Fig. S1. GenomeScope k-mer profiling. GenomeScope analysis of sequencing reads.

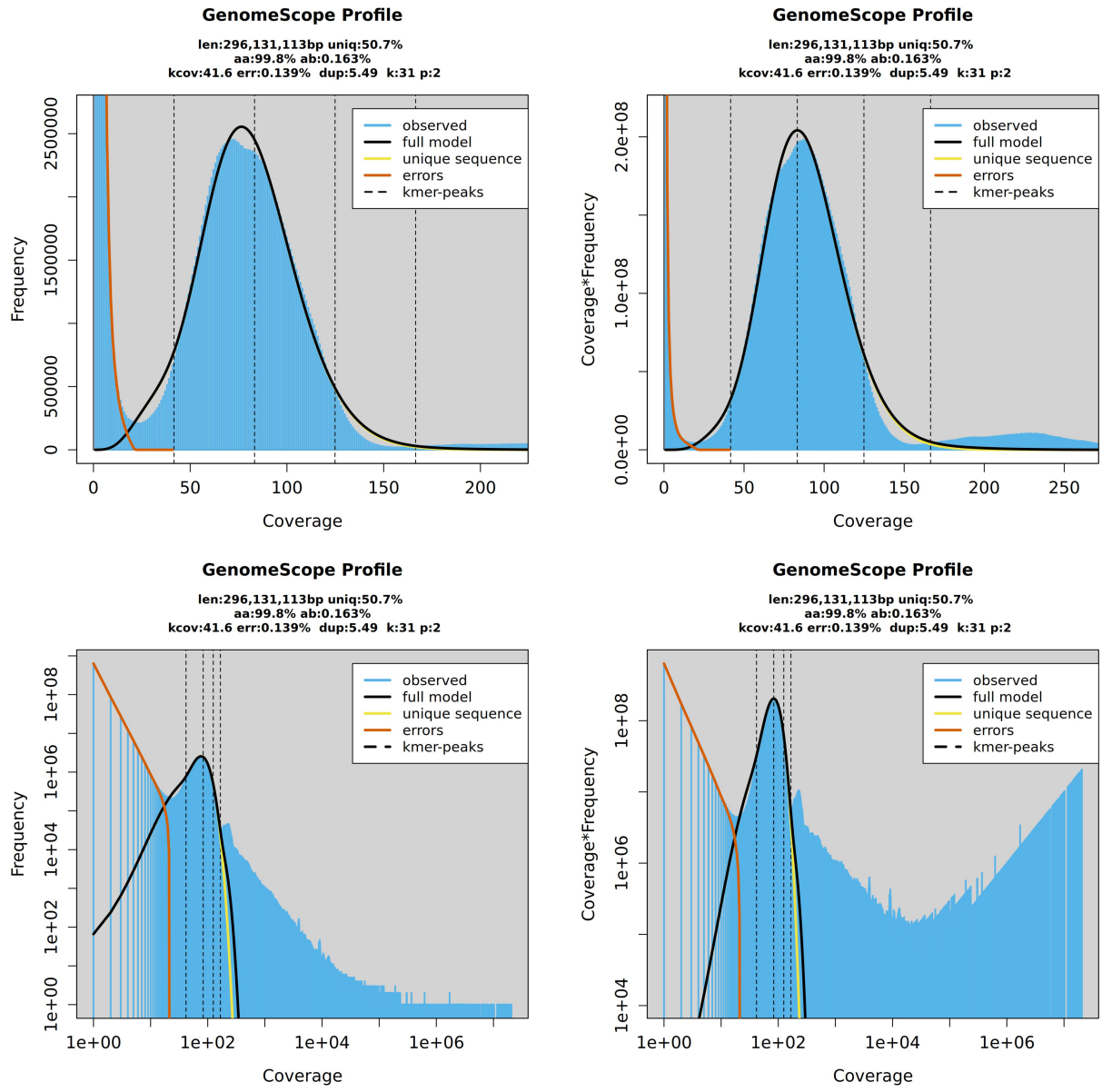

Fig. S2. Genome completeness assessment. **(A)** Genome-level Arthropoda BUSCO results (98.4% complete; 96.2% single copy, 2.2% duplicated, 0.9% fragmented, 0.7% missing). **(B)** Protein-level BUSCO results (92.3% complete; 90.2% single copy, 2.0% duplicated, 4.1% fragmented, 3.7% missing).

