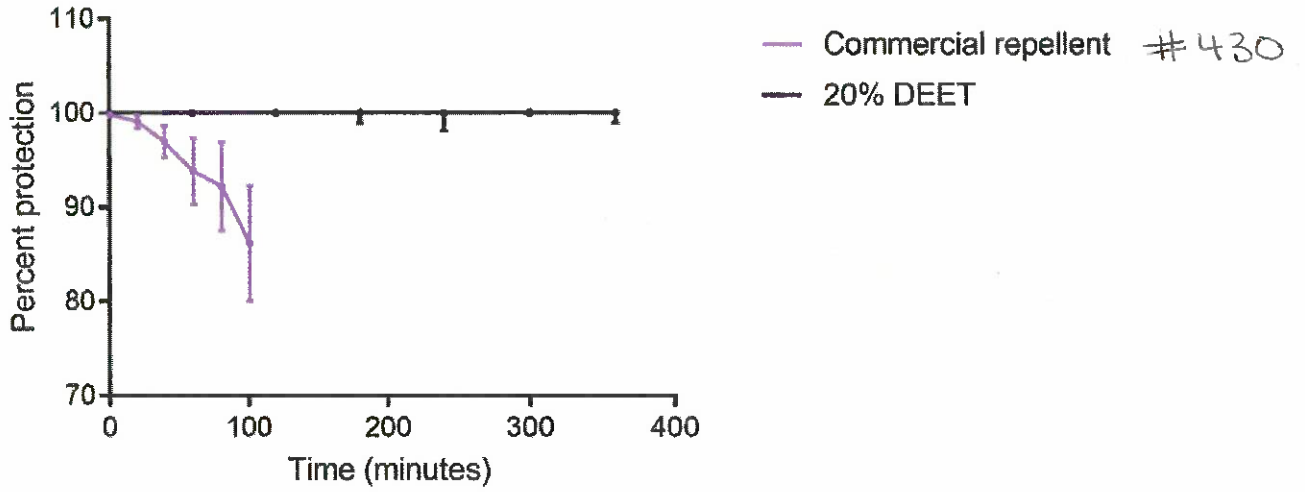
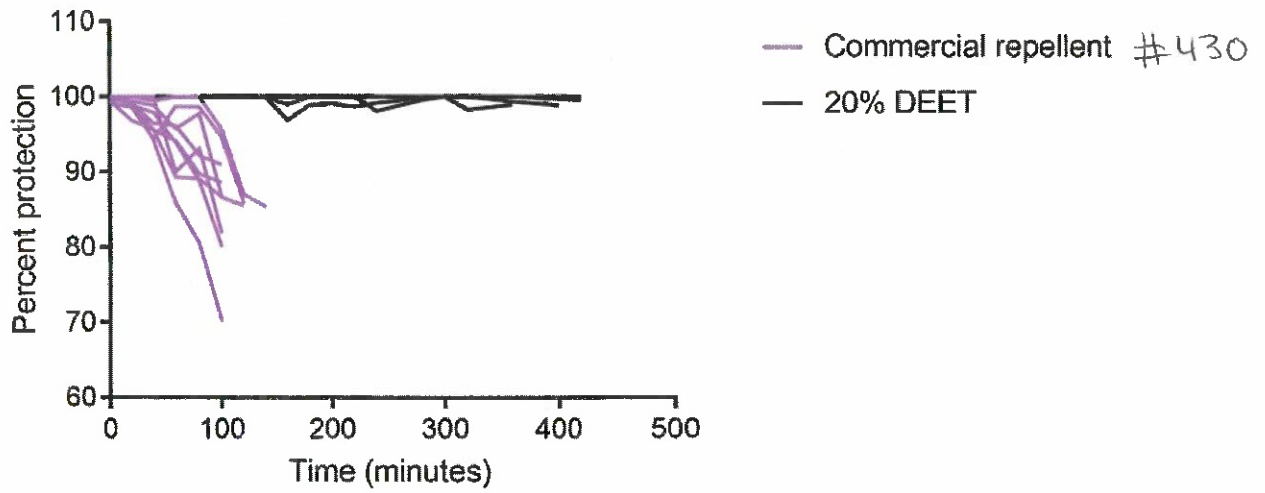


