

# Biological Control of *Oryctes rhinoceros* L. (Coleoptera: Scarabaeidae) with Entomopatogen Nematodes

*by* Dyah Indriyanti

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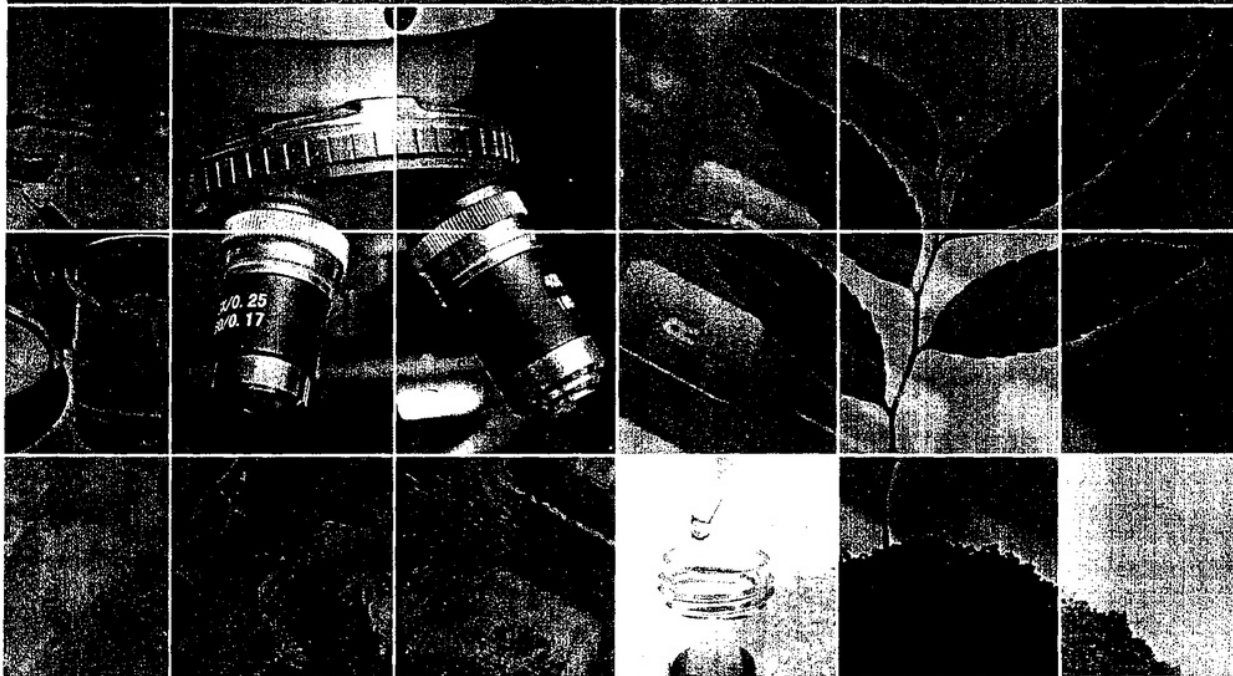
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on Research Inovation and Commercialization (UICRIC) for Better Life 2015

Patra Jasa Hotel Semarang, November 27 - 28<sup>th</sup> 2015





**6** 1st UNNES INTERNATIONAL CONFERENCE

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## FOREWORD

First, we would like to express our gratitude to Allah Almighty for His blessings so that this proceeding of the "1<sup>ST</sup> UNNES International conference on research and commercialization for better life 2015" can be published. These proceedings consist of all papers presented at the conference on 27th-28th November 2015 at Patrajasa Hotel Semarang Central Java Indonesia. The papers were internally reviewed by the qualified reviewers.

The theme of the conference was "1<sup>ST</sup> UNNES International conference on research and commercialization for better life 2015". It was expected that through this proceeding, we are able to disseminate the results of studies in the field of research.

This event invited seven speakers who presented materials closely related to the theme, namely: ..... (by Prof. Muhammad Nasir), ..... (by Prof. Fathur Rokhman), ..... (by Prof. Prof. Rahim MD.Sail), ..... (by Joop Van De Flier), ..... (by Asst. Prof. Rotchanatach Darnsawadi), ..... (Prof. Chow Yang lee) and ..... (by Dr. Ayami Nakaya). We hope that this proceeding will be beneficial for the society in terms of education, research, and community services.

Semarang, 26<sup>th</sup> November 2015

Editorial Board

## WELCOMING SPEECH FROM THE COMMITTEE CHAIR PERSON

In order to realize the vision of Semarang State University (UNNES) as the University of 4<sup>th</sup> conservation with an international reput, Institute for Research and Community Services (LP2M) establish 1<sup>st</sup> *UNNES International Conference on Research Innovation and Commercialization (UICRIC) for the better life 2015*. This event aims to increase the number of research publications and improvement of academic atmosphere through improving the quality of research works which we expect to occur downstream of research results to be a product that can be mass produced in an attempt to increase the welfare of society in general. It also aims to increase the capacity of researchers in generating better quality of research proposals in the future.

The scope of the research clusters that will be presented in this international seminar are: Education Innovations, Science and Technology, Quality of Life and Resource Development, Conservation, and the Art, Culture and Humanity.

Chairman of the Committee

Evi Widowati, S.KM., M.Kes.

