WALS™

An Educational Module

WALS Origin & Operational Use

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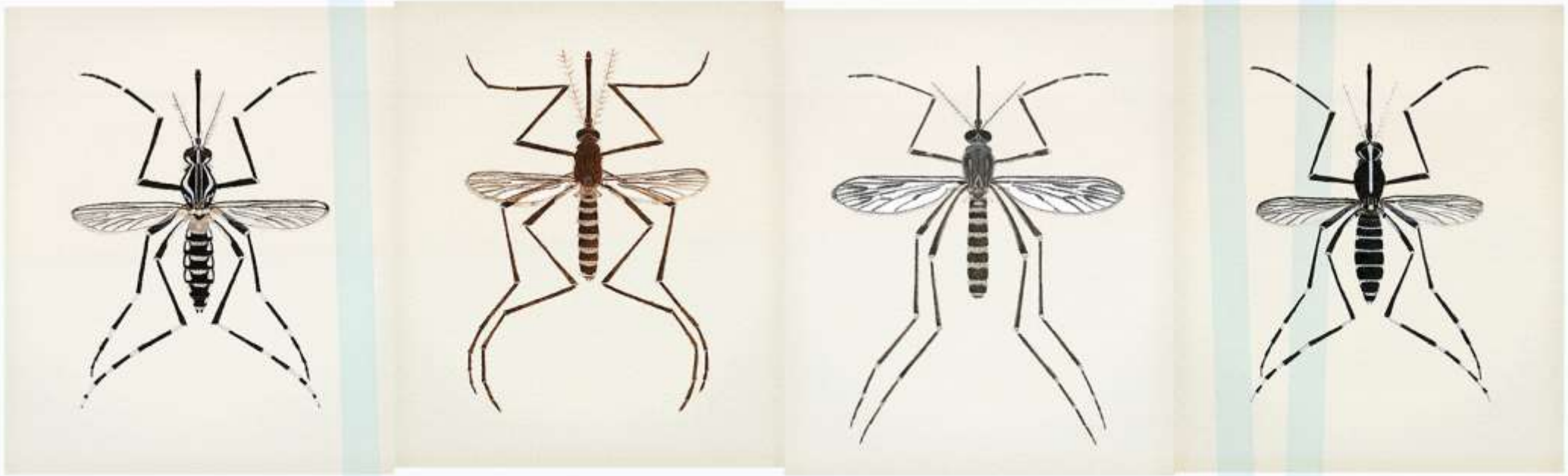
Container mosquitoes



Aedes aegypti ***Culex pipiens*** ***Culiseta incidens*** ***Aedes albopictus***

Complex Vector Problems

Courtesy: NPR.org

Over the last 20+ years, Valent BioSciences has partnered with Public Health professionals from around the globe to co-innovate a biorational application strategy for controlling mosquito larvae in difficult to find/access habitats.

And this strategy has been branded by the industry and is referred to as...