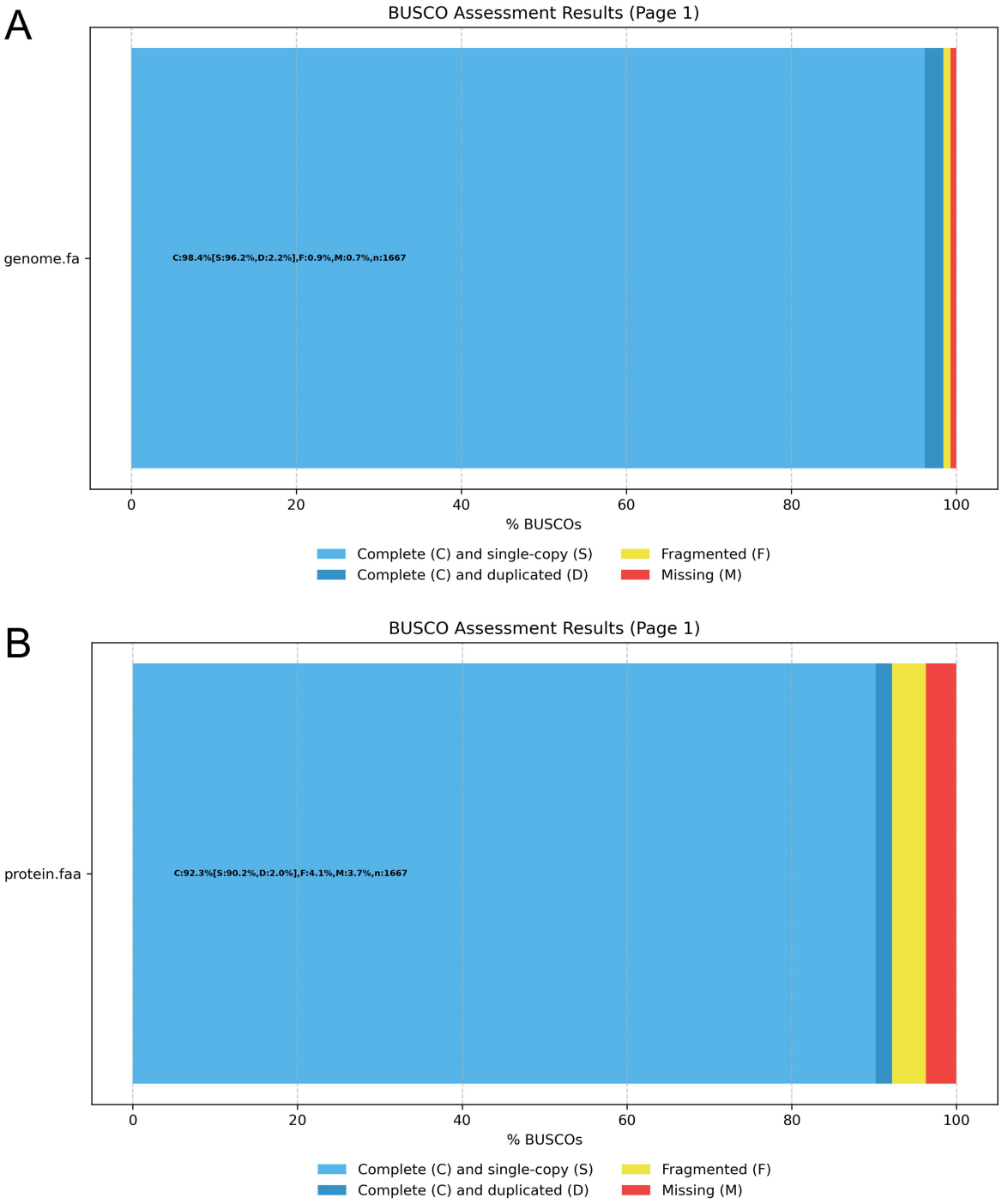

Fig. S3. Chromosome length distribution. Bar graph showing lengths of 15 assembled chromosomes, 50 unplaced contigs, and the mitochondrial genome.

