

## Supplementary materials

**Table S1.** Extracted and identified hydrocarbon compounds from cuticle layer and homogenised body of *T. castaneum*.

No	ID	Compound name	NIST RI	Calculated RI	GC-MS response ( $10^5$ ) $\pm$ SD, n=4		Fold change (A/B)	p value ( $10^{-3}$ )	GC-MS response ( $10^5$ ) $\pm$ SD, n=4		Fold change (A/B)	p value ( $10^{-3}$ )
					Cuticular hydrocarbons				Homogenised body hydrocarbons			
					Resistant (A)	Susceptible (B)			Resistant (A)	Susceptible (B)		
1	16.28_154	1-Pentadecene	1502	1504	1639 $\pm$ 50	1017 $\pm$ 161	1.61	0.31	1451 $\pm$ 111	1172 $\pm$ 113	1.24	7.90
2	31.48_253	Unknown1	-	2505	67 $\pm$ 17	8 $\pm$ 1	8.24	0.40	25 $\pm$ 5	4 $\pm$ 1	6.31	12.00
3	33.32_238	Pentacosane	2500	2515	195 $\pm$ 8	122.07 $\pm$ 24	1.60	1.10	110 $\pm$ 15	53 $\pm$ 9	2.09	0.59
4	33.89_266	Hexacosane	2600	2612	17 $\pm$ 1	18 $\pm$ 2	0.93	230.00	13 $\pm$ 2	9 $\pm$ 1	1.46	6.90
5	34.06_267	Unknown2	-	2618	123 $\pm$ 8	72 $\pm$ 20	1.72	2.90	78 $\pm$ 5	42 $\pm$ 5	1.87	0.057
6	34.27_294	2-methylhexacosane	2661	2684	7 $\pm$ 1	6 $\pm$ 1	1.29	100.00	8.78 $\pm$ 1.69	4 $\pm$ 0.4	2.18	1.30
7	34.73_296	13-methylheptacosane	2731	2741	509 $\pm$ 63	236 $\pm$ 43	2.16	0.37	235 $\pm$ 67	274 $\pm$ 46	0.86	370.00
8	34.82_309	11-methylheptacosane	2734	2750	2399 $\pm$ 57	1799 $\pm$ 363	1.33	17.00	1609 $\pm$ 133	1024 $\pm$ 122	1.57	0.64
9	35.02_336	2-methylheptacosane	2762	2766	50 $\pm$ 7	29 $\pm$ 4	1.71	1.90	31 $\pm$ 2	11 $\pm$ 2	2.76	0.013
10	35.58_337	3-methylheptacosane	2773	2771	2180 $\pm$ 156	1584 $\pm$ 352	1.38	21.00	1427 $\pm$ 116	839 $\pm$ 87	1.70	0.18
11	35.87_323	Octacosane	2800	2815	634 $\pm$ 29	393 $\pm$ 96	1.62	2.900	323 $\pm$ 18	254 $\pm$ 37	1.27	1.00
12	36.28_351	3-methyloctacosane	2872	2849	453 $\pm$ 12	369 $\pm$ 57	1.23	28.00	217 $\pm$ 25	128 $\pm$ 18	1.69	1.20
13	36.60_365	Nonacosane	2900	2902	134 $\pm$ 10	80 $\pm$ 17	1.67	1.50	51 $\pm$ 6	27 $\pm$ 3	1.88	0.58
14	36.85_324	Unknown3	-	2908	162 $\pm$ 13	95 $\pm$ 21	1.70	1.70	74 $\pm$ 8	38 $\pm$ 5	1.96	0.28
15	37.08_394	Unknown4	-	2911	91 $\pm$ 4	62 $\pm$ 14	1.45	8.30	36 $\pm$ 7	15 $\pm$ 2	2.44	1.20
16	37.49_378	Unknown5	-	2917	427 $\pm$ 40	346 $\pm$ 50	1.23	45.00	200 $\pm$ 34	364 $\pm$ 67	0.55	4.40
17	37.58_379	13-methylnonacosane	2930	2927	584 $\pm$ 47	501 $\pm$ 170	1.17	380.00	233 $\pm$ 36	128 $\pm$ 18	1.81	2.00
18	37.92_393	11-methylnonacosane	2939	2950	188 $\pm$ 31	149 $\pm$ 52	1.26	250.00	66 $\pm$ 13	35 $\pm$ 6	1.87	1.60
19	38.13_421	Nonacosane, 2-methyl-	2962	2961	409 $\pm$ 28	282 $\pm$ 69	1.45	14.00	156 $\pm$ 16	95 $\pm$ 13	1.65	0.64
20	38.44_395	3-methylnonacosane	2974	2973	87 $\pm$ 6	39 $\pm$ 8	2.21	0.068	40 $\pm$ 6	18 $\pm$ 2	2.17	0.53
21	39.64_239	Triacontane	3000	3003	35 $\pm$ 5	2 $\pm$ 5	1.44	27.00	16 $\pm$ 1	10 $\pm$ 1	1.59	0.17
22	42.37_449	Dotriacontane	3200	3203	41 $\pm$ 2	37 $\pm$ 4	1.12	75.00	12 $\pm$ 2	7 $\pm$ 1	1.70	4.60

The list consists of only the compounds that were identified; some compounds may present on the GC-MS chromatogram but are not presented due to the lack of the identification; ID includes the retention time and mass to charge ratio that used to identify the chemical; "Unknown" features are compounds that were identified as hydrocarbons by NIST database, but were reported as unknown because of the big difference between the NIST RI and the calculated RI (> 30 difference); RT=retention time; NIST RI=retention indices acquired from National Institute of Standards and Technology database (NIST); Calculated RI=retention indices calculated using n-alkane standard C7-C40; Fold changes obtained from dividing GC-MS response (areas) of resistant insects by the GC-MS response (areas) of susceptible insects; p values were generated by t-tests as ( $p \leq 0.05$ , n=4); ND=not detected.

