Standardising Bioassays for Spatial Emanators against Mosquito Vectors

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Table S1. Physical and airflow-related characteristics of cage mesh materials

	n	Diameter*	SD diameter	Area*	SD area	Rim*	SD Rim	Airflo index*	SD airflow index
BugDorm	14	0.497	0.046	0.196	0.036	85.476	7.667	3.575	0.9
MMC-1	13	1.233	0.054	1.196	0.104	43.144	2.192	0.286	0.034
MMC-2	12	2.093	0.044	3.441	0.145	46.484	2.599	0.106	0.007
MMC-3	7	2.715	0.080	5.792	0.341	60.852	2.820	0.083	0.006
MMC-4	9	1.704	0.040	2.281	0.108	76.086	2.041	0.263	0.016

*mean in mm

Table S2. Replicate-level comparison of flight inhibition (FI) time-response trajectories using slope-based interaction models.

Configuration	strain	fan_speed	baffle	cage_design	n_reps	p_value	p_adjusted	significant
MMC	resistant	medium	with	mesh_1	2	0.444376	0.994601	NO
MMC	resistant	medium	with	mesh_2	2	0.431268	0.994601	NO
MMC	resistant	medium	with	mesh_3	2	0.892589	0.994601	NO
MMC	resistant	medium	with	mesh_4	2	0.890395	0.994601	NO
MMC	resistant	medium	without	mesh_1	2	0.634714	0.994601	NO
MMC	resistant	medium	without	mesh_2	2	0.267689	0.994601	NO
MMC	resistant	medium	without	mesh_3	2	0.880044	0.994601	NO
MMC	resistant	medium	without	mesh_4	2	0.812522	0.994601	NO
MMC	resistant	medium	without	mesh_5	2	0.364873	0.994601	NO
MMC	susceptible	medium	with	mesh_1	2	0.824907	0.994601	NO
MMC	susceptible	medium	with	mesh_2	2	0.77457	0.994601	NO
MMC	susceptible	medium	with	mesh_3	2	0.454633	0.994601	NO
MMC	susceptible	medium	with	mesh_4	2	0.897502	0.994601	NO
MMC	susceptible	medium	with	single	3	0.975416	0.994601	NO
MMC	susceptible	medium	without	mesh_1	2	0.941702	0.994601	NO
MMC	susceptible	medium	without	mesh_2	2	0.707663	0.994601	NO
MMC	susceptible	medium	without	mesh_3	2	0.88912	0.994601	NO
MMC	susceptible	medium	without	mesh_4	2	0.745546	0.994601	NO
MMC	susceptible	medium	without	mesh_5	2	0.973584	0.994601	NO
MMC	susceptible	medium	without	single	3	0.994601	0.994601	NO
Single/Dual	resistant	low	with	dual	6	0.000135	0.000557	YES
Single/Dual	resistant	low	with	single	3	0.000236	0.00063	YES
Single/Dual	resistant	low	without	dual	6	3.48E-08	5.57E-07	YES
Single/Dual	resistant	low	without	single	3	0.000174	0.000557	YES
Single/Dual	resistant	medium	with	dual	6	3.31E-07	2.65E-06	YES
Single/Dual	resistant	medium	with	single	3	0.000172	0.000557	YES
Single/Dual	resistant	medium	without	dual	6	0.532522	0.994601	NO
Single/Dual	resistant	medium	without	single	3	0.513447	0.994601	NO
Single/Dual	susceptible	low	with	dual	6	0.918076	0.994601	NO
Single/Dual	susceptible	low	with	single	3	0.85624	0.994601	NO
Single/Dual	susceptible	low	without	dual	6	0.952868	0.994601	NO
Single/Dual	susceptible	low	without	single	3	0.767857	0.994601	NO
Single/Dual	susceptible	medium	with	dual	6	0.991503	0.994601	NO
Single/Dual	susceptible	medium	with	single	3	0.975416	0.994601	NO
Single/Dual	susceptible	medium	without	dual	6	0.985661	0.994601	NO
Single/Dual	susceptible	medium	without	single	3	0.994601	0.994601	NO

Table S3. Time × chamber interaction analysis of flight-inhibition trajectories for chamber-reproducibility assessment.

Dataset	strain	Slope F	Slope P	Slope p adj	Slope sig	N chamber_1	N chamber_2
MMC cage	resistant	0.18487	0.667713	0.921935	NO	5	4
MMC cage	susceptible	0.009629	0.921935	0.921935	NO	5	4
Single/dual cage	resistant	19.26926	1.43E-05	2.86E-05	YES	7	5
Single/dual cage	susceptible	1.05545	0.304836	0.304836	NO	7	5

Table S4. Generalised linear model estimates of airflow and cage structure effects on flight inhibition (FI).

