

**POTENTIAL OF *Streptomyces* sp. FROM RHIZOSPHERE OF
MANGROVE *Avicennia marina* AS A BIOLOGICAL AGENT OF
Sclerotium rolfsii CAUSING PLANT SOUTHERN STEM BLIGHT ON
BIRD'S EYE CHILI (*Capsicum frutescens* L.)**

UNDERGRADUATE THESIS



Written by:

YERNI ANDRYANI
NPM. 21025010144

**DEPARTMENT OF AGROTECHNOLOGY
FACULTY OF AGRICULTURE
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR
SURABAYA
2026**

**POTENTIAL OF *Streptomyces* sp. FROM RHIZOSPHERE OF
MANGROVE *Avicennia marina* AS A BIOLOGICAL AGENT OF
Sclerotium rolfsii CAUSING PLANT SOUTHERN STEM BLIGHT ON
BIRD'S EYE CHILI (*Capsicum frutescens* L.)**

UNDERGRADUATE THESIS

Submitted in fulfillment for obtaining
the Bachelor of Agriculture degree



Written by:

YERNI ANDRYANI
NPM. 21025010144

**DEPARTMENT OF AGROTECHNOLOGY
FACULTY OF AGRICULTURE
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" JAWA TIMUR
SURABAYA
2026**

APPROVAL SHEET

POTENTIAL OF *Streptomyces* sp. FROM RHIZOSPHERE OF MANGROVE *Avicennia marina* AS A BIOLOGICAL AGENT OF *Sclerotium rolfsii* CAUSING PLANT SOUTHERN STEM BLIGHT ON BIRD'S EYE CHILI (*Capsicum frutescens* L.)

Written by:

YERNI ANDRYANI
NPM. 21025010144

Submitted on:

June 2nd, 2026

This undergraduate thesis is accepted as one of the requirements for obtaining a Bachelor of Agriculture degree

Universitas Pembangunan Nasional "Veteran" Jawa Timur

Approved by,

Main Advisor

Co-Advisor


Dr. Ir. Arika Purnawati, M.P.
NIP. 19650422 199003 2001


Dr. Ir. Tri Mujoko, M.P.
NIP. 19660509 199203 1001

Known by,

Dean of the
Faculty of Agriculture

Coordinator Agrotechnology
Undergraduate Program


Prof. Dr. Ir. Wanti Mindari, M.P.
NIP. 19631208 199003 2001


Dr. Ir. Tri Mujoko, M.P.
NIP. 19660509 199203 1001

APPROVAL SHEET

POTENTIAL OF *Streptomyces* sp. FROM RHIZOSPHERE OF MANGROVE *Avicennia marina* AS A BIOLOGICAL AGENT OF *Sclerotium rolfsii* CAUSING PLANT SOUTHERN STEM BLIGHT ON BIRD'S EYE CHILI (*Capsicum frutescens* L.)

Written by:

YERNI ANDRYANI
NPM. 21025010144

Submitted on:
June 2nd, 2026


This undergraduate thesis is accepted as one of the requirements for obtaining a Bachelor of Agriculture degree Universitas Pembangunan Nasional "Veteran" Jawa Timur

Approved by,

Main Advisor

Co-Advisor


Dr. Ir. Arika Purnawati, M.P.
NIP. 19650422 199003 2001


Dr. Ir. Tri Mujoko, M.P.
NIP. 19660509 199203 1001

STATEMENT OF ORIGINALITY

I, the undersigned:

Name : Yerni Andryani
NPM : 21025010144
Program : Bachelor's Degree
Study Program : Agrotechnology
Faculty : Agriculture

I declare that I have not committed plagiarism in writing my undergraduated thesis entitled: "Potential of *Streptomyces* sp. from Rhizosphere of Mangrove *Avicennia marina* as a Biological Agent of *Sclerotium rolfsii* Causing Plant Southern Stem Blight on Bird's Eye Chili (*Capsicum frutescens* L.)". Theories and/or findings from previous research conducted by other researchers have been cited appropriately. If it is proven that I have committed plagiarism, I will accept the sanctions in accordance with applicable laws and regulations. I hereby declare that this statement is true, without coercion from any party, and can be used as intended.

Surabaya, June 2nd, 2026

Stated by,



Yerni Andryani
NPM. 21025010144

**POTENTIAL OF *Streptomyces* sp. FROM RHIZOSPHERE OF
MANGROVE *Avicennia marina* AS A BIOLOGICAL AGENT OF
Sclerotium rolfsii CAUSING PLANT SOUTHERN STEM BLIGHT ON
BIRD'S EYE CHILI (*Capsicum frutescens* L.)**

Yerni Andryani¹, Arika Purnawati^{2*}, Tri Mujoko³

^{1,2,3}. Department of Agrotechnology, Faculty of Agriculture, Universitas
Pembangunan Nasional “Veteran” Jawa Timur, Jl. