INTERNATIONAL EXHIBITION & SYMPOSIUM ON PRODUCTIVITY, INNOVATION, KNOWLEDGE & EDUCATION

E-PROCEEDING

EXTENDED ABSTRACT

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EXTENDED ABSTRACT

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e ISBN 978-967-2948-91-9

9 789672 948919

UiTM Cawangan Kedah

Published by:
Universiti Teknologi MARA (UiTM) Cawangan Kedah
Sungai Petani Campus
08400 Merbok
Kedah
Malaysia

Welcome Message

RECTOR, UITM KEDAH BRANCH

Assalamualaikum warahmatullahi wabarakatuh,

First and foremost, I would like to extend my deepest appreciation to the organising committee of i-SPiKE 2025 for their steadfast dedication and commitment in making this prestigious event a reality. My heartfelt congratulations to the committee for their tireless efforts in ensuring that i-SPiKE continues to grow as a meaningful and impactful platform for academics, researchers, students, and industry players worldwide.

The theme for this year, "Empowering Minds: Bridging Innovation, Knowledge and Education for a Sustainable Future," is both timely and significant. It reflects our shared responsibility to not only embrace creativity and technological advancement, but also to ensure that innovation directly contributes to sustainable development, equitable education, and the well-being of future generations.

i-SPiKE 2025 provides a dynamic platform for showcasing innovations that address real-world challenges while opening new avenues for collaboration, engagement, and inclusivity. By bridging knowledge, innovation, and education, this symposium strengthens our collective capacity to design solutions that empower communities and inspire positive change.
I am truly impressed by the diversity and calibre of participants in this year's event. The projects and ideas presented highlight the extraordinary creativity and determination of our innovators. I am confident that the insights and solutions shared here will pave the way for continuous advancement in teaching, learning, and innovation.

It is my sincere hope that you will find i-SPiKE 2025 an enriching experience, one that sparks new ideas, builds lasting collaborations, and strengthens our shared vision for a sustainable future. To all participants, I wish you every success, and to the winners, my warmest congratulations.
Once again, I thank the organising committee, partners, and contributors for their invaluable support. May i-SPiKE 2025 continue to inspire and empower minds for many years to come.

Professor Dr. Roshima Haji Said
Acting Rector
Universiti Teknologi MARA (UiTM) Kedah Branch

Welcome Message
(i-SPiKE 2025 CHAIR)

It is my great pleasure to welcome you to the 4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2025 (i-SPiKE 2025). This year's theme, "Empowering Minds: Bridging Innovation, Knowledge, and Education for a Sustainable Future," reflects our collective commitment to advancing innovation and fostering meaningful collaboration across academia, industry, and communities.

i-SPiKE 2025 provides a platform for scholars, researchers, students, and practitioners from diverse fields to showcase their ideas, share knowledge, and inspire new solutions to global challenges. We extend our sincere appreciation to all participants and contributors whose efforts and dedication have made this symposium possible.
We hope that this e-proceedings serves not only as a record of the innovations presented but also as a valuable resource that continues to inspire long after the event.

Thank you.

Dr Junaida Ismail
Chair
4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2025 (i-SPiKE 2025)

PREFACE

The 4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education (i-SPiKE 2025) marks yet another milestone in our ongoing commitment to fostering innovation, creativity, and collaboration across disciplines. Guided by this year's theme, "Empowering Minds: Bridging Innovation, Knowledge and Education for a Sustainable Future," the event provides a dynamic platform for students, educators, researchers, and professionals to share their ideas, showcase their innovations, and engage in meaningful knowledge exchange.

This year, we are pleased to report that i-SPiKE 2025 received approximately 50 initial submissions, with more than 35 projects successfully advancing to final presentation and exhibition. These projects reflect a rich diversity of innovation, ranging from educational technologies, digital applications, and gamified learning tools to sustainable materials, cultural heritage preservation, and community-focused solutions. Collectively, they embody the spirit of bridging innovation and education to address pressing societal and global challenges.

We sincerely thank all participants, reviewers, and committee members for their invaluable contributions in making i-SPiKE 2025 a success. It is our hope that this e-proceedings will not only serve as a record of the ideas and innovations presented, but also as an inspiration for future collaborations and advancements in the pursuit of sustainable knowledge and innovation.