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## Contents

FOREWORD.....	iii
WELCOMING SPEECH FROM THE COMMITTEE CHAIR PERSON.....	iv
REVIEW TEAM .....	v
LIST OF PAPER .....	xii
Research and Universities' Responsibility to Shape a Better and Sustainable World.....	1
Fathur Rokhman.....	1
Quality of life and resource development (health and sustainability issues), an overview of the current situation in the Netherlands .....	5
J. A. van der Flier.....	5
River Management based on Local Wisdom: Flood Preparedness in Hatyai, Thailand and Semarang, Indonesia.....	15
Rotchanatch Darnsawadi <sup>1</sup> , Subagyo <sup>2</sup> , Dewi Liesnoor Setyowati <sup>1</sup> , Satya Budi Nugraha <sup>2</sup> , Fidia Fibriana <sup>3</sup> .....	15
Making Technical, Vocational Education and Training a Premier Choice among Communities with Integration of Social Skills and Social Values in Technical Subjects .....	22
Rahim M. Sail .....	22
The Strategies of Tofu and Fermented Soybean Cake Cooperation in Facing China-Asean Free Trade.....	28
Abdullah Ahmed <sup>1</sup> , Mohaned Rabee <sup>2</sup> , Rusdarti <sup>2</sup> .....	28
Community-based Ecotourism Model to Improve Welfare Study: Rural Blumah Sub District Plantungan District Kendal .....	35
Apik Budi Santoso, Ananto Aji.....	35
Spatial overview of bush and swamp contribution to filariasis evidence in filariasis endemic area .....	39
Arum Siwiendrayanti <sup>1</sup> , Eram Tunggul Pawenang <sup>2</sup> , Sofwan Indarjo <sup>3</sup> .....	39
Rising Farm Labour Wages in India: Trends, Causes and Impact .....	43
B. Suresh Lal <sup>1</sup> , M. Ravindar <sup>2</sup> , A. Venkata Ramana <sup>2</sup> .....	43
The Needs Analysis of Vocational High School (VHS) In Banjarmasin Based on Local Resources Potential .....	53
Dwi Atmono <sup>1</sup> , Muhammad Rahmattullah <sup>2</sup> .....	53
Empowerment Street Children Through Atenho in Semarang City .....	62
Emas Agus Prastyo Wibowo <sup>1</sup> , Lia Inarotut Darojah <sup>2</sup> , Aziz Amrullah <sup>3</sup> Nuni Widiarti <sup>4</sup> .....	62
Strategic Policies for Increasing the Competitive Powers of Indonesian Horticultural Products in Asean Markets.....	64
Etty Soesilowati <sup>1</sup> , Sucihatiningsih DWP <sup>2</sup> .....	64
Identification of Social Potential in Lok Baintan's Floating Market Area .....	76
Fatimah <sup>1</sup> , Muhammad Rahmattullah <sup>2</sup> , Elyn Normelani <sup>3</sup> , Taufik Hidayat <sup>4</sup> .....	76
Analysis of Distribution of Local Education and Government Policy Study of Regency Level in Central Java Province.....	81
Firmansyah <sup>1</sup> , Shanty Oktavilia <sup>2</sup> .....	81
Good Governance in Malang Tourism to Improve People's Prosperity.....	89
Ika Nurhayani <sup>1</sup> , Hipolitus Kewuel <sup>2</sup> , Diah Ayu Wulan <sup>3</sup> , Ria Yuliati <sup>4</sup> .....	89
The Strategy of Development Ecotourism in Conservation Areas in Central Kalimantan Province .....	93
Irawan.....	93

The Influence of Pornographic Media Towards Adolescents Sexual Behavior at Public Senior High School in Bengkulu City .....	104
Ismiati, Eliana, Mariati .....	104
Rapid Appraisal for Agricultural Land Utilization (RAPALU) .....	110
Juhadi .....	110
Analysis of Determinant Regional Expenditure Allocation In The Autonomy Era In Sumatra .....	119
Konsi Koranti <sup>1</sup> , Mella Sri Kencanawati <sup>2</sup> , Elia Dewi Sagita <sup>3</sup> .....	119
Religiosity Develop Model Employee As Environmental Control Based Islamic Paradigm .....	124
Kusumantoro <sup>1</sup> , Ahmad Nurkhin <sup>1</sup> , Hasan Mukhibad <sup>2</sup> .....	124
Strategic Policies for Increasing The Competitive Power of Malaysian Fruits .....	129
Lailawati Mohd Salleh .....	129
Climate Change Impact on the Livelihood of Semarang Coastal Community .....	137
Nana Kariada Tri Martuti* <sup>1)</sup> , Dhita Prasisca Mutiatari <sup>1)</sup> , Roni Wijayanto <sup>2)</sup> .....	137
On Community Academy at Tanah Bumbu Regency .....	142
Muhammad Rahmattullah <sup>1</sup> , Nana Noviana <sup>2</sup> , Reza <sup>3</sup> .....	142
Medicinal Plants in Semarang State University .....	149
Nugrahaningsih <sup>1</sup> , .....	149
Generation of Conservation Based on Green Socioentrepreneurship Education In Order To Achieve Demographic Dividend as Sustainable Solutions of The Independent Indonesia .....	151
Nuriyanti, Imada Cahya Septyaningsih .....	151
Strategies for Increasing The Competitiveness of Manufacturing Industry in Semarang Regency, Central Java Province to Face Asean Economic Community .....	155
Shanty Oktavilia <sup>2</sup> Fafurida <sup>1</sup> , .....	155
Determinants and Impact of Performance to Achieve a Sustainable Competitive Advantage on SMEs Industrial Crafts Goods and Arts in Indonesia .....	161
Sri Wulan Windu Ratih .....	161
Ecopreneurship Mini Market as the First Step in Creating International Inorganic Waste Management Centre Based on Entrepreneurship in Indonesia .....	171
Tubagus Fahmi <sup>1</sup> , Sandy Arief <sup>2</sup> .....	171
Community based education to improve quality of life: Case study of Muatan Lokal in Indonesia .....	178
Ayami Nakaya .....	178
The Effect of Intellectual Capital on Earning Per Share .....	181
Mifta Huljannah <sup>1)</sup> , Bertilia Lina Kusrina <sup>2)</sup> .....	181
Serotonine as Biomarker of Lead Contamination in Brass Craftsmen .....	186
Aditya Marianti <sup>1</sup> , A. Anies <sup>2</sup> , Henna Rya Sunoko Abdurachim <sup>3</sup> .....	186
The Test of the Lethal Effect of Lansium Leaf Extract ( <i>Lansium domesticum</i> Correa) as the Electric Liquid Vaporizer Insecticide Against <i>Aedes aegypti</i> .....	190
Arifah Budi Nuryani <sup>1</sup> , Widya Hary Cahyati <sup>2</sup> .....	190



