

Additional file 2 – Supplemental figures and tables

Multiple phenotypic traits as triggers of host attacks towards ant symbionts: body size, morphological gestalt, and chemical mimicry accuracy

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Figure S1. Ant behaviors towards ecitophiles and ecitophile dry weight. (a-e) Violin jitter plots showing different ant behaviors towards specimens of different ecitophile genera. The ant behavior *seizing* was uncommon and is not shown here. Note the differing scales on y-axes. (f) Dry weight of ecitophiles in milligram. Species are lumped here within their genera for better data visualization. Raw data contain information for each ecitophile individual (Additional file 1).

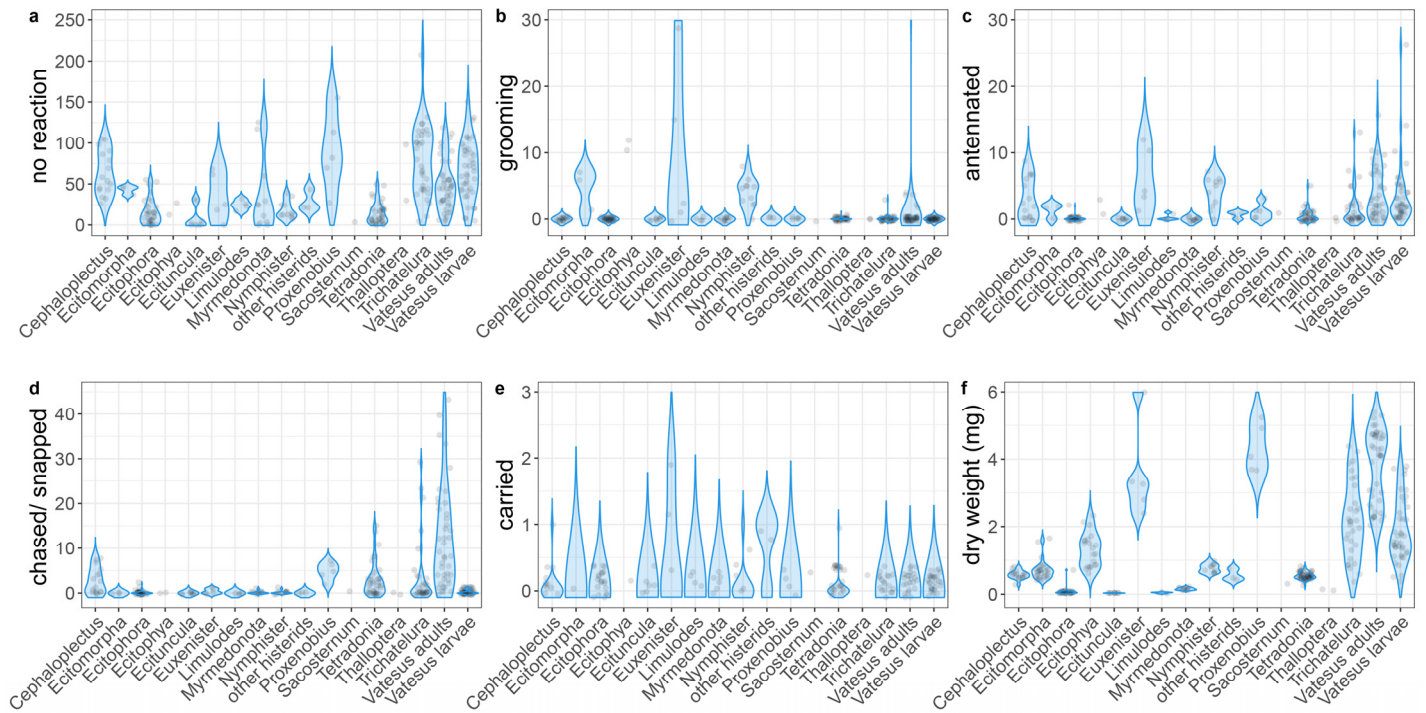


Figure S2. CHC profiles of army ant workers. NMDS plots visualizing the compositional differences of army ant CHC profiles in (a) 2D-space and (b, c) for a subset of data in 3D-space. Data have been rotated in 3D-space for better visualization of compositional species differences. 'Stress' is a quality measure of NMDS.

