Endophytic *Trichoderma* in the disease management of *Ganoderma* – TrichoTec



Oil palm

- ✓ Elaeis guineensis Jacq.
- ✓An important commodity crop in Malaysia
- ✓ Planted **5.64 million hectarage**
- ✓ Contribute approximately 64.92 billion export revenue (Parveez et al., 2020)
- ✓ Vulnerable to several diseases
- ✓ Thirty-two diseases and disorders affects
 the oil palm in Africa, Southeast Asia, and
 South America
- ✓ Confined to the region planted











 Flattening of the crown and unopened spear leaves. (daun pucuk tidak kembang)

- Skirting look-alike (tergantung bawah)
- Decay of the lower stem and root system of the oil palm.
- Collapse of palms in final stage.



 BSR causes death of more than 80% of plantings midway through their economic life.



Basal Stem Rot (BSR) disease

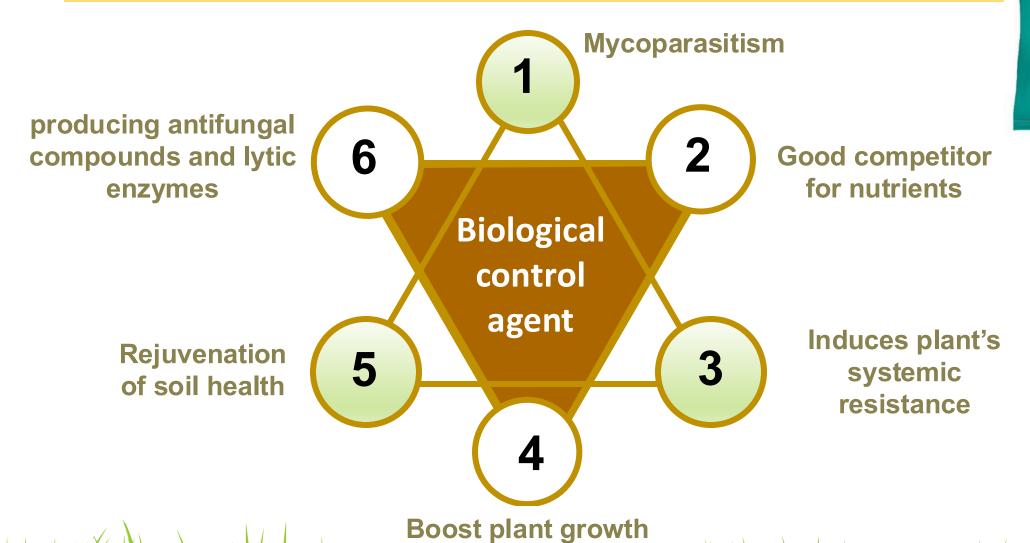




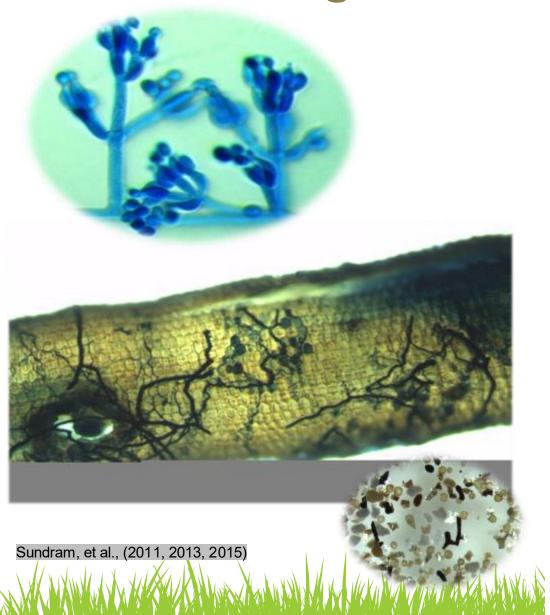


Trichotec (AI: Trichoderma Viren 159C) A Powerful Biocontrol Agent

OrichoTec



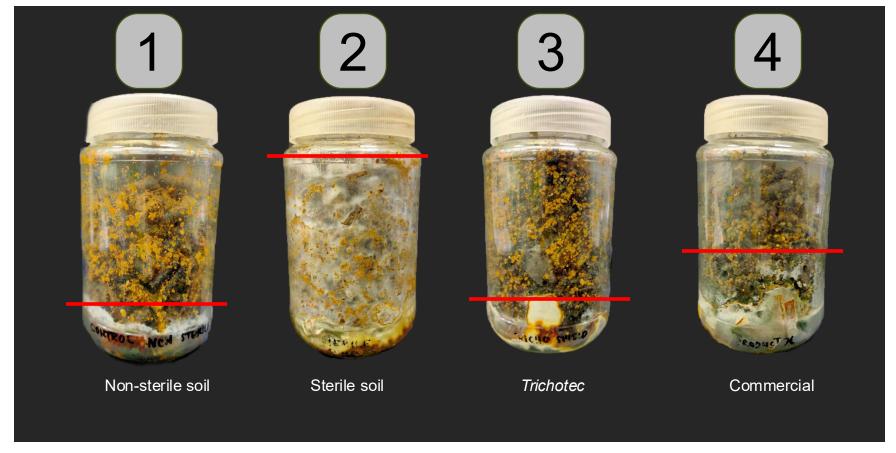
Biocontrol Agents



Potential biocontrol agent	Microbial group	References
Pseudomonas fluorescens, Bacillus	Bacteria	Susanto et al. (2005); Alexander
species		et al. (2017)
Burkholderia cepacia, B.	Bacteria	Zaiton et al. (2008); Buana et al.
vietnamiensis, Burkholderia species		(2014); Nurrashyeda et al. (2016)
Serratia marcescens	Bacteria	Zaiton et al. (2008)
Nocardiopsis alba	Bacteria	Widada et al. (2021)
Pseudomonas aeruginosa, P. syringae,	Bacteria	Nurrashy eda et al. (2016);
Pseudomonas species		Muniroh et al. (2019)
Bacillus and Enterobacter species	Bacteria	Suryanto et al. (2011); Suryanto et al. (2012)
Streptomyces species	Actinobacteria	Shariffah-Muzaimah et al. (2017);