Behavior Model of Entrepreneurship on Woman Entrepreneur based on Entrepreneurship Intentions and the Level of Internet Adoption on SMEs in West Java .....	194
Bambang Gunawan H. <sup>1</sup> , Prihantoro <sup>2</sup> , Sri Wulan Windu Ratih <sup>3</sup> .....	194
<sup>4</sup> Opportunity of Free Open Source ERP System as a Competitive Advantage for Small and Medium Enterprise .....	200
Dionisya Kowanda <sup>1</sup> , Muhammad Firdaus <sup>2</sup> , Rowland Bismark Fernando Pasaribu <sup>3</sup> .....	200
Reconceiving franchise business formations paradigms for better business competitiveness.....	212
Dorojatun Prihandono .....	212
✓ Biological Control of <i>Oryctes rhinoceros</i> L. (Coleoptera: Scarabaeidae) with Entomopatogen Nematodes .....	217
Dyah Rini Indriyanti <sup>1</sup> , Priyantini Widiyaningrum <sup>1</sup> , Lita Dafosa <sup>1</sup> , Haryuni <sup>2</sup> .....	217
Design of Evacuation Maps as A Disaster Preparedness in Trangkil Semarang City .....	220
Evi Widowati.....	220
Personal Values Effect on Intention and Usage Behavior of E-Procurement in Government Institution .....	225
Hery Suliantoro .....	225
Proposing A Study on Global Water Sustainability Reporting .....	234
Indah Fajarini Sri Wahyuningrum.....	234
Optimization Extraction Process of Winged Bean ( <i>Psophocarus tetragonolobus</i> L.) Protein Using Respond Surface Methodology .....	236
Indah Riwayati <sup>1*</sup> , Helmy Purwanto <sup>2</sup> , Suwardiyono <sup>4</sup> .....	236
Comparative Study Relation of CPO Rendemen to FFB Production Risk In the Plantation Company with Different Performance .....	240
Lili Dahliani .....	240
Optimization of Hydrolysis for Production The Substance of Color Indigo by Enzyme Cellulase Using Response Surface Methodology .....	243
Prima Astuti Handayani <sup>1</sup> , Megawati <sup>2</sup> , Wara Dyah Pita Rengga <sup>3</sup> .....	243
Exploration bacteria trash of Rawasari and Bantar Gebang Indonesia as a superior candidat of compost bacterial agent .....	246
Rini Puspitaningrum <sup>1</sup> , Mohamad Irfan <sup>1</sup> , Mohamad Isnin Noer <sup>1</sup> , Gilang Ainan <sup>1</sup> , Ria Amelia <sup>1</sup> , Gladies Neolaka <sup>1</sup> , Shuhei Yabe <sup>2</sup> , Yasuteru Sakai <sup>2</sup> , Masaru Hazaka <sup>2</sup> , Dalia Sukmawati <sup>1</sup> , Muzajjanah <sup>1</sup> , Yokota Akira <sup>2</sup> .....	246
The Effects of Isoflavone on Antioxidant Status in The Serum of Rats DMBA-Induced Breast Cancer and Treated With Tempe.....	251
Siti Hamina Bintari <sup>1</sup> , Tuti Widiandi <sup>1</sup> , Kartika Nugraheni <sup>2</sup> .....	251
Antimicrobial Activity of Methanol Extract from Mahogany Seeds ( <i>Swietenia macrophylla</i> , King) .....	254
Sri Mursiti*, Supartono .....	254
Photocatalytic Activity and Antimicrobial Properties of TiO <sub>2</sub> -SiO <sub>2</sub> -PVA Composite.....	257
Sri Wahyuni <sup>1,a)</sup> , Agung Tri Prasetya <sup>2,b)</sup> .....	257
The Potency Of Household Contacts As Peer Support To Decrease The Number Of Tuberculosis Prevalence .....	262
Suharyo <sup>1</sup> , Kismi Mubarakah <sup>2</sup> .....	262
Ground Acceleration in Yogyakarta Based on Earthquake Data .....	265
Supriyadi <sup>1</sup> , Khumaedi <sup>2</sup> , Agus Susilo <sup>3</sup> .....	265

