

Appendix 1. Butterfly species recorded feeding on *Lantana* and *Wedelia* with their cumulative abundance (total number of individuals from 15 counts each in pre-removal and post-removal treatments), body length, proboscis length and relative proboscis length (proboscis length/body size). Number in parenthesis after the species name is sample size from which average morphometric values for that species were calculated.

Sr. no.	Species	Cumulative abundance				Body length (mm)	Proboscis length (mm)	Relative proboscis length
		<i>Lantana</i>		<i>Wedelia</i>				
		Pre-removal	Post-removal	Pre-removal	Post-removal			
1	<i>Adelpha basiloides</i> (1)	0	1	0	0	18.30	11.80	0.64
2	<i>Adelpha celerio</i> (1)	0	1	0	0	19.30	12.30	0.64
3	<i>Adelpha cytherea</i> (2)	0	2	0	0	15.25	9.75	0.64
4	<i>Anartia fatima</i> (13)	661	25	448	0	17.44	11.17	0.64
5	<i>Anartia jatrophae</i> (10)	242	0	229	0	16.67	11.00	0.66
6	<i>Anthanassa tulcis</i> (1)	0	6	11	36	10.10	5.80	0.57
7	<i>Antigonus nearchus</i> (1)	0	0	0	2	18.00	13.90	0.77
8	<i>Aphrissa statira</i> (1)	0	1	0	0	20.90	22.50	1.08
9	<i>Ascia minuste</i> (4)	22	17	1	11	20.77	13.50	0.65
10	<i>Autochton bipunctus</i> (2)	4	6	0	0	14.70	14.50	0.99
11	<i>Callicore texa</i> (1)	0	1	0	0	18.90	11.80	0.62
12	<i>Chlosyne hippodrome</i> (1)	0	0	2	0	13.3	8.00	0.60
13	<i>Chlosyne lacinia</i> (1)	0	0	6	2	14.00	9.20	0.66
14	<i>Cogia calchas</i> (1)	1	3	38	77	13.90	12.60	0.91
15	<i>Danaus gilippus</i> (1)	0	3	0	4	27.10	11.40	0.42
16	<i>Dione juno</i> (2)	28	34	0	0	22.00	16.35	0.74
17	<i>Dryadula phaelusa</i> (1)	0	0	0	1	28.40	16.20	0.57
18	<i>Dryas julia</i> (2)	5	8	0	0	22.55	14.65	0.65
19	<i>Eantis thraso</i> (1)	0	0	0	1	16.20	13.10	0.81
20	<i>Eueides aliphera</i> (1)	0	1	0	3	17.20	8.40	0.49
21	<i>Euptoieta hegesia</i> (1)	1	13	13	24	19.20	13.00	0.68
22	<i>Eurema albula</i> (2)	1	4	2	13	12.80	10.95	0.86
23	<i>Eurema lisa</i> (1)	0	1	0	7	15.20	12.30	0.81
24	<i>Helias cama</i> (1)	0	0	0	3	13.10	9.00	0.69
25	<i>Heliconius erato</i> (4)	6	10	0	0	22.20	17.15	0.77
26	<i>Heliconius hecale</i> (4)	14	6	0	0	29.80	21.95	0.74
27	<i>Heliconius sara</i> (1)	7	22	0	0	21.50	14.10	0.66
28	<i>Heliopetes arsalte</i> (1)	0	0	28	19	14.00	11.50	0.82
29	<i>Hesperiid</i> sp. 1 (2)	22	30	62	71	10.50	11.50	1.10
30	<i>Hylephila phyleus</i> (2)	0	0	0	10	15.40	14.25	0.93
31	<i>Junonia evarete</i> (2)	8	41	29	80	17.25	10.70	0.62
32	<i>Mechanitis lysimnia</i> (5)	0	1	0	0	21.00	12.90	0.61
33	<i>Morys</i> sp. (1)	11	24	1	15	14.50	22.40	1.54
34	<i>Nica flavilla</i> (1)	0	1	0	0	15.00	10.30	0.69
35	<i>Nisoniades rubescens</i> (1)	0	0	0	1	13.00	10.30	0.79
36	<i>Nyctelius nyctelius</i> (1)	1	2	0	1	18.80	19.80	1.05
37	<i>Papilio androgeus</i> (1)	0	1	0	0	34.60	25.00	0.72
38	<i>Papilio thoas</i> (2)	0	18	0	0	29.15	20.50	0.70
39	<i>Papilio victorinus</i> (1)	0	2	0	0	33.00	20.80	0.63
40	<i>Parides childrenae</i> (3)	0	1	0	0	30.87	22.93	0.74
41	<i>Phoebis sennae</i> (1)	4	7	0	0	22.00	27.10	1.23
42	<i>Pompeius pompeius</i> (1)	22	20	28	32	15.40	15.00	0.97
43	<i>Pseudolycaena damo</i> (1)	0	0	0	2	15.90	8.50	0.53