Recipe location: Quality Public > Recipe TGM+FOIA > Insect Repellent Data* > "Insect Repellent Recipe"

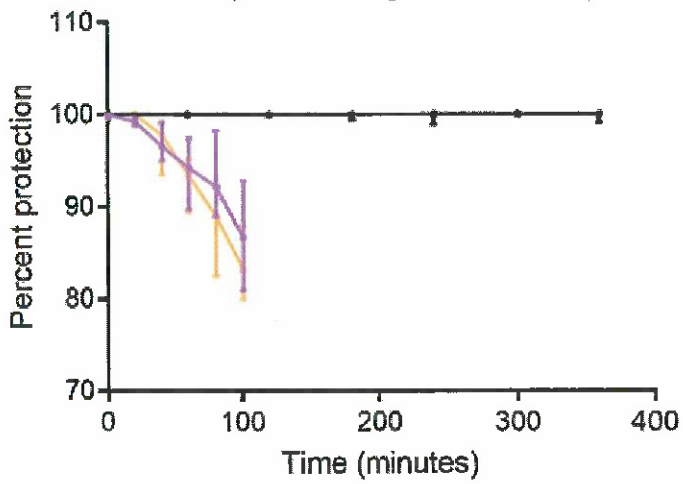
Combined trials



Separate trials

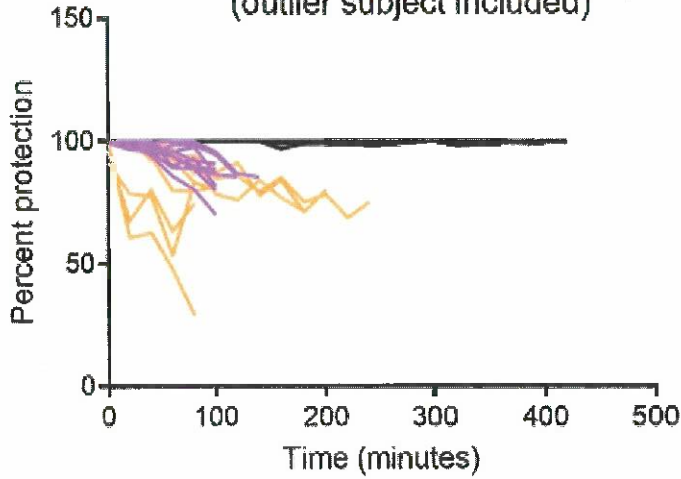


Combined trials
(outlier subject excluded)