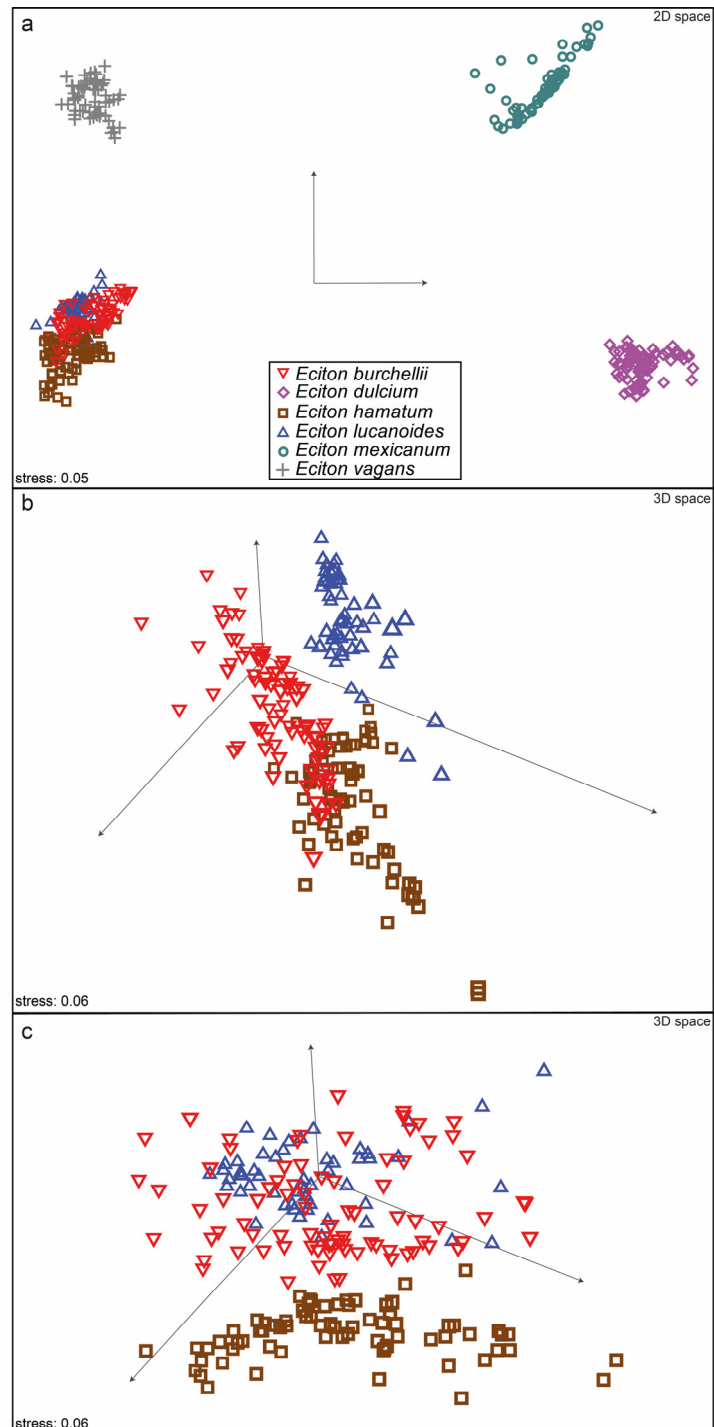
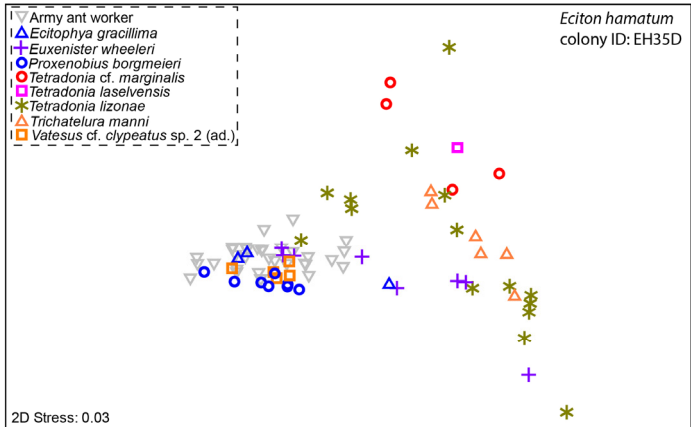
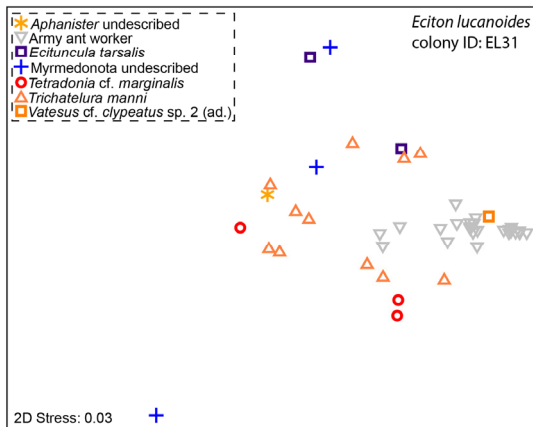
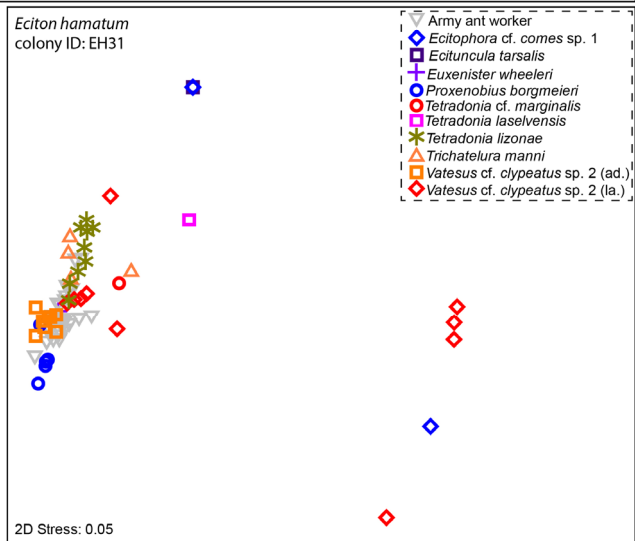