• •		Lim et al. (2018); Shariffah-
		Muzaimah et al. (2020)
Streptomyces palmae	Actinobacteria	Sujarit et al. (2020b)
Streptomyces philanthi	Actinobacteria	Boukaew et al. (2022)
Streptomyces gelaticus	Actinobacteria	Budi et al. (2022)
Chaetomium lucknowense, C.	Fungi	Soytong (2014)
cochiliodes		
Hendersonia species	Fungi	Idris et al. (2012); Ismail et al. (2022)
Amphinema species	Fungi	Nurrashyeda et al. (2012a)
Phlebia species	Fungi	Nurrashyeda et al. (2012b)
Scytalidium parasiticum	Fungi	Goh et al. (2016)
Pycnoporus sanguineus, Trametes	Fungi	Naidu et al. (2015)
lactinea, Grammothele fuligo		
Muscodor padawan, M. sarawak	Fungi	Mahidi (2015)
Diaporthe miriciae, T. asperellum	Fungi	Sim et al. (2019)
Clonostachys rosea	Fungi	Goh et al. (2020a)
Trichoderma harzianum, T. viride,	Fungi	Susanto et al. (2005); Sundram et
Gliocladium viride, Trichoderma		al. (2008); Alexander et al. (2017)
species		
T. asperellum	Fungi	Muniroh et al. (2019)
Mycorrhizae	Fungi	Sundram et al. (2011); Rini et al.
		(2022)
Fomes sp., Trametes elegans, T.	Fungi	Darlis et al. (2023)
lactinea	-Khoo and Chong, 2023-	

Suppressive Soil Concept

- ✓ Ganoderma poor competitor
- ✓ Limitation in space, nutrient and food substrate
- ✓ Introducing a beneficial microbe increase the challenge in survival



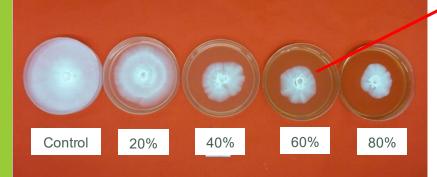
Result after 1 week

Mycoparasitism: Endophytic Trichoderma vs G. boninense

Dual Culture assay



Poison food agar assay



Mycoparasitic interaction of endophytic *Trichoderma* strains with *G. boninense*:

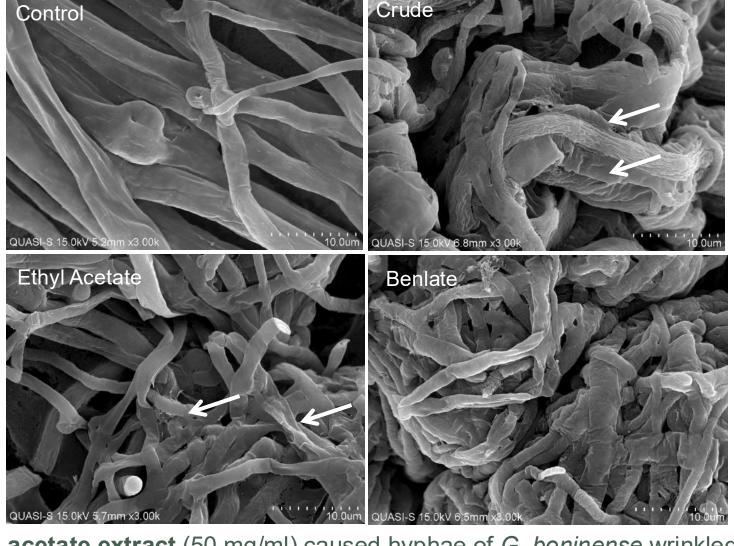
- Trichoderma fast-growing fungi
- •Suppressed the growth of *G. boninense*