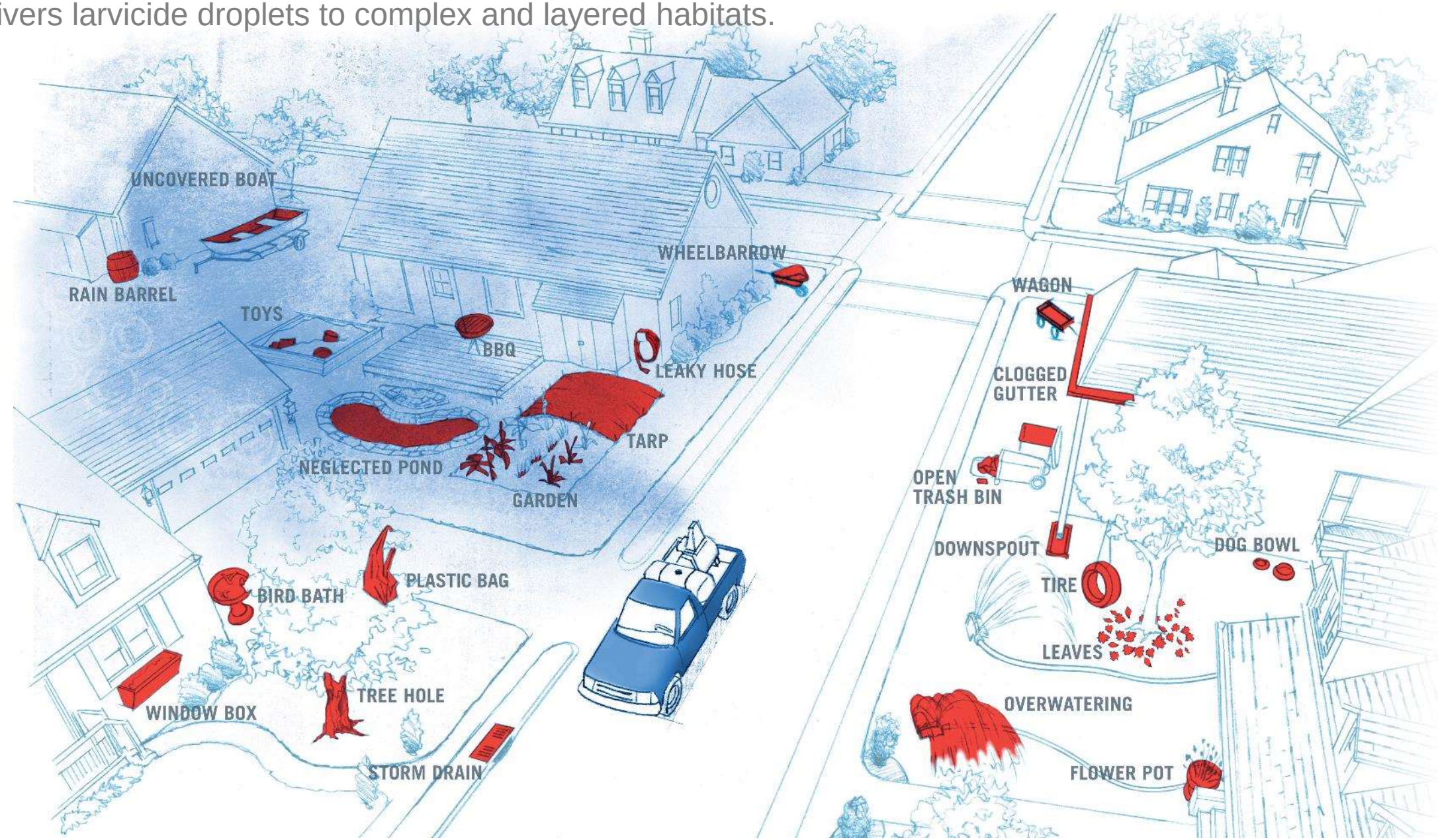
WALS™

A Valent BioSciences Co-Innovation

What is WALS™?

WALS is a biorational application strategy

Delivers larvicide droplets to complex and layered habitats.