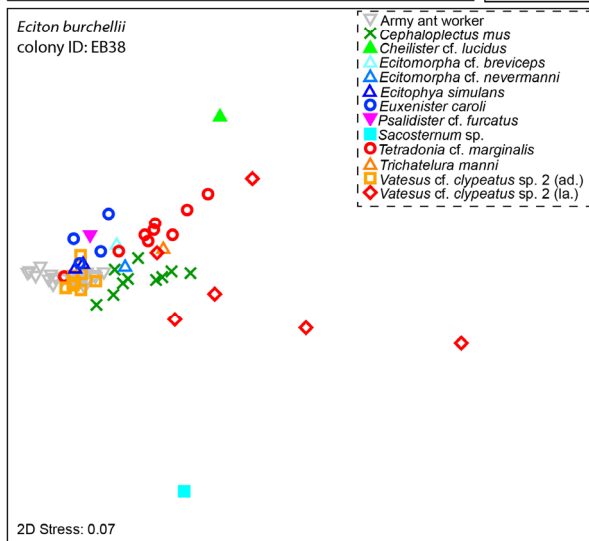
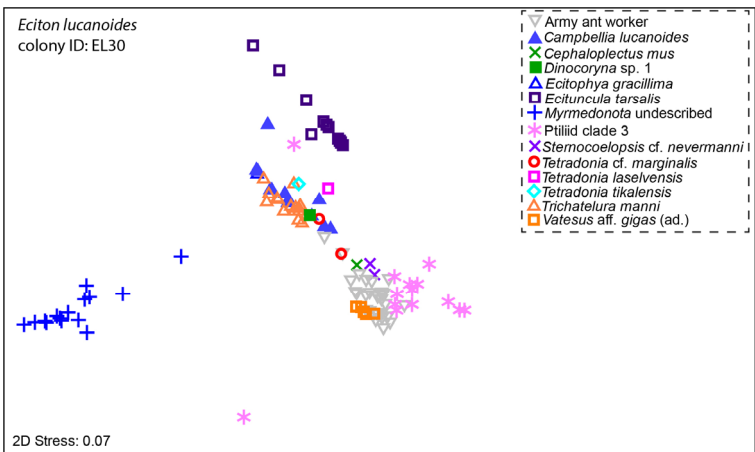
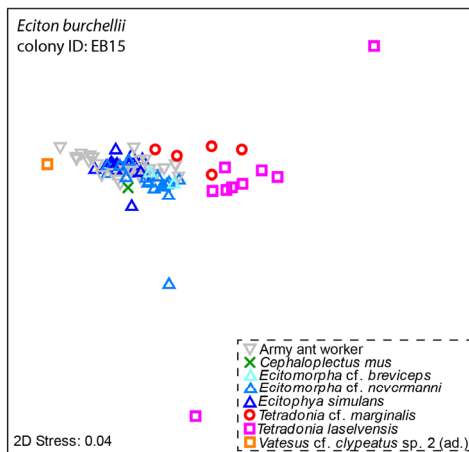


