

# Supplementary information: Effectiveness of herbal essential oils as single and combined repellents against *Aedes aegypti*, *Anopheles dirus* and *Culex quinquefasciatus* (Diptera: Culicidae)

Essential oil pairwise results were evaluated with Dunn's test for multiple comparisons, corrected with the Benjamini–Hochberg correction. Significant differences between essential oils were indicated by \* at FWER = 0.1 and \*\* at FWER = 0.05. The labels of each oil were indicated in Table S1. Multiple comparisons of 10 undiluted essential oils and citronella (control) were shown in Table S2A for *Aedes aegypti*, Table S2B for *Anopheles dirus* and Table S2C *Culex quinquefasciatus*. The top row in each cell of pairwise comparison results represents the test statistics whereas the bottom represents the *p*-values.

**Table S1.** Labels of essential oil used in this study.

Oil		Type
1	Citronella oil (control)	Single
2	Anise oil	Single
3	Basil oil	Single
4	Bergamot oil	Single
5	Coriander oil	Single
6	Patchouli oil	Single
7	Peppermint oil	Single
8	Petitgrain oil	Single
9	Rosemary oil	Single
10	Sage oil	Single
11	Vetiver oil	Single

**Table S2A** Pairwise comparisons of undiluted essential oils and citronella (control)  
against *Aedes aegypti*.

	1	10	11	2	3	4	5	6	7	8
10	-0.03628 0.4855									
11	2.194869 0.0775*	2.231148 0.0784								
2	1.741384 0.132	1.777663 0.1383	-0.4534 0.4064							
3	-0.58046 0.3677	-0.54418 0.375	-2.7753 0.0506*	-2.32185 0.0795*						
4	0.770658 0.3277	0.811219 0.3278	-1.6838 0.141	-1.17627 0.2352	1.419634 0.1862					
5	-0.30837 0.453	-0.27209 0.4409	-2.5032 0.0564*	-2.04975 0.101	0.272091 0.4501	-1.11543 0.2348				
6	0.807163 0.3205	0.847724 0.3208	-1.6467 0.1442	-1.13976 0.2332	1.456138 0.1817	0.042152 0.5014	1.151931 0.2365			
7	0.653019 0.3446	0.689297 0.3373	-1.5415 0.1693	-1.08837 0.2376	1.23348 0.2214	-0.04056 0.4928	0.961389 0.2803	-0.07707 0.4964		
8	-0.73821 0.3332	-0.69765 0.3423	-3.1925 0.0388**	-2.68514 0.0498**	-0.08923 0.5009	-1.74229 0.14	-0.39344 0.4241	-1.78444 0.146	-1.46831 0.186	
9	1.922778 0.1153	1.959057 0.1148	-0.2709 0.4596	0.181394 0.4708	2.503239 0.0677*	1.379073 0.1924	2.231148 0.0882*	1.342568 0.1974	1.269759 0.2159	2.887941 0.0533*

**Table S2B** Pairwise comparisons of undiluted essential oils and citronella (control)  
against *Anopheles dirus*.

	1	10	11	2	3	4	5	6	7	8
10	-1.77377 0.1744									
11	1.115381 0.28	2.795807 0.0712*								
2	-0.32965 0.4434	1.28456 0.2736	-1.3517 0.2554							
3	-0.51028 0.3993	1.095654 0.2591	-1.5206 0.2353	-0.16896 0.4492						
4	-0.2574 0.4472	1.360122 0.2655	-1.2841 0.2607	0.067585 0.4731	0.236547 0.4384					
5	0.862501 0.3142	2.531339 0.0625*	-0.2365 0.4472	1.115152 0.2697	1.284115 0.2489	1.047567 0.2615				
6	-1.50231 0.2286	0.287931 0.4431	-2.5464 0.0748*	-1.0352 0.2583	-0.8463 0.3122	-1.11077 0.2619	-2.2819 0.0884*			
7	-1.9712 0.1488	-0.2094 0.4411	-2.9771 0.08*	-1.46591 0.2308	-1.277 0.231	-1.54147 0.242	-2.7126 0.0612*	-0.49734 0.3958		
8	-0.76195 0.3228	1.073198 0.2596	-1.8663 0.155	-0.35514 0.4415	-0.16624 0.442	-0.43071 0.4167	-1.6019 0.2309	0.785267 0.3213	1.282602 0.2387	
9	0.519307 0.4048	2.172417 0.1025	-0.5575 0.3968	0.794124 0.3263	0.963086 0.2796	0.726539 0.3297	-0.3213 0.4378	1.923062 0.1498	2.353767 0.0852*	1.243 0.2353

**Table S2C** Pairwise comparisons of undiluted essential oils and citronella (control)  
against *Culex quinquefasciatus*.

	1	10	11	2	3	4	5	6	7	8
10	1.483844 0.1723									
11	3.788799 0.0042**	2.023901 0.0844								
2	1.882333 0.0967*	0.372751 0.3981	-1.62541 0.1363							
3	1.085356 0.2634	-0.37275 0.4064	-2.42239 0.0424**	-0.7455 0.3135						
4	2.61639 0.0305**	1.059399 0.2567	-0.89136 0.2847	0.686647 0.3223	1.432151 0.1673					
5	0.833679 0.3006	-0.60817 0.3473	-2.67407 0.0343**	-0.98093 0.2642	-0.23542 0.4389	-1.66757 0.1312				
6	3.727963 0.0027**	2.09918 0.0757*	0.220217 0.4367	1.726429 0.1287	2.471932 0.0411**	1.039781 0.2487	2.707354 0.0373**			
7	1.461151 0.1721	-0.13108 0.4561	-2.32765 0.0457**	-0.52957 0.3645	0.267406 0.434	-1.26363 0.2102	0.519083 0.3609	-2.3752 0.0438**		
8	0.602975 0.3416	-0.82398 0.2967	-2.90477 0.0253**	-1.19673 0.2273	-0.45123 0.3814	-1.88338 0.1025	-0.2158 0.4302	-2.9231 0.0318**	-0.74979 0.3197	
9	2.61639 0.0349**	1.059399 0.2653	-0.89136 0.2929	0.686647 0.3302	1.432151 0.1743	0 0.5	1.667573 0.1381	-1.0397 0.2565	1.263627 0.2183	1.883377 0.1094