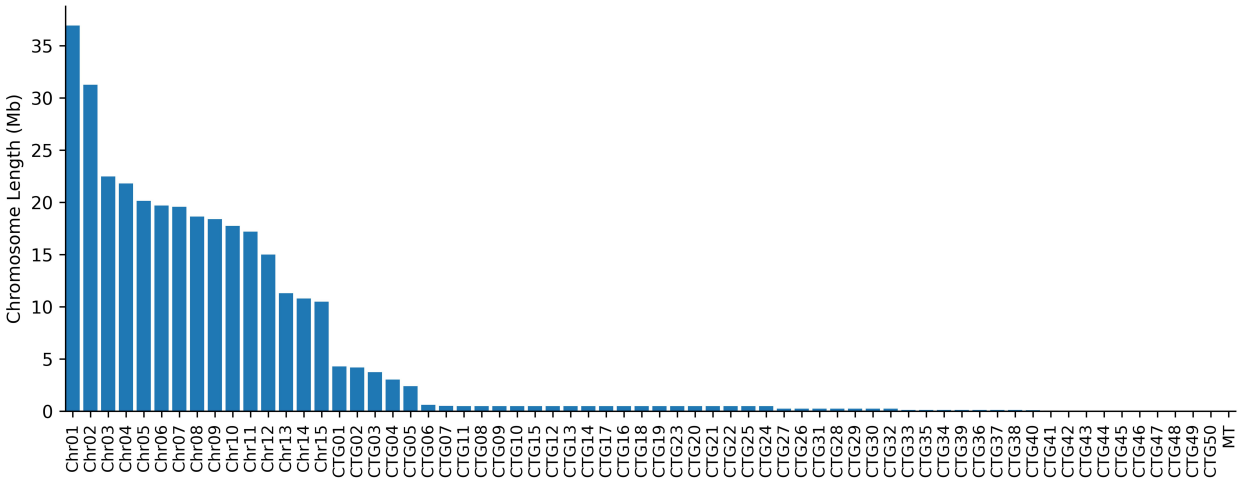

Fig. S4. Chromosome-scale Hi-C maps. Hi-C contact maps for all 15 chromosomes at 40-kb resolution.

