



Proven Efficacy of Biogents Traps

Biogents' mosquito traps were invented by scientists who have been doing research on the behaviour of mosquitoes and other blood-sucking insects for over 16 years. There are more than 400 scientific publications in which Biogents traps were either evaluated, or used as a mosquito monitoring tool. This proves that scientists world-wide trust in Biogents traps for the collection of important mosquito surveillance data.

List of studies with Biogents traps: <https://us.biogents.com/wp-content/uploads/Publication-List-Biogents-Mosquito-Traps.pdf>

On the next pages you find **selected studies that show the control effect** of Biogents traps.



Selected Publications – Mosquito Traps as Control Tool

Biogents Suction Traps



Englbrecht et al. 2015: Reduction of *Aedes albopictus* nuisance in Italy.

In Europe, Italy is one of the countries, that are heavily infested with the day-active Asian tiger mosquitoes (*Aedes albopictus*). This study showed that it is possible to reduce biting rates and local populations of *Aedes albopictus* in Cesena, Italy, by using Biogents suction traps:

For the experiment, 3 small intervention sites with different characteristics were selected: a) single-family house surrounded by a garden, b) area dominated by apartment houses, c) cemetery. The mosquito biting pressure in outdoor areas of the three areas was compared to those in three untreated similar environments by human landing collections (the lower legs of an investigator were exposed to

mosquitoes, and landing mosquitoes were collected, identified and counted). The study duration was 16 weeks from June to October.

From the beginning of the study, the biting pressure was lower in areas with Biogents suction traps, but after 5 weeks, the effect of trapping on mosquito nuisance became more evident. Over the course of the whole study, an average of 11.2 *Ae. albopictus* per hour were collected by human landing collections in areas without Biogents traps, while only an average of 1.4 *Ae. albopictus* per hour were collected in areas with Biogents traps. This means, that the overall biting pressure in intervention areas was reduced by 87% (Fig. 1).

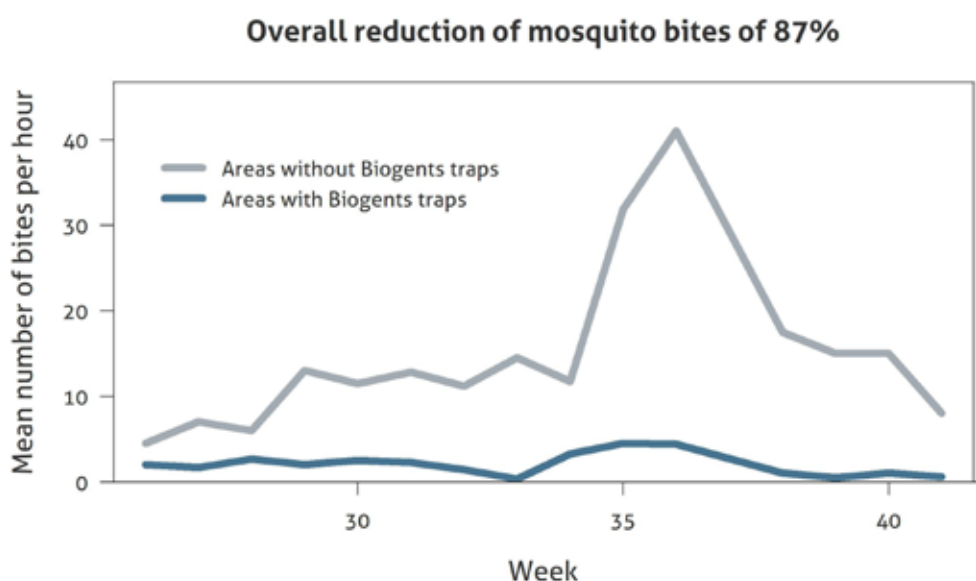


Fig. 1: Mean number of *Aedes albopictus* bites per hour in human landing collection at three intervention sites treated with Biogents traps, and three similar sites without traps in Cesena, Italy.

Read more about the results in the publication:
Englbrecht C, Gordon S, Venturelli C, Rose A, Geier M. 2015. Evaluation of BG-Sentinel Trap as a Management Tool to Reduce *Aedes albopictus* Nuisance in an Urban Environment in Italy. *J Am Mosq Control Assoc.* 31(1):16–25. doi:10.2987/14-6444.1.



Degener et al. 2014: Mass trapping of Dengue Vectors with BG-Sentinel Traps

Aedes aegypti, the main vector of viral diseases such as dengue, Zika and chikungunya, is highly adapted to urban areas. Routinely employed dengue vector control strategies, that usually consist of the reduction of breeding sites and application of insecticides, have failed to control virus transmission in most settings, including Brazil. This long-term study shows that Biogents suction traps can reduce the abundance of *Aedes aegypti* in urban settings. The study that was co-financed by the world-bank was conducted over 18 months in Manaus, Brazil.

