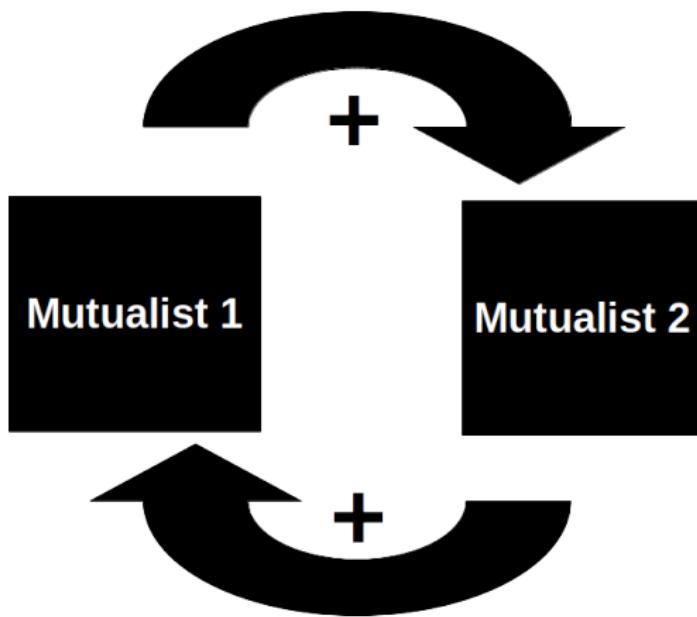


Figs and their associated wasps

Mutualistic species interactions

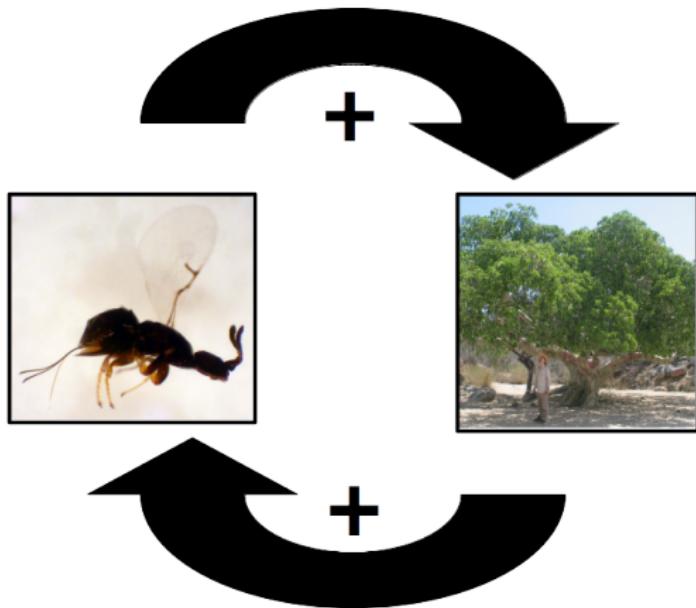


Mutualism

- ▶ Reciprocally beneficial interactions between species
- ▶ Critical component of evolutionary and ecological processes¹

¹Bronstein, J. L. (2001). The costs of mutualism. American Zoologist, 41:825-839. [\[Link\]](#)

Mutualism between figs and pollinating wasps

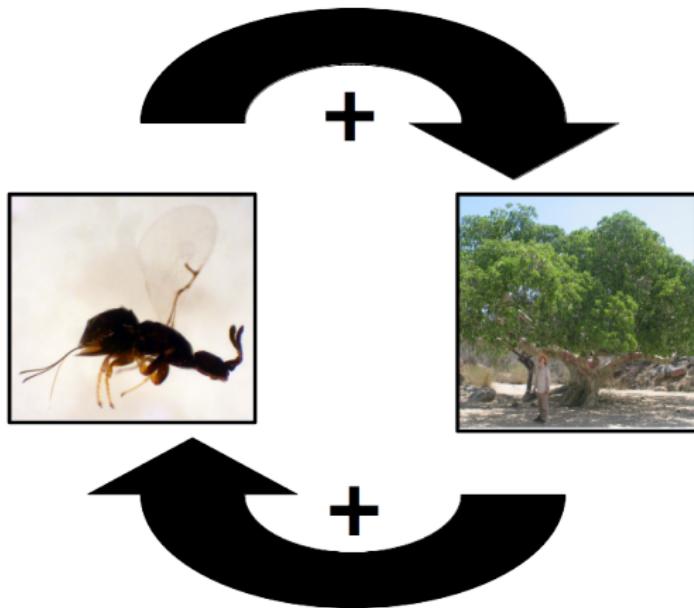


Plant benefits

- ▶ Pollinator production¹
- ▶ Seed production

¹Janzen, D. H. (1979). How to be a fig. Annual review of ecology and systematics, 10:13-51. [\[Link\]](#)