Assoc. Prof. Dr. Azlyn Ahmad Zawawi
Editor-in-Chief, i-SPiKE 2025 Proceedings

TABLE OF CONTENTS

CATEGORY 1

S&T (ACADEMIC)

MA-TICK 2.0: A TRULY GREEN TICKICIDE

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ABSTRACT

The Malaysian livestock industry, particularly the beef sector, faces a persistent challenge from *Rhipicephalus microplus*, a cattle tick responsible for transmitting diseases, reducing animal productivity, and causing significant economic losses. Current tick control strategies are heavily reliant on synthetic acaricides such as permethrin and ivermectin, which, over time, have led to widespread resistance, environmental contamination, and residue accumulation in meat and milk. These issues pose not only health and trade concerns but also hinder national efforts to improve local beef production and reduce dependency on imports. MA-Tick 2.0 represents a truly green, locally driven innovation in tick control. Developed from *Metarhizium anisopliae*, a fungal isolate sourced from the Malaysian environment, this formulation advances from MA-Tick 1.0—which proved effective against tick eggs—by demonstrating efficacy against adult ticks and significantly reducing oviposition. Applied to the environment rather than directly to animals, MA-Tick 2.0 minimizes chemical exposure, aligns with organic and sustainable livestock practices, and helps preserve ecological balance. This biocontrol innovation is particularly vital for smallholder and backyard farmers, who represent the majority of cattle owners in Malaysia. By offering an effective, residue-free alternative, MA Tick 2.0 supports national aspirations for beef self-sufficiency and provides a sustainable tool in integrated parasite management. It paves the way for greener veterinary solutions while reinforcing Malaysia's competitiveness in environmentally responsible agriculture. With further development, MA-Tick 2.0 holds the potential to transform tick management practices regionally and contribute to the global shift toward safe and sustainable livestock production.

Keywords: alternative acaricide, biocontrol, cattle industry, environmentally friendly, sustainable livestock

INTRODUCTION

The beef industry in Malaysia continues to face significant challenges in achieving self-sufficiency, with local production fulfilling less than 30% of national demand (Ali et al., 2023). One of the major impediments to improving cattle productivity and health is the persistent burden of tick infestation, particularly from Rhipicephalus microplus, a species known to transmit debilitating diseases such as babesiosis and anaplasmosis (Arreguin-Perez et al., 2024). These infestations not only reduce weight gain and milk yield (Ritonga et al., 2019) but also increase production costs due to the need for frequent treatment and veterinary care (Singh et al., 2022).

The problem is compounded by the fact that the majority of cattle in Malaysia are reared by smallholder farmers, especially in rural and East Coast regions, where resources and access to effective tick control strategies are limited. Most rely on conventional synthetic acaricides; however, overreliance and improper application have led to increasing resistance among tick populations, diminishing the effectiveness of these chemicals (Obaid et al., 2022). Furthermore, chemical residues in meat and milk pose public health concerns and may affect marketability (Saranya et al., 2020).

Given these issues, there is a pressing need for alternative, environmentally friendly tickicides that are both effective and suitable for local use. Previous research demonstrated that a Malaysian strain of Metarhizium anisopliae was highly effective against tick eggs. Building on this success, MA-Tick 2.0 was developed and has now been shown to be effective not only against adult R. microplus but also in significantly reducing egg production. This innovation marks a critical step forward in providing a sustainable, residue-free solution for tick control in Malaysia's livestock sector.

PROOF OF CONCEPT

Materials & Methods

MA-Tick 2.0 was developed using solid-state fermentation (SSF) to mass-produce M. anisopliae conidia. The fungal strain was grown on sterilized rice grains under controlled humidity and temperature, and conidia were harvested after 16 days (Moslim et al., 2005). These conidia were suspended in sterile water with Tween 80 and adjusted to concentrations of 1×10^7, 1×10^8, and 1×10^9 conidia/mL. Viability was confirmed through germination tests on SDAY media.

For the bioefficacy assay, the adult immersion test (AIT) based on the Food and Agriculture Organization (FAO) guideline was adopted. A total of 150 engorged adult female ticks were randomly assigned to five groups: three treatment groups receiving different conidia concentrations, one negative control group (distilled water with 0.05% Tween 80), and one positive control group treated with flumethrin (Bayticol®). Each treatment was applied by immersing ticks in 10 mL of their respective solution for 30 seconds. Ticks were then incubated on moist filter paper in Petri dishes at $27 \pm 2°C$ with 80% humidity and monitored daily for 14 days. Mortality, oviposition, and fungal outgrowth were recorded. Dead ticks were transferred to new moist Petri dishes to observe sporulation. Egg masses were collected, weighed, and incubated further to assess hatchability.