Six mass trapping areas (areas where on average 60% of households received a Biogents suction trap for constant mosquito trapping) and six control areas (areas without trapping intervention) were selected in the same neighborhood. The mass trap-

ping areas included a total of 734 houses, 444 of which accepted a Biogents suction trap for constant use, and the control areas comprised 753 houses. The effect of the intervention was monitored by installing 4 BG-Sentinel monitoring traps in all 6 intervention and all six control areas for 24 h once every two weeks.

Monitoring indicated that the mass trapping intervention significantly reduced the abundance of adult female *Ae. aegypti* during the first five rainy months of the study. Additionally, recent dengue infections were less common in participating houses of mass trapping areas. The majority (88%) of 235 inhabitants from the mass trapping areas that participated in a questionnaire reported that the trap perceptibly reduced both mosquito density and nuisance.

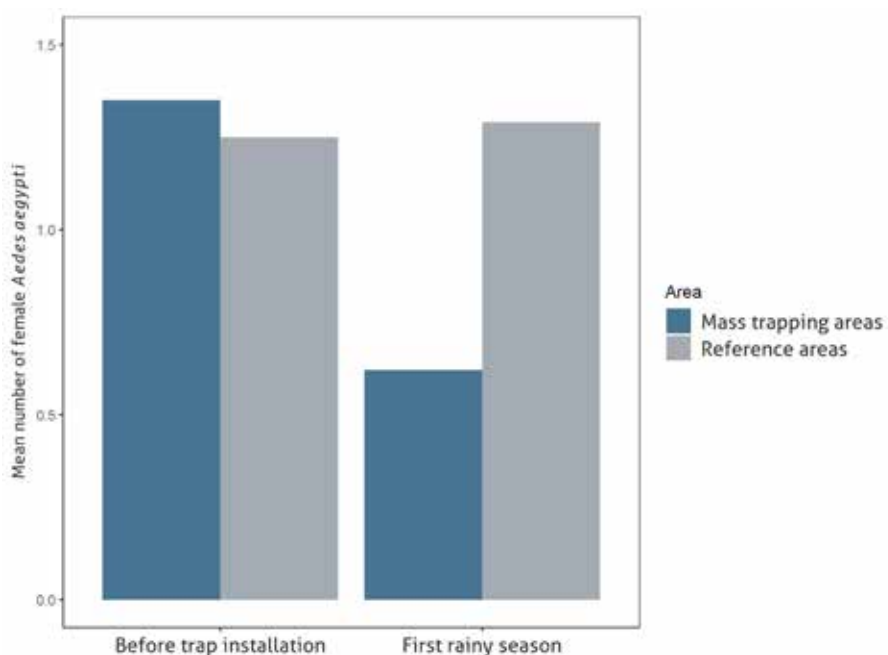


Fig. 2: Comparison of mean numbers of collected female *Aedes aegypti* in monitoring traps in six mass trapping areas and six reference areas (areas without trapping intervention) before trap installation and during the first rainy season of the long-term study.

Read more about the results in the publication:

Degener CM, Eiras E, Ázara TMF, Roque RA, Rösner S, Codeço CT, Nobre AA, Rocha ESO, Kroon EG, Ohly JJ, et al. 2014. Evaluation of the Effectiveness of Mass Trapping With BG-Sentinel Traps for Dengue Vector Control: A Cluster Randomized Controlled Trial in Manaus, Brazil. *J Med Entomol.* 51(2):408–420. doi:10.1603/ME13107.

Biogents CO₂ Suction Traps



Akhoundi et al., 2018: Effectiveness of a field trap barrier system for controlling *Aedes albopictus*: a “removal trapping” strategy

A scientific study from southern France demonstrated the potential of Biogents suction traps to significantly reduce Asian tiger mosquito biting pressure to almost zero: Three houses with garden were treated with a network Biogents traps that were operated with CO₂ and BG-Lure for three months during the peak activity season of *Ae. albopictus*. The average distance between the traps was 5 m. The three treated properties received 9, 13, and 18 traps, depending on their size (Fig. 3). The trap network is called “Bio-Belt Anti-Moustique” and was patented by the French company HBM Distribution SAS.

