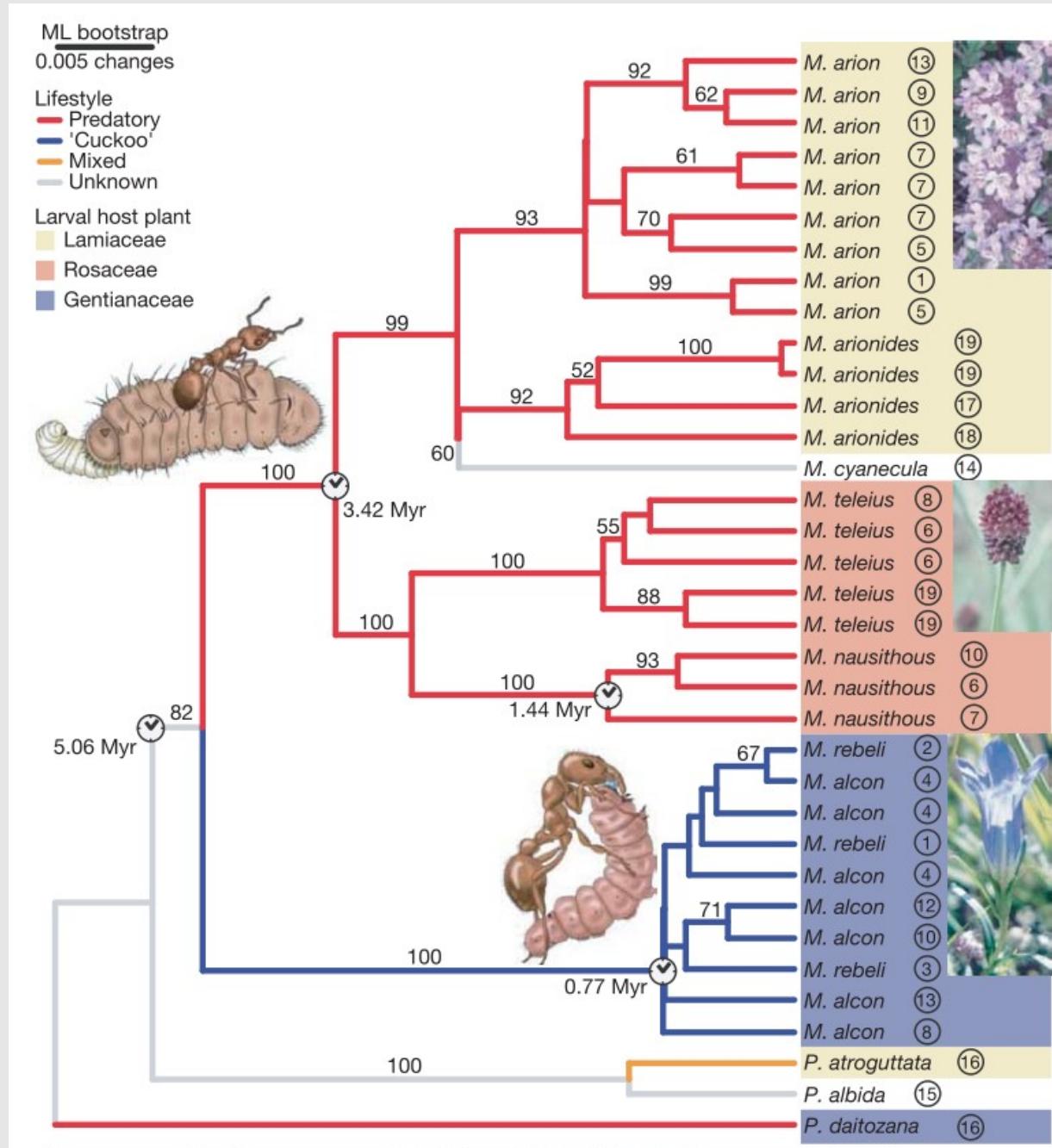
remora-shark

wasp-aphid

predation







Duration of interaction for
shorter-lived species

Life-long

Brief

+

0

-

Benefit to less-helped host

ant-butterfly
(x-axis butterfly)

butterfly-ant
(x-axis ant)