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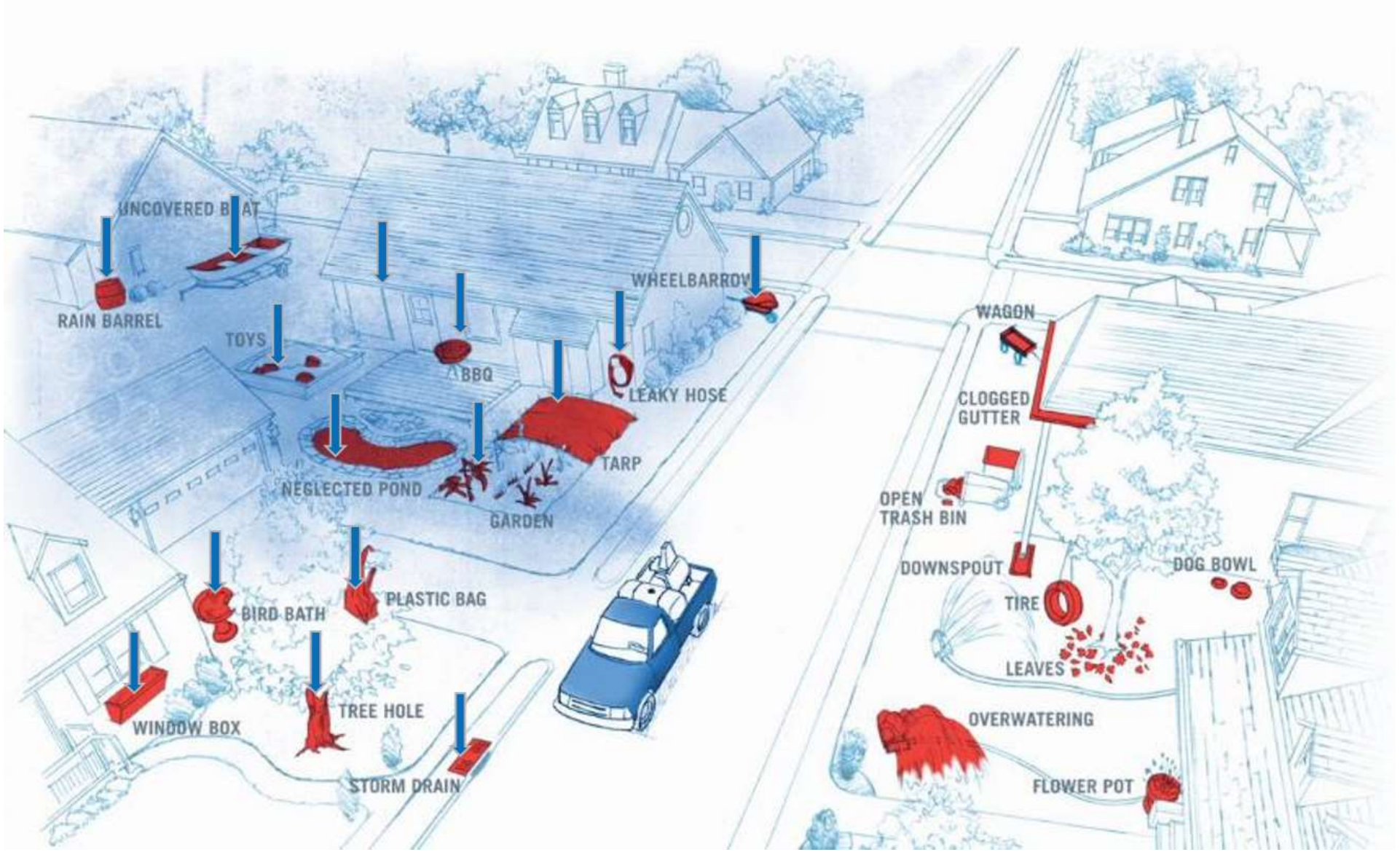


Long History of Research and Operations

20+ Academic Studies

10+ Publications

11 Countries

So let’s go back to the beginning…

Medical Entomology Unit

First WALS Evaluations at Medical Entomology Division, IMR, Malaysia

1992 - 1994 : Vehicle mounted ULV generator IGEBA and DynafogMaxiPro– Bti (VectoBac) & malathion – open football field, residential sites, construction site - larvae in cups and cages with adults – residual larval control study for 14 days – & droplet analysis

#21

Microdroplet Application of Mosquitocidal *Bacillus thuringiensis* Using Ultra Low Volume Generator for the Control of Mosquitoes

P. Seleena and H. L. Lee
Div. of Med. Entomology, Inst. for Med. Research, Malaysia

Ultra low volume (ULV) fogging trials of mosquitocidal *Bacillus thuringiensis* subsp. *israelensis* (B.t.i.) together with malathion against mosquito larvae and adults were conducted in an open air field, housing estates and in a construction site. Commercial aqueous B.t.i. formulation, VECTOBAC 12AS (Abbott Laboratories) containing 1200 ITU/mg against *Aedes aegypti*, and malathion 96% technical grade were used. ULV generators viz. IGEBA and Dynafog Maxipro4 were used to disperse these formulations at discharge rates ranging between 0.25 to 0.50 L/min. The effectiveness of the ULV fogging at various distances from the ULV generator was evaluated by measuring 4 different parameters: larval mortality, adult mortality, B.t.i. count from the test samples and ULV droplet analysis. These trials have indicated that ULV fogging is effective in dispersing the B.t.i. (9v) together with malathion (1v) to affect complete larval and adult mortality. However the mortality varied in relation to the distances from the ULV generator depending on the structure and surrroundings of the building and other environmental factors. Larval mortality remained the same in the test samples even 14 days after the fogging, indicating the persistency of the fogged B.t.i. particles at 28-32°C. These trials have shown that ULV fogging is effective in dispersing bacteria and malathion but to ensure a successful fogging operation the flow rates have to be adjusted in accordance to the ULV generator used and the environment.