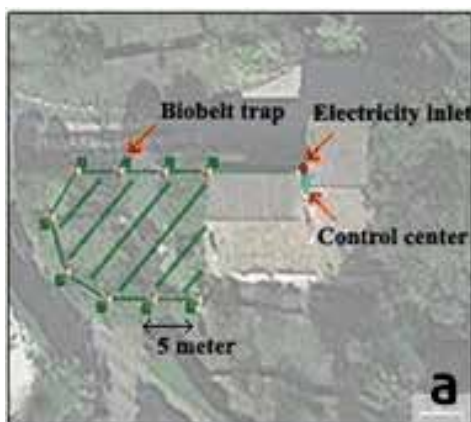


Fig. 3: Biobelt traps installation in the treated houses. Spatial schematic depiction of the array of the “belt” of traps around one of the three treated houses, traps are shown in green. The area protected by the barrier is hatched.

The mosquito biting pressure in outdoor areas of the three treated houses was compared to the biting pressure in three untreated houses with similar environments. An effect of the trap barrier is visible from the time, when traps were turned on (vertical dashed line in Fig. 4). After three weeks of continuous trapping, the biting pressure was substantially reduced in the houses that were protected by traps, in comparison to untreated houses, and after six weeks, the biting pressure was reduced to almost zero.

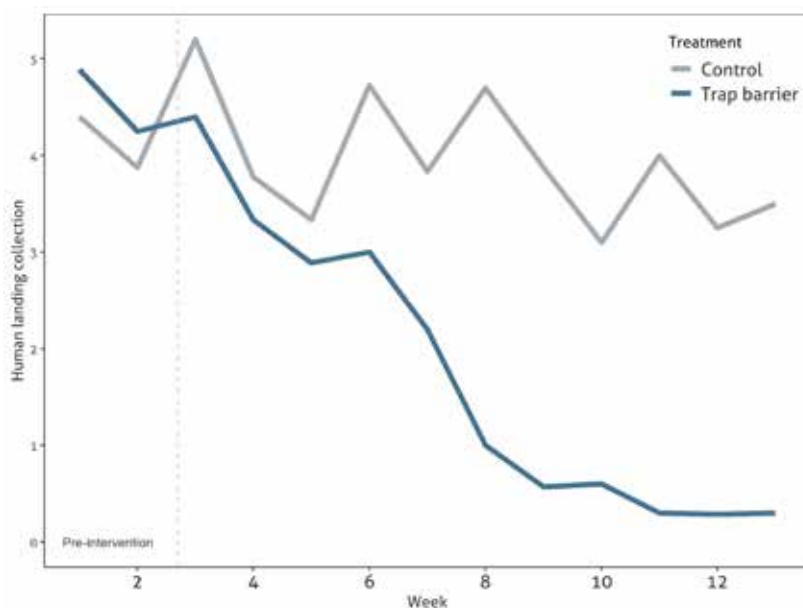


Fig. 4: Weekly mean *Ae. albopictus* biting pressure in three houses with BG-Sentinel trap barrier system and in three untreated control houses in southern France, July – Sept 2016. The dashed vertical line indicates when the trap barrier system was turned on.

Read more about the results in the publication:

Akhoundi M, Jourdain F, Chandre F, Delaunay P, Roiz D. 2018. Effectiveness of a field trap barrier system for controlling *Aedes albopictus*: a “removal trapping” strategy. *Parasit Vectors*. 11(1):101. doi:10.1186/s13071-018-2691-1.

Biogents Passive Gravid *Aedes* Trap: BG-GAT



Johnson et al. (2018): Neighbors help neighbors control urban mosquitoes

Government-led programs to control dengue have often failed. Urban mosquitoes such as the yellow fever mosquito *Ae. aegypti* and the asian tiger mosquito *Ae. albopictus* mainly breed in small containers on private properties. They are therefore ideal species to be targeted by control programs that strongly rely on citizen participation.

The town of University Park, MD, USA used the BG-GAT traps in a citizen-based mosquito control intervention. The town is highly infested with *Ae. albopictus* and comprises approximately 1000 residential yards. The approach named Citizen Action through Science (Citizen AcTS) is based on citizen volunteers that are mentored by scientific advisors.

Residents were encouraged to purchase two BG-GAT traps (one for the front- and one for the back yard). Each block of houses had a community leader that informed their neighbors about the initiative. Every participant was responsible for the installation and maintenance of the purchased traps.

Almost the half of the town's residential yards (439 of 954) were equipped with GATs. Results indicate effective mosquito control, however the reduction of mosquito nuisance was significantly higher in blocks, where more than 80% of households used GAT traps (Fig. 5).