Antibiosis involved:

- •accompanied by the released of **secondary metabolites (antifungal compounds)** and secrete lytic enzymes (Atanasova *et al.* 2013)
- •Scanning electron microscopy (SEM) imaging showed severe deformation on the *Ganoderma* hyphal network

Antibiosis: Scanning electron microscope (SEM) imaging

SEM imaging of G. boninense hyphae at the inhibition region (10.0µm) by T. virens 159c.

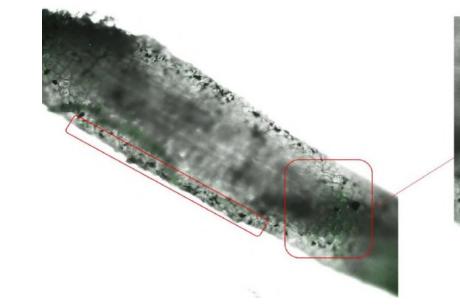


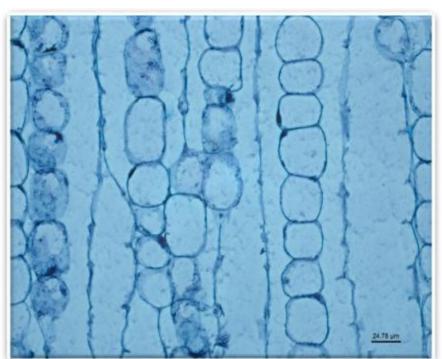
Ethyl acetate extract (50 mg/ml) caused hyphae of *G. boninense* wrinkled, folded and collapse, leading to deformation of mycelia network.

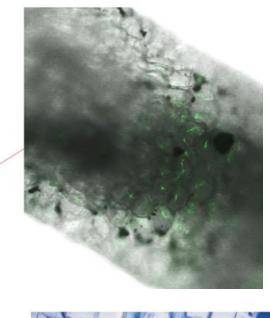


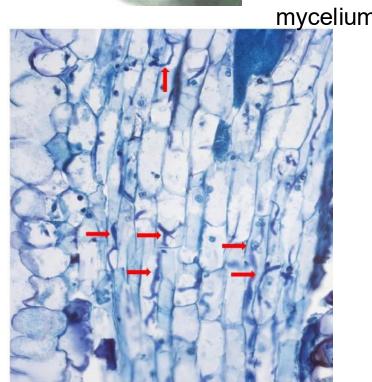
Oil palm root colonization study using *T. virens* GFP











Biocontrol Efficiency T1

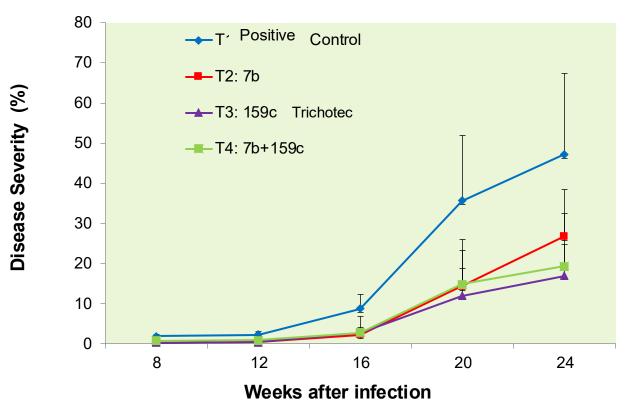
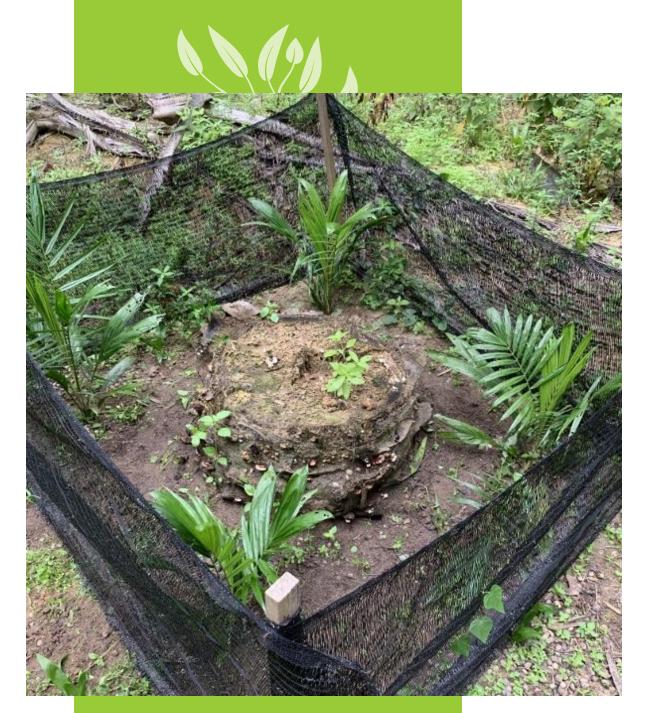