Single /dual cage Model															
	30 min								60 min						
term	odds ratios	std.error	statistic	p.value	conf.low	conf.high	Significant 0.05		estimate	std.error	statistic	p.value	conf.low	conf.high	Significant 0.05
(Intercept)	0.04	0.413	-8.02	1E-15	0.02	0.08	Yes		0.18	0.22	-8.04	0.00	0.11	0.27	Yes
Medium Speed	1.28	0.507	0.49	6E-01	0.48	3.47	No		2.44	0.26	3.43	0.00	1.47	4.06	Yes
No baffle	3.75	0.460	2.88	4E-03	1.52	9.24	Yes		7.75	0.26	8.01	0.00	4.70	12.79	Yes
Single Cage	0.82	0.562	-0.36	7E-01	0.27	2.45	No		1.50	0.29	1.40	0.16	0.85	2.65	No
Medium speed / No baffle	1.59	0.542	0.86	4E-01	0.55	4.61	No		1.45	0.31	1.21	0.23	0.79	2.67	No
Medium speed / single cage	0.91	0.454	-0.20	8E-01	0.38	2.22	No		0.73	0.32	-1.01	0.31	0.39	1.35	No
No baffle / Single cage	1.23	0.550	0.37	7E-01	0.42	3.60	No		1.32	0.32	0.89	0.38	0.71	2.46	No
Mesh Comparison Model															
	30 min								60 min						
term	odds ratios	std.error	statistic	p.value	conf.low	conf.high	Significant 0.05		estimate	std.error	statistic	p.value	conf.low	conf.high	Significant 0.05
(Intercept)	0.38	0.23	-4.20	0.00	0.24	0.60	Yes		5.62	0.29	6.03	0.00	3.21	9.86	Yes
No baffle	9.40	0.34	6.59	0.00	4.83	18.32	Yes		33.27	1.45	2.41	0.02	1.92	575.15	Yes
Mesh-2	2.90	0.31	3.49	0.00	1.59	5.27	Yes		2.56	0.50	1.89	0.06	0.96	6.80	No
Mesh-3	2.94	0.31	3.43	0.00	1.59	5.44	Yes		2.23	0.50	1.60	0.11	0.84	5.95	No
Mesh-4	1.83	0.31	1.97	0.05	1.00	3.34	Yes		1.53	0.44	0.98	0.33	0.65	3.60	No
Mesh-5	0.19	0.33	-5.13	0.00	0.10	0.36	Yes		0.11	1.51	-1.46	0.14	0.01	2.13	No
Single cage	0.12	0.49	-4.22	0.00	0.05	0.33	Yes		0.08	0.35	-7.21	0.00	0.04	0.16	Yes
No baffle / mesh-2	0.42	0.48	-1.84	0.07	0.16	1.06	No		0.39	2.08	-0.46	0.65	0.01	22.65	No
No baffle / mesh-3	0.50	0.48	-1.44	0.15	0.19	1.29	No		0.49	2.08	-0.34	0.73	0.01	28.77	No
No baffle / mesh-4	1.15	0.51	0.27	0.79	0.42	3.10	No		0.68	2.06	-0.19	0.85	0.01	38.72	No
No baffle / mesh-5	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA
No baffle / single cage	0.54	0.60	-1.03	0.30	0.16	1.75	No		0.46	1.49	-0.52	0.60	0.02	8.61	No

Table S5. Odds ratios (ORs) and 95% confidence intervals for flight inhibition at 30 and 60 min in single/dual- and MMC-cage bioassays.

Model	Timepoint	Variable	Odds ratios	Conf. low	Conf. high	P value
Single/dual cage	30 min	Strain: R vs S	1.02E-04	1.62E-05	3.45E-04	3.15E-35
		Fan: M vs L	1.815642	1.182009	2.829983	0.007244
		Baffle: NB vs B	5.944158	3.563015	10.50136	7.86E-11
		Cage: Dual vs Single	1.068024	0.699011	1.645111	0.762536
	60 min	Strain: R vs S	4.60E-04	2.61E-05	0.002075	2.35E-14
		Fan: M vs L	2.581813	1.914153	3.505322	7.67E-10
		Baffle: NB vs B	10.78887	8.002391	14.68969	2.96E-53
		Cage: Dual vs Single	0.680822	0.504635	0.916241	0.011446
MMC cage	30 min	Strain: R vs S	0.00214	9.06E-04	0.004401	1.57E-53
		Baffle: NB vs B	6.327	4.654	8.687	4.17E-31
		Cage: Mesh 1 vs Single	9.379	5.778	15.547	6.78E-19
		Cage: Mesh 2 vs Single	19.265	11.663	32.599	1.38E-29
		Cage: Mesh 3 vs Single	20.602	12.429	35.004	1.93E-30
		Cage: Mesh 4 vs Single	13.790	8.461	22.994	6.95E-25
		Cage: Mesh 5 vs Single	2.176	1.258	3.792	0.0056
	60 min	Strain: R vs S	0.01198	0.003568	0.02987	5.71E-17
		Baffle: NB vs B	18.891	10.414	36.801	4.57E-20
		Cage: Mesh 1 vs Single	13.205	7.036	26.411	1.52E-14
		Cage: Mesh 2 vs Single	34.787	15.354	94.173	6.68E-15
		Cage: Mesh 3 vs Single	30.826	13.594	83.497	5.51E-14
		Cage: Mesh 4 vs Single	13.974	7.456	27.919	3.56E-15
		Cage: Mesh 5 vs Single	2.619	0.906	9.470	0.0988