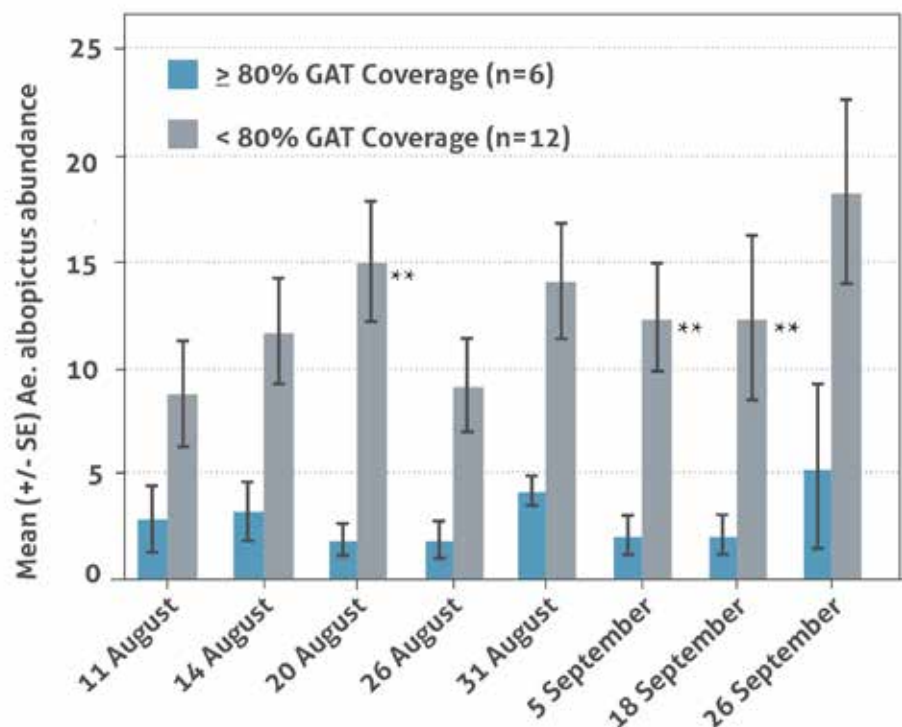


Fig. 5: Mean (\pm SE) female *Ae. albopictus* abundance in monitoring traps (BG-Sentinel + BG-Lure) in areas where $\geq 80\%$ of households and $< 80\%$ of households used GAT traps. Presence of '**' indicate statistical significance between observations.

Read more about the results in the publication:
Johnson BJ, Brosch D, Christiansen A, Wells E, Wells M, Bhandoola AF, Milne A, Garrison S, Fonseca DM. 2018. Neighbors help neighbors control urban mosquitoes. *Sci Rep.* 8(1):15797. doi:10.1038/s41598-018-34161-9.

Mosquito Attractants:

The effectiveness of Biogents' BG-Sweetscent and of CO₂



Degener et al. 2019: Field tests of mosquito lures and traps

The growing spread of the invasive mosquito species *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) increases the complexity of mosquito control. In contrast to several other mosquito species that are found in the home environment, such as the house mosquito *Culex quinquefasciatus*, the container-inhabiting tiger mosquitoes are day-active. Adulticidal operations at daytime are not feasible and reaching all breeding sites in larviciding operations is practically impossible. Many home owners use mosquito traps to reduce mosquito populations in their backyards. Several traps with different attraction mechanisms and price categories are commercially available, but most of these traps were not scientifically proven to be effective.

The Biogents BG-Sentinel trap has been used by researchers all over the world for over a decade to

monitor dengue vectors and is generally recognized as the gold standard mosquito trap for yellow fever and Asian tiger mosquitoes. The trap uses the BG-Sweetscent, an artificial human skin scent that contains lactic acid (--> **Question 1**).

The BG-Sentinel can additionally be operated with CO₂ to increase catch rates and species spectrum. The commercially available BG-Mosquitaire trap uses the same mosquito attraction and collecting mechanisms as the BG-Sentinel, but instead of being lightweight and collapsible for scientific or public health purposes, it was designed to be more robust and visually pleasing, for use in fixed positions throughout the whole mosquito season in backyards, restaurants, hotels, and similar locations.

(--> **Question 2 and 3**)

The study answered three questions:

Question 1) Do tiger mosquito catch rates of other commercially available mosquito traps increase when adding the BG-Sweetscent lure?

Yes – catch rates of tiger mosquitoes in different UV light mosquito traps increased up to 4.2-fold.



Fig. 6: Biogents BG-Sweetscent increases Asian tiger mosquito catch rates in commercially available mosquito traps.

2) Is the commercially available BG-Mosquitaire trap as good as the professional BG-Sentinel trap?

