

Positive Flavocide® Efficacy Results Presented at Leading Conference on Tick-borne Diseases

Highlights

- **Purdue University presents new Flavocide® efficacy results for tick control at the 17th International Conference on Lyme Borreliosis and Other Tick-Borne Diseases in the USA**
- **Laboratory efficacy studies confirm >90% mortality of *Ixodes scapularis* nymphs, a major vector of Lyme disease in the United States**
- **Residual activity in a prototype formulation of Flavocide was observed for up to four weeks post-application under laboratory conditions**
- **Findings confirm Flavocide's potential for use as a novel acaricide¹ against ticks and mites in public health and animal health applications**

Bio-Gene Technology Limited (ASX: BGT, Bio-Gene or the Company), an Australian company developing the next generation of novel insecticides derived from nature, is pleased to announce that researchers from Purdue University, Indiana, USA, have presented promising new data on Flavocide at the 17th International Conference on Lyme Borreliosis and Other Tick-Borne Diseases in Chicago, USA.

This conference is the major international conference on Lyme disease and other tick-borne infections and brings together the most knowledgeable investigators in the world to share scientific discoveries relevant to infections transmitted by *Ixodes* ticks². The conference is arranged by the Mayo Clinic, Michigan State University, and University of North Dakota.

The presentation by researchers Maria Murgia, Phurchhoki Sherpa and Professor Catherine Hill from the Department of Entomology at Purdue University titled 'Assessment of New, Natural Product Formulation to Control Ticks in the Midwest, United States' describes laboratory studies showing that Flavocide formulated in a prototype emulsion in water formulation achieved greater than 90% mortality of *Ixodes scapularis* nymphs within 24 hours of exposure, validating its acaricidal potential. Residual activity was observed for up to four weeks under controlled laboratory conditions.

The research was conducted using a novel test arena, 'Phenocosm' tick assay system that is designed to simulate natural tick habitats such as mulch, leaf litter, and turfgrass. These studies confirm that Flavocide has potential utility in addressing tick-borne diseases of major concern in the United States and globally.

¹ *Acaricides* are pesticides that kill members of the arachnid subclass *Acari*, which includes ticks and mites.

² *Ixodes* is a genus of hard-bodied ticks (family *Ixodidae*). It includes important disease vectors of animals and humans (tick-borne disease), and some species (notably *Ixodes holocyclus*) inject toxins that can cause paralysis. Some ticks in this genus may transmit the pathogenic bacterium *Borrelia burgdorferi* responsible for causing Lyme disease. Additional organisms that may be transmitted by *Ixodes* are parasites from the genus *Babesia*, which cause babesiosis, and bacteria from the related genus *Anaplasma*, which cause anaplasmosis.

These results have been generated under a vector control program funded by the US Center for Disease Control (CDC) co-ordinated by the Midwest Center of Excellence for Vector Borne Disease and research conducted by Purdue University. Under this program the researchers plan to undertake additional field validation of Flavocide's effect on *Ixodes scapularis* nymphs and techniques to observe their behaviour in the presence of Flavocide.

Commenting on the results, **Catherine Hill, Professor of Entomology at Purdue University** said: *"Tick-borne diseases are a growing public health concern, with Lyme disease cases continuing to rise across the United States. Our research demonstrates that Flavocide shows strong acaricidal activity against Ixodes scapularis, the key vector of Lyme disease, with promising residual efficacy. These results highlight its potential as a valuable new tool in integrated tick management strategies."*

Peter May, Bio-Gene Technology's Executive Director R&D said: *"We are delighted that Purdue has presented these data at a leading international conference. Flavocide continues to demonstrate versatility across multiple species that are vectors of disease and this strong performance against ticks opens additional pathways in the public health, companion animal, and livestock markets. With the rising incidence of tick-borne disease, there is a clear global need for safer, more effective acaricides."*

These results further support Bio-Gene's strategy to develop Flavocide as a next-generation insecticide/acaricide, leveraging its novel mode of action and favourable safety profile. The presentation slides are attached.

Approved for release on ASX by Bio-Gene Board of Directors.

- ENDS -

For further information, please contact:

Bio-Gene Technology Limited:
E: bgt.info@bio-gene.com.au

Matthew Wright
NWR Communications
E: matt@nwrcommunications.com.au
M: 0451 896 420

About Bio-Gene Technology Limited

Bio-Gene is an Australian company developing novel bio-insecticides to address the global challenges of insecticide resistance. Its unique products are based on a naturally occurring class of compounds proven to overcome resistance to control pests with minimal impact on human health and the environment.

Bio-Gene's products have multiple applications across crop protection, grain storage, public health and consumer uses. They provide new options derived from nature to meet market demand for effective and safe pest management solutions.

www.bio-gene.com.au

Flavocide® and Qcide® are registered trademarks of Bio-Gene Technology Limited.

Assessment of New, Natural Product Formulation to Control Ticks in the Midwest, United States

Maria V. Murgia, **Phurchhoki Sherpa**, Catherine A. Hill
Department of Entomology, Purdue University

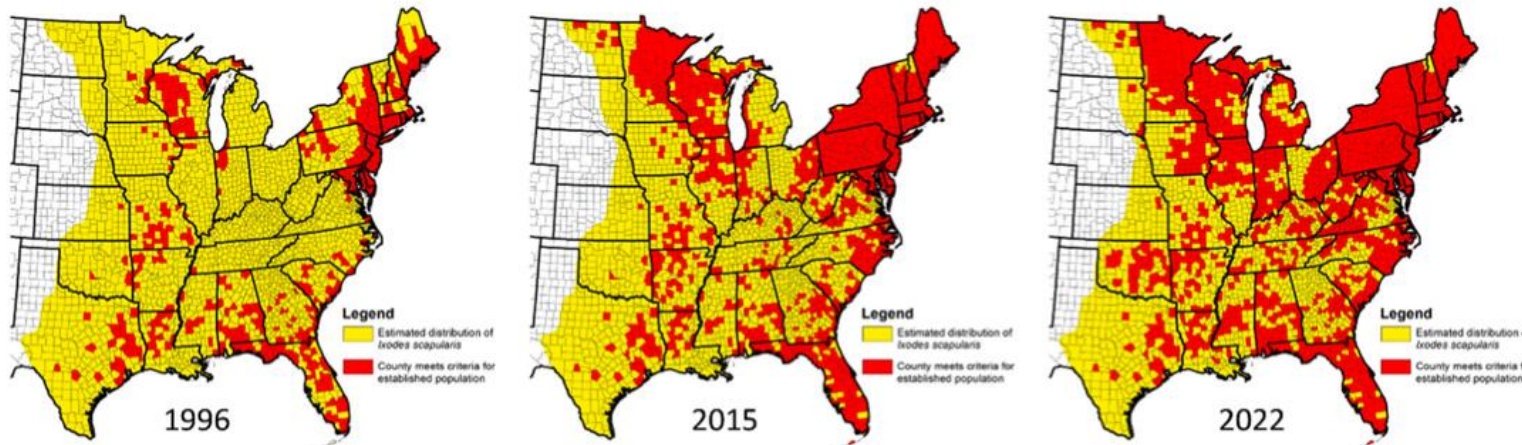
17th Lyme Borreliosis International Conference, Chicago, September 9, 2025

Outline


- Background
- Development of the Phenocosm Test Arena
- Product Efficacy Studies
- Tick Biology Studies
- Take Home Messages
- Acknowledgements

Tick-Borne Diseases, an Increasing Public Health Threat

Vector Expansion (*Ixodes scapularis*)




Eisen and Eisen, Ticks Tick-borne Dis., 1(10), 2023



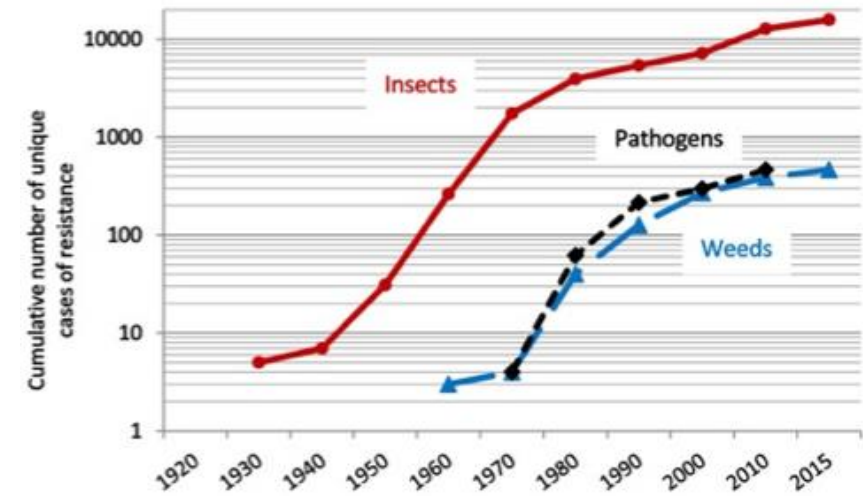
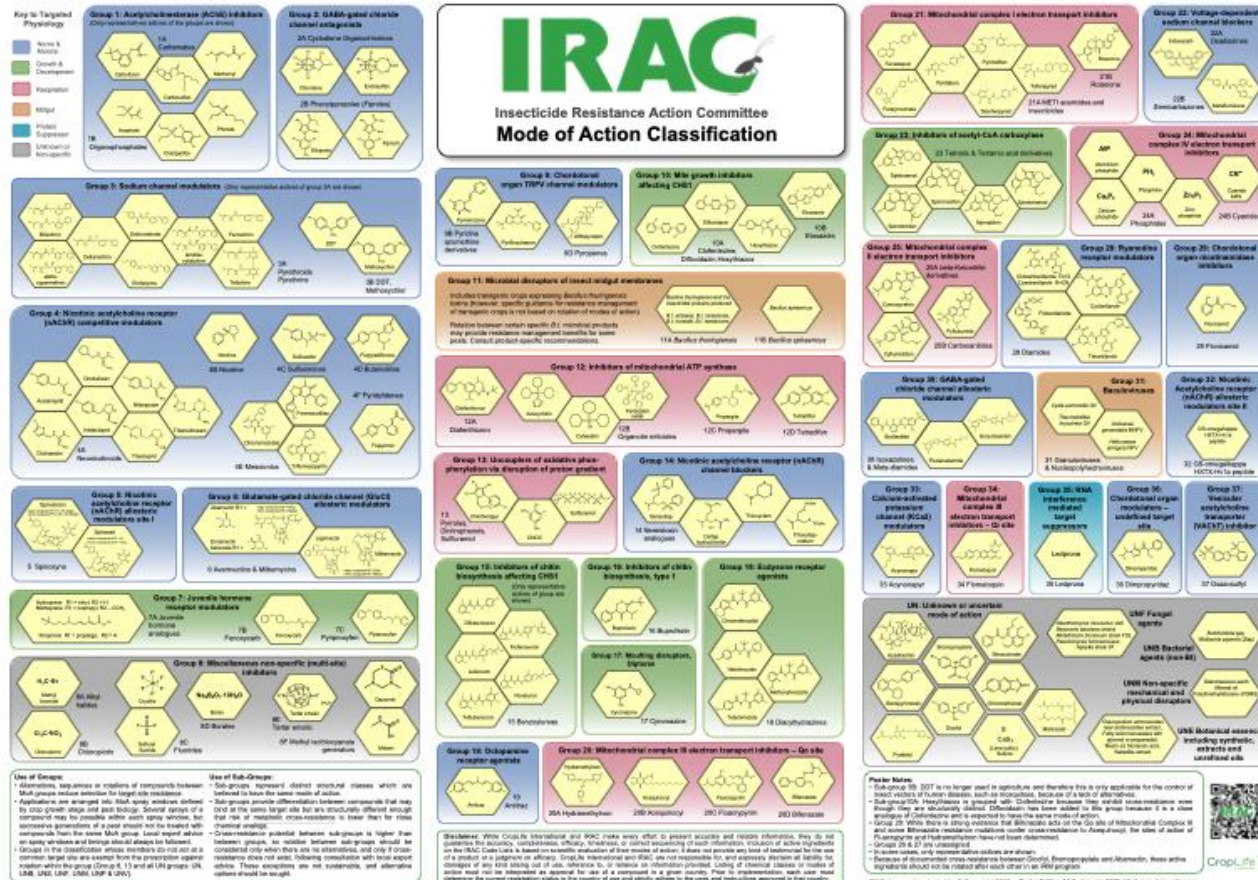
PREVENT TICK BITES!