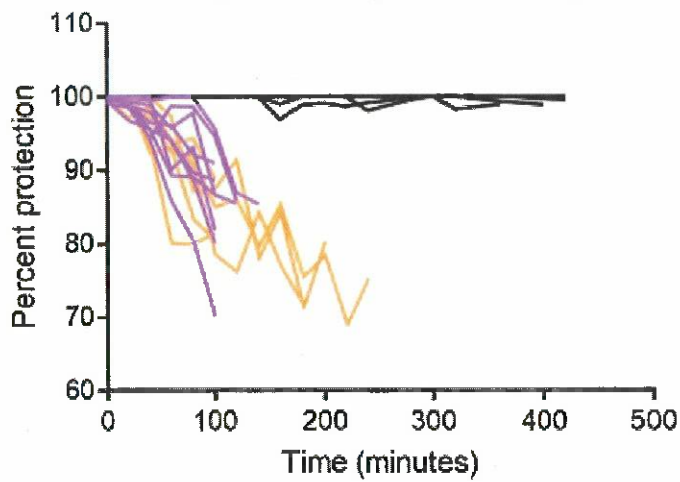


- Commercial repellent #430
- 20% DEET
- Commercial repellent 2 #636

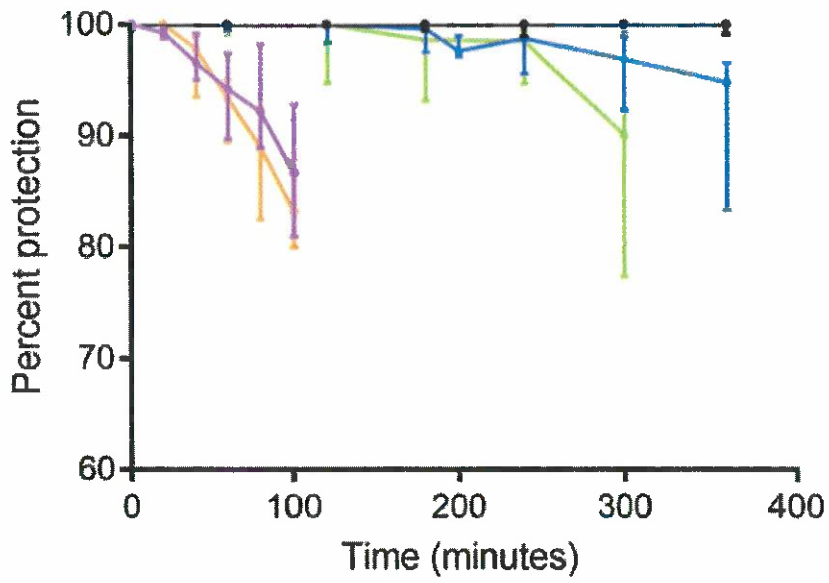
Separate trials
(outlier subject included)



Separate trials
(outlier subject excluded)

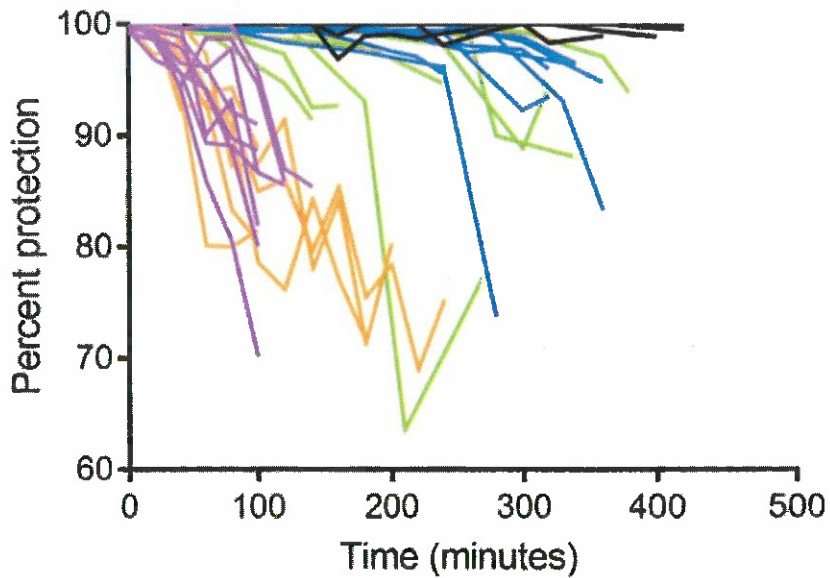


Combined trials



- Commercial repellent #430
- 20% DEET
- Commercial repellent 2 #636
- Formulation 1036
- Formulation 1037

Separate trials



- 20% DEET
- Commercial repellent #430
- Commercial repellent 2 #636
- Formulation 1036
- Formulation 1037

MOSQUITO REPELLENCY TESTS – *Aedes Aegypti*

Experimental design, implementation, and data analysis – Dr Perran Stott-Ross
Report prepared with assistance from Courtney Brown and Nick Bell