Table 3: The disease development of basal stem rot in bole of oil palm seedlings pre-treated with endophytic *Trichoderma* after infection of *Ganoderma boninense* PER 71

Treatment	Disease severity (%)	
T1 (Control)	85.49ª	
T2 (7b)	53.43 ^b	
T3 (159c) Trichotec	41.17°	
T4 (7b+159c)	55.88 ^b	

Seedling bait trial treated by Trichotec













Untreated

Seedling bait trial



Basal stem rot disease development in oil palm seedlings treated with *Trichoderma virens*

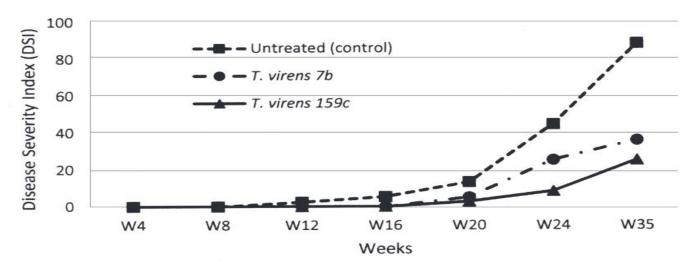


Figure 4. Basal stem rot disease development in oil palm seedlings treated with Trichoderma virens 7b and 159c assessed via disease severity index (DSI).

Disease progression of basal stem rot with the application of *Trichoderma virens* 159C (T2) as compared to positive control (T1). Sundram et al., 2016

Trichotec

cumul of Oil Palm Research Vol. 25 (3) December 2013 a. 368-37.

FIRST REPORT: ISOLATION OF ENDOPHYTIC Trichoderma FROM OIL PALM (Elaeis guineensis Jacq.) AND THEIR in vitro ANTAGONISTIC ASSESSMENT ON Ganoderma boninense



Endophytic *Trichoderma* isolation

First reported!

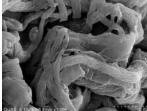
CERTIFICATE OF FILING

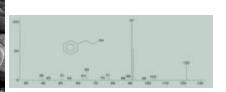
REQUEST RECEIVED ON

PI 2016790979 18 MARCH 2016









Phenylethyl Alcohol

antifundal

4. Antibiosis

Trichoderma virens 159c

A novel antimicrobial compound identified and effective against Ganoderma boninense (PI2016700979)

1. Mycoparasitism

TrichoTec®



2. Excellent competitor for nutrients

An in vitro study of the antifungal activity of Trichoderma virens 7b and a profile of its non-polar antifungal components released against Ganoderma boninense

Lee Pei Lee Angel^{1,5}, Mohd Termizi Yusof¹, Intan Safinar Ismail^{2,3}, Bonnie Tay Yen Ping⁴, Intan Nur Ainni Mohamed Azni⁵,





T. virens 159c

G. boninense

Fast release of iron chelators (siderophore) for uptake of irons

oderma TRACKING IN PLANTS USING GREEN **FLUORESCENT LABELLING**

SIRAJUDDIN: LEE PEI LEE ANGEL and IDRIS ABU SEMAN

MPOB INFORMATION SERIES . ISSN 1511-7871 . JULY 2019

introduced as biocontrol agent in strain through T-DNA transfer. the agricultural industry to enhance Thacon et al., 2007; Angel et al., 2016;

plasmid containing SGFP (pCAMBIAgfp) into

Journal of Oil Palm Research Vol. 31 (4) December 2019 p. 572-581

INDUCED SYSTEMIC RESISTANCE AND PROMOTION OF PLANT GROWTH IN OIL PALM SEEDLINGS BY ENDOPHYTIC Trichoderma virens

FARAH AMIRA MD PAUDZAI'; SHAMALA SUNDRAM"; MOHD TERMIZI YUSOF LEE PELLEE ANGEL**: AMALIA MOND HASHIM! and SITI NOR AKMAR ARDULL AN

Plants treated with Trichoderma (A) had better survival compared to plants without any treatment (B)



3. Induces systemic resistance









AWARDS AND PATENTS



NPS 2014 ITEX 2015 2nd Price Silver Medal



Patent (2016) PI201670097



i-inova 2016 Silver Medal



ITEX 2020 MIPA



ITEX 2020 Silver Medal



MTE 2020 Gold Medal



Patent (2020) PI202000160



ITEX 2017 Silver Medal



Achievements:

Publications

2013

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Journal of CM Plain Research Vol. 25 (b) December 2013 p.