- WEAR REPELLENT
- CHECK FOR TICKS DAILY
- SHOWER SOON AFTER BEING OUTDOORS
- CALL YOUR DOCTOR IF YOU GET A FEVER OR RASH

For more information: www.cdc.gov/ticks



Centers for Disease
Control and Prevention
National Center for Emerging and
Zoonotic Infectious Diseases



Sparks and Lorsbach. Pest. Manag. Sci. 2017

- Insecticides are the backbone of vector control.
- Increase in insecticide resistance.
- Need insecticides with novel Mode of Action (MoA).

Natural Products (NPs): an Alternative for Tick Control

Journal of Medical Entomology, 58(2), 2021, 814–820
doi: 10.1093/jme/tjaa248
Advance Access Publication Date: 20 November 2020
Vector Control, Pest Management, Resistance, Repellents

Synthetic Pyrethroid, Natural Product, and Entomopathogenic Fungal Acaricide Product Formulations for Sustained Early Season Suppression of Host-Seeking *Ixodes scapularis* (Acari: Ixodidae) and *Amblyomma americanum* Nymphs

Terry L. Schulze¹ and Robert A. Jordan^{2,3}

¹Terry L. Schulze, Ph.D., Inc., 9 Evergreen Court, Perrineville, NJ 08535, ²Monmouth County Mosquito Control Division, 1901 Wayside Road, Tinton Falls, NJ 07724, and ³Corresponding author, e-mail: robert.jordan@co.monmouth.nj.us

Journal of Medical Entomology, 58(1), 2021, 390–397
doi: 10.1093/jme/tjaa188
Advance Access Publication Date: 12 October 2020
Vector Control, Pest Management, Resistance, Repellents

Evaluating the Effects of Minimal Risk Natural Products for Control of the Tick, *Ixodes scapularis* (Acari: Ixodidae)

Megan C. Dyer,^{1,2,5} Matthew D. Requistina,¹ Kathryn A. Berger,^{1,3} Gavino Puggioni,⁴ and Thomas N. Mather^{1,2}

scientific reports

OPEN

Balsam fir (*Abies balsamea*) needles and their essential oil kill overwintering ticks (*Ixodes scapularis*) at cold temperatures

Shelley A. Adamo^{1,2}, Amal El Nabbout¹, Laura V. Ferguson^{1,2}, Jeffrey S. Zbarsky¹ & Nicoletta Faraone³

Acta Parasitologica (2024) 69:1141–1147
<https://doi.org/10.1007/s11686-024-00835-w>

ORIGINAL PAPER

Chemical Composition and Acaricidal Activity of Essential Oil of *Lavandula dentata* L. on Engorged Females of *Rhipicephalus (Boophilus) microplus* (Acari: Ixodidae)

eira Xavier¹ · Eduardo Henrique Amorim Silva¹ · Ivaldo Victor Mota de Siqueira¹ · icedo¹ · Vanderson Barbosa Bernardo² · Henrique Fonseca Goulart³ · ulart Santana³ · Rafael Antonio Nascimento Ramos¹ · Pedro Gregório Vieira Aquino⁴ · Carvalho¹



Experimental and Applied Acarology (2022) 86:299–312
<https://doi.org/10.1007/s10493-022-00692-0>

Repellency and toxicity of a CO₂-derived cedarwood oil on hard tick species (Ixodidae)

Lina B. Flor-Weiler¹ · Robert W. Behle¹ · Fred J. Eller² · Ephantus J. Muturi¹ · Alejandro P. Rooney³

Project Goal: Evaluate novel NP actives for potential to control disease vector ticks, tick-bite prevention

Test Articles: Active Ingredients/NP formulations; positive controls (bifenthrin/botanical oils); negative control (vehicle)

Tick Species: *Ixodes scapularis* nymphs

Project Roadmap



Developing The Phenocosm

- Laboratory and Small-Cage Studies
- Multiple Substrates:
 - Filter Paper
 - Simulated Tick Habitats:
 - Leaf litter, Mulch, Turfgrass
- Multipurpose:
 - Insecticide Efficacy: ✓ Contact Toxicity
✓ Repellency
✓ Residual Activity
 - Tick Biology and Behavior



Product Efficacy Assay Design

- **Ticks:** *Ixodes scapularis* nymphs
- 3 Technical Replicates/Biological Replicate/Product; 5 ticks/Technical Replicate
- **Test Chemistry:** Flavocide™ Oil-in-Water Emulsion (**FLC-EW**; 50% Flavesone; used undiluted)
- **Commercial Products: Talstar-P** (7.9% bifenthrin; used at 0.062% active ingredient);
Outdoor Pest Control (OPC; Wondercide; 40.42% Cedarwood oil, 8.74% Sesame oil, 3.5% Sodium Lauryl Sulfate and 47.3% of inert ingredients; used at 0.4 fl. oz./gallon)
- **Negative Control:** untreated filter paper



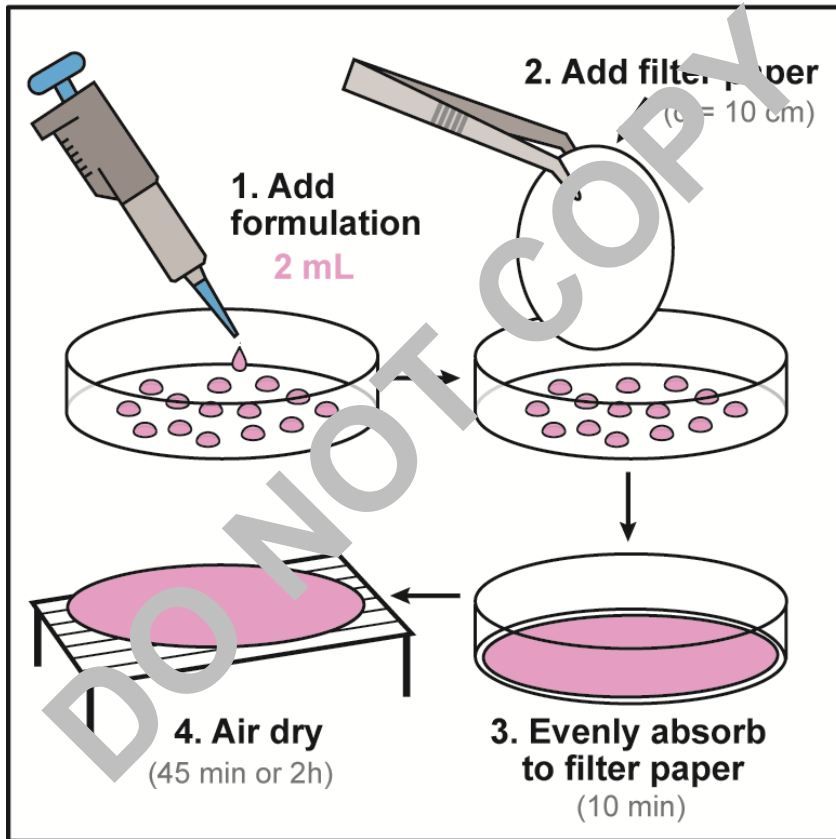
Flavocide™

- ❖ “Nature-Identical beta-triketone molecule (flavesone) produced synthetically by a chemical process.”
- ❖ Natural plant compound found in leaves of some Myrtaceae plants (Eucalyptus).
- ❖ New Mode of Action (studies by Pacific Discovery Services).

Method

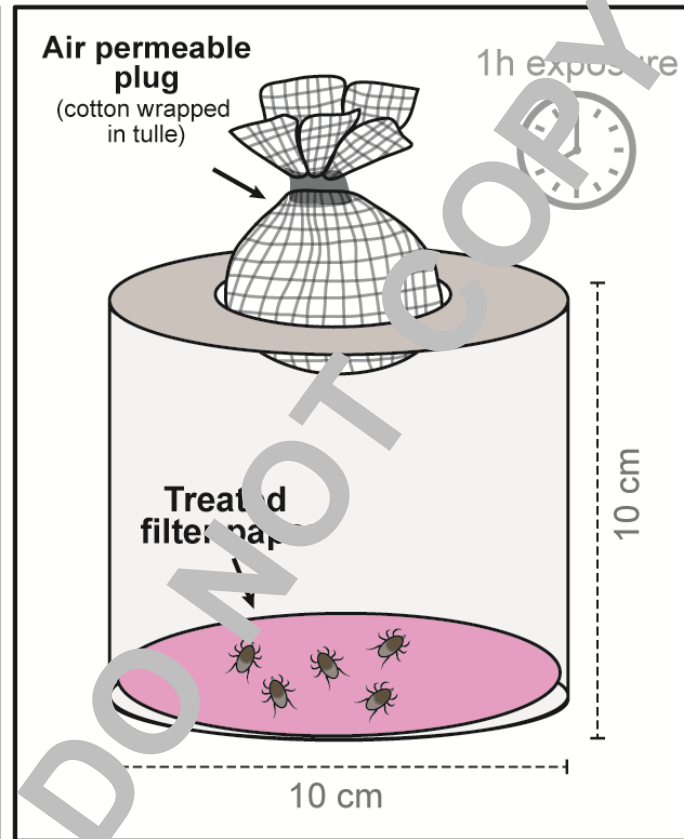


Preparation



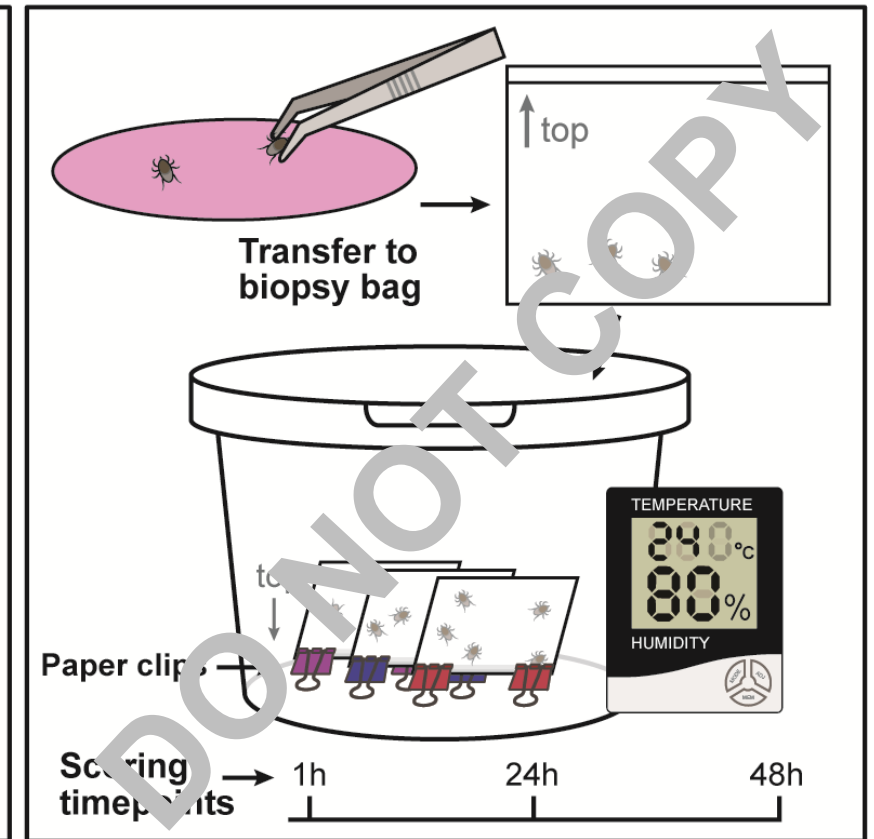
in fume hood

Tick Exposure



in fume hood

Scoring

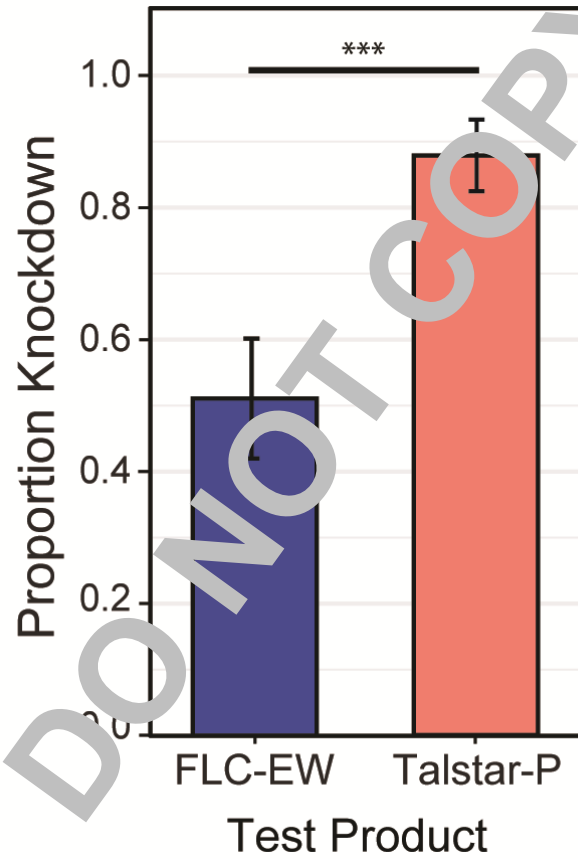


on lab bench

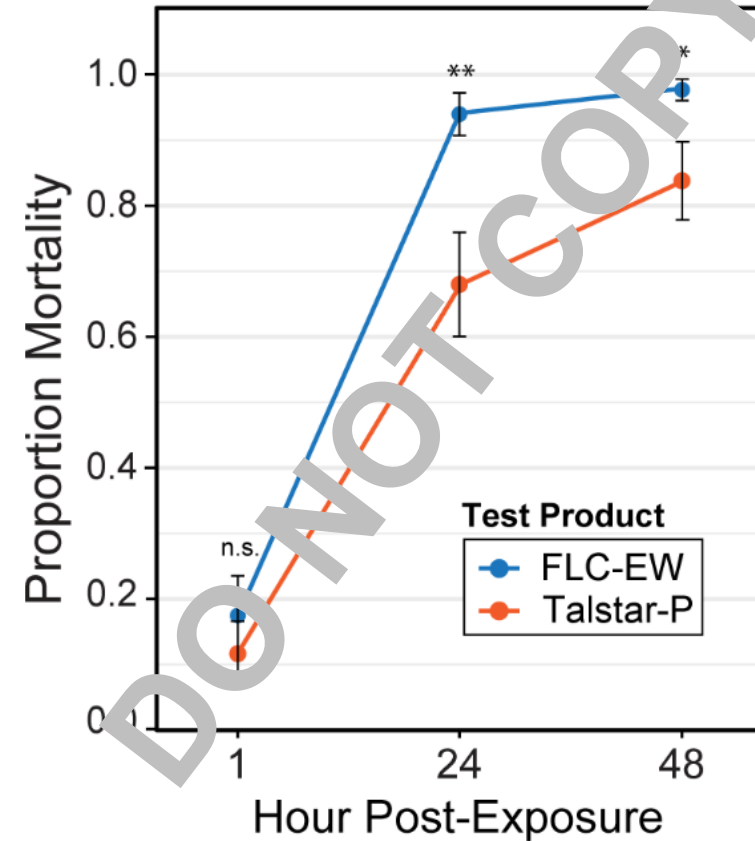
FLC-EW Meets the EPA Registration Targets (>90% mortality at 24hrs PE)



Predicted Knockdown at 1-hr Post-Exposure



Model Predicted Probability of Mortality



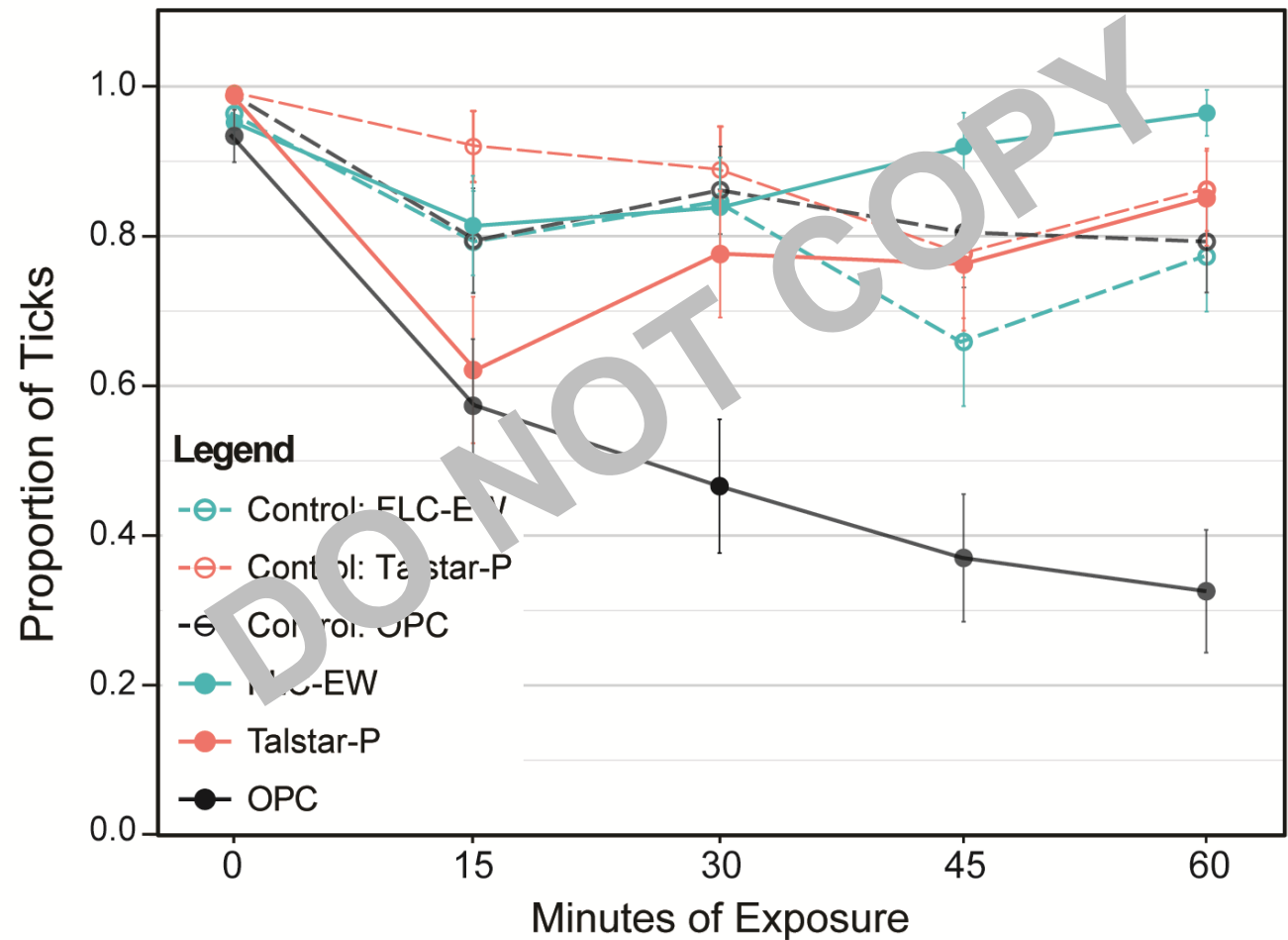
N=3 Biological Replicates

➤ **OPC: No knockdown or toxicity**

OPC Exhibits Repellency



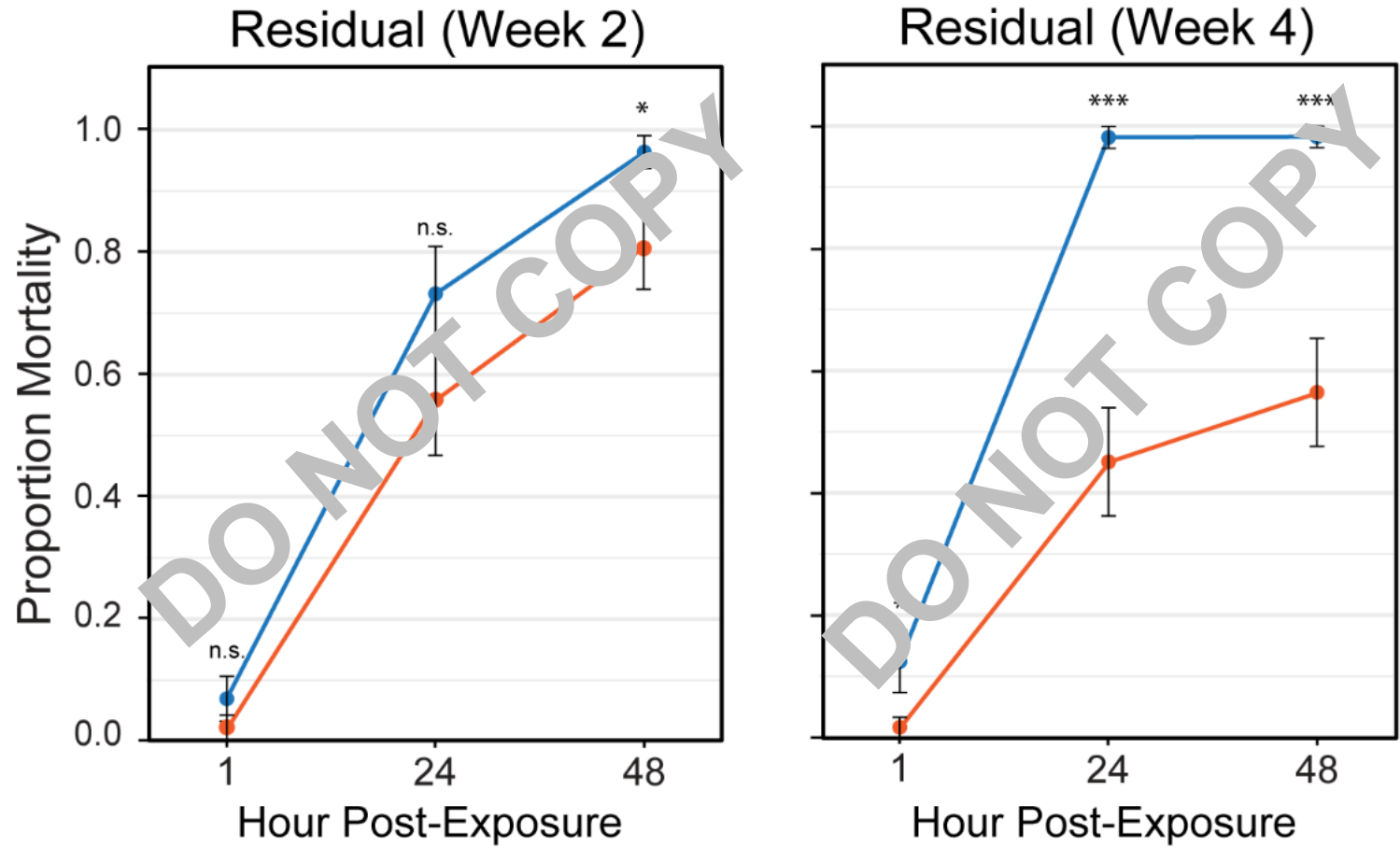
Predicted Probability of Ticks in Contact with the Product Treated Filter Paper



FLC-EW Exhibits Residual Activity up to 4 Weeks Post-Application



Model Predicted Probability of Mortality



N = 3 Biological Replicates

Summary: Product Efficacy Studies

- The Phenocosm enabled the assessment of toxicity, repellency, and residual activity.
- Confirmed Talstar-P contact toxicity (selected as positive control for small-cage studies).
- OPC elicited repellency, but not toxicity under the conditions of this assay.
- FLC-EW met **EPA targets** under laboratory conditions.
- FLC-EW maintained efficacy for up to 4 weeks post-application.
- **FLC-EW is a promising candidate for small-cage trials.**

Phenocosm Modifications for Simulated Environments (Without Products)