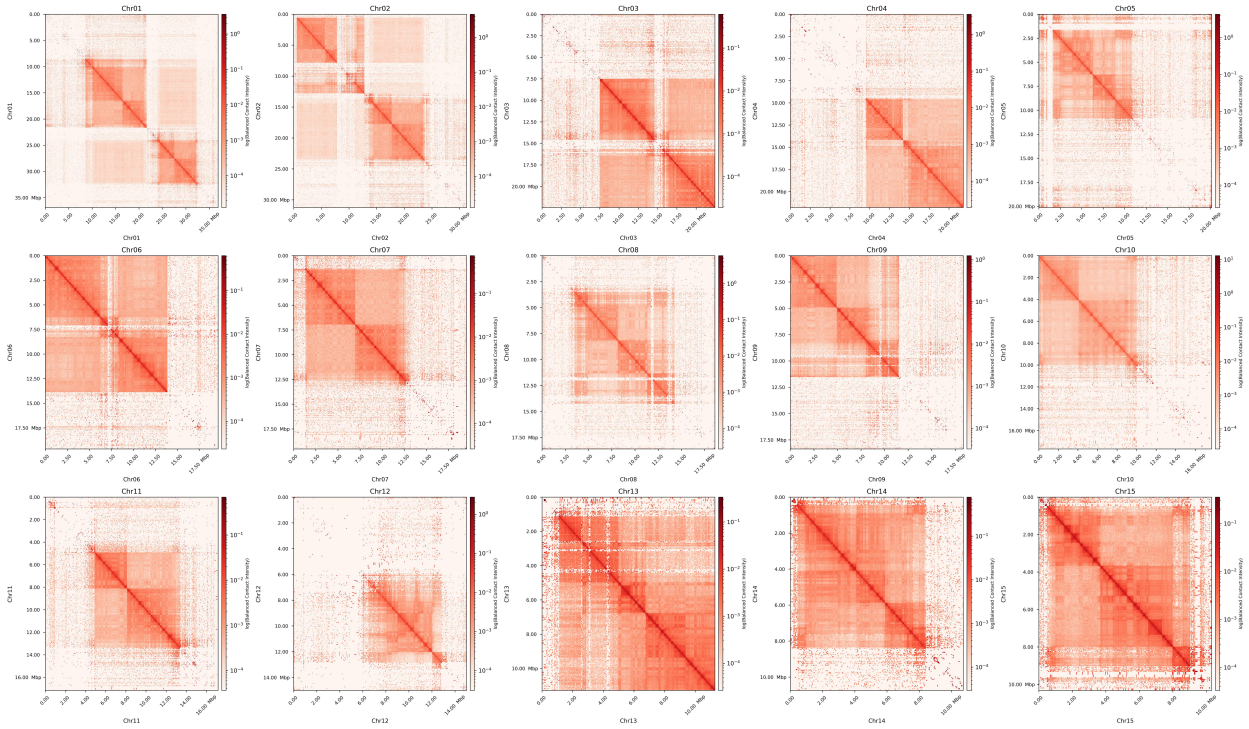

Fig. S5. Comparative chemoreceptor repertoire sizes. Stacked bar graph showing total OR (pink), GR (green), and IR (blue) counts in *S. guani*, *N. vitripennis*, *A. mellifera*, *E. dilemma*, *C. floridanus*, *H. saltator*, and *D. melanogaster*.