Typology of Coastal Areas and Effect on Mangrove Vegetation Distribution in The Zone Sediment Cell Between River yo River Comal- Bodri Central Java .....	269
Tjaturahono Budi Sanjoto .....	269
Residual Pesticide Study on Shallot Cultivation .....	275
Ubad Badrudin <sup>1)</sup> , Bambang Suryotomo <sup>1)</sup> Budi Prakoso <sup>2)</sup> .....	275
The Power of Online Consumer Community: an Elaboration Likelihood Model (ELM) Perspectives .....	278
Yusye Milawaty .....	278
Facial Expression Recognition by Using Wavelet Based Approach .....	282
Zaenal Abidin <sup>1</sup> , Alamsyah <sup>2</sup> .....	282
Factor Analysis of Student Motivation to Learn .....	286
Sri Hermawati <sup>1</sup> , Miftahul Jannah <sup>2</sup> .....	286
Model Women Empowerment through the Role and Potential of Women Cadres in Political Parties and the Effect on Economic of Women.....	291
Ary Natalina <sup>1</sup> , Syntha Noviyana <sup>2</sup> , Winda Widya Ariestya <sup>3</sup> .....	291
Art, Culture and Humanity.....	295
Suyahmo.....	295
Ornaments in Mantingan Mosque and Tomb: Analysis of Form, Function, and Symbolic Meaning.....	301
Muh Fakhrihun Na'am.....	301
<b>8</b> Determinants of Upper Secondary School Dropout in Central Java Province, Indonesia: A Gender-differentiated Approach.....	308
Andryan Setyadharma <sup>1</sup> , Hans-Jürgen Engelbrecht <sup>2</sup> , Hatice O. Balli <sup>3</sup> .....	308
The Development of Visual Media-Based History Room with Semarang Local History Theme in History Learning .....	319
Andy Suryadi & Tsabit Azinar Ahmad .....	319
Student's Mental Health Problems Assessment and Teacher's Mental Health State at Primary School .....	324
Anna Undarwati <sup>1</sup> , Nuke Martiarini <sup>2</sup> , Binta Mu'tiya Rizki <sup>3</sup> .....	324
The Development of Badminton Agility Test .....	330
Donny Wira Yudha Kusuma <sup>1,2</sup> , Hermawan Pamot Raharjo <sup>2</sup> .....	330
<b>9</b> Scientific Approach Based Worksheet For Physics Used to Develop Senior High School Students Characters.....	341
Dwi Yulianti <sup>1</sup> , Siti Khanafiyah, Pratiwi Dwijananti.....	341
The Importance of Researching Teachers' Social Emotional Competencies in an Indonesian Context .....	348
Edilburga W. Saptandari <sup>1</sup> , Shane T. Harvey <sup>1</sup> , Alison Sewell <sup>2</sup> , David T. Bimler <sup>3</sup> .....	348
Sport in Education System: a comparative study .....	352
Johansyah Lubis <sup>1</sup> , Eva Julianti <sup>2</sup> .....	352
<b>11</b> Pitching Biomechanics and Injury Prevention to Improving Performance for Young Baseball Pitchers -- A review	361
Fajar Awang Irawan <sup>1</sup> , Chuang Long-Ren <sup>2</sup> .....	361
Habitus, Space Influence, The Activity and Social Construction of Teacher to The MGMP .....	365
Hamdan Tri Atmaja.....	365

The Production Process of Manipulative for Commercial Purpose to Support the Success of Implementation of the School Mathematics Curriculum in Indonesia .....	369
Isti Hidayah <sup>1)</sup> , Sugiarto <sup>2)</sup> , Dwijanto <sup>3)</sup> , and Margunani <sup>4)</sup> .....	369
Development of Entrepreneurship Education Management Model Based Local Excellence on Vocational High School.....	374
Joko Widodo <sup>1</sup> , Samsudi <sup>2</sup> , Trisnani Widowati <sup>3</sup> .....	374
The Importance of Financial Education for Vocational School Students in Indonesia .....	379
Kardoyo <sup>1</sup> , Widiyanto <sup>2</sup> , Partono Thomas <sup>3</sup> , Khasan Setiaji <sup>4</sup> .....	379
Learning Dance Through Appreciation and Creation Approach In Public Schools.....	384
Malarsih.....	384
Character Hermitage: The Development Model of Character Reinforcement Management Locus .....	388
Maman Rachman, Aris Munandar, Andi Suhardiyanto.....	388
Multy Teaching Method On History Lesson .....	392
R. Soelistijanto .....	392
The Contrastive Verb of Paser Language.....	395
Rika Istianingrum <sup>1</sup> , Khizwar Muthmainah <sup>2</sup> .....	395
Students' Achievement On Entrepreneur Subject Matter At Fashion Technology Study Program By Applying Project-Based Learning .....	402
Sicilia Sawitri <sup>1</sup> , Ade Novi Nurul Ichani <sup>2</sup> , Siti Nurrohmah <sup>3</sup> .....	402
Forming Arabic Linguistics Terms (Analysis of Morphology and Syntax) .....	409
Singgih Kuswardono Ph.D candidate from Institute of Arab Reseach & Studies Cairo Egypt.....	409
Prevention and Control of Academic Plagiarism Based on Information Technology.....	413
Siti As'adah Hijriwati <sup>1</sup> , Achmad Soeharto <sup>2</sup> , Dwi Edi Wibowo <sup>3</sup> .....	413
Mung Bean Biscuits For Early Childhood .....	416
Siti Fathonah <sup>1</sup> , Fahriza Arifianty Muvida <sup>2</sup> .....	416
Development of Chemsitry Teacher Professionalism Through Pedagogical Content Knowledge Training .....	420
Sri Haryani <sup>1</sup> , Sri Wardani <sup>2</sup> , Agung Tri Prasetya <sup>3</sup> .....	420
The Self Concept in Children with Asthma to Participation in Physical Activity.....	426
Sri Sumartiningsih <sup>12</sup> .....	426
Development of Industry Practice Model in Vocational High School Based Entrepreneurship .....	428
Sunyoto <sup>1</sup> , Muhammad Khumaedi <sup>2</sup> .....	428
Effect of Use Learning Resources and Learning Motivation for Learning Outcomes Science Subject on Open Junior High School.....	431
Susetyo Widiasmoro <sup>1</sup> , Trisnani Widowati <sup>2</sup> , Dwi Purwanti <sup>3</sup> .....	431
Forms, Development and The Application of Music Media in The Kindergartens: A Comparative Study of Two Kindergartens in Semarang .....	435
Totok Sumaryanto F & Udi Utomo.....	435
Creativity of Students in Creating Ornaments/Accessories Hair with Waste Material .....	439
Trisnani Widowati <sup>1</sup> , Endang Setyaningsih <sup>2</sup> , Musdalifah <sup>3</sup> .....	439