FIRST REPORT: ISO Trichoderma FROM Jacq.) AND THEIR ASSESSMENT O

The isolation of endophytic Trichodorma for (Elaris guineensis Jacq.) was investigated plantation plots and it was found that Trick roots of oil pulm and none were found in the l used for isolation. Identification of the isolat isolates some obtained with 10 from stem and to dual culture away; a preliminary away to against Ganoderma boninense. Subseques antibiosis properties through poison food agisolated from oil palm with biocontrol potent

Keywords: oil palm, andophyli

Date received: 19 March 2013; Bent for revision: 16 Jun

INTRODUCTION

Trichoderma species are usually considered soil: that colonise superficially on the plant root sur sometimes forming a symbiotic relation The genus is typically considered soilborne associated with the roots of plants and is come considered for their potential to control plant d in what can be a close association with many a typical of endophytic association (Harman

Malaysian Palm Ol Board, 6 Persiaran Irathusi, Bander Baru Bangi, 43000 Kajang, Selangor, Malaysia.

lournal of Microbiology (2014) Vol. 54, No. 11, pp. 732-744 DOI 10.1007/s12275-014-6304-4

An in vitro study of the antifun and a profile of its non-polar ar Ganoderma boninense'

Lee Pei Lee Angel^{1,5}, Mohd Termizi Yusof⁴, Intan Safinar Ismail^{2,5}, Bonnie Tay Yen Ping⁴, Intan Nur Ainni Mohamed Azni*, Norman Hj Kamarudin⁵, and Shamala Sundran

Department of Microbiology, Faculty of Biotechnology and Biomolocu Science, 'Department of Chemistry, Faculty of Science, Laboratory of Natural Products, 'Institute of Bioscience, University Patric Malaysia. 43400 Sendang, Selanger, Malaysia *Advanced Olaschomical Technology Division, *Biology Research Division, Malaysian Palm Od Buard, 43000 Kajang, Selanger, Malays

Received Jun 24, 2016 / Revised Sep 7, 2016 / Accepted Sep 7, 2016)

Ganoderma boninense is the causal agent of a devastating ease affecting oil palm in Southeast Asian countries. B stem rot (BSR) disease slowly rots the base of palms, wh radically reduces productive lifespan of this lucrative cr Previous reports have indicated the successful use of Tric derma as biological control agent (BCA) against G. bonin and isolate T. virers 7b was selected based on its initial scre ing. This study attempts to decipher the mechanisms resp sible for the inhibition of G. boninense by identifying characterizing the chemical compounds as well as the ph cal mechanisms by T. vireus 7b. Hexane extract of the late gave 62.60% ± 6.41 inhibition against G. bonisense servation under scanning electron microscope (SEM) tected severe mycelial deformation of the pathogen at region of inhibition. Similar mycelia deformation of G. ninense was observed with a fungicide treatment, Benla indicating comparable fungicidal effect by T. virens 7b. Fr tion 4 and 5 of hexane active fractions through prepara thin layer chromatography (P-TLC) was identified giving best inhibition of the pathogen. These fractions comprise ketones, alcohols, aldehydes, lactones, sesquiterpenes, mo erpenes, sulphides, and free fatty acids profiled through chromatography mass spectrometry detector (GC/MSD) novel antifungal compound discovery of phenylethyl al hol (PEA) by T. viresu 7b is reported through this study vireus 7b also proved to be an active siderophore produ through chrome azurol S (CAS) agar assay. The study de onstrated the possible mechanisms involved and resp

For correspondence. E-mail: shamalajimpoh.gov.my; Tel.: +605-876 27; Fat: +603-69258215

pplemental material for this article may be found at http://www.apringerlink.com/content/120906. Copyright II. 2016, The Microbiological Society of Korea

sible in the successful inhibition of G. boninense.

Journal of Oil Palm Research Vol. 30 (1) March 2018 p. 63 DOI: https://doi.org/10.21894(upr.2017.0009

PROFILING OF AN Trichoderma vire BIOCONTROL ASSA

LEE PEI LEE ANGEL"; SHAMALA SUNDRA

Trichoderma has long been recognised as a fungi due to antagonistic characteristics and the nursery stage in previous study. This is suppression of G. bonimense and the anti-fier 159c. Therefore, culture filtrates of endophys (EIOAc) and butanol (BuOH) and anti-funanti-fringal activity with percentage inhibitio electron microscope (SEM) should severe del inhibition region caused by EICIAc extract, I fungal away revealed that fractions 2 and 4 ha chrimatography-mass spectrimetry detector alcohol, lactones and free fatty acids. Pheny because the presence was only in the highly in lactone in fraction 4 of T. vinens 159c was fir