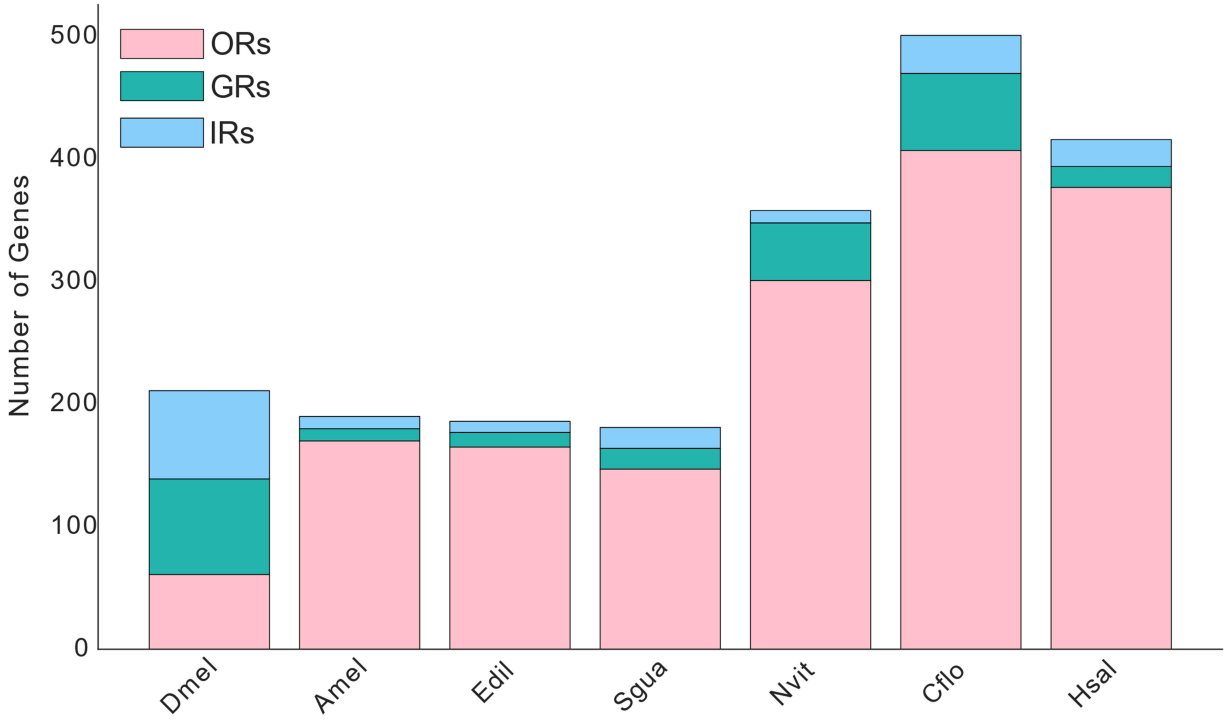

Fig. S6. Adult mass measurement. T-tests suggest no significant differences in adult weights between wild-type and *Orco* mutant females **(A)** (n = 27-28) and males **(B)** (n = 7). ns, not significant. Error bars = SEM.

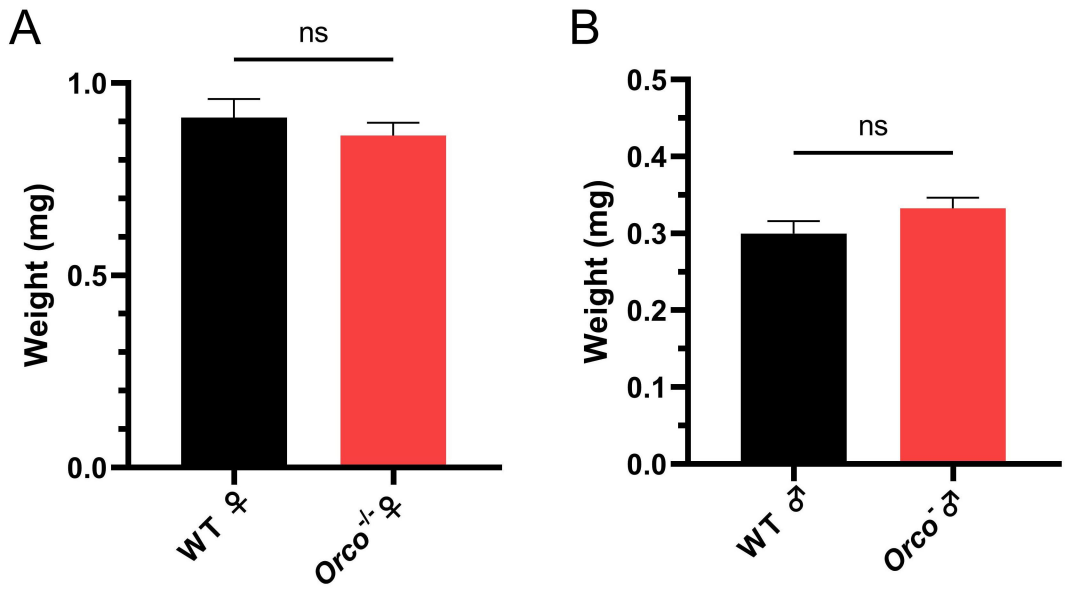

Fig. S7. Egg eclosion rate. T-test suggests no significant differences in eclosion rate between wild-type and *Orco* mutant eggs (n = 7). ns, not significant. Error bars = SEM.