Song as A Means to Convey Educational Messages for Preschool Students .....	444
Wadiyo .....	444

## LIST OF PAPER

Volume 1 | QUALITY OF LIFE AND RESOURCE DEVELOPMENT

No	Name	Paper Title
1	Joop A. Van der Flier	Quality of Life and Resource Development (Health and Sustainability Issues), an Overview of the Current Situation in the Netherlands
2	Rotchanatch Damsawasdi	River Management based on Local Wisdom: Flood Preparedness in Hatyai, Thailand and Semarang, Indonesia
3	Abdullah Ahmed	The Strategies of Tofu and Farmanted Soybean Cake Cooperation in Facing China-Asean Free Trade
4	Apik Budi Santoso	Community-based Ecotourism Model to Improve Welfare Study: Rural Blumah Sub District Plantungan District Kendal
5	Arum Siwiendrayanti	Spacial Overview of Bush and Swamp Contribution to Filariasis Evidence in Filariasis Endemic Area
6	B Suresh Lal	Rising Farm Labour Wages in India: Trends, Causes and Impact
7	Dwi Atmono	The Needs Analysis of Vocational High School (VHS) in banjarmasin Based on Local Resources Potential
8	Emas Agus Prastyo Wibowo	EMPOWERMENT STREET CHILDREN THROUGH ATENHO IN SEMARANG CITY
9	Etty Soesilowati	THE COMPETITIVE POWERS OF INDONESIAN HORTICULTURAL PRODUCTS IN ASEAN MARKETS
10	Fatimah	Identification of Social Potencies in Lok Baintan's Floating Market Area
11	Firmansyah	Analysis of Distribution of Local Education and Government Policy: Study of Regency Level in Central Java Province
12	Ika Nurhayani	Good Governance in Malang Tourism to Improve People's Prosperity
13	Irawan	The Strategy of Development Ecotourism in Conservation Areas in Central Kalimantan Province
14	Ismiati	The Influence of Pornographic Media Towards Adolescents Sexual Behavior at Public Senior High School in Bengkulu City
15	Juhadi	RAPID APPRAISAL FOR AGRICULTURAL LAND UTILIZATION (RAPALU)
16	Komsi Koranti	Analisis Determinan Alokasi Belanja Daerah Dalam Era Otonomi Pada Kabupaten / Kota di Sumatera
17	Kusumantoro	Religiosity Develop Model Employee as Environmental Control Based Islamic Paradigm
18	Lailawati Mohd Salleh	Strategic Policies for Increasing the Competitive Power of Malaysian Fruits
19	Nana Kariada Tri Martuti	Climate Change Impact on the Livelihod of Semarang Coastal Community
20	Nana Noviana	Study of the Establishment Planning on Community Academy at Tanah Bumbu Regency
21	Nugrahaningsih WH	MEDICINAL PLANT IN SEMARANG STATE UNIVERSITY
22	Nuriyanti	GENERATION OF CONSERVATION BASED ON GREEN SOCIOENTREPRENEURSHIP EDUCATION IN ORDER TO DEMOGRAPHIC DIVIDEND AS SUSTAINABLE SOLUTION INDEPENDENT INDONESIA
23	Shanty Oktavilia	Strategies for Increasing The Competitiveness of Manufacturing Industry in Semarang Regency, Central Java Province to Face Asean Economic Community
24	Sri Wulan Windu Ratih	Determinant of Performance and Its Impact Through Meditation Sustainable Competitive Advantage on SMEs Batik and Handicraft
25	Tubagus Fahmi	Ecopreneurship Mini Market as the First Step in Creating International Inorganic Waste Management Centre Based on Entrepreneurship in Indonesia
26	Ayami Nakaya	Community based education to improve quality of life: Case study of Muatan Lokal in Indonesia
27	Bertilia Lina Kusrina	The Effect of Intelctual Capital on Earning Per Share