Yes, there was no statistical difference between the *Ae. aegypti* and the *Culex quinquefasciatus* catch rates of the two traps, neither when tested with (Fig. 7 A), nor without CO₂ (Fig. 7 B).

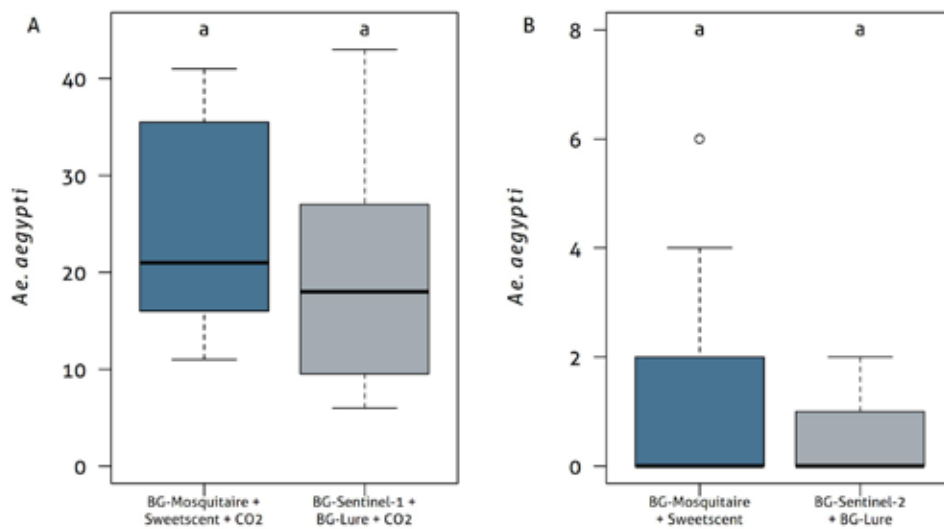


Fig 7: Boxplots of *Aedes aegypti* (female and male) catches in BG-Mosquitaire and BG-Sentinel traps (A) in Clovis, CA, and (B) New Orleans. The same letters indicate insignificant different catch rates.

3) Is the BG-Mosquitaire trap with and without CO₂ better than two other mosquito traps that need to be obligatorily operated with CO₂?

Without CO₂, the BG-Mosquitaire with BG-Sweetscent is already as good as the Mosquito Magnet Patriot, and better than the SkeeterVac SV3100. With CO₂, the BG-Mosquitaire collects seven to twelve times more *Ae. albopictus* than the other two traps.

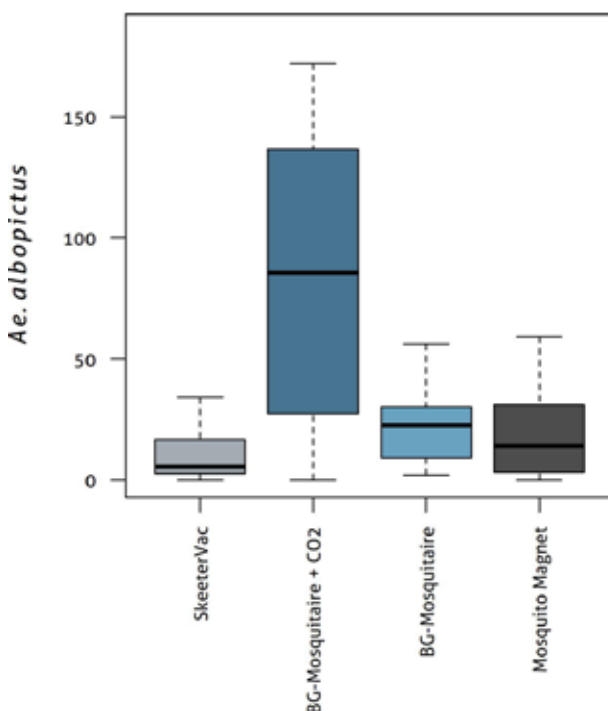


Fig. 8: Boxplots of (A) *Aedes albopictus* (female and male) in 4 different mosquito traps in Lake Charles, LA. Please note that 2 outliers (302 and 523 *Ae. albopictus* in the BG-Mosquitaire+Sweetscent+CO₂) are not shown in order to facilitate visual comparison between boxes. Different letters indicate significantly different catch rates.

Read more about the results in the publication:
 Degener CM, Geier M, Kline DAN, Urban J, Willis S. 2019. Field trials to evaluate the effectiveness of the BG-Sweetscent lure in combination with several commercial mosquito traps and to assess the effectiveness of the BG-Mosquitaire trap with and without carbon dioxide. 35(1):32-39. doi:10.1038/s41598-018-34161-9.