METHODS

We evaluated the repellency of four commercial repellent + sunscreen (Antaria) formulations against *Aedes aegypti* mosquitoes in laboratory trials. Trials were spread across two to five human subjects, with two or three replicate experiments per person, per repellent. For each trial, 1 gram of repellent was applied evenly to one forearm of the subject (from wrist to elbow) and introduced into a cage of 50 female *Aedes aegypti* mosquitoes. We then recorded the number of landings (where mosquitoes landed on the skin for more than 3 seconds) for a total of 3 minutes. Before each test, an untreated control arm was introduced into the same cage, and the number of landings in 1 minute was recorded. Experiments did not proceed if fewer than 10 landings were observed on the control arm. Latex gloves were worn for each trial to ensure that only treated skin was exposed to mosquitoes. This protocol is based on the [WHO Guidelines for Efficacy Testing of Mosquito Repellents for Human Skin \(2009\)](#).

To evaluate protection time, the repellent was left on the arm and the process was repeated every 20 minutes. Complete protection time was determined by observing when more than 3 mosquitoes landed on the treated arm in at least two consecutive trials. As a positive control, trials were repeated with 20% DEET and sunscreen (Bushman™ repellent plus). Trials ran for up to six hours or until loss of complete protection was confirmed.

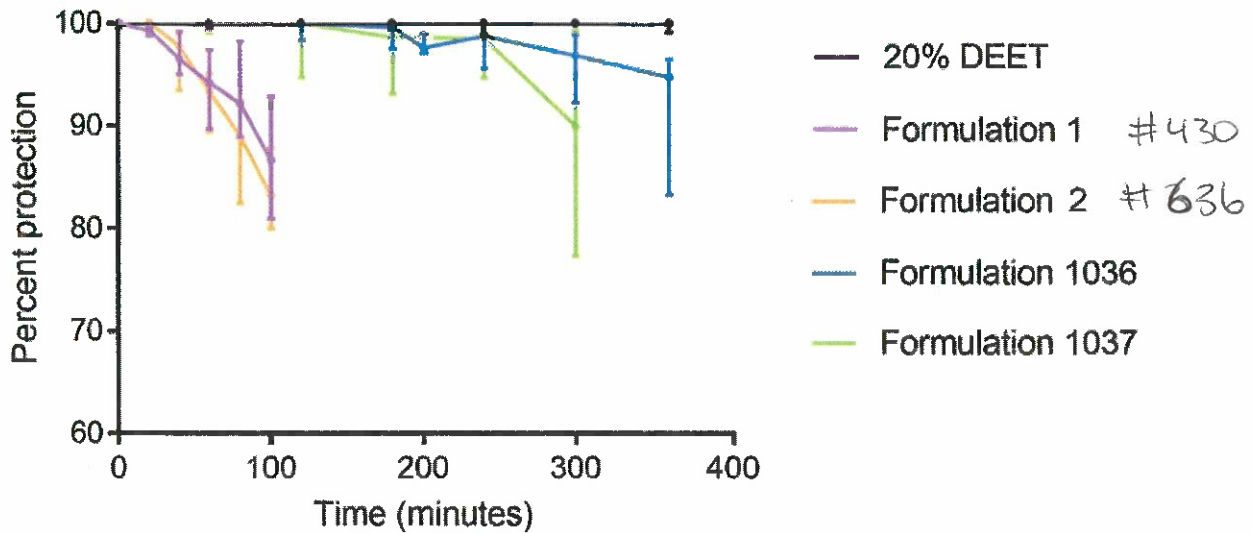
RESULTS

All human subjects were attractive to mosquitoes, with >10 landings in every control test. The positive control provided complete protection for >6 hours in all trials, while all four commercial formulations had a complete protection time of five hours or less. The first two formulations provided limited protection, with median complete protection times of 40 minutes. However, a second set of formulations (1036 and 1037) provided much stronger protection than previous formulations. Complete protection time (time to 3 or more mosquitoes landing in a 3 min period) was 300 minutes (median) and 281.25 minutes (average) for formulation 1036, and 180 minutes (median), 200 minutes (average) for formulation 1037. In the attached figure, you can see relative protection conferred for each repellent across time, either for all replicate trials combined, or for individual replicate trials.