44	<i>Pyrgus oileus</i> (1)	1	14	133	138	13.30	9.10	0.68
45	<i>Remella vopiscus</i> (0)	1	1	0	2	–	–	–
46	<i>Staphylus</i> sp. (1)	2	6	11	61	9.50	7.30	0.77
47	<i>Thecla bathildis</i> (1)	0	0	4	4	12.90	6.80	0.53
48	<i>Thessalia ezra</i> (3)	0	0	4	4	15.40	8.63	0.56
49	<i>Timochares trifasciata</i> (1)	0	0	0	1	15.00	11.50	0.77
50	<i>Urbanus dorantes</i> (1)	3	4	0	5	19.20	18.60	0.97
51	<i>Urbanus proteus</i> (1)	0	1	0	0	16.60	16.70	1.01
52	<i>Urbanus simplicius</i> (3)	59	59	0	64	14.80	14.80	1.00
53	<i>Urbanus teleus</i> (1)	0	0	0	1	15.70	17.10	1.09
54	<i>Xenophanes tryxus</i> (3)	0	1	2	8	13.17	10.40	0.79

Appendix 2. Effects of *Anartia* removal on diversity and structure of butterfly community on *Wedelia*.

## Results

### Impacts of *Anartia* removal on nectar availability

At 8 a.m.: pre-removal:  $0.0016 \pm 0.0036 \mu\text{l}$ , post-removal:  $0.065 \pm 0.058 \mu\text{l}$ ,  $W = 2350.5$ ,  $DF = 118$ ,  $p < 0.0001$ ). At noon: pre-removal:  $0.0 \pm 0.0 \mu\text{l}$ , post-removal:  $0.007 \pm 0.022 \mu\text{l}$ ,  $W = 2940$ ,  $DF = 118$ ,  $p = 0.0003$ . Comparison between nectar quantity at 8 a.m. in post-removal treatment (quantities as above) and bagged flowers (pre- and post-removal treatments pooled:  $0.093 \pm 0.053 \mu\text{l}$ ):  $W = 3126$ ,  $DF = 118$ ,  $p = 0.008$ . There was no difference in the nectar quantities in bagged flowers between pre- and post-removal treatments (pre-removal:  $0.09 \pm 0.058 \mu\text{l}$ , post-removal:  $0.09 \pm 0.049 \mu\text{l}$ ;  $W = 895$ ,  $DF = 58$ ,  $p = 0.77$ ). The density of *Wedelia* flowers in the  $70 \times 2$  m transect had not changed between the pre- and post-removal treatments (pre-removal:  $452.88 \pm 22.09$  flowers  $140 \text{ m}^{-2}$ , post-removal:  $444.76 \pm 28.11$  flowers  $140 \text{ m}^{-2}$ ;  $W = 272.5$ ,  $DF = 15$ ,  $p = 0.4$ ).

### Changes in the intensity of competition

The average number of individuals feeding on the nectar plants decreased between the pre-removal and post-removal treatments ( $W = 124$ ,  $p < 0.0001$ ; Supplementary Table 1) because the two *Anartia* species comprised 65% of the total number of individuals foraging at a given time on *Wedelia* before their removal. The number of non-*Anartia* individuals foraging on *Lantana* increased ( $W = 120$ ,  $p < 0.0001$ ; Supplementary Table 1).

### Diversity of butterfly assemblages

Removal of *Anartia* butterflies significantly increased species richness, diversity and evenness of the butterfly assemblages (Supplementary Table 1, Fig. 1b). The total number of species recorded in 15 counts almost doubled from 19 to 35. The average number of species recorded per count also increased ( $W = 145$ ,  $p = 0.0003$ ; Supplementary Table 1). Values of all the diversity indices were substantially higher in the post-removal treatment compared to the pre-removal treatment with or without *Anartia* included in the dataset (Supplementary Table 1). ANCOVA for the rank/abundance distributions:  $F_{5,62} = 14.1743$ ,  $p < 0.0001$  (Supplementary Fig. 1).

