

Host range of myrmecophiles: how many ant hosts can a myrmecophile have?

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Introduction

Myrmecophiles are organisms that have symbiotic associations with ants. These associations can be facultative or obligate, range from mutualistic to parasitic relationships, and are widespread.

Host range, the number of host species an organism uses, is important in understanding ecology of symbiotic relationships. Knowing how degree of reliance and type relationship affects host range can reveal the evolutionary pressures on host specificity. Host range of myrmecophiles has not been well explored in the literature, except with a few particular taxa, such as endangered Lycaenid butterflies or Syrphid flies

Objectives

1. Does degree of reliance effect host range?
2. Does type relationship effect host range?
3. Do the patterns found overall stay true to specific taxonomic groups?



Figure 1. Example of Myrmecophiles. From left to right, aphids, myrmecophilic cricket, staphylinid beetle, and syrphid fly larva all with their host ants. Photos by Alex Wild.

Methods

We searched the literature for information on macro-invertebrate myrmecophiles. This yielded in 304 references. We excluded ant-ant associations.

Databased information: taxonomic details, sample locality, ant host(s), degree of reliance, and relationship type.

Degree of reliance: facultative or obligate.

Relationships: mutualistic (defined as having an association that benefited both myrmecophile and host), commensal (defined as associations where there were no benefits or detriments to hosts), parasitic (defined for this study as associations where food and resources are stolen from host) and predacious (defined as myrmecophiles that fed on ants or their brood).

Analysis: Analysis of variance to determine if host species richness differed between myrmecophiles that were facultative or obligate, and between the four relationships. ArcGIS was used to map out each locality. Analysis was done using the statistical program R (R Core Team 2014).