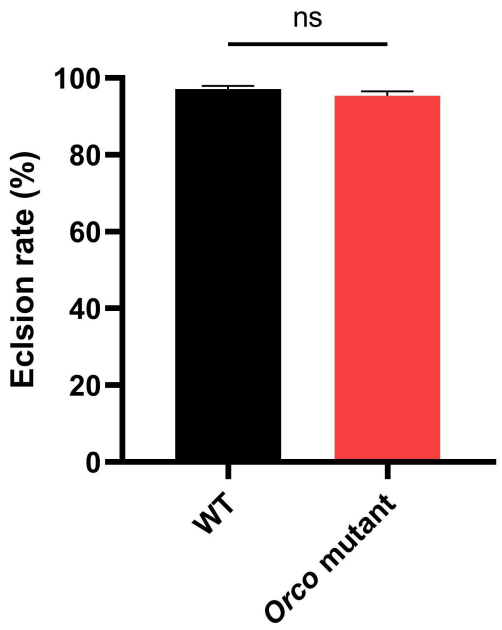

Table S1. Assembly statistics.

Metric	Value
Total Assembly Length (bp)	322491966
Chromosomes (n)	15
Unplaced Contigs (n)	50
Mitochondrial Genome (n)	1
Nuclear Genome Anchored to Chromosomes (%)	90.40
Unplaced Sequence Length (bp)	30965787
Scaffolds (n)	66
Scaffold N50	19575621
Scaffold L50	7
Contigs (n)	136
Contig N50	4514714
Contig L50	27
Gaps (%)	0.0022
GC Content (%)	42.71
Complete BUSCOs (%)	98.4
Single-copy BUSCOs (%)	96.2
Duplicated BUSCOs (%)	2.2
Fragmented BUSCOs (%)	0.9
Missing BUSCOs (%)	0.7
Total Assembly Length (bp)	322491966
Chromosomes (n)	15
Unplaced Contigs (n)	50
Mitochondrial Genome (n)	1
Nuclear Genome Anchored to Chromosomes (%)	90.40

Table S2. Repetitive content.

Class	Elements_n	Covered_bp	Covered_pct_genome
TOTAL	195341	181257619	56.205313
DNA	112058	21075504	6.535203
LINE	16960	2341941	0.726201
SINE	715	46317	0.014362
LTR	51330	157147501	48.729121
Satellite	1897	190265	0.058998
RC	1720	974374	0.302139
Other	10661	1854213	0.574964

Table S3. TAD Mixed linear model results (N = 1000).

response	contrast	higher	lower	ns	median	q25	q75
TAD_score	GR/IR_vs_BUSCO	0	0	1000	-0.0186	-0.0187	-0.0185
TAD_score	ORsin_vs_BUSCO	1000	0	0	0.0517	0.0514	0.0519
TAD_score	ORsin_vs_GR/IR	934	0	66	0.0703	0.0700	0.0705
TAD_score	ORsin_vs_Othertan	0	511	489	-0.0636	-0.0684	-0.0604
TAD_score	ORtan_vs_BUSCO	1000	0	0	0.1102	0.1017	0.1192
TAD_score	ORtan_vs_GR/IR	1000	0	0	0.1288	0.1204	0.1378
TAD_score	ORtan_vs_ORsin	22	0	978	0.0590	0.0501	0.0683
TAD_score	ORtan_vs_Othertan	0	0	1000	-0.0050	-0.0135	0.0043
TAD_score	Othertan_vs_BUSCO	1000	0	0	0.1150	0.1118	0.1197
TAD_score	Othertan_vs_GR/IR	1000	0	0	0.1334	0.1304	0.1383
norm_gmidpoint_to_boundary	GR/IR_vs_BUSCO	0	0	1000	-0.0510	-0.0511	-0.0508
norm_gmidpoint_to_boundary	ORsin_vs_BUSCO	1000	0	0	0.1421	0.1419	0.1423
norm_gmidpoint_to_boundary	ORsin_vs_GR/IR	1000	0	0	0.1931	0.1929	0.1932
norm_gmidpoint_to_boundary	ORsin_vs_Othertan	0	0	1000	0.0440	0.0423	0.0456
norm_gmidpoint_to_boundary	ORtan_vs_BUSCO	1000	0	0	0.2747	0.2680	0.2826
norm_gmidpoint_to_boundary	ORtan_vs_GR/IR	1000	0	0	0.3256	0.3189	0.3335
norm_gmidpoint_to_boundary	ORtan_vs_ORsin	0	0	1000	0.1327	0.1259	0.1405
norm_gmidpoint_to_boundary	ORtan_vs_Othertan	294	0	706	0.1768	0.1695	0.1846
norm_gmidpoint_to_boundary	Othertan_vs_BUSCO	822	0	178	0.0981	0.0965	0.0998
norm_gmidpoint_to_boundary	Othertan_vs_GR/IR	887	0	113	0.1491	0.1475	0.1507
norm_gmidpoint_to_center	GR/IR_vs_BUSCO	0	0	1000	0.0510	0.0508	0.0511
norm_gmidpoint_to_center	ORsin_vs_BUSCO	0	1000	0	-0.1421	-0.1423	-0.1419
norm_gmidpoint_to_center	ORsin_vs_GR/IR	0	1000	0	-0.1931	-0.1932	-0.1929
norm_gmidpoint_to_center	ORsin_vs_Othertan	0	0	1000	-0.0440	-0.0456	-0.0423
norm_gmidpoint_to_center	ORtan_vs_BUSCO	0	1000	0	-0.2747	-0.2826	-0.2680
norm_gmidpoint_to_center	ORtan_vs_GR/IR	0	1000	0	-0.3256	-0.3335	-0.3189
norm_gmidpoint_to_center	ORtan_vs_ORsin	0	0	1000	-0.1327	-0.1405	-0.1259
norm_gmidpoint_to_center	ORtan_vs_Othertan	0	294	706	-0.1768	-0.1846	-0.1695
norm_gmidpoint_to_center	Othertan_vs_BUSCO	0	822	178	-0.0981	-0.0998	-0.0965
norm_gmidpoint_to_center	Othertan_vs_GR/IR	0	887	113	-0.1491	-0.1507	-0.1475