Phenocosm Modifications



Tick Labeling and Identification



Photo Credits: M. Murgia, P. Sherpa

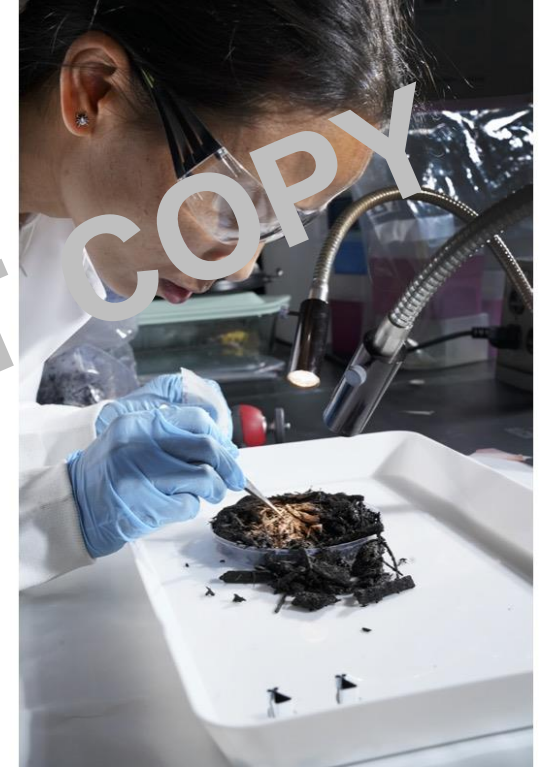


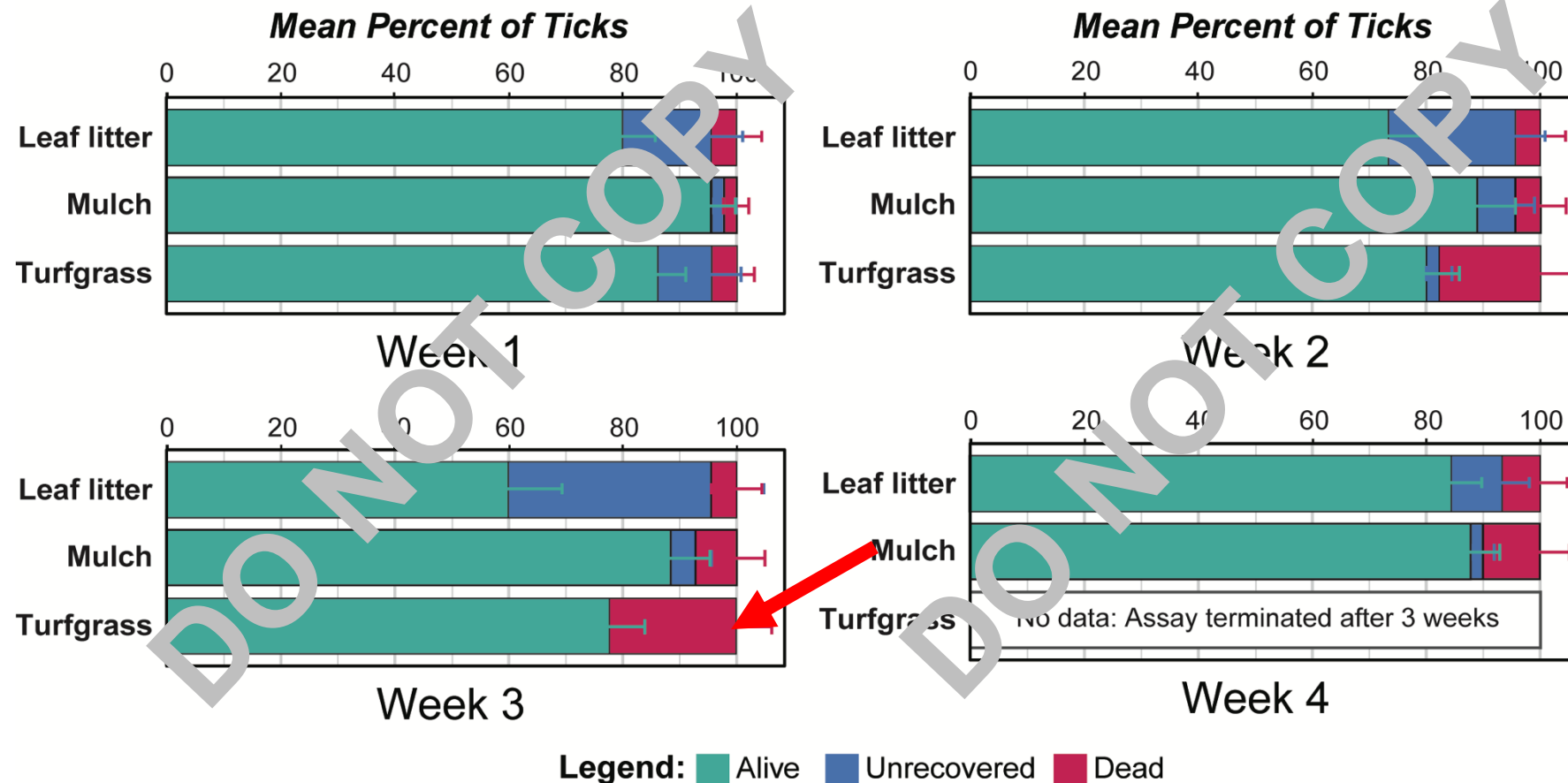
Photo Credits: T. Campbell

Tick Viability Assay Design

- Ticks: *Ixodes scapularis* nymphs
- 3 Technical Replicates/Biological Replicate/Substrate; 5 ticks/Technical Replicate
- Location of ticks in the phenocosms
- Viability assessment for up to 4 weeks