**Table S2.** Extracted and identified hydrocarbon compounds from cuticle layer and homogenised body of *R. dominica*.

NO	ID	Compound name	NIST RI	Calculated RI	GC-MS response (10 <sup>5</sup> ) ±SD, n=4		Fold change (A/B)	p value (10 <sup>-3</sup> )	GC-MS response (10 <sup>5</sup> ) ±SD, n=4		Fold change (C/D)	p value (10 <sup>-3</sup> )
					Cuticular hydrocarbons				Homogenised body hydrocarbons			
					Resistant (A)	Susceptible (B)			Resistant (C)	Susceptible (D)		
1	31.46_253	Unknown1	-	2515	35±9	12±3	2.77	6.90	15±4	ND	NA	0.28
2	31.94_281	11-methylpentacosane	2535	2555	330±61	6±1	59.17	0.044	7±1	2±0.3	3.65	0.014
3	32.91_295	Unknown2	-	2628	27±8	17±3	1.64	80.00	11±2	ND	NA	100.00
4	34.41_296	13-methylheptacosane	2731	2741	156±18	260±41	0.60	100.00	236±92	143±35	1.65	0.14
5	34.84_336	2-methylheptacosane	2762	2766	373±87	96±24	3.91	1.40	111±10	33±3	3.38	0.0046
6	35.34_337	3-methylheptacosane	2773	2771	73±15	70±10	1.03	0.16	60±9	35±11	1.70	13.00
7	35.72_323	Octacosane	2800	2815	73±15	57±10	1.28	120.00	33±9	31±6	1.07	700.00
8	37.10_394	Unknown3	-	2912	306±40	306±52	1.00	110.00	147±27	220±31	0.67	12.00
9	37.50_379	13-methylnonacosane	2930	2927	86±12	34±7	2.51	0.82	27±5	3±0.7	8.15	0.14
10	39.64_239	Triacontane	3000	3003	104±10	157±40	0.66	41.00	169±23	101±6	1.67	1.10
11	41.22_435	Hentriacontane	3100	3117	235±63	67±5	3.52	1.80	57±8	27±5	2.15	0.58
12	41.53_436	2-Methylhentriacontane	3162	3152	213±57	68±1	3.13	2.30	36±10	16±2	2.23	7.40
13	42.01_424	3-Methylhentriacontane	3172	3182	69±18	34±10	2.06	13.00	18±1	6±1	3.11	0.0027
14	42.37_449	Dotriacontane	3200	3203	750±130	266±33	2.82	0.36	208±37	72±10	2.89	0.36
15	42.50_477	10-Methyldotriacontane	3235	3218	1001±75	541±36	1.85	0.033	287±51	139±32	2.07	2.70
16	42.60_450	8-Methyldotriacontane	3240	3221	297±37	88±9	3.39	0.0031	47±5	16±3	2.96	0.026
17	42.78_464	Unknown4	-	3231	66±6	19±3	3.53	0.0006	11±1	3±1	3.57	0.0077
18	42.87_466	Unknown5	-	3237	261±8	96±9	2.71	0.0001	57±12	20±3	2.86	0.89
19	42.96_478	Unknown6	-	3249	204±13	61±7	3.34	0.0012	37±7	15±2	2.44	1.10
20	43.22_481	2-Methyldotriacontane	3263	3266	406±49	242±21	1.67	8.90	85±9	37±8	2.21	0.25
21	43.40_416	Unknown7	-	3276	435±86	240±16	1.81	0.67	83±6	38±7	2.17	0.056
22	44.03_463	15-Methyltriacontane	3333	3323	435±86	242±44	1.80	7.00	84±8	30±5	2.84	0.032
23	44.47_479	Unknown8	-	3351	951±87	443±49	2.15	0.054	159±16	61±14	2.59	0.10
24	44.88_492	Tetracontane	3400	3387	134±5	56±4	2.40	0.0003	25±1	9±2	2.82	0.015

The list consists of only the compounds that were identified; some compounds may present on the GC-MS chromatogram but are not presented due to the lack of the identification; ID includes the retention time and mass to charge ratio that used to identify the chemical; "Unknown" features are compounds that were identified as hydrocarbons by NIST database, but were reported as unknown because of the big difference between the NIST RI and the calculated RI (> 30 difference); RT=retention time; NIST RI=retention indices acquired from National Institute of Standards and Technology database (NIST); Calculated RI=retention indices calculated using n-alkane standard C7-C40; Fold changes obtained from dividing GC-MS response (areas) of resistant insects by the GC-MS response (areas) of susceptible insects; p values were generated by t-tests as ( $p \leq 0.05$ , n=4); ND=not detected.