Figure S3. CHC host resemblance of ecitophiles. NMDS plots based on Bray-Curtis similarities visualize CHC profile similarities between host ants and ecitophiles for 14 *Eciton* colonies. Host species and colony IDs are given for each subplot. Asterisks indicate that only NMDS subsets are shown to optimize visualization. Excluded specimens stretched the 2-D space in a way that workers and some ecitophiles were densely clumped. The following species were excluded in NMDS plots: colony EB38D: one *Vatesus* cf. *chypeatus* sp. 2 larva; colony ED36: four *Tetradonia laticeps* specimens and four *Ecitophora pilusola* specimens; colony ED37: eight *T. laticeps* specimens; colony ED38: four *T. laticeps* specimens. 'Stress' is a quality measure of NMDS. Note that we were not able to determine if the two colonies denoted as 'EB38' and 'EB38D' were different *E. burchellii* colonies, as they were collected three weeks apart from each other at the same collection spot (within a radius of < 200m). We treated them as different colonies in the present work. For a likelihood assessment of re-collection events of nomadic army ant colonies at the study site see previous publications [1,2].

References

1. von Beeren C, Maruyama M, Kronauer DJC. Cryptic diversity, high host specificity and reproductive synchronization in army ant-associated *Vatesus* beetles. *Mol Ecol*. 2016;25:990–1005.
2. Hoenle PO, Blüthgen N, Brückner A, Kronauer DJ, Fiala B, Donoso DA, et al. Species-level predation network uncovers high prey specificity in a Neotropical army ant community. *Molecular Ecology*. 2019;28:2423–40.