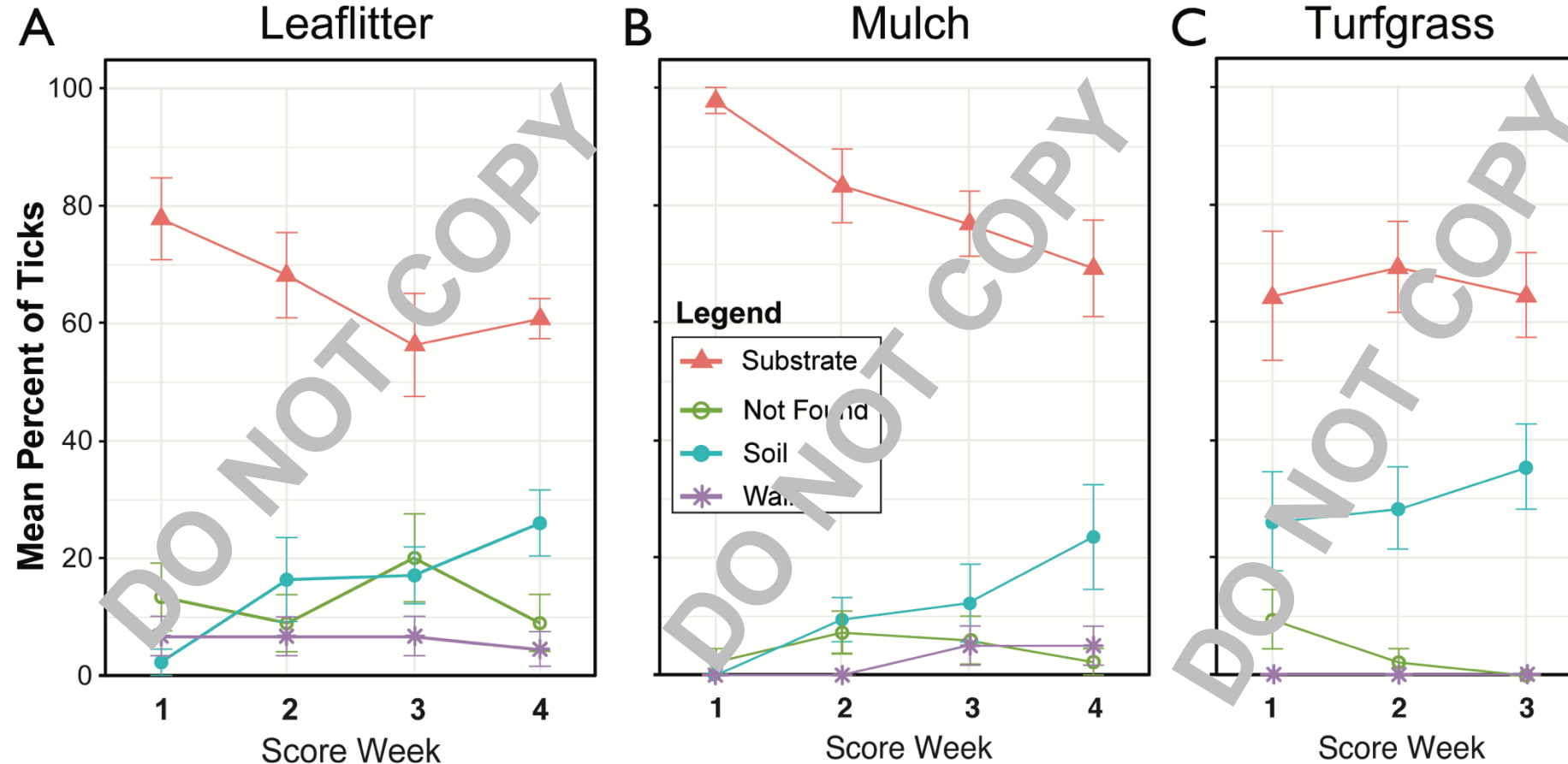
Phenocosm Supports Tick Viability in Simulated Environments

Weekly Tick Viability



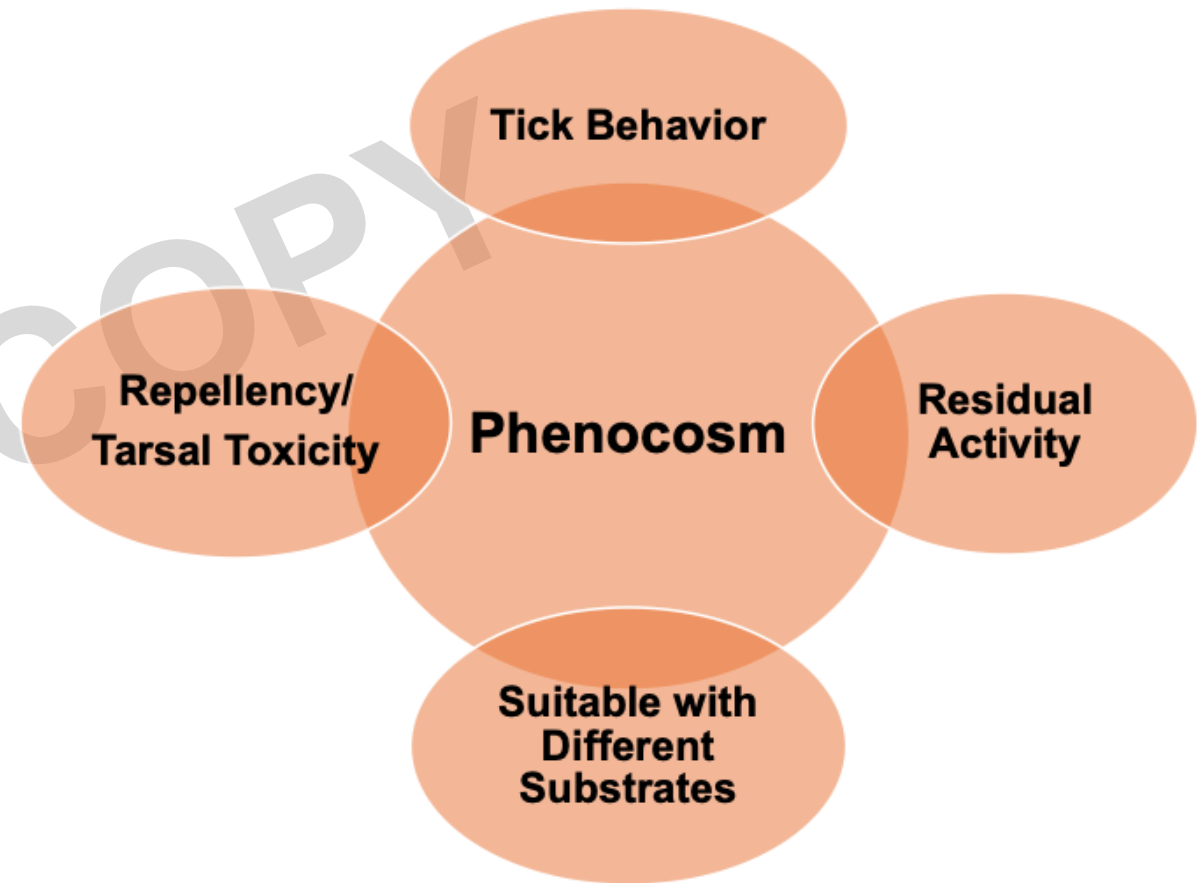
Most Ticks Were Found on Substrates

Location of ticks in the phenocosms with substrate



Take Home Messages

- The Phenocosm is a versatile, multipurpose test arena.
- FLC-EW is a promising candidate for small-cage trials.
- Acaricide application may require substrate-disturbing methods.



Acknowledgements

MCEVBD

Dr. Lyric C. Bartholomay
Dr. Susan Paskewitz

CDC

Dr. Lars Eisen

Purdue University

Dr. Andres F. Oliveros-Diaz
Dr. Krystal R. Hans
Dr. Douglas Richmond

ENTM Capstone Students

Brianna L. Gast
Kayla Bliven

Purdue University
Center for Urban and
Industrial Pest
Management

Bio-Gene Technology
Peter May
Dr. James Wade

Funding: MCEVBD, Purdue Internal Funding, BGT