Table S4. Odorant lists used in female *S. guani* electroantennogram.

Chemicals	CAS	Company	Purity	Reference
Terpinolene	586-62-9	Macklin	85%	1,2,3
Limonene	138-86-3	Macklin	95%	1,2,3,4
Phellandrene	99-83-2	Macklin	85%	1,2,3
Myrcene	123-35-3	Macklin	90%	1,2,3
Longifolene	475-20-7	Macklin	95%	1,2
(+)-α-Pinene	7785-70-8	Macklin	92%	1,2,3
(-)-β-Pinene	18172-67-3	Macklin	98%	2,3
β-Caryophyllene	87-44-5	Macklin	80%	1,2,3
Borneol	464-43-7	Macklin	98%	4
Geranyl acetate	105-87-3	Macklin	96%	
γ-Octalactone	104-50-7	Macklin	99%	
Phenethyl acetate	103-45-7	Macklin	99%	
Isopentyl acetate	123-92-2	Macklin	99%	
(E)-2-Hexenyl acetate	2497-18-9	Macklin	99.8%	
(-)-Fenchone	4695-62-9	Macklin	97%	1,3
(+)-Fenchone	7787-20-4	Macklin	98%	1
2-Nonanone	821-55-6	Macklin	99%	
6-Methyl-5-hepten-2-one	110-93-0	Macklin	98%	
Cyclohexanone	108-94-1	Macklin	99%	
2-Decanone	693-54-9	Macklin	99.5%	
(-)-Carvone	6485-40-1	Macklin	99%	
Camphor	76-22-2	Macklin	96%	1,3
Butanoic acid	98-55-5	Macklin	98%	
Pentanoic acid	109-52-4	aladdin	99%	3,4
α-Terpineol	98-55-5	Macklin	98%	1
Geraniol	106-24-1	Macklin	98%	
Eucalyptol	470-82-6	Macklin	99%	
1-Heptanol	111-70-6	Macklin	99.5%	
2-Ethyl-1-hexanol	104-76-7	Macklin	98%	
(Z)-2-Hexenol	928-94-9	Macklin	92%	
(E)-2-Hexenol	928-95-0	Macklin	97%	
2-(Undecyloxy)ethanol	38471-47-5	YUANYE	98%	3
Benzaldehyde	100-52-7	Macklin	98.5%	3
Acetophenone	98-86-2	Macklin	98%	
Eugenol	97-53-0	Macklin	99%	
(S)-(-)-Perillaldehyde	2111-75-3	Macklin	90%	
Citral	5392-40-5	Macklin	97%	
Butanal	123-72-8	Macklin	98%	
Propanal	123-38-6	Macklin	97%	
Isobutanal	78-84-2	Macklin	98%	
2-Methylbutanal	96-17-3	Macklin	98%	
Pentanal	110-62-3	Macklin	98%	