Mutualism between figs and pollinating wasps



Plant benefits

- ▶ Pollinator production¹
- ▶ Seed production

Pollinator benefits

- ▶ Offspring production

¹Janzen, D. H. (1979). How to be a fig. Annual review of ecology and systematics, 10:13-51. [\[Link\]](#)

Mutualism between figs and pollinating wasps

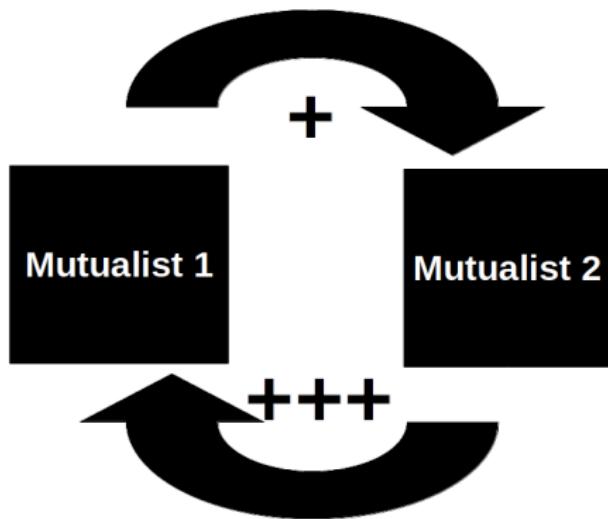


Fig syconia



Fig wasp eggs

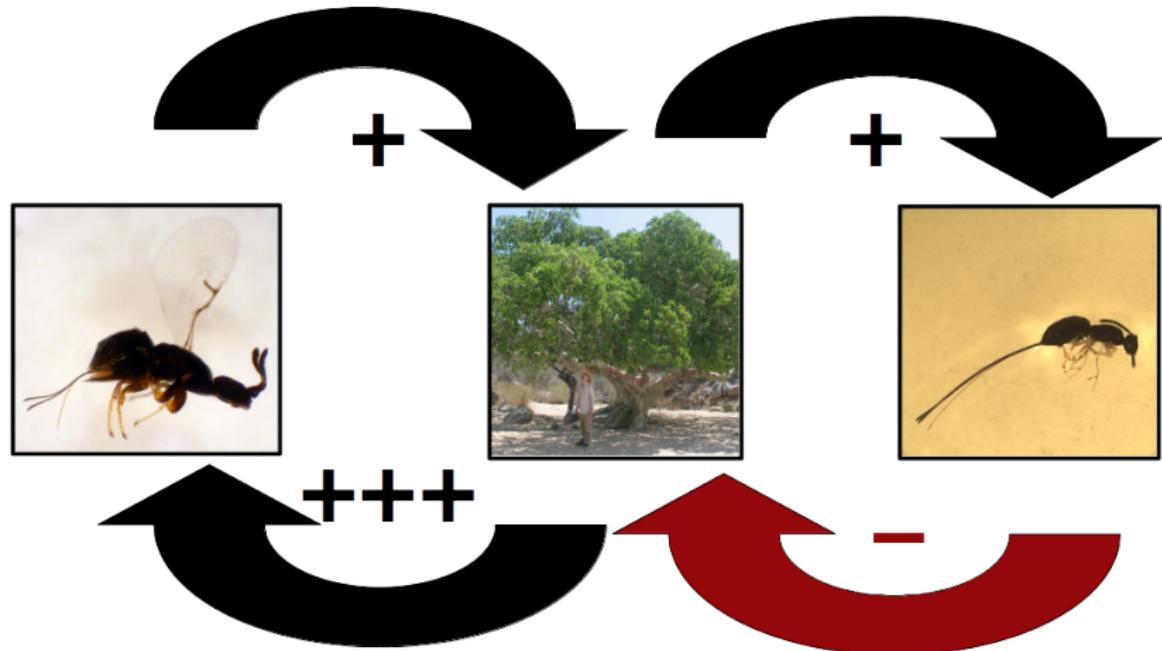
Mutualisms can be asymmetrical



- ▶ One mutualist might obtain more benefit than the other
- ▶ Need to consider costs and benefits associated with interaction¹