Keywords: endophytes, anti-fungal, Trans

Data received: 13 May 2017: Sent for revision: 6 June 2

INTRODUCTION

Biological control agent (BCA) is defined as the of a single or mixed culture of organisms to con phytopathogens and to allow the restoration of s

- Maleysian Palm Ol Soard. 6 Persianan Inditios, Bandar Baru Bangi. 43000 Kajang, Selangor, Maleysia, E-mail, shamala Bripoti, gov.my
- Department of Microbiology. Faculty of Biotechnology and Biomotecular Sciences. Universiti Putra Malaysia, 4340G UPM Serdang. Selangor, Malaunia
- Department of Chemistry, Faculty of Science; Universiti Putra Maleysia, 43400 UPM Sentang. Selangor, Malaonia.

CM Pales Bulletin 76 (May NOR) a 73.77

The Use of Indigenous Trichode Phytophthora palmivora - An

S Sundram* and M A Intan Nur Ainni*

ABSTRACT

Oil palm bud rot is a disease that destroys the young tissues of palms, and Phytophthora palmivora has been identified as the caseal pathogen. The disease is depostating the South American oil pulm industry. The pathogen is also known to be responsible for a number of serious diseases in cocoa, durian, jackfruit and cocmut. A bimecurity threat is imminent in Malaysia due to the fact that P. palmivora is an indigenous perhogen affecting local commodity crops. Various research activities have been initiated to assess the petential threat imposed by the pathogen on oil palm. These include an introdugation into one of the three componen of biosecurity, i.e. developing long-term approaches for reducing and managing the effects of a potential outbrook. Four condidates of Trichodorma viness (PP9, PP29, T7b and T159c) that control Ganoderma effectively were selected for further intestigation. An in vitro assessment subjected on 21 strains of P. palmiyora to these Trichodorma isolates. Endophytic T. vincos isolates T7b and T159c recorded good mycelial inhibition, ranging from 54%-77%, compared with the non-endophytic solates of T. virens PP9 and PP29. The efficacy of extracellular metabolites of those four T. vincos isolates tous also tested on the two most aggressio strains representation of P. palmivora (P3 and P7). The study demonstrates the potential use of local Trichoderma isolates in controlling P. palmivora, and warrants further investigations to be conducted in the nursery and in the field.

ABSTRAK

Reput ambut sauit adalah penyakit yang sorrosakkan tisu-tisu muda pokok sawit dan Phytophthoea palmivora triah dikevalpasti schagai patogen penyakit tersabut. Penyakit ini kini menghancurkan industri sasuit di Amerika Selatan. Patopre ini juga menyebahkan leberapa penyakit serius pada koko, durien, nengka dan kelapa. Ancaman biosekuriti dikhuatiri di Malaysia kerana P. palmivora adalah patogos yang menjangkiti tanaman komoditi temputan. Pelbagai aktiviti penyelidikan sedang dilakukan untuk menlai

6. Persianan Institute, Bundar Bana Bunut. D00 Kajang, Selangse, Mala E-mail: shamalaftespob.pon.mr

Od Polin Bulletin 77 (November 2018) p. 13-14

Profiling of Metabolites Presi Fractionation of Trichoderma

Lee Pei Lee Angel*; Shamala Sundram*; Bo Mohd Termizi Yusof** and Intan Safinar Isr

ABSTRACT

EndrePortic Trichoderma vinens 7b isolated from oil pulm roots has been extensively studied to determine its potential against the oil pulm pethogen. Ganoderma. The activities of its nonpolar metabolites were previously reported to show the highest inhibition on G. boninense PERTI growth compared to other extracts. Nevertheless, it is also important to understand the activity of its semisolar metabolites towards G. boninerse. Therefore this study aims to recoil the list of rectabolities in T. vinens 7b extracted using ethyl acetate and the effect of extracts on G. boninense PER71. The ethylacetate extract led to a significant decrease in the growth rate of G. boninense PER71 from 6.7 sem day" to 2.9 seen day". This resulted in a percentage inhibition of radial growth (PIRG) of 59.63% a 9.13. Calling and charging of the G. boninense's hyphae observed by scenning electron microscope subjected to ethné acetate extract explain the growth inhibition. The metabolite profiles shared the presence of potential artifungal compounds which may contribute to the inhibition. These include sucriminade and isolongifolese, 4.5,9.10-delpolyo,

ABSTRAK

Trichoderma virens 7b endofisk umg direncil deripade oler pelok amer telah dikaji asetuk removituhes potrocinya dalam recording pategore smit, Ganoderma. Aktiviti metalolit lukan poloyang dilaparkan seleban ini telah menunjukkan percentain perturbahan paling tinggi terhadap G. boninense PER/I berbuuding elatrak latu. Walex Ingermengran, aktiviti metabolit semi-pole terholay G. boninense adalah penting untuk dikuji. Olok the kinjan ini hertschan nestak mengetalne profil metabolit dalam T. visens 7b yang diskatrak menggunakan etil asetat dan kesan ekstrak terhadap G. boninense PER71. Elstral etil asetat heriesa

Materian Palm Oct Board, ts. Persianae Incotoni.