remora-shark

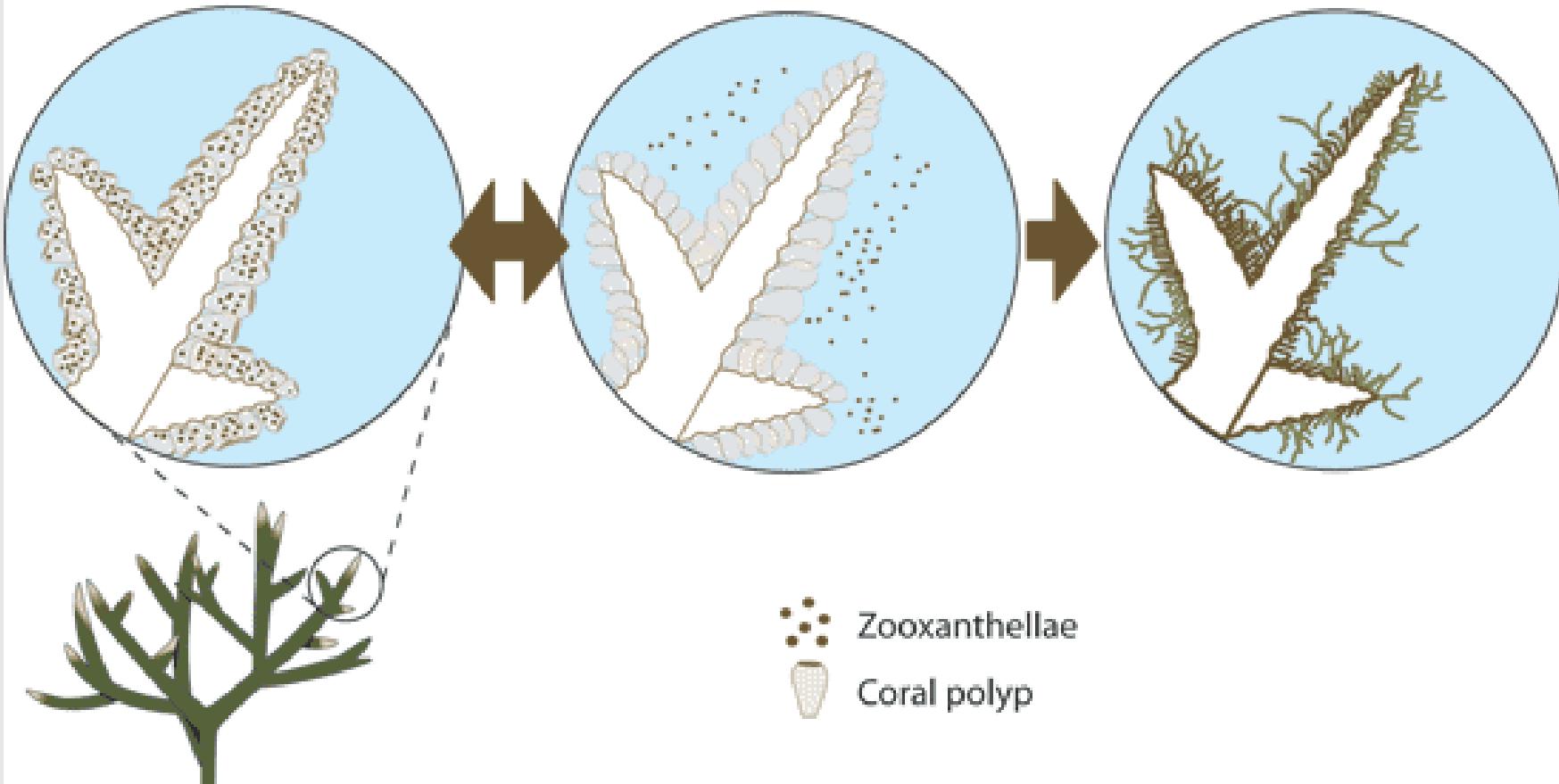
wasp-aphid

predation

Healthy coral -
zooxanthellae
in coral tissue

Bleached coral -
zooxanthellae expelled
from tissue

Dead coral -
skeleton covered in
filamentous algae



http://www.gbrmpa.gov.au/corp_site/key_issues/climate_change/climate_change_and_the_great_barrier_reef/what_is_coral_bleaching