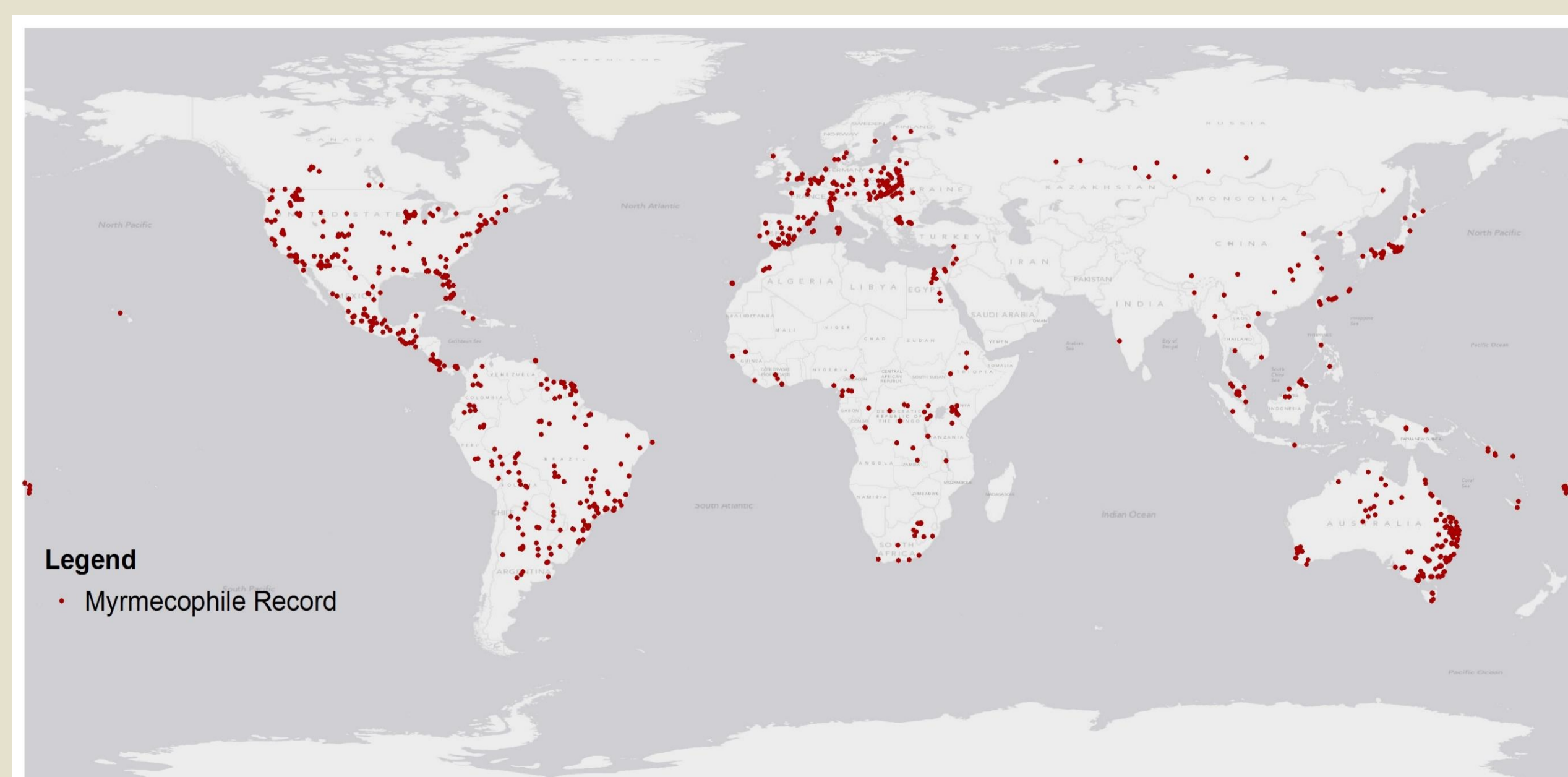


Figure 2. World map with all reported myrmecophiles in study. Literature synthesis found a total of 304 references, with 3686 records of 1404 species from 22 different orders.

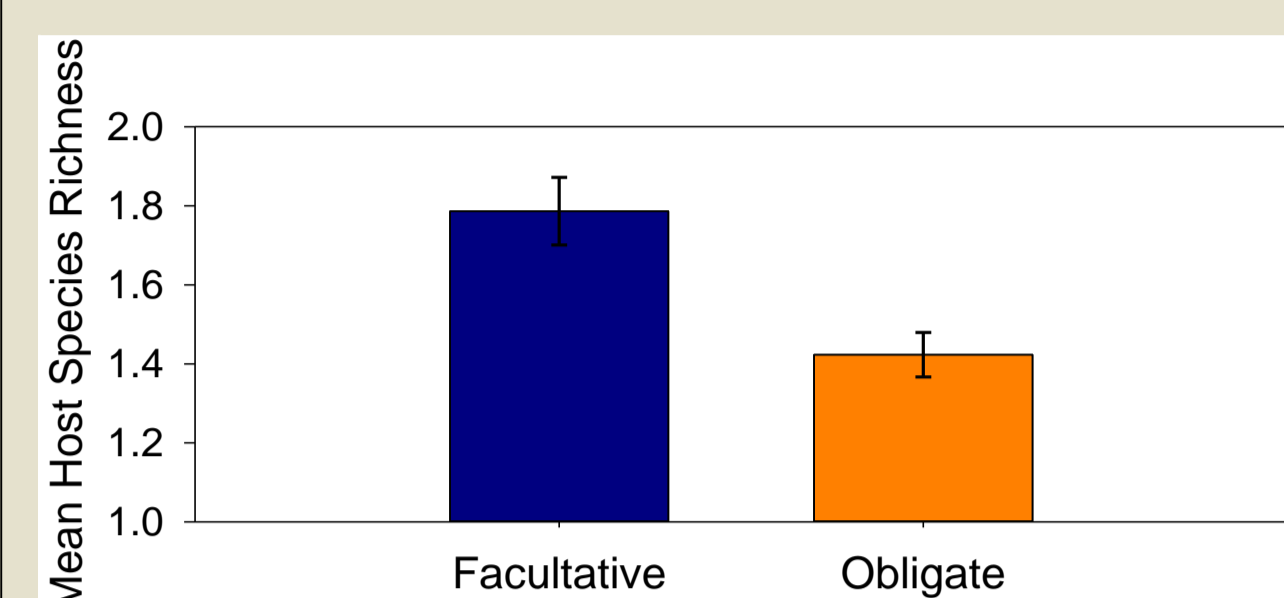


Figure 3. Host species richness of facultative and obligate myrmecophiles.