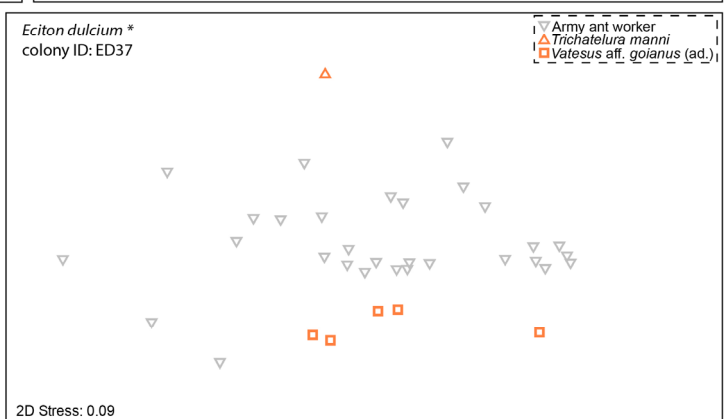
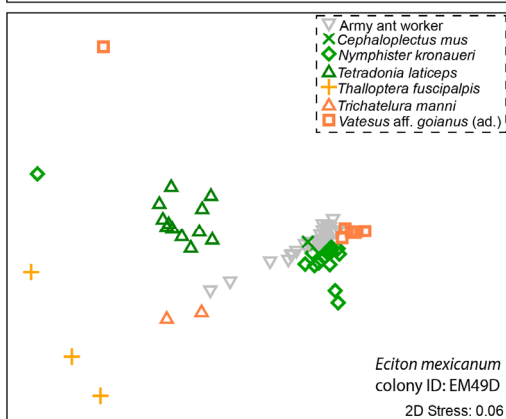
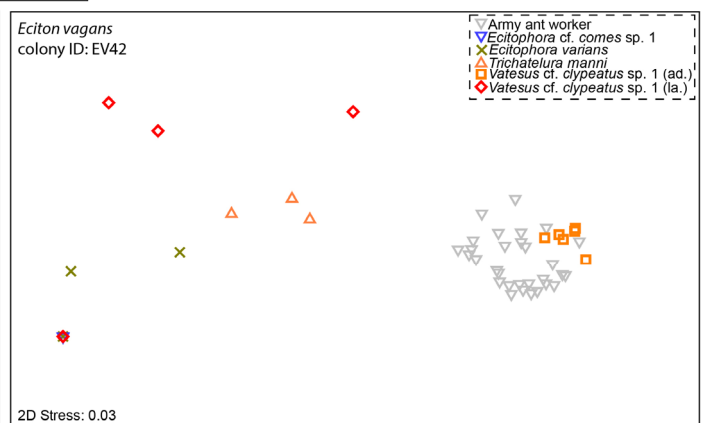
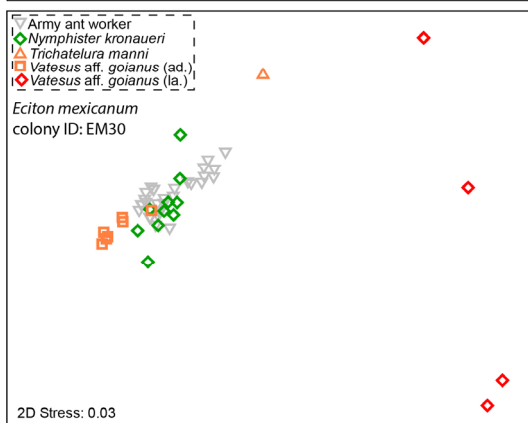
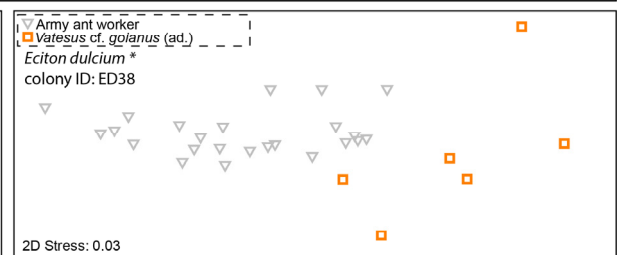
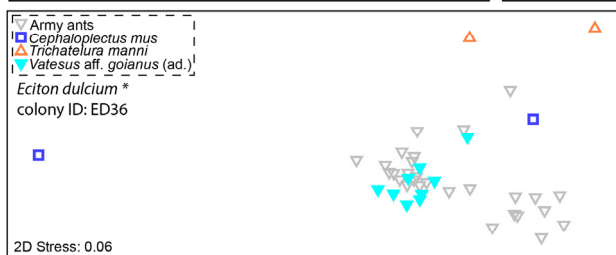
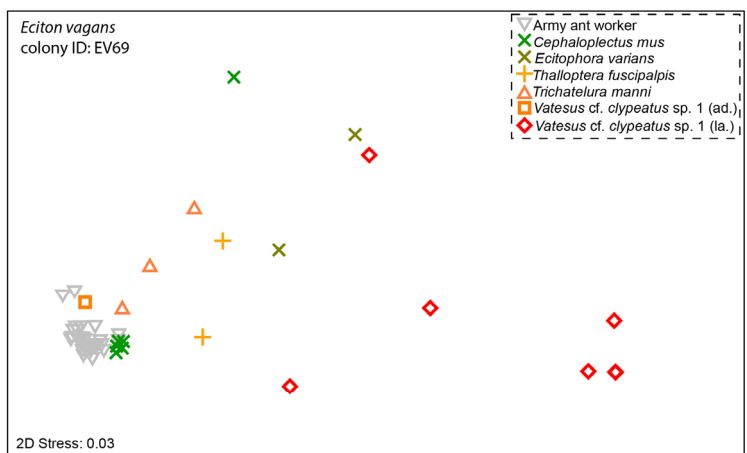
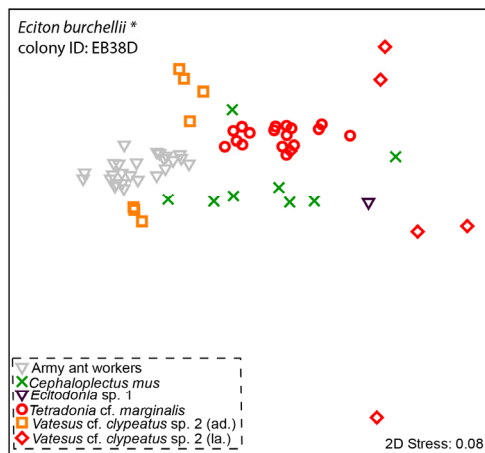


Figure S4. Intraspecific CHC profile differences in the rove beetle *Vatesus* cf. *clypeatus* sp. 2. Top: 2D NMDS plots based on Bray-Curtis similarities visualize CHC profile similarities between adults of the rove beetle species *Vatesus* cf. *clypeatus* sp. 2. For better visualization, this graph shows only two of its host ant species, i.e. *E. burchellii* and *E. hamatum*. Bottom: 3D NMDS plot including the third host species *E. lucanoides*. 'Stress' is a quality measure of NMDS.