Pairwise comparing: airflow conditions (unrestricted [no baffle] vs restricted [with baffle]), strain (resistant vs susceptible), and cage configurations relative to reference categories.

P values indicate the significance of each contrast.

Table S6: Hazard ratios (HRs) from Cox proportional hazards models for time to 25%, 50%, and 90% flight inhibition (FI).

term	Hazard ratio (HR)	std.error	statistic	p.value	conf.low	conf.high	model
Strain susceptible	419.8802003	0.64108	9.421551	4.44E-21	119.519	1475.074	cox_25%
Airflow No baffle	7.976129667	0.402704	5.156281	2.52E-07	3.622515	17.56201	cox_25%
Fan speed medium	2.871210261	0.287143	3.673194	2.40E-04	1.63549	5.040597	cox_25%
system MMC	3.363046305	0.260507	4.655717	3.23E-06	2.018314	5.603726	cox_25%
strain susceptible:airflow No baffle	0.36341224	0.503392	-2.01079	0.044347	0.135491	0.974737	cox_25%
Strain susceptible	2271.046498	0.874662	8.835407	9.97E-19	408.9896	12610.72	cox_50%
Airflow No baffle	12.16000298	0.499508	5.001226	5.70E-07	4.56827	32.36798	cox_50%
Fan speed medium	3.667834693	0.322301	4.032261	5.52E-05	1.950144	6.898471	cox_50%
System MMC	4.11956671	0.280122	5.054036	4.33E-07	2.379091	7.133325	cox_50%
Strain susceptible:airflow No baffle	0.269353636	0.583836	-2.24674	0.024656	0.085775	0.845833	cox_50%
Strain susceptible	86277824670	3684.162	0.006835	0.994547	0	Inf	cox_90%
Airflow No baffle	5.162201567	0.591554	2.774665	0.005526	1.619211	16.45759	cox_90%
Fan speed medium	5.290638503	0.39233	4.246266	2.17E-05	2.4522	11.41459	cox_90%
System MMC	6.246546448	0.333809	5.488256	4.06E-08	3.247142	12.01652	cox_90%
Strain susceptible:airflow No baffle	1.324955305	0.67719	0.415509	0.677769	0.351379	4.996049	cox_90%

Table S7: Within-strain effects of airflow configuration on 24-h mortality.

strain	term	Odds ratio	std.error	statistic	p.value	conf.low	conf.high	P >0.05
Resistant	(Intercept)	0.140	0.198	-9.913	4E-23	0.093	0.203	Yes
	Airflow Low - No baffle	0.389	0.368	-2.570	1E-02	0.182	0.778	Yes
	Airflow Medium - Baffle	1.233	0.226	0.926	4E-01	0.801	1.949	No
	Airflow Medium - No baffle	1.076	0.229	0.318	8E-01	0.695	1.709	No
Susceptible	(Intercept)	2.064	0.138	5.253	1E-07	1.581	2.718	Yes
	Airflow Low - No baffle	4.402	0.259	5.713	1E-08	2.687	7.458	Yes
	Airflow Medium - Baffle	8.799	0.218	9.973	2E-23	5.780	13.616	Yes
	Airflow Medium - No baffle	327.019	1.010	5.732	1E-08	71.799	5790.126	Yes

Estimates are odds ratios (ORs) from binomial generalised linear models (GLMs), expressed relative to the Low–Baffle airflow condition within each strain.

Table S8. Comparison of observed 24-h mortality and strain-specific mean mortality across airflow conditions.

strain	airflow	dead	tested	Mortality pct	Mean mortality pct	P vs Strain mean
resistant	Low - Baffle	29	236	12.28814	12.72321	0.922261
resistant	Low - No baffle	11	213	5.164319	12.72321	4.14E-04
resistant	Medium - Baffle	100	673	14.85884	12.72321	0.10498
resistant	Medium - No baffle	88	670	13.13433	12.72321	0.728112
susceptible	Low - Baffle	161	245	65.71429	92.21267	2.63E-32
susceptible	Low - No baffle	209	232	90.08621	92.21267	0.220161
susceptible	Medium - Baffle	672	709	94.78138	92.21267	0.00934
susceptible	Medium - No baffle	675	676	99.85207	92.21267	1.52E-22