Bonder Beru Bangt, 4300 Kajang, Selongen Malaysia. Faculty of Bartedesology and Bussuloyalas Sonners. University Putra Malaysia, 43400 Sendang, Selanges. I-mail diamatellingoh govern

Journal of Cirl Palm Research Vol. 31 Mil December 2019 p. 573,581 DOI: https://doi.org/10.21894/opr.2019.0031

INDUCED SYSTEMIC RESISTANCE AND PROMOTION OF PLANT GROWTH IN OIL PALM SEEDLINGS BY ENDOPHYTIC Trichoderma virens

FARAH AMIRA MD PAUDZAI"; SHAMALA SUNDRAM"; MOHD TERMIZI YUSOF"; LEE PEI LEE ANGEL": AMALIA MOND HASHIM! and SITI NOR AKMAR ABDULLAH!

Trichoderma spp. have been undely used as a bulogical control agent for plant disease including basid stem not (BSR) on all palm. Trichoderma spp. control pathogens through reacongressism, autibiosis and triggering induced systemic resistance (ISR) in plants during the colonisation of plant roots, limiting the manifestation of the pathogenic fungi. In this study, we investigated the role of endophytic Trichoderma visens as a plant-evoluth promoter and its ability to prime the increme system of the host flourek ISR in all palm. Mixed application of two endophytic isolates of T. vipens 7b and 159c ass found to significently enhance the growth and development of all palm seaflings, in terms of height, girth and chlorophyll context compared to individual treatment. However, results showed that individual treatment of 7b and 15%: was better in ligrare biosynthesis. Plant defence-related enzyme activities; peroxidase, polyphenol exidase, superexiste dismutase and phonylalarine lyase were prominently elevated in the leaves of oil pubs sendings soon treatment of the respective T. visions isolates via plant roots. This study doministrated the tripper ince of ISR in all palm sealings via T. vipens beatment and proving that the inoculation of T. vipens isolates 7b and 159c some able to promote the vegetative growth and development of all palm seedlings.

Keywords: oil paim, endophytic Trichoderma, plant growth promoter, induced systemic resistance.

Date received: 30 August 2016. Sent for revision: 7 September 2018. Received in tirual form: 15 April 2019. Accepted: 2 October 2018.

INTRODUCTION

Oil palm (Elaris guinerusis Jacq.) is an important commodity crop in Malaysia that plays major

- Department of Microbiology, Faculty of Biotechnology lecular Science, Universiti Putra Malisytia 43400 LPM Serdang, Selangor, Malaysia.
- Malaysian Palm Oli Board, 6 Persianan Instituti, Bandar Bany Bangi, 43000 Kajang, Selangor, Malaysia. E-mell shamate through giviny
- Department of Cell and Molecular Biology, Faculty of Biotechnology and Biomolecular Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selengor, Malaysia
- Plantation Crop Laboratory, Institute of Tropical Agriculture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor

13

roles in Malaysia economy. Malaysia as the second largest oil palm producer in the world is currently contributing 34% of world palm oil production in 2017 (Kushain et al., 2018). Oil palm planted areas in Malaysia grew from approximately 640 000 ha in 1975 to 5.81 mullion hectares in 2017 (MPOB, 2018). However, oil palm industry is faced with a serious fungal disease known as basal stem rot (BSR), which is caused by Genoderna bosphense that results in substantial losses in oil palm production worldwide (Khairudin, 1990; Rao, 1990). This disease is lethal, not only to old oil palms but also to the younger one (Singh, 1991). The emergence of the first symptom of the disease in oil palm indicates extensive internal tictue decay and the application of disease control at this stage would be metiective (Hushianan et al., 20135.