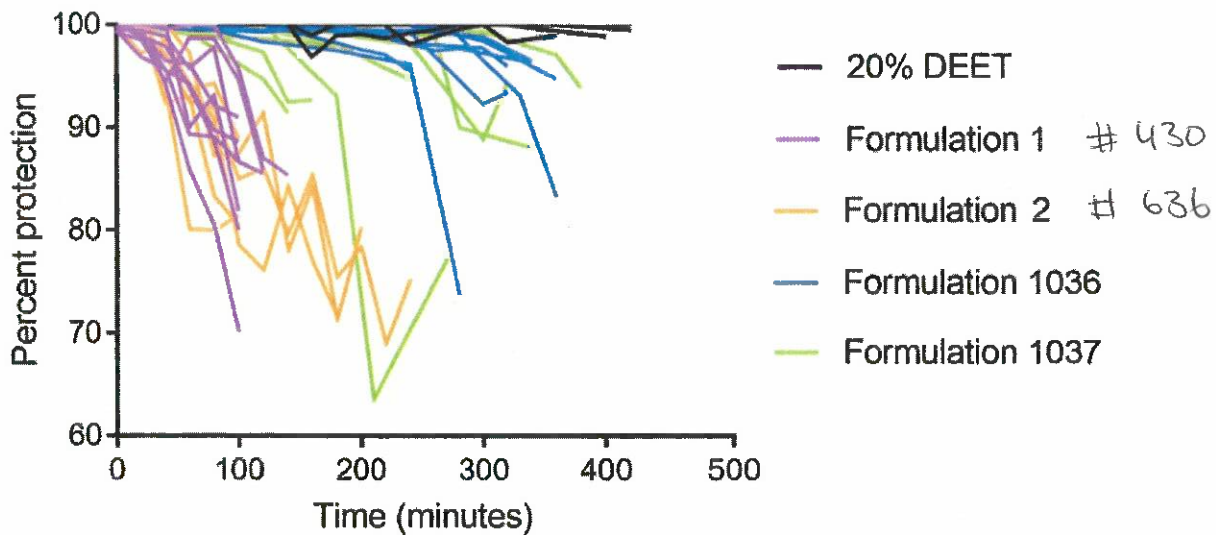
SUMMARY TABLE

Product	Replicate trials	Number of human subjects	Complete protection time in minutes (mean)	Complete protection time in minutes (median)
Bushman™ 20% DEET with sunscreen	6	3	>360	>360
Formulation 1 #430	9	3	46.7	40
Formulation 2 #636	9	3	33.3	40
Formulation 2 (outlier subject excluded)	6	2	46.7	40
1036	8	5	281.3	300
1037	8	5	200	180

Combined trials



Separate trials



SUMMARY REMARKS

Our study of the repellency of the commercial repellent and sunscreen found that in laboratory trials, *Aedes aegypti* mosquitoes were more repelled by formulations 1036 and 1037 than the two previous formulations. Across eight replicate trials, the 1036 formulation provided the longest protection time (a mean of 281.3 minutes). Both it and the



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1037 formulation (with a mean complete protection time of 200 minutes) lasted over four times as long as the second formulation tested prior.

Complete protection time was calculated by taking the total time from when the product was applied to the time when more than three mosquitoes landed on the treated arm in at least two consecutive trials (including the 20 minute rests between each trials).

The first formulation, while providing near complete protection immediately after applying the protection (a 98.8% decrease in mosquito landings was observed), the repellent efficiency decreased over time. After one hour the repellency was 93.8% when compared to the untreated arm. The second formulation provided a near identical repellency when compared to the original formulation, providing a complete protection time of 47 minutes.

From our studies we conclude that the 1036 formulation provides the best protection against *Aedes aegypti* in laboratory conditions, out of the four formulas studied.