Duration of interaction for shorter-lived species

Life-long

coral-zooanthellae

ant-butterfly
(x-axis butterfly)

butterfly-ant
(x-axis ant)

wasp-aphid

remora-shark

predation

Brief

+

0

-

Benefit to less-helped host

Gophers

Lice

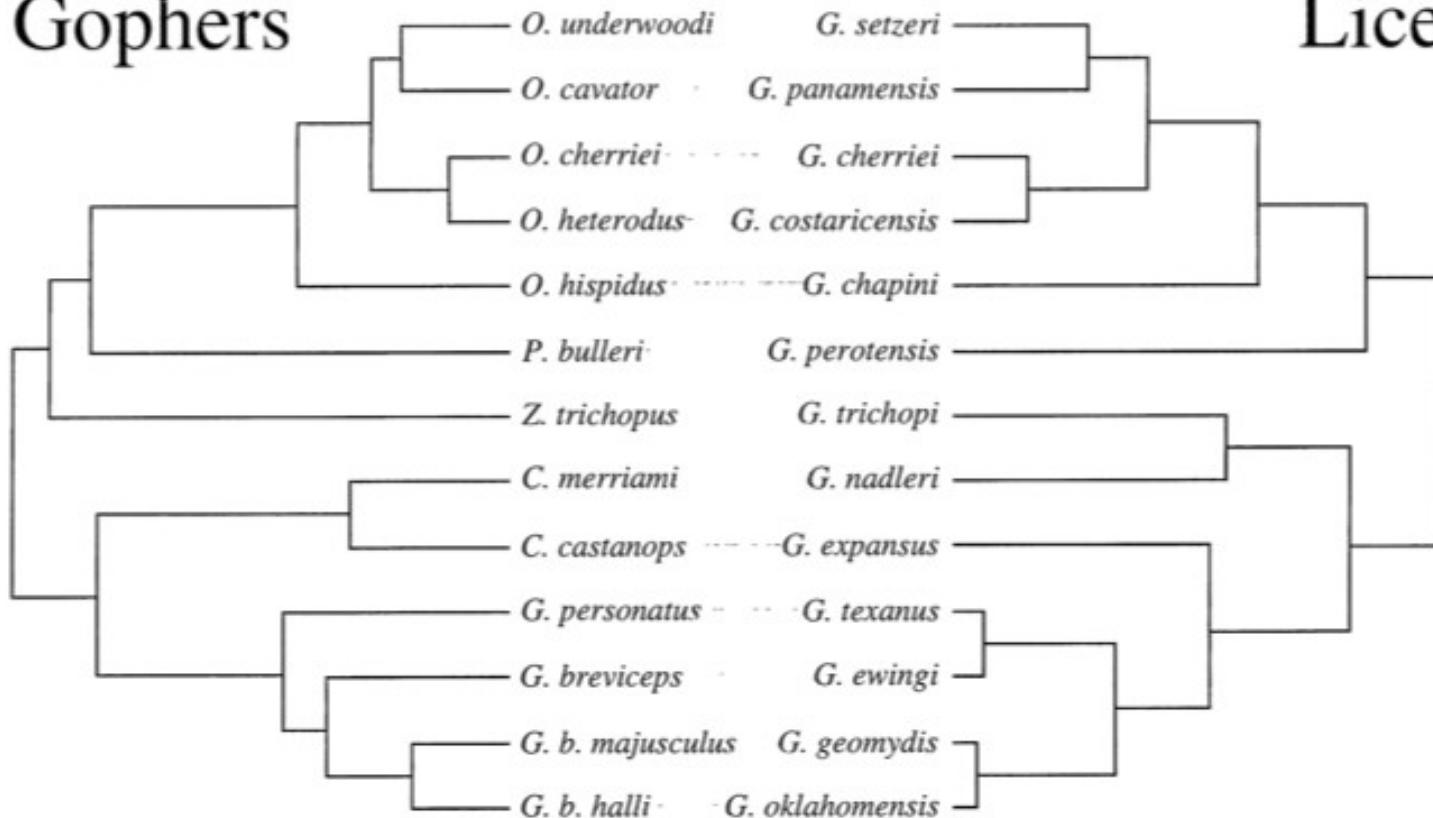


FIG. 4. The phylogenies estimated for the large dataset for the gopher and louse sequences. Hosts are joined to the parasites they harbor by the grey lines. *Geomys bursarius* is abbreviated as "G. b." Maximum likelihood was used, with the F84 + Γ model of DNA substitution and the molecular clock assumed. This model provides the best statistical fit to the data without superfluous parameters. The log likelihoods and parameter estimates (κ , transition/transversion rate ratio; α , gamma shape parameter) for the gopher (G) and louse (L) trees are: $\log L_G = -1923.01$, $\log L_L = -2352.55$, $\kappa_G = 4.63$, $\kappa_L = 7.17$, $\alpha_G = 0.15$, $\alpha_L = 0.18$.