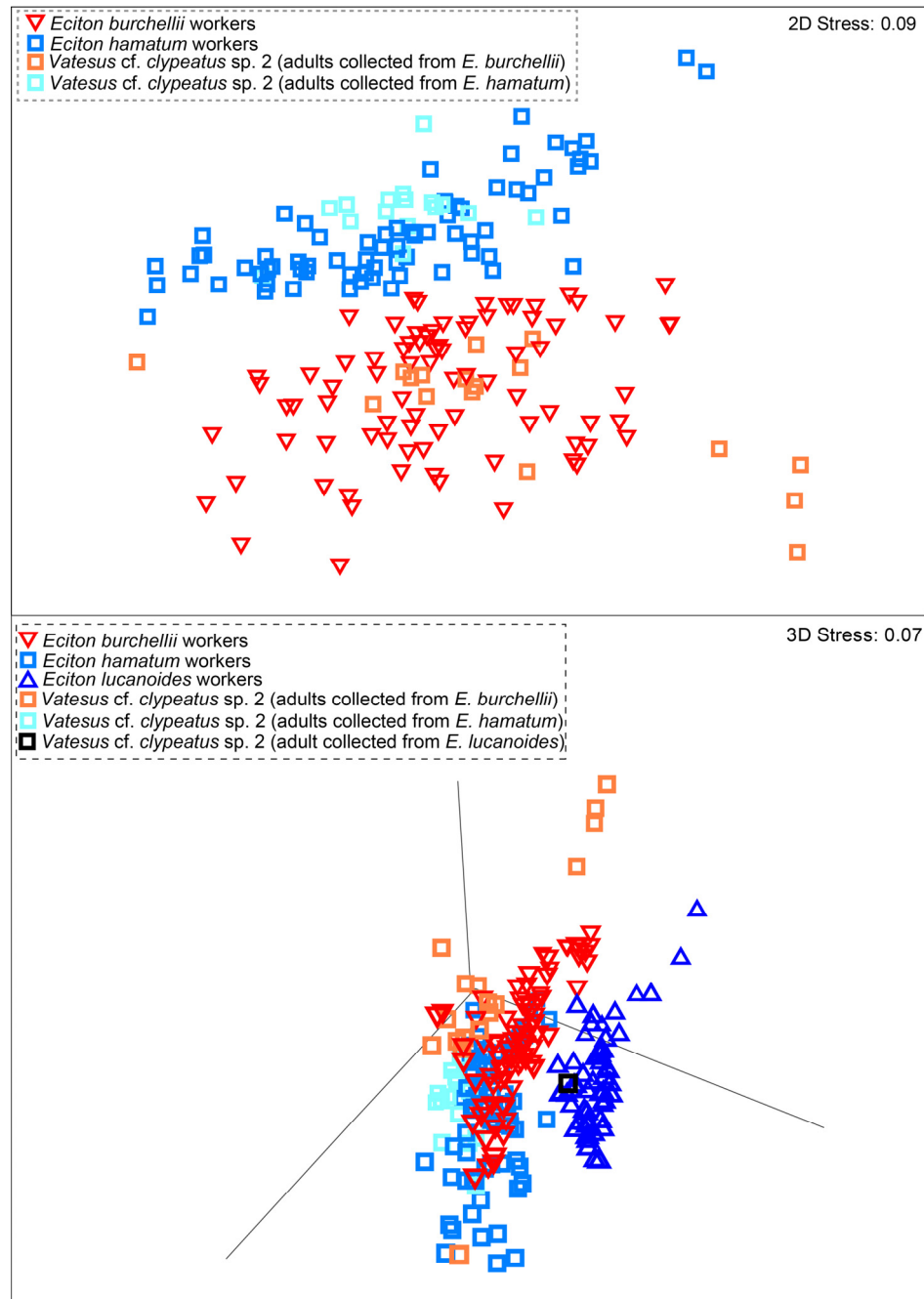


Figure S5. Ant aggression towards different types of ecitophile gestalt in relation to CHC host similarity. The aggression index summarizes the proportion of aggressive ant responses towards ecitophiles relative to the total number of contacts. CHC host similarity is given as Bray-Curtis similarity of an ecitophile to the centroid of its host colony. Size of data points correspond to dry weight as given in the figure legend. Note that the scale in CHC host similarity can be different in subplots.