Ben Gurion University of the Negev

The 20th Anniversary of the Bti Discovery

August 12-16, 1996

Shoresh
(near Jerusalem)
Israel

FIRST ANNOUNCEMENT AND CALL FOR PAPERS

WALS Efficacy Publications

Publication	Author/Year	Journal
Microdroplet application of mosquitocidal *Bacillus thuringiensis* using ultra-low-volume generator for the control of mosquitoes.	Seleena, P et al (1996)	SEAJTMPH 27(3):628-632
Impact of larviciding with a *Bacillus thuringiensis israelensis* formulation, VectoBac WDG on dengue mosquito vectors in a dengue endemic site in Selangor state, Malaysia	Lee, H.L. et al (2008)	SEAJTMPH, 39 (4): 601-609
Aedes albopictus control with spray application of *Bacillus thuringiensis israelensis*, strain AM 65-52	Lam, et al (2010)	SEAJTMPH 41(5): 1071-1081
Bacillus thuringiensis var. *israelensis* Misting for Control of *Aedes* in Cryptic Ground Containers in North Queensland, Australia	Jacups, S.P. et al (2013)	AJTMH 88(3) 490 - 496
Area-Wide Ground Applications of *Bacillus thuringiensis var. israelensis* for the Control of *Aedes albopictus* in Residential Neighborhoods: From Optimization to Operation	Williams G.M. et al (2014)	PLoS ONE 9(10): e110035.
Taming a Tiger in the City: Comparison of Motorized Backpack Applications and Source Reduction Against the Asian Tiger Mosquito, *Aedes albopictus*	Sun D. et al (2014)	JAMCA 30(2):99-105

WALS Publications Indicating Disease Reduction

Publication	Author/Year	Journal
Spray application of *Bacillus thuringiensis israelensis* (Bti strain AM65-52) against *Aedes aegypti* (L.) and *Ae albopictus* Skuse populations and impact on dengue transmission in a dengue endemic residential site in Malaysia.	Tan AW et al (2012)	SEAJTMPH, Vol. 43(2): 296-310
A Large Scale Biorational Approach Using *Bacillus thuringiensis israelensis* (Strain AM65-52) for Managing *Aedes aegypti* Populations to Prevent Dengue, Chikungunya and Zika Transmission.	Pruszynski CA et al (2017)	PLoS ONE 12(2): e0170079.
Managing *Aedes aegypti* populations in the first Zika transmission zones in the continental United States	Stoddard, PK (2018)	Acta Tropica 187 (2018) 108–118
Wide area spray of bacterial larvicide, *Bacillus thuringiensis israelensis* strain AM65-52, integrated in the national vector control program impacts dengue transmission in an urban township in Sibu district, Sarawak, Malaysia	Bohari, R et al (2020)	PLoS ONE 15(4): e0230910.

WALS Drops

Optimal WALS Droplet Size

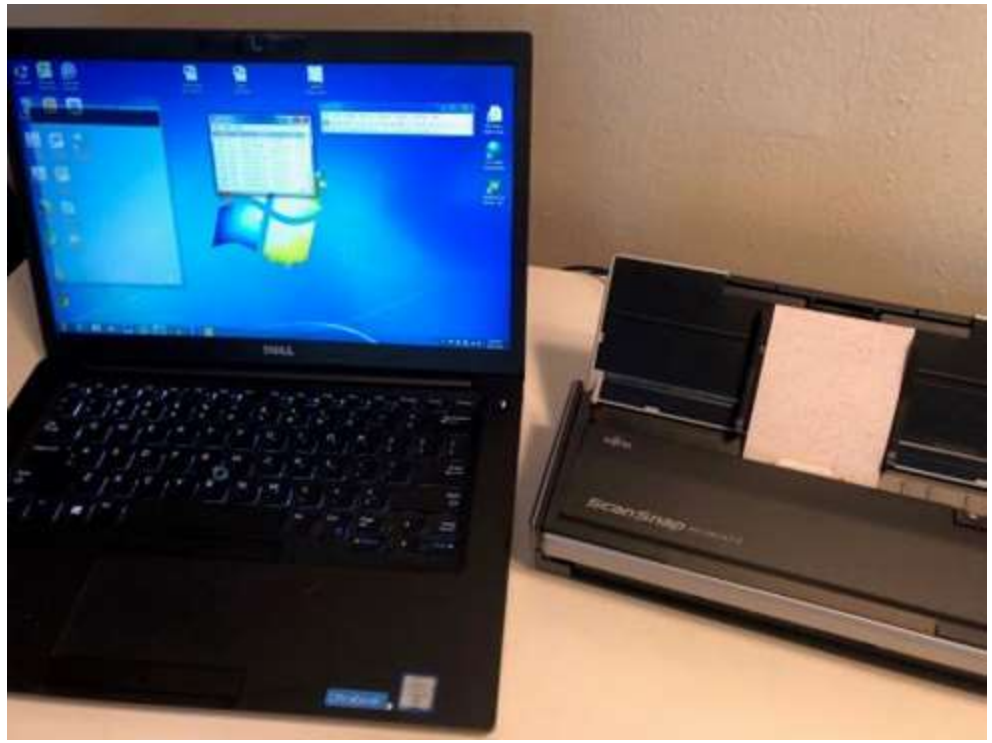
SPRAY QUALITY	VOLUME MEAN DIAMETER (MICRONS)	EQUIPMENT TYPE
Extremely Fine	30 - 60	Cold Fogger / Air Blast (Micronair AU 5000 with EX6353 set at 55º)
Very Fine	61 – 105	
Fine	106 - 235	