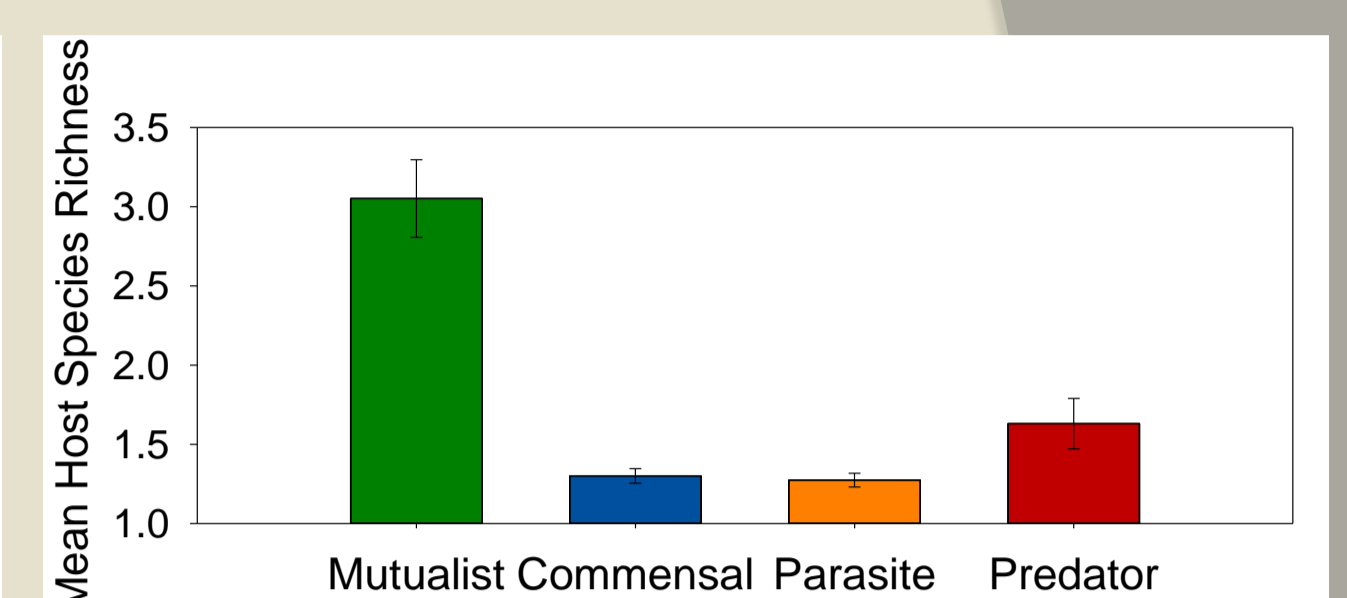


Figure 4. Mean host species richness for myrmecophile relationships.

Results

We recorded 1404 myrmecophile species from 22 orders. Average host species richness was 1.6, with a minimum of 1 and maximum of 20 hosts.

Facultative myrmecophiles had broader host range than obligates ($P < 0.001$) (Figure 3). Mutualists had significantly broader host range than commensals, parasites or predators ($P = 0.016$, Figure 4).

Within Coleoptera, facultative and obligate did not have different host ranges ($P = 0.899$) (Figure 5). Commensal and parasitic Coleoptera did not have different host ranges ($P = 0.572$). Predacious Coleoptera had broader host range than commensals ($P = 0.008$) and parasites ($P = 0.030$) (Figure 5).

Within Hemiptera, facultative had broader host range than obligates ($P = 0.002$) (Figure 5). There was no difference between mutualists and predators ($P = 0.914$) (Figure 5).

Within Lepidoptera, facultatives had broader host range than obligates ($P = 0.005$) (Figure 5). Host range between relationship types was not significantly different ($P = 0.710$) (Figure 5).