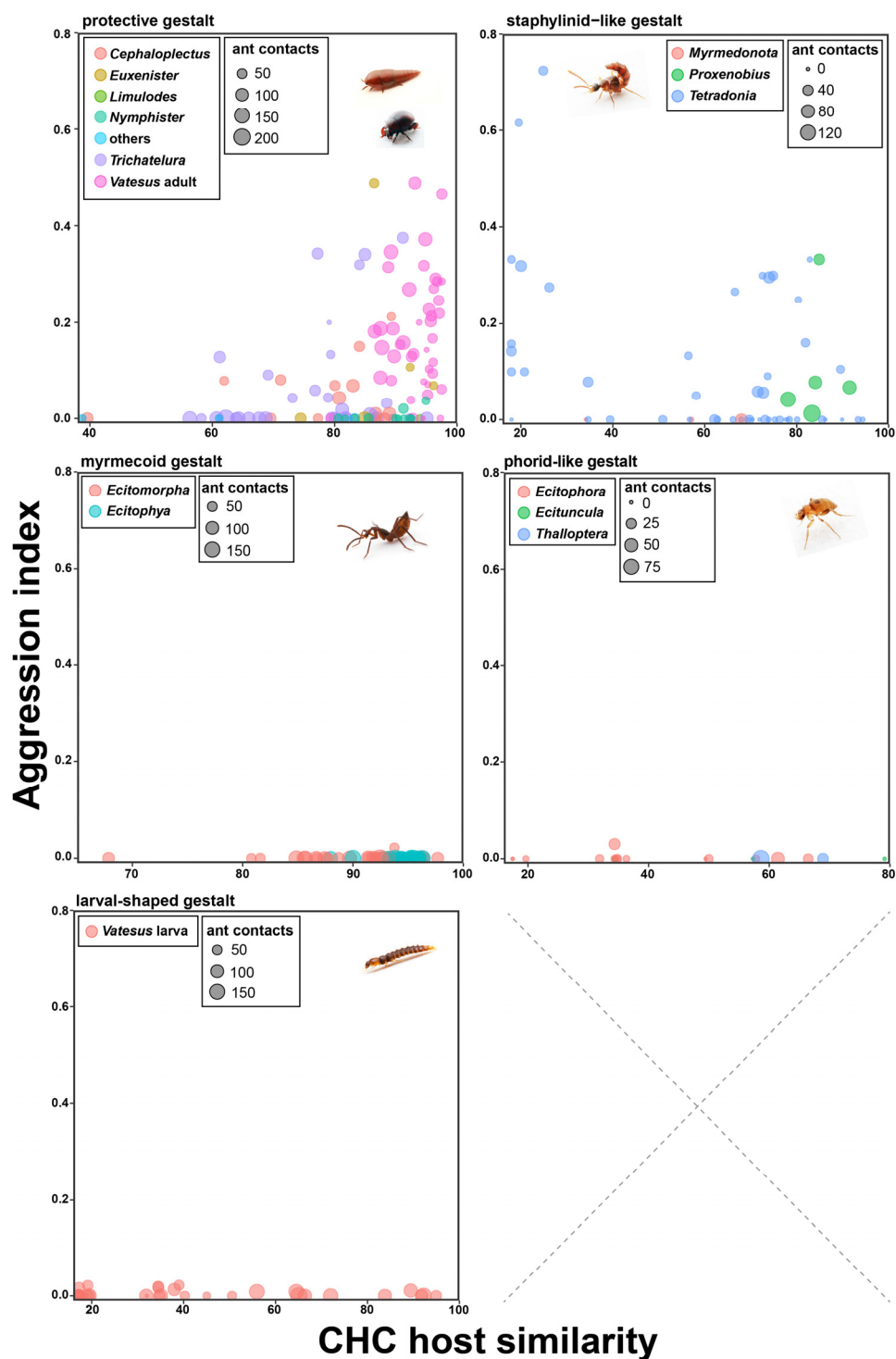


Table S1. Univariate data summary of behavioral tests. Given are the number of tested specimens per ecitophile species (sample size) and the means $\pm$ standard deviations of ant behaviors towards ecitophiles.