Volume 2 | SCIENCE AND TECHNOLOGY  
 ART, CULTURE, AND HUMANITY

No	Name	Paper Title
1	Aditya Marianti	Serotonine as Biomarker of Lead Contamination in Brass Craftsmen
2	Arifah Budi Nuryani	KILLING POWER OF ELECTRIC LIQUID ANTI MOSQUITO OF LANSIUM LEAF EXTRACT ( <i>Lansium doemesticum</i> Correa) On <i>Aedes aegypti</i>
3	Bambang Gunawan H	Behavior Model of Entrepreneurship on Woman Entrepreneur based on Entrepreneurship Intentions and the Level of Internet Adoption on SMEs's in West Java
4	Dionysia Kowanda	Opportunity of Free Open Source ERP System As a Competitive Advantage for Small and Medium Enterprise
5	Dorojatun Prihandono	Reconceiving Franchise Business Formations Paradigms for Better Business Competitiveness
6	Dyah Rini Indriyanti	Biological Control of <i>Oryctes rhinoceros</i> L. (coleoptera: Scarabaeidae) with Entomopatogen Nematodes
7	Evi Widowati	Design of Evacuation Maps as a Disaster Preparedness in Trangkil Semarang City
8	Hery Suliantoro	Personal Values Effect on Intention and Usage Behavior of E-procurement in Government Institution
9	Indah Fajarini Sri Wahyuningrum	Proposing a Study on Global Water Sustainability Reporting
10	Indah Riwayati	Optimization Extraction Process of Winged Bean Protein Using Respond Surface Methodology
11	Lili Dahliani	Comparative Study Relation of CPO Rendemen to FFB Production Risk in the Plantation Company with Different Performance
12	Prima Astuti Handayani	Optimization of Hydrolysis for Production The Substance of Color Indigo by Enzyme Cellulase Using Response Surface Methodology
13	Rini Puspitaningrum	Exploration Bacterial Trash of Rawasari and Bantar Gebang from Indonesia as a Superior Candidat of Compost Bacterial Agent
14	Siti Harnina Bintari	The Effects of Isoflavone on Antioxidant Status in the Serum of Rats DMBA-Induced Breast Cancer and Treated With Tempe
15	Sri Mursiti	Antimicrobial Activity of Methanol Extract from Mahogany Seeds ( <i>Swietenia macrophylla</i> , King)
16	Sri Wahyuni	Silica-titania nanocomposite as anti-microbial agent
17	Suharyo	The Potency of Houshold Contacts as Peer Support to Decrease The Number of Tuberculosis Prevalance
18	Supriyadi	GROUND ACCELERATION IN YOGYAKARTA BASED ON EARTHQUAKE DATA
19	Tjaturahono Budi Sanjoto	Typology of Coastal Areas and Effect on Mangrove Vegetation Distribution in The Zone Sediment Cell Between River to River Comal - Bodri Central Java
20	Ubad Badrudin	Residual Peticide Study on Shallot Cultivation ( <i>Allium ascalonicum</i> L.) in Brebes District
21	Yusye Milawaty	The Power of Online Consumer Community : An Elaboration Likelihood Model (ELM) Perspectives
22	Zaenal Abidin	Facial Expression Recognition by Using Wavelet Based Approach
23	Sri Hermawati	Factor Analysis of Student Motivation
24	Syntha Noviyana	Model Women Empowerment Through The Role And Potential of The Women Cadres in Political Parties And The Effect On The Economic of Women
25	Suyahmo	ART, CULTURE AND HUMANITY
26	Muh Fakhrihun Na'am	Ornaments in Mantingan Mosque and Tomb: Analysis of Form, Function, and Symbolic Meaning

No	Name	Paper Title
1	Rahim M. Sail	Making Technical, Vocational Education and Training a Premier Choice among Communities with Integration of Social Skills and Social Values in Technical Subjects
2	Andryan Setyadharna	Determinates of Upper Secondary School Dropout in Central Java Province, Indonesia: A Gender-differentiated Approach
3	Andy Suryadi	Development of History Room Based Visual Media and Themed Local History of Semarang in History Learning
4	Anna Undarwati	STUDENT'S MENTAL HEALTH PROBLEMS ASSESSMENT AND TEACHER'S MENTAL HEALTH STATE AT PRIMARY SCHOOL
5	Donny Wira Y. K.	The Development of Badminton Agility Test
6	Dwi Yulianti	Scientific Approach Based Worksheet for Physics Used to Develop Senior High School Students Characters
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28	Wadiyo	Song as a Means to Convey Educational Messages for Preschool Students



# Biological Control of *Oryctes rhinoceros* L. (Coleoptera: Scarabaeidae) with Entomopatogen Nematodes

<sup>13</sup> Dyah Rini Indriyanti<sup>1</sup>, Priyantini Widiyaningrum<sup>1</sup>, Lita Dafosa<sup>1</sup>, Haryuni<sup>2</sup>  
<sup>1</sup>Biology Department, Faculty of Mathematics and Sciences, Semarang State University  
<sup>2</sup> Faculty Of Agriculture, Tunas Pembangunan University  
Email : [dyahrini36@gmail.com](mailto:dyahrini36@gmail.com)

**Abstract** — The Coconut production in Jepara, Central Java decreased due *Oryctes rhinoceros* beetle attack, more than 75% plants attacked. Biological control using the entomopatogen nematodes (EPN) has not been done. The aims of the study was conducting efficacy EPN on *O. rhinoceros* larvae on rainy season in the field condition. Biopesticide (Coleonema) containing EPN used for the test. The study used a randomized block design, four treatments and six replications of Biopesticides doses. The first treatment: 1 package biopesticides containing ten million EPN dissolved in 14 liters of water, second treatment 1 package biopesticides dissolved in 7 liters of water, and third treatment 1 package biopesticides dissolved in 3.5 liters of water. One package contains ten million EPN. The black Pot diameter 32 cm and height 25 cm were used for test sites. One pot was given 5 kg of organic soil, ten third instar larvae and 1 liter water containing EPN for each treatment, total 240 larvae. The pot surface covered with a perforated plastic to protect from animals nuisance. Observation was done every week for 8 weeks. The results showed the death of the larvae occurred at third week (2-5%) to eighth week (100%). The experiments carried out on the high rainfall intensity every day. EPN applications on *O. rhinoceros* larvae during the rainy season is not effective because it takes a long time up to 8 weeks.

**Keywords**—Entomopathogenic (EPN); *Oryctes rhinoceros*; Biological control

## INTRODUCTION

Jepara district is one of the cities in Central Java which is located at the edge of the northern coast of Java Sea, consists of 16 districts. One of them was Jeruk Wangi Village which well-known as a producer of coconut. Coconut production in Jeruk Wangi currently declining due to pests attacked coconut beetle (*Oryctes rhinoceros* L.). Farmers do not control this pest, even though the plant attacked has reached 75%.