¹Bronstein, J. L. (2001). The costs of mutualism. American Zoologist, 41:825-839. [\[Link\]](#)

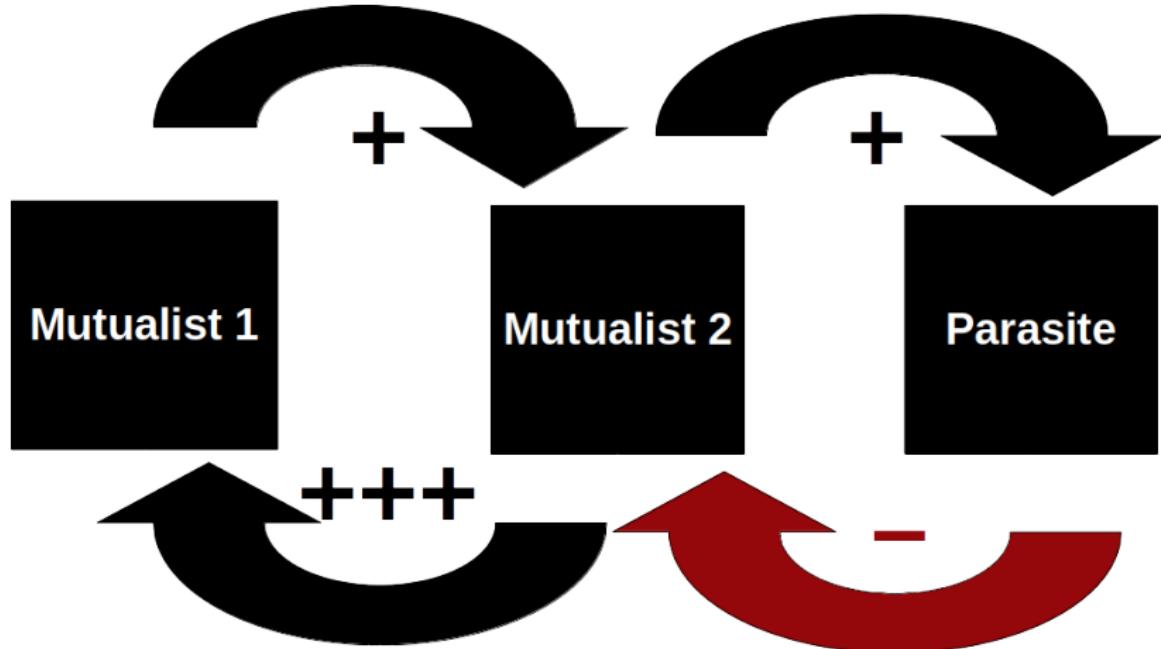
Mutualisms can be parasitised



¹Janzen, D. H. (1979). How to be a fig. Annual review of ecology and systematics, 10:13-51. [\[Link\]](#)

²Borges, R. M. (2015). How to be a fig wasp parasite on the fig–fig wasp mutualism. Current Opinion in Insect Science, 8:34-40. [\[Link\]](#)

Mutualisms can be parasitised



¹Janzen, D. H. (1979). How to be a fig. Annual review of ecology and systematics, 10:13-51. [\[Link\]](#)

²Borges, R. M. (2015). How to be a fig wasp parasite on the fig–fig wasp mutualism. Current Opinion in Insect Science, 8:34-40. [\[Link\]](#)