### Community composition

Changes in community composition on *Wedelia*:

body length: pre-removal:  $14.43 \pm 2.94 \text{ mm}$ , post-removal:  $15.8 \pm 4.13 \text{ mm}$ ,  $W = 431$ ,  $DF = 48$ ,  $p = 0.29$ ; Fig. 2a in the main text.

Proboscis length: pre-removal:  $10.98 \pm 3.65 \text{ mm}$ , post-removal:  $12.2 \pm 3.87 \text{ mm}$ ,  $W = 425$ ,  $DF = 48$ ,  $p = 0.24$ ; Fig. 2b in the main text.

Relative proboscis length: pre-removal:  $0.77 \pm 0.24$ , post-removal:  $0.79 \pm 0.23$ ,  $W = 456.5$ ,  $DF = 48$ ,  $p = 0.58$ ; Fig. 2c in the main text.

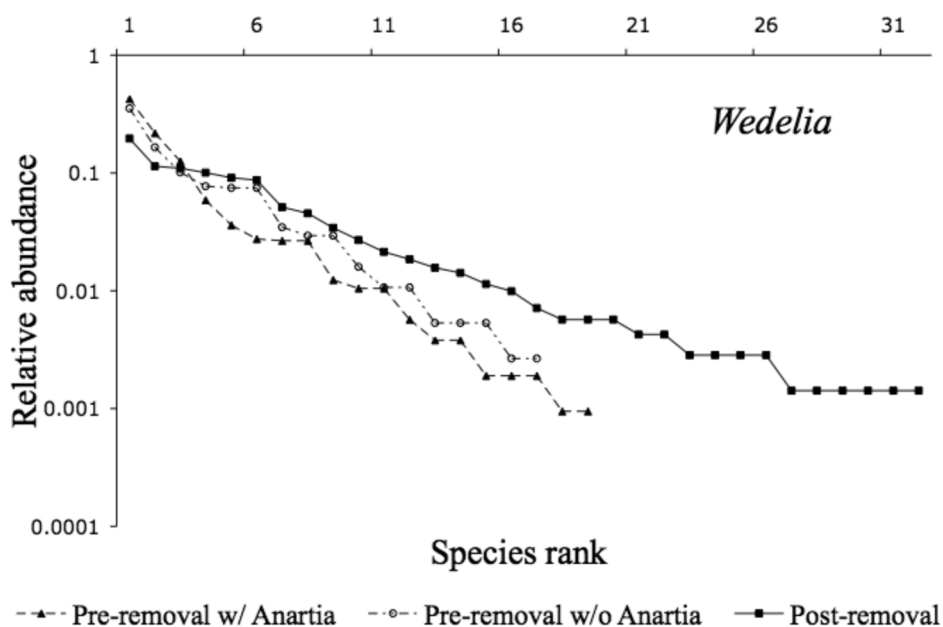
### Behavior

See Appendix 3.

Supplementary Table 1. Differences in the abundance and diversity of butterfly assemblages on *Wedelia* before and after the removal of the dominant *Anartia* butterflies. Mean and standard deviations are presented for average number of individuals and species. Significance values for diversity indices (Fisher's  $\alpha$ , Simpson index and Shannon index) between pre- and post-removal treatments were calculated using the student's t-test on average bootstrap values from 1000 simulations in EstimateS. Mean and standard errors from the bootstrap simulations are given for the diversity indices.

	Pre-removal	Pre-removal without <i>Anartia</i> included in the dataset	Post-removal
Total individuals	1052	375	703
Avg. no. individuals per count	70±7.1	25±5.7	47±6.9
Total species	19	17	35
Avg. no. spp. per count	10.9±2.3	8.9±2.3	14.7±2.2
Fisher's $\alpha$	3.07±0.3	3.37±0.41	6.2±0.55
Simpson index ( $E_{1/D}$ )	3.97±0.17	5.49±0.39	10.28±0.33
Shannon index ( $H'$ )	1.8±0.05	2.07±0.07	2.63±0.03

$p < 0.0001$  in all pair-wise comparisons between the pre- and post-removal treatments for all the diversity indices and for average number of individuals and species per count.