<sup>10</sup> *Oryctes rhinoceros* <sup>12</sup> (Coleoptera: Scarabaeidae) or coconut rhinoceros beetle is one of the most important pest of coconut and oil palm in Indonesia (Mulyono 2007). *O. rhinoceros* adults feed in the crown region of coconut and oil palm. They bore through petiole bases into the central unopened <sup>10</sup> yes. Damaged fronds show typical triangular <sup>10</sup> s. The larvae do not damage crops, but instead grow in dead, decaying trunks and other organic matter.

<sup>1</sup> *O. rhinoceros* control is often neglected, due to several <sup>3</sup> reasons: 1) the coconut plant is not a major food crop so that less attention, 2) the coconut plant generally has a high stem, so it is difficult to control adult of *O. rhinoceros*. 3) the control of larvae also have difficulties because the larvae live

<sup>3</sup> in the soil and the location of the nest is often outside the plantation. So *O. rhinoceros* attacks often known after the pest population was high. Control efforts often use chemical pesticides by farmers in Indonesia.

<sup>7</sup> To limit larval infestation, growers typically incorporate <sup>7</sup> chemical insecticides. However, there is considerable interest <sup>7</sup> reducing pesticide inputs because of the risk they pose to humans and the environment and increased resistance in pest populations (Ansari et al. 2008). The use of synthetic insecticides causing the death of the natural enemies. Therefore environmental friendly biological control is needed. The agents of biological control are fungi, nematode, virus and bacteria.

There were entomopathogenic nematodes (EPNs) of the families Steinernematidae and Heterorhabditidae can be <sup>3</sup> applied as biocontrol agents. These EPNs have been <sup>7</sup> successfully used against a wide range of soil-inhabiting pests, including black vine weevil, in potted plants and glasshouse crops.

<sup>5</sup> Nematodes are microscopic, nonsegmented worms that occur naturally in soil all around the world. They are parasitic to insect pests that typically have a larval or pupal stage of life in the soil; however, they have been known to also parasitize above ground stages of adults, nymphs and larvae. Once they are released, the nematodes seek out host insects and enter their prey through body openings, injecting them with lethal bacteria (Acosta 2011)

This research was conducted on a coconut plantation owned by the people in the village of Jeruk Wangi, Jepara Central Java, Indonesia. Due to more than 75% Coconut plants attacked by *O. rhinoceros*. The aims of the study was conducting efficacy EPN on *O. rhinoceros* larvae on rainy season in the field condition.

## MATERIAL AND METHODS

Species of Entomopathogenic nematodes was Heterorhabditis sp, obtained in the form of commercial (Biopesticides), product by faculty of Agriculture, University of Jember. An aluminum pouch packaging containing  $10 \times 10^6$  EPN, the recommended dose of 1 bag dissolved in 14 liters of water.

Prepared 24 black pot diameter 34 cm, height 22 cm, the bottom of the pot there was a hole for discharge of water. Each pot is filled media sawdust mixture of soil and coconut



trees as much as 5 kg / pot. Each pot contains soil media was mixed with one liter of EPN as prescribed.

Preparation for a solution of EPN: EPN squeezed sponge containing water, squeeze in several time, repeated until the clean sponge. There were four treatment doses of EPN (abbreviated N), namely: 1 pouch packaging EPN was dissolved in 3.5 liters of water (N3,5); 1 pouch packaging EPN dissolved in 7 liters of water (N7); 1 pouch packaging EPN dissolved in 14 liters of water (N14).

Control (K) no EPN just water. Each unit pots were given 10 tails of *O.rhinoceros* larvae 3<sup>rd</sup> instar, larval size 7-10 cm long and weighing 9-11 grams / larvae. Each unit dose treatment was repeated six times, for a total of 24 pots and 240 larvae. Each pot contains 10 larvae watered as much as 1 liter of water containing the appropriate dose EPN.

*O.rhinoceros* larvae obtained from the nest in palm plantations in Jeruk Wangi village.

After completion of the perforated plastic surface covered pot (netting) is reasonably safe from animals. Pots and placed in the garden shaded plants. Observations conducted once a week for 8 weeks. Dead larvae were observed in the laboratory to ensure die because EPN or not. Data mortality of larvae were analyzed using descriptive charts mortality progress every week.

## RESULTS AND DISCUSSION

*O.rhinoceros* larval mortality due to EPN for eight weeks is presented in Figure 1 as follows.

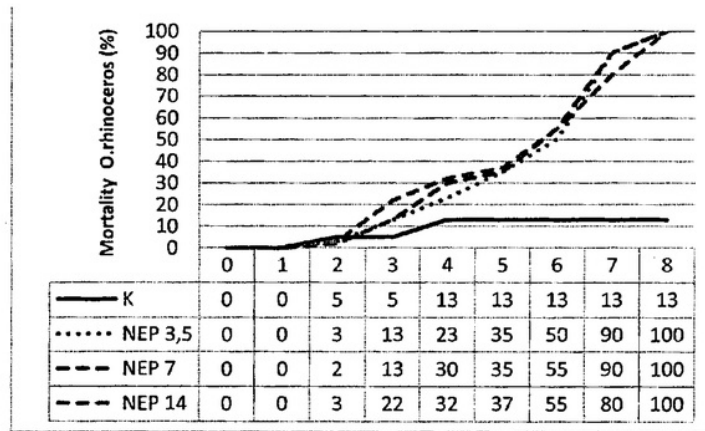


Figure 1. The percentage of *O.rhinoceros* larval mortality due entomopathogenic nematodes (EPN or NEP) treatment: doses of control (K), one package EPN was dissolved in 3.5 liters of water (EPN 3.5); EPN dissolved in 7 liters of water (EPN 7) and EPN dissolved in 7 liters of water (EPN 14). Treatment for eight weeks (average of six replicates).