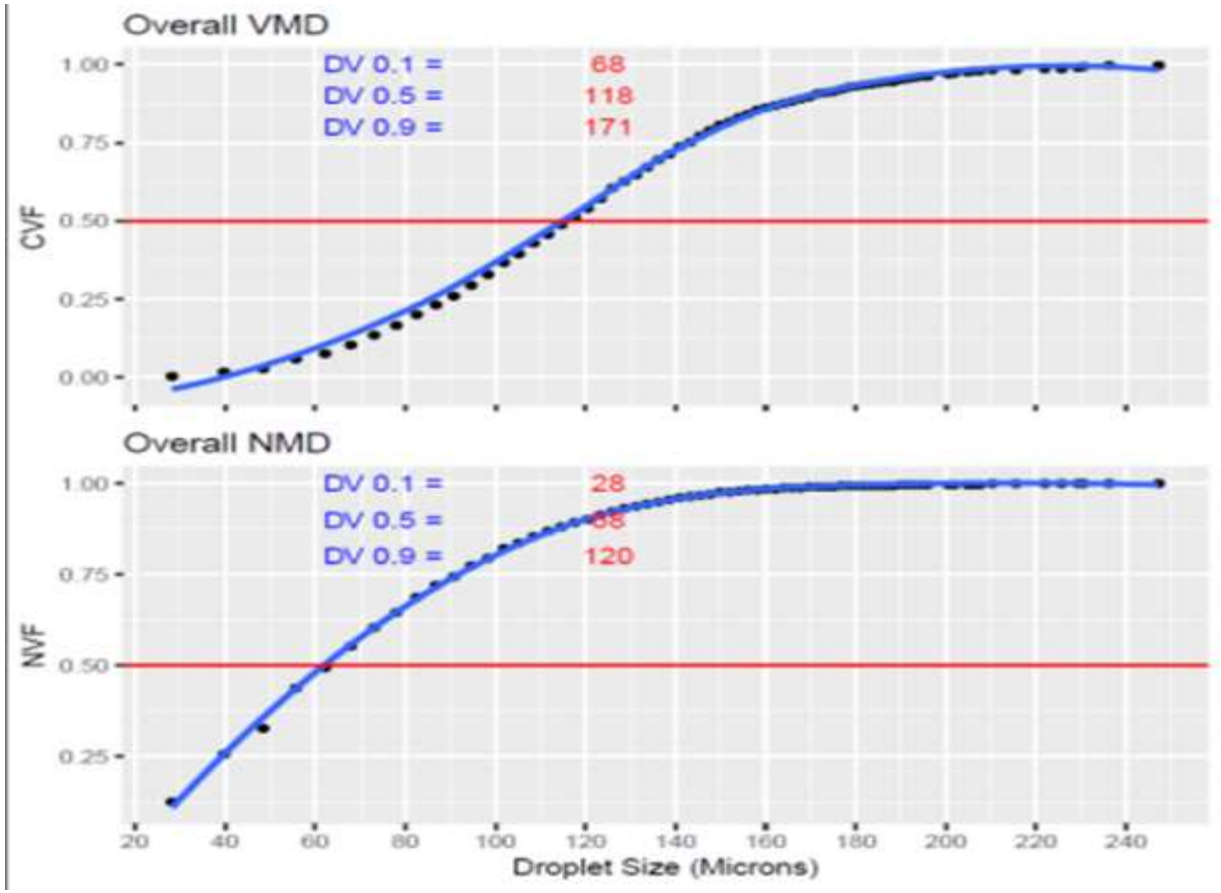
WALS requires a unique droplet size range in the extremely fine to fine (30 – 235 microns), which can drift through areas such as neighborhood backyards where inaccessible containers may be abundant.