Supplementary Fig. 1. Species rank/abundance or “Whittaker” plots for *Anartia* pre-removal and post-removal treatments on *Wedelia*. Two plots are presented for pre-removal treatment, one including and the other excluding *Anartia* from the dataset.

Appendix 3. Differences in foraging behavior of butterflies on the two nectar plants in pre- and post-removal treatments. Handling time per flower was calculated in seconds as the amount of time spent on an inflorescence divided by the number of flowers probed in that inflorescence. Fraction of flowers probed was calculated as the number of flowers in an inflorescence divided by the number of flowers probed by the butterfly. Mean values  $\pm$  SD are presented. Difference between the two treatments is calculated using a Wilcoxon two-sample test. All values are statistically non-significant except for the fraction of flowers probed for an unidentified species of Hesperidae (“*Hesperid* sp.” in the table below). Some species had only pre- or post-removal data, for which mean values  $\pm$  SD (sample size in parenthesis) are given but significance values are not calculated.

Species	<i>Lantana</i>						<i>Wedelia</i>					
	Handling time (s)		Fraction of flowers probed		Handling time (s)		Fraction of flowers probed		Handling time (s)		Fraction of flowers probed	
	Pre-removal	Post-removal	Pre-removal	Post-removal	Pre-removal	Post-removal	Pre-removal	Post-removal	Pre-removal	Post-removal	Pre-removal	Post-removal
<i>Anartia fatima</i>	2.21 $\pm$ 1.02 (n=17)	–	0.42 $\pm$ 0.2 (n=17)	–	1.94 $\pm$ 1.14 (n=18)	–	0.54 $\pm$ 0.26 (n=18)	–	–	–	–	–
<i>Anartia jatrophae</i>	1.59 $\pm$ 0.72 (n=11)	–	0.53 $\pm$ 0.25 (n=11)	–	2.01 $\pm$ 1.5 (n=16)	–	0.46 $\pm$ 0.27 (n=16)	–	–	–	–	–
<i>Anthanasia tulcis</i>	–	–	–	–	6.2 $\pm$ 2.56	5.74 $\pm$ 2.74	0.72 $\pm$ 0.22	0.66 $\pm$ 0.27	–	–	–	–
<i>Ascia minuste</i>	3.18 $\pm$ 1.7	3.08 $\pm$ 0.9	0.41 $\pm$ 0.18	0.49 $\pm$ 0.13	2.97 $\pm$ 0.99 (n=10)	–	0.52 $\pm$ 0.24 (n=10)	–	–	–	–	–
		W=115, DF=18, p=0.97		W=100, DF=18, p=0.34								
<i>Autochton bipunctatus</i>	5.01 $\pm$ 2.55	5.38 $\pm$ 1.59	0.39 $\pm$ 0.19	0.46 $\pm$ 0.19	–	–	–	–	–	–	–	–
		W=90.5, DF=30, p=0.64		W=97, DF=12, p=0.37								
<i>Chlosyne lacinia</i>	–	–	–	–	3.03 $\pm$ 1.43	2.64 $\pm$ 0.66	0.49 $\pm$ 0.23	0.57 $\pm$ 0.21	–	–	–	–
		–		–	W=48, DF=10, p=0.78	–	W=44, DF=10, p=0.92	–	–	–	–	–
<i>Cogia calchas</i>	–	–	–	–	4.05 $\pm$ 1.33	4.55 $\pm$ 0.89	0.57 $\pm$ 0.32	0.60 $\pm$ 0.32	–	–	–	–
		–		–	W=85.5, DF=18, p=0.25	–	W=91.5, DF=18, p=0.87	–	–	–	–	–
<i>Dione juno</i>	3.05 $\pm$ 1.51	2.89 $\pm$ 1.27	0.34 $\pm$ 0.13	0.45 $\pm$ 0.22	–	–	–	–	–	–	–	–
		W=91, DF=16, p=0.9		W=87, DF=16, p=0.31								
<i>Dryas julia</i>	2.85 $\pm$ 1.12 (n=7)	–	0.39 $\pm$ 0.19 (n=7)	–	–	–	–	–	–	–	–	–
<i>Euptoieta hegesia</i>	1.65 $\pm$ 0.58	1.88 $\pm$ 0.84	0.56 $\pm$ 0.28	0.45 $\pm$ 0.14	1.74 $\pm$ 0.71	2.11 $\pm$ 0.94	0.51 $\pm$ 0.25	0.60 $\pm$ 0.23	–	–	–	–
		W=81.5, DF=16, p=0.59		W=73.5, DF=16, p=0.86								
		–		–	W=91, DF=19, p=0.15	–	W=84.5, DF=19, p=0.36	–	–	–	–	–