Figure 1. *O.rhinoceros* larvae died began in the second week (control and treatment). This shows that there were already living microbes before given EPN. This is evident in the control 5% larvae dead, but on 3<sup>rd</sup> week larval mortality increased. This means that at 2<sup>nd</sup> - 3<sup>rd</sup> weeks EPN have infected larvae but not yet dead.

Giving nematodes into soil media, caused percentage of larvae mortality increased. At 7<sup>th</sup> week the larval mortality increased become (80-90%) while the controls (13%). Giving EPN into soil media increased the natural enemies of insect pests that live in the soil and accelerate death of the larvae (67-77%) (Figure 1).

The data (Figure 1) show that nematodes can kill larvae of the order Coleoptera, it supports the statement Imanandi (2012). However, the mortality of larvae *O.rhinoceros* require a longer time compared with larvae of insects of the order Lepidoptera.

Comparative studies show that nematodes can kill the larvae of *Crocidolomia binotalis* (50.70 hours), *Spodoptera litura* (51.60 hours) (Subagiya 2005).

To kill *O.rhinoceros* larvae with nematodes take a long time, due in this study used 3<sup>rd</sup> instar which has a hard skin, large larval size. Nematodes will effectively kill the larvae when the larvae enter the body through natural openings, for example through the mouth and holes spiracles. Another possibility is due to weather factors. Application of nematodes in the rainy season was not effective because the nematode dissolve in water before penetrating the larval body. The rains caused the penetration EPN to larvae was fail.

## CONCLUSION

Entomopathogen nematodes (EPN) applications on *O. rhinoceros* larvae during the rainy season is not effective because it takes a long time up to 8 weeks until all the larvae die

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# Design of Evacuation Maps as A Disaster Preparedness in Trangkil Semarang City

Evi Widowati

Lecturer of Public Health, Sport Science Faculty, Semarang State Univeristy, Semarang Indonesia  
evihasma@gmail.com

**Abstract** — Based on identification result can be seen that in Trangkil is high risk area to get disaster and has not had the emergency response system yet especially on evacuation system. Post-catastrophic landslides in Trangkil make a people who live there develop a division of labor Trangkil disaster response team to tackle the disaster that is going on, but the establishment of a disaster response team personnel are still not complete and it is only made incidentally. Therefore, this research aims is make design of evacuation map, to complete the disaster response team which can be used as guidance for Trangkil community if they want to evacuate themselves when disaster come to this area. This research design is research and development (R & D) with simple design because the research stage only up to the third stage or Main Model Revision of evacuation map, which are constructed by assessment from the key persons in Trangkil area. The research result show that the evacuation map had been developed by the research team through direct observation in the field and interviews with the key persons. Then the initial design which already had been assessed by local community leaders (for 3 people) through interviews process as improvement input of the evacuation map design

**Keywords**— maps, evacuation, emergency, preparedness.

## INTRODUCTION

The evacuation process, especially before the disaster will determine the number of victims and the amount of losses that might occur during catastrophic events. As in the Act of Indonesia number 1, year 1970 Section III Article 3 has been set on the terms of work safety is to prevent, reduce and extinguish fires, prevent and reduce the danger of explosion, as well as provide an opportunity or a way to save themselves at the time of the fire or incident occur.

This evacuation becomes very important because the evacuation process is not easy to do on a community that does not respond to the disaster. As mentioned by Gwynne et al that there are four main factors that determine the performance of the evacuation system, namely: configuration/arrangement of land that existed at the housing, factors environmental conditions, reliability of the evacuation procedures were applied, and the most important is the behavior of its inhabitants. Because of the behavior/nature of the occupants is affected by the physical condition, psikhis and sociological.

Indonesia is a country prone to disasters ranging from fires, earthquakes, bombings, floods, volcanic eruptions, landslides and so forth. The incidence of landslides also occurred in Trangkil Semarang. Wherein based on the identification of potential risks can be seen that in Trangkil which is a disaster-prone areas do not have a disaster response system including an adequate evacuation system

especially evacuation maps that can provide guidance for local residents to evacuate themselves when disaster comes. Post-landslide that occurred in Trangkil only made public Trangkil division of labor set up a disaster response team but the determination of the emergency response team personnel are still not accurate and complete, and the team there is still a very incidental. And do not have a comprehensive design-related emergency response system especially mapmaking evacuation.

### *Formulation of the problem*

Based on this background, it can be formulated the problem in this research is: "How does the design of evacuation maps that can be used as a disaster response efforts in Trangkil Semarang?"

### *Research purposes*

The aim of this study is to develop a map of the evacuation as disaster response efforts in Trangkil Semarang.

### *Benefits of research*

This research could provide theoretical benefits that can enrich the scientific field of Occupational Health and Safety (OHS), particularly at the Semarang State University in the form of related references evacuation systems within the community, especially design of evacuation maps. Moreover, it can provide a practical contribution directly to the public in the form of Semarang Trangkil draft evacuation maps that can be used when the disaster come in that area.

### *Theoretical Overview*

Evacuation is the rescue of the human soul from one room or building to another place safer in emergencies situation. In addition evacuation also be understood as an attempt to rescue the soul in the fire disaster. Evacuation facilities, consisting of:

#### 1) Assembly point

assembly point is a safe place. Personnel who are not directly involved in dealing with emergencies immediately evacuated from the site toward a safe gathering place.

An assembly point should be clearly marked and equipped with communication devices such as: telephone and radio with an emergency control center. This meeting place should be more than one so that workers are

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