Mutualism-parasitism is more of a gradient

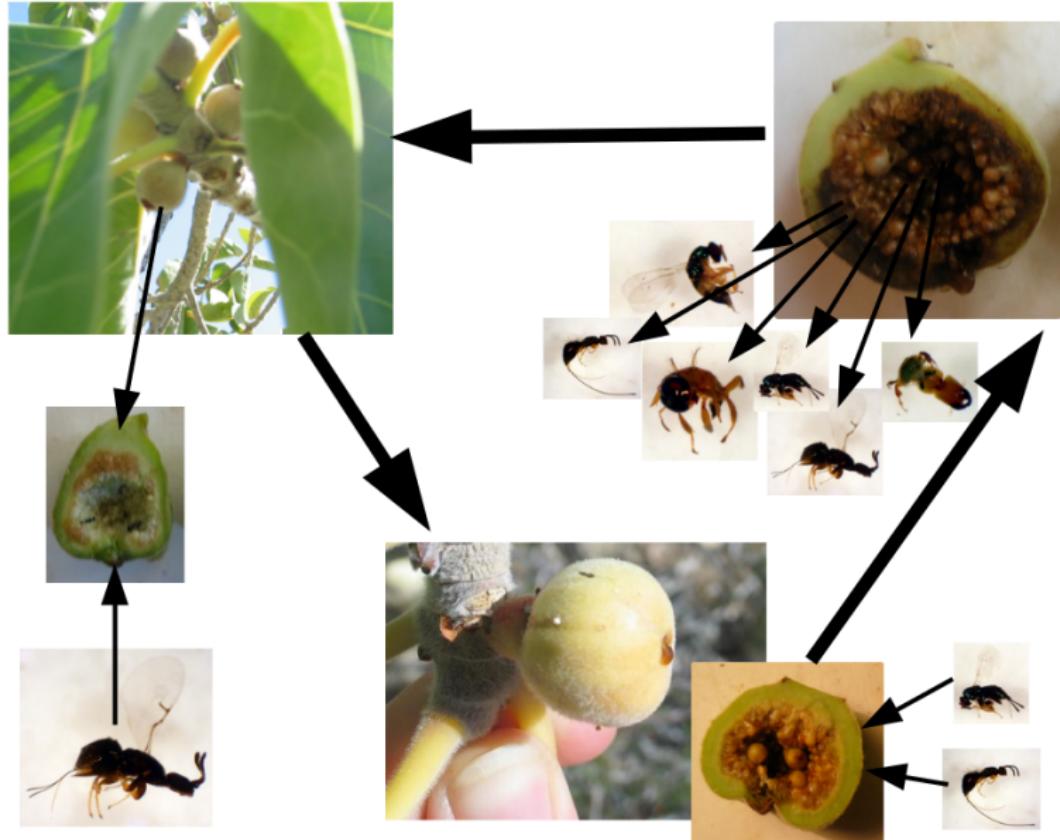


- ▶ The plant *Lithophragma parvifloru* is pollinated by the moth *Greya politella* and other insect species
- ▶ The *Greya* moth also eats some plant seeds
- ▶ Where the *Greya* moth is the only pollinator, the association is mutualistic
- ▶ Where other pollinators are available, the association is parasitic¹

¹Thompson, J. N., & Cunningham, B. M. (2002). Geographic structure and dynamics of coevolutionary selection. *Nature*, 417:735-738. [\[Link\]](#)

²Image: [Public Domain](#)

Figs and fig wasps



Figs and fig wasps

- ▶ 750+ Species of figs
- ▶ 70-90 million year old mutualism
- ▶ Model system for coevolution

¹Duthie, A. B., Abbott, K. C., & Nason, J. D. (2015). Trade-offs and coexistence in fluctuating environments: evidence for a key dispersal-fecundity trade-off in five nonpollinating fig wasps. *The American Naturalist*, 186:151-158. [\[Link\]](#)

Figs and fig wasps

- ▶ 750+ Species of figs
- ▶ 70-90 million year old mutualism
- ▶ Model system for coevolution
- ▶ Interactions among many species¹
- ▶ Figs a keystone food source
- ▶ Model system for ecology

¹Duthie, A. B., Abbott, K. C., & Nason, J. D. (2015). Trade-offs and coexistence in fluctuating environments: evidence for a key dispersal-fecundity trade-off in five nonpollinating fig wasps. *The American Naturalist*, 186:151-158. [\[Link\]](#)