RESULTS & DISCUSSIONS

The results demonstrated a clear dose-dependent effect. The highest concentration (10^9 conidia/mL) caused 100% adult tick mortality and completely inhibited both oviposition and egg hatching. Although 10^8 and 10^7 conidia/mL also resulted in total mortality, some treated ticks still laid eggs; however, none of these eggs hatched (Table 1). Fungal growth was observed on tick cadavers across all treatments, confirming the presence of infection. Ticks exposed to higher concentrations died more rapidly, likely due to faster hyphal penetration and toxin release (Ren et al., 2016; Lee et al., 2019). Lower concentrations delayed the infection process but still resulted in high mortality with prolonged exposure (Fauzana et al., 2020; Barbieri et al., 2023).

Effective biocontrol agents must not only kill adult ticks but also suppress reproduction (Fernandez-Salas et al., 2016). In this study, fungal spores appeared to inhibit reproduction either by directly infecting eggs or contaminating laying surfaces. The negative control group produced over 1,567 eggs, while treated ticks laid fewer than 81, reflecting a 95% reduction. None of the eggs in the treated groups hatched, and many were covered in mycelium, indicating fungal-induced death (Nur Izzati et al., 2021; Luz et al., 2015). Reproductive index (RI) values dropped with increasing conidial concentration: 0.83 for both 10^7 and 10^8, and 0 for 10^9, compared to 4.82 in the negative control. Inhibition of oviposition (IO) reached 100% at 10^9 and 83% at 10^7 and 10^8. All fungal treatments significantly reduced egg production and hatchability, aligning with previous studies reporting 55–100% reproductive suppression in R. microplus (Fernandez-Salas et al., 2016; Luz et al., 2015).

Table 1: Tick Mortality, Number of eggs laid and hatched, Reproductive Index (RI) and Inhibition of oviposition (IO) between the different concentrations of M. anisopliae isolate.

Conc.	Tick mortality (n)	No. egg laid	No. egg hatch	RI	IO (%)
Negative	0.67 ± 0.33^a	1567.33 ± 314.04^a	1321.33 ± 250.84^a	4.82^a	-
10^7	10.00 ± 0.00^b	80.67 ± 46.19^b	0 ± 0.00^b	0.83^b	83^a
10^8	10.00 ± 0.00^b	47.67 ± 28.32^b	0 ± 0.00^b	0.83^b	83^a
10^9	10.00 ± 0.00^b	0 ± 0.00^b	0 ± 0.00^b	0.00^b	100^a
Positive	10.00 ± 0.00^b	0 ± 0.00^b	0 ± 0.00^b	0.00^b	100^a

Within the column, means followed by the same letter did not differ significantly at $P < 0.05$.

Table 2 shows a clear inverse relationship between concentration and lethal time: both LT50 and LT_{90} values decreased as conidial concentration increased. While 10^9 conidia/mL resulted in the

fastest tick mortality, its advantage over 10^8 conidia/mL was marginal. The difference between these two higher concentrations was not statistically significant, indicating that 10^8 conidia/mL may offer a more practical and cost-effective option without compromising efficacy. However, the 10^7 conidia/mL concentration required significantly more time to achieve 50% mortality, despite showing similar LT_{90} to 10^8. This suggests that 10^8 conidia/mL strikes the optimal balance between rapid tick control and resource efficiency, making it the preferred concentration for consistent field application.

Table 2: Lethal Times and Confidence Interval (CI) of *M. anisopliae*'s isolate, PR1 concentrations against *R. microplus*

Conc.	LT50 (day) [CI]	LT90 (day) [CI]
10^7	5.53 [5.07-5.91]^a	7.24 [6.78-7.87]^a
10^8	3.82 [3.42-4.13]^b	5.09 [4.70-5.75]^{ab}
10^9	2.46 [2.09-2.75]^b	3.63 [3.25-4.29]^b

Within the column, means followed by the same letter did not differ significantly at $P < 0.05$.

The findings of this study confirm that MA-Tick 2.0, developed from a local strain of *M. anisopliae*, is highly effective in inducing adult tick mortality and significantly suppressing egg production and hatchability. Its bioefficacy, combined with its environmentally friendly nature and potential for reducing reliance on synthetic acaricides, positions MA-Tick 2.0 as a promising green alternative for sustainable tick control. This innovation aligns with the growing demand for safer, residue-free livestock practices and supports Malaysia's goal of improving cattle health and beef self-sufficiency through sustainable technologies.

ACKNOWLEDGEMENT

This study is supported by funding from the Ministry of Higher Education (MOHE) through the Fundamental Research Grant Scheme (FRGS)– FRGS/1/2022/WAB04/UMK/02/9.

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i-SPiKE2025