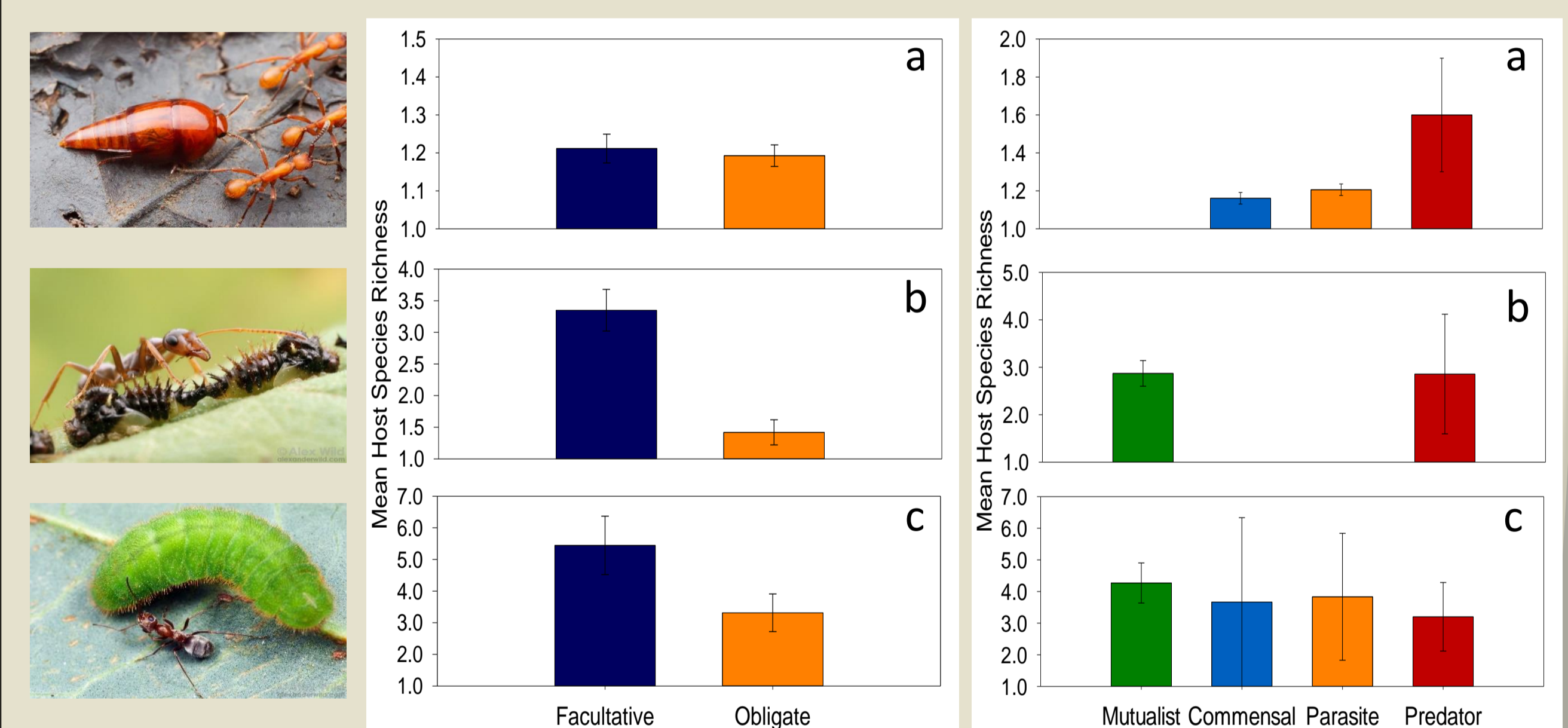


Figure 5. Mean host species richness for myrmecophilic associations from selected taxa. Left graphs show comparisons for degree of reliance; right graphs show comparison for relationship type. a: comparison for host ranges in Coleoptera; b: comparison for host ranges in Hemiptera; c: comparison for host ranges in Lepidoptera.

Conclusions

- Reported host range in myrmecophiles is low (average 1.6), indicating that host specificity is important for myrmecophilic relationships.
- Facultative myrmecophiles have broader host ranges than obligate species.
- Mutualistic myrmecophiles have broader host ranges than other relationships.
- Host range patterns differ between taxa; indicating that more in-depth study for each taxa may be important.
- Future research will look at climatic influences on host range, relationships, and distribution of myrmecophiles.

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