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Intellectual Property (IP)

Patent 2016 PI2016700979



Patent 2020

PI2020001604

Patents Form No. 1 PATENTS ACT 1983

REQUEST FOR GRANT OF PATENT

(Regulations 7(1))

To: The Registrar of Patents Patents Registration Office Kuala Lumpur, Malaysia

Please submit this Form in duplicate

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For Official Use

Application No: PI2020001604

Filing Date

Request received on: 26 MARCH 2020 Fee received on: 26 MARCH 2020

Amount: RM 260

*Cheque / Postal Order / Money Order / Draft Cash No.: IPOL2020000000014548

Applicant's file reference P/MPOB/20PC83(MY)/WA

THE APPLICANT(S) REQUEST(S) THE GRANT OF A PATENT IN RESPECT OF THE FOLLOWING PARTICULARS:

Title Of Invention: COMPOSITIONS FOR DEFENSE FROM PATHOGEN INFECTION AND METHOD THEREOF

APPLICANT(S) (the data concerning each applicant must appear in this box or, if the space insufficient, in the space below :

Name: Malaysian Palm Oil Board Address: No. 6, Persiaran Institusi, Bandar Baru Bangi, 43000 Kajang Selangor Malaysia

Address for service in Malaysia : C/O ADASTRA INTELLECTUAL PROPERTY SDN. BHD., A-39-10 PENTHOUSE, MENARA UOA BANGSAR, NO. 5, JALAN BANGSAR UTAMA 1, 59000 Wilayah Persekutuan Kuala Lumpur, Malaysia

Nationality : Malaysia

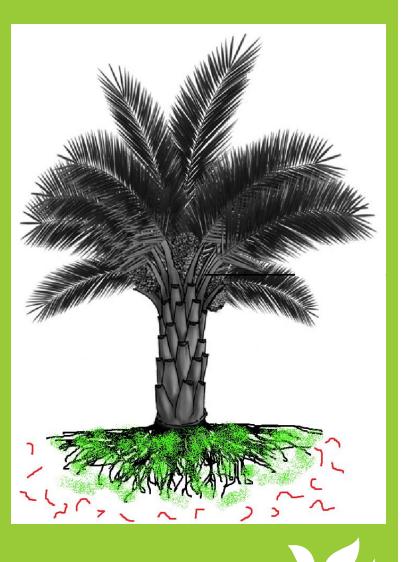
*Permanent residence or principal place of business :

C/O ADASTRA INTELLECTUAL PROPERTY SDN. BHD., A-39-10 PENTHOUSE, MENARA UOA BANGSAR, NO. 5, JALAN BANGSAR UTAMA 1, 59000 Wilayah Persekutuan Kuala Lumpur, Malaysia

Telephone Number (if any) 03-22842281

Fax Number (if any)

Additional Information (if any)



Trichotec

- ✓ is able to protect the roots from being infected by the previous stand's root fragments
- ✓ strengthens the palms induce defense mechanisms (ISR).

✓ releases metabolites that promote increased root and vegetative growth.

✓ remediates poor soil condition in and around the rhizosphere. Able to increase soil ecosystem via microbial diversity

Recommendation

 An effective management of Ganoderma disease requires the application of TrichoTec®

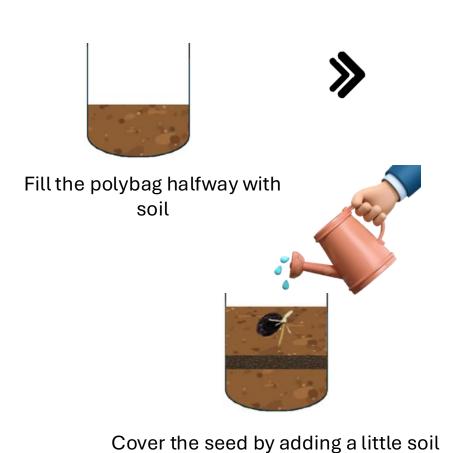
TrichoTec® application at different stages of oil palm plantings

stin	g
MO.05	5
M0.25	5
M2.55	5
Л4.2 С	

20 g	10 ⁷	RM0.05
100 g	10 ⁷	RM0.25
1 kg	10 ⁷	RM2.55
3 kg	104	RM4.20
	100 g 1 kg	100 g 10 ⁷ 1 kg 10 ⁷

Germinated Seed





on top. Then water the polybag.







Mix TrichoTec with soil, then add another layer of soil





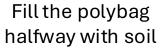
Using finger, poke a hole in the soil to make space for the germinated seed. Place the seed in the correct position.

Main Nursery

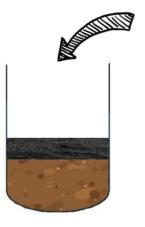
















Mix TrichoTec with the soil, then add another layer of soil on top.



Main Nursery





Place the seedling in the center of the polybag



Fill it with soil until full and water the polybag



1 Year Replanting

Field

*The total usage of TrichoTec is 1kg, divide it into 3 parts.









Add soil and apply one-third of the TrichoTec product.







1 Year Replanting







Transplant the one-year-old oil palm seedling into the prepared hole. Then, apply another one-third of the TrichoTec product around the hole



Cover the hole with soil.

The remaining one-third of the product should be spread on top of the soil, close to the base of the seedling

Demonstration video







Thank You

- A Collaborative R&D project between MPOB and Mygro Trading Sdn Bhd.
- Active Ingredient: Trichoderma Viren 159C