ACHIEVES RAPID COVERAGE

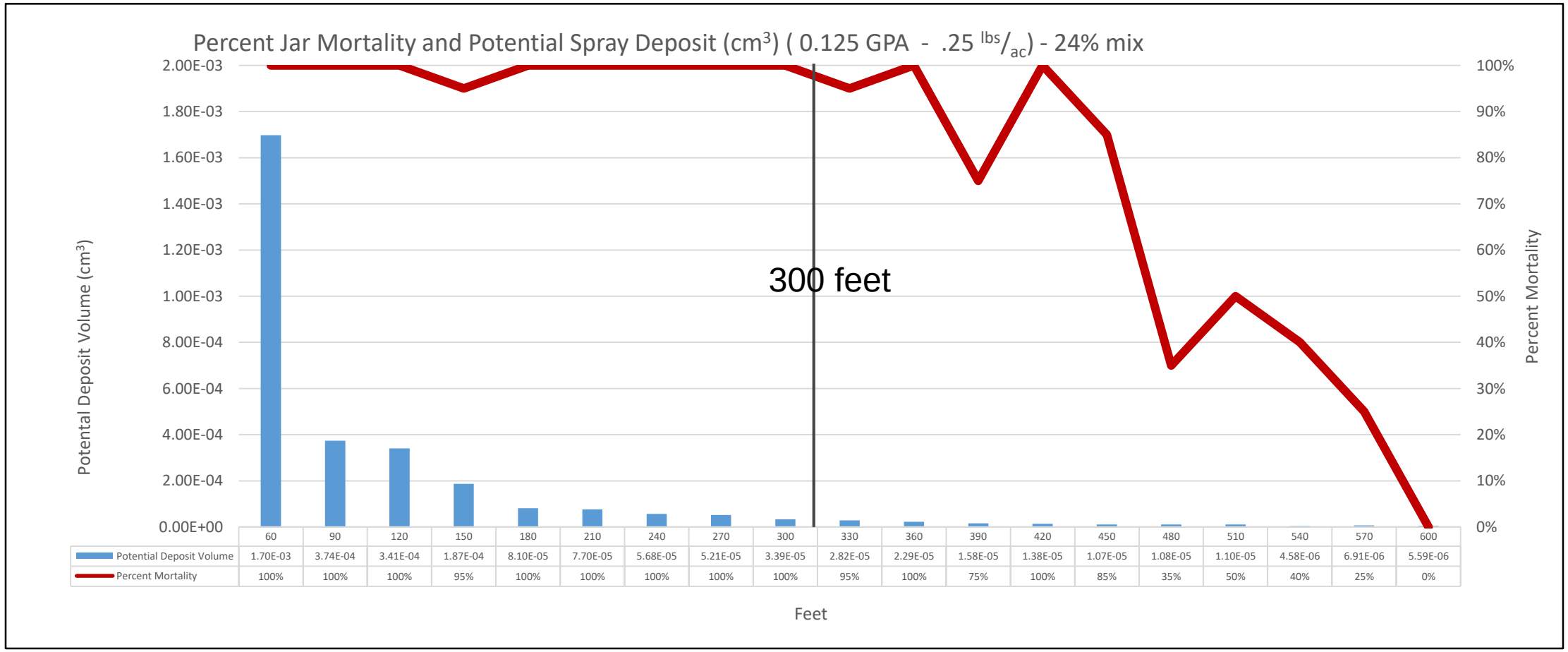
DEPOSITS IN CRYPTIC CONTAINERS

WALS Drop Spectrum Measured using BacDrop™ Analysis





WALS drop spectrum enables deposition to habitats >300-feet downwind of truck sprayers.