Order	Family	Ecitophile species	Sample size	no reaction	grooming	antennating	chasing/snapping	stinging	carrying	seizing
Coleoptera	Histeridae	<i>Aphanister</i> sp. 1	1	21	0	0	0	0	0	0
		<i>Cheilister</i> cf. <i>lucidulus</i>	1	21	0	1	0	0	1	0
		<i>Euxenister caroli</i>	4	37 $\pm$ 33	12 $\pm$ 13	7 $\pm$ 4	0 $\pm$ 1	2 $\pm$ 3	1 $\pm$ 1	4 $\pm$ 7
		<i>Euxenister wheeleri</i>	1	25	1	1	1	0	0	1
		<i>Nymphister kronaueri</i>	11	18 $\pm$ 11	4 $\pm$ 2	4 $\pm$ 2	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Psolidister</i> cf. <i>furcatus</i>	1	44	0	1	0	0	1	0
	Hydrophilidae	<i>Sacosternum</i> aff. <i>lebbinorum</i>	1	3	0	1	0	0	0	0
	Ptiliidae	<i>Cephaloplectus mus</i>	16	64 $\pm$ 27	0 $\pm$ 0	3 $\pm$ 3	3 $\pm$ 3	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Limulodes</i> sp. 2	2	25 $\pm$ 2	0 $\pm$ 0	1 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Limulodes</i> sp. 3	2	25 $\pm$ 11	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
	Staphylinidae	<i>Ecitomorpha</i> cf. <i>breviceps</i>	2	41 $\pm$ 6	4 $\pm$ 4	2 $\pm$ 0	0 $\pm$ 0	1 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0
		<i>Ecitomorpha</i> cf. <i>nevermanni</i>	1	47	7	0	0	0	0	0
		<i>Ecitophya simulans</i>	2	20 $\pm$ 11	11 $\pm$ 1	2 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Ecituncula tarsalis</i>	8	9 $\pm$ 14	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Myrmedonota</i> sp. 1	11	36 $\pm$ 46	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Proxenobius borgmeieri</i>	5	89 $\pm$ 48	0 $\pm$ 0	1 $\pm$ 1	5 $\pm$ 2	2 $\pm$ 3	0 $\pm$ 0	0 $\pm$ 0
		aff. <i>Tetradonia</i> sp. 1	1	20	0	0	5	0	1	0
		<i>Tetradonia</i> cf. <i>marginalis</i>	14	13 $\pm$ 13	0 $\pm$ 0	1 $\pm$ 1	1 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Tetradonia laselvensis</i>	1	48	0	0	3	0	0	0
		<i>Tetradonia laticeps</i>	12	17 $\pm$ 11	0 $\pm$ 0	0 $\pm$ 1	5 $\pm$ 5	0 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 1
		<i>Tetradonia lizonae</i>	9	10 $\pm$ 12	0 $\pm$ 0	1 $\pm$ 2	3 $\pm$ 4	1 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0
		Adult <i>Vatesus</i> aff. <i>goianus</i>	14	32 $\pm$ 16	0 $\pm$ 0	1 $\pm$ 1	9 $\pm$ 9	0 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0
		Larval <i>Vatesus</i> aff. <i>goianus</i>	7	72 $\pm$ 25	0 $\pm$ 0	2 $\pm$ 3	1 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		Adult <i>Vatesus</i> cf. <i>clypeatus</i> sp. 1	7	100 $\pm$ 14	0 $\pm$ 0	5 $\pm$ 3	16 $\pm$ 5	3 $\pm$ 2	0 $\pm$ 0	0 $\pm$ 0
		Larval <i>Vatesus</i> cf. <i>clypeatus</i> sp. 1	14	54 $\pm$ 26	0 $\pm$ 0	2 $\pm$ 2	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		Adult <i>Vatesus</i> cf. <i>clypeatus</i> sp. 2	20	41 $\pm$ 23	2 $\pm$ 7	6 $\pm$ 4	14 $\pm$ 14	3 $\pm$ 4	0 $\pm$ 0	0 $\pm$ 0
		Larval <i>Vatesus</i> cf. <i>clypeatus</i> sp. 2	21	73 $\pm$ 41	0 $\pm$ 0	5 $\pm$ 6	0 $\pm$ 1	0 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0
Diptera	Phoridae	<i>Ecitophora bruchi</i>	6	14 $\pm$ 7	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Ecitophora</i> cf. <i>comes</i> sp. 1	9	15 $\pm$ 18	0 $\pm$ 0	0 $\pm$ 1	0 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Ecitophora pilosula</i>	10	22 $\pm$ 20	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Ecitophora varians</i>	5	7 $\pm$ 7	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
		<i>Thallopoda fuscipalpis</i>	2	64 $\pm$ 48	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0
Thysanura	Nicoletiidae	<i>Trichatelura manni</i>	32	79 $\pm$ 43	0 $\pm$ 1	2 $\pm$ 3	4 $\pm$ 7	0 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0