<i>Eurema albula</i>	7.26±1.99 (n=8)	0.48±0.29 (n=8)	5.36±1.67	6.01±2.12	0.58±0.21	0.67±0.19
<i>Heliconius erato</i>	2.97±1.15 (n=7)	0.52±0.3 (n=7)	-	-	-	-
<i>Heliconius hecale</i>	2.58±1.01	0.52±0.29	-	-	-	-
	W=54, DF=18, p=0.81	W=48.5, DF=18, p=0.81	-	-	-	-
<i>Heliconius sara</i>	2.31±1.07	0.29±0.16	-	-	-	-
	W=77, DF=16, p=0.89	W=76, DF=16, p=0.96	-	-	-	-
<i>Helipetes arsalte</i>	-	-	7.44±4.06	6.62±3.75	0.80±0.24	0.73±0.29
<i>Hesperiid</i> sp.	9.19±8.6	0.18±0.22	W=124, DF=22, p=0.98	W=116, DF=2, p=0.62	W=116, DF=2, p=0.62	W=116, DF=2, p=0.62
	W=24, DF=18, p=0.44	W=14.5, DF=18, p=0.03*	9.94±4.09	9.18±4.14	0.84±0.16	0.77±0.22
<i>Junonia evarete</i>	1.33±0.83	0.42±0.16	W=93, DF=21, p=0.87	W=83, DF=21, p=0.42	W=83, DF=21, p=0.42	W=83, DF=21, p=0.42
	W=73.5, DF=18, p=0.62	W=59, DF=18, p=0.09	2.29±0.96	2.99±1.21	0.51±0.2	0.7±0.37
<i>Morys</i> sp.	5.69±1.5	0.39±0.13	W=118, DF=21, p=0.15	W=117, DF=21, p=0.17	W=117, DF=21, p=0.17	W=117, DF=21, p=0.17
	W=58, DF=16, p=0.28	W=152, DF=16, p=0.91	5.75±0.78	5.61±1.06	0.61±0.16	0.73±0.26
<i>Papilio thoas</i>	3.49±1.63 (n=9)	0.42±0.23 (n=9)	W=39.5, DF=16, p=0.87	W=31.5, DF=16, p=0.46	W=31.5, DF=16, p=0.46	W=31.5, DF=16, p=0.46
<i>Phoebis sennae</i>	5.04±2.43	0.43±0.21	-	-	-	-
	W=108, DF=19, p=0.74	W=95.5, DF=19, p=0.4	-	-	-	-
<i>Pompeius pompeius</i>	5.15±2.48	0.5±0.24	2.72±1.04	3.43±1.43	0.66±0.26	0.55±0.29
	W=63, DF=17, p=0.76	W=70, DF=17, p=0.36	W=83.5, DF=19, p=0.29	W=111.5, DF=19, p=0.36	W=111.5, DF=19, p=0.36	W=111.5, DF=19, p=0.36

<i>Pyrgus oilens</i>	5.48±2.8 (n=6)	0.52±0.21 (n=6)	4.55±1.60	4.2±1.59	0.66±0.25	0.63±0.3
<i>Staphylus</i> sp.	6.09±2.88 W=66, DF=14, p=0.83	0.44±0.19 W=67, DF=14, p=0.76	4.83±1.72	5.04±1.15	0.52±0.26	0.46±0.19
<i>Thecla bathildis</i>	-	-	13.01±6.1	11.76±5.35	0.8±0.22	0.77±0.29
<i>Thessalia ezra</i>	-	-	3.69±1.39	3.58±1.06	0.59±0.28	0.5±0.16
<i>Urbanus dorantes</i>	3.48±1.53 (n=7)	0.41±0.25 (n=7)	-	-	-	-
<i>Urbanus simplicius</i>	3.14±1.6 W=90, DF=28, p=0.12	0.46±0.23 W=198, DF=28, p=0.92	4.15±1.04 (n=9)	4.15±1.04 (n=9)	0.5±0.23 (n=9)	0.5±0.23 (n=9)
<i>Xenophanes tryxus</i>	-	-	3.71±1.45 (n=9)	3.71±1.45 (n=9)	0.7±0.28 (n=9)	0.7±0.28 (n=9)