Nonanal	124-19-6	Macklin	98%	3,4
Linalool oxide	1365-19-1	Macklin	97%	

Table S5. Odorant lists used in male *S. guani* electroantennogram.

Chemicals	CAS	Company	Purity	Reference
Nonadecane	629-92-5	Macklin	98%	5,6
Eicosane	112-95-8	Macklin	99%	6
Heneicosane	629-94-7	Macklin	99%	5,6
Docosane	629-97-0	Macklin	99%	6
Tricosane	638-67-5	Macklin	99%	5,6
Tetracosane	646-31-1	Macklin	99%	5,6
Pentacosane	629-99-2	Macklin	99%	5,6
Hexacosane	630-01-3	Macklin	99%	5,6
Heptacosane	593-49-7	Macklin	97%	5,6
Octacosane	630-02-4	Macklin	98.5%	6
Nonacosane	630-03-5	Macklin	99%	5,6
Triacontane	638-68-6	Macklin	98%	
Hentriacontane	630-04-6	Macklin	97%	6
(Z)-11-Octadecenoic acid	506-17-2	YUANYE	98%	6
n-Hexadecanoic acid	57-10-3	Macklin	99%	
9-Hexadecenoic acid	373-49-9	Bidepharm	98%	5
Nonanal	124-19-6	Macklin	96%	6
Benzeneacetaldehyde	122-78-1	Macklin	95%	6
Dibutyl phthalate	84-74-2	Macklin	98.5%	6
Ethyl palmitate	628-97-7	Macklin	98%	
1-Tetracosanol	506-51-4	Macklin	80%	5,6
1-Heptacosanol	2004-39-9	Bidepharm	98%	5,6
(Z)-9-Tricosene	27519-02-4	Macklin	93%	5,6
1-Docosene	1599-67-3	Macklin	99%	5,6

References

1. L. Li, Z. Liu, J. Sun, Olfactory cues in host and host-plant recognition of a polyphagous ectoparasitoid *Scleroderma guani*. *BioControl* **60**, 307–316 (2015).
2. J. Fan, J. Sun, J. Shi, Attraction of the Japanese pine sawyer, *Monochamus alternatus*, to volatiles from stressed host in China. *Ann. For. Sci.* **64**, 67–71 (2007).
3. G. Huang, Z. Liu, S. Gu, B. Zhang, J. Sun, Identification and functional analysis of odorant-binding proteins of the parasitoid wasp *Scleroderma guani* reveal a chemosensory synergistic evolution with the host *Monochamus alternatus*. *Int. J. Biol. Macromol.* **249**, 126088 (2023).
4. Z. Li, B. Li, Z. Hu, J. P. Michaud, J. Dong, Q. Zhang, X. Liu, The ectoparasitoid *Scleroderma guani* (Hymenoptera: Bethylidae) uses innate and learned chemical cues to locate its host, larvae of the pine sawyer *Monochamus alternatus* (Coleoptera: Cerambycidae). *Florida Entomol.* **98**, 1182–1187 (2015).
5. L. Li *et al*., https://www.researchsquare.com/article/rs-8433826/v1 (2025).
6. L. Luo, "Mating behavior of *Sclerodermus guani* (Hymenoptera: Bethylidae) and its mechanism of chemical ecology," thesis, Guizhou Normal University, Guiyang, Guizhou, China (2018). (In Chinese)