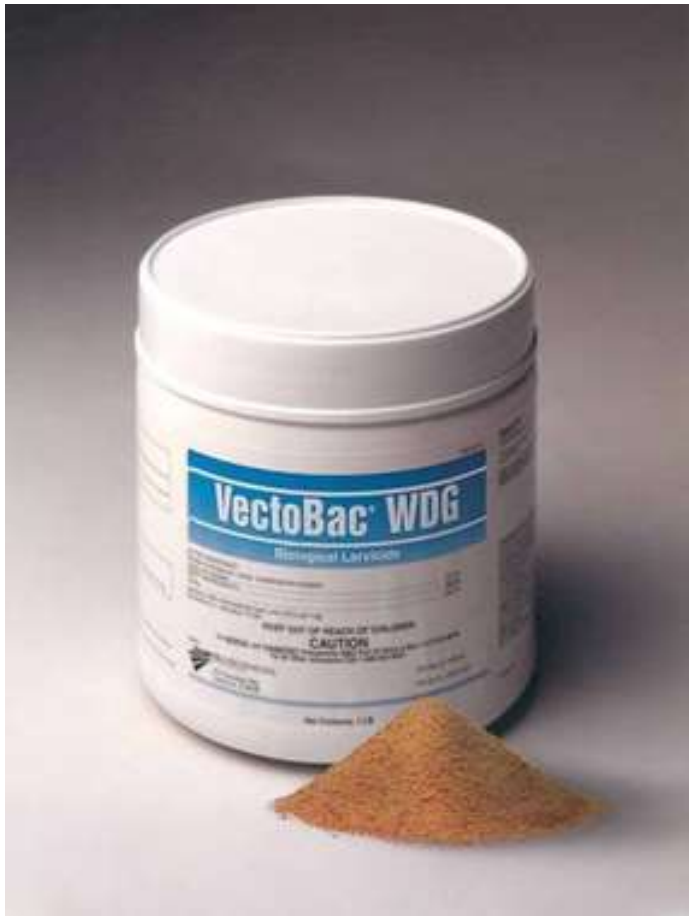
	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600
Potential Deposit Volume	1.70E-03	3.74E-04	3.41E-04	1.87E-04	8.10E-05	7.70E-05	5.68E-05	5.21E-05	3.39E-05	2.82E-05	2.29E-05	1.58E-05	1.38E-05	1.07E-05	1.08E-05	1.10E-05	4.58E-06	6.91E-06	5.59E-06
Percent Mortality	100%	100%	100%	95%	100%	100%	100%	100%	100%	95%	100%	75%	100%	85%	35%	50%	40%	25%	0%

Application Platforms

Application Methods

PLATFORM	UTILITY	EQUIPMENT	REMARKS
Backpack Sprayers	Targeted coverage of hot spots and wide area coverage of small areas	Power Backpack Blowers capable of generating fine to very fine drop spectra	Targeted within properties or clusters of houses
Vehicle-mounted Sprayers	Wide area coverage of urban and suburban areas	Modified cold fogger and air blast machines capable of generating fine to very fine drop spectra	Spray passes limited to streets for application; highly dependent on wind for drop distribution
Aerial Application	Rapid coverage of large blocks	Helicopters and fixed-wing with atomizers capable of generating fine to very fine drop spectra	Not dependent on streets or property access

Formulation



- Maintains drop integrity
- Cost effective operations
- Visible efficacy
- Stable in storage

- Target specific
- Organic approvals
- WHO Prequalified

WALS Evaluations for *Culex* Control in California - 2018

Cooperators	Objective	Remarks
Coachella Valley MVCD	*Culex* larval mortality in open field sprays and block sprays	Larval mortality to 600' in open field, complete mortality in block sprays.
Greater Los Angeles County VCD	*Culex* larval mortality in block sprays	High larval mortality in block sprays
Sacramento-Yolo MVCD	*Culex* larval mortality in single pass and block sprays	Larval mortality in single-pass farmstead sprays and wind-dependent mortality in block sprays

Conclusions

- WALS application of Bti strain AM65-52 WG has been successfully deployed in sustained operational programs for control of dengue, Zika and chikungunya virus vectors throughout the world (40+).
- Through research and development, WALS technology continues to advance and is becoming an essential part of the mosquito control toolbox.
- The WALS method is used not only for virus response but as a proactive approach to control container mosquitoes.
- WALS has shown promise for the control of *Culex spp.* which are vectors of WNv and other arboviruses.
- With continued evaluations in cooperation with Public Health partners, VBC is committed to improving the role WALS can play in overall mosquito control.

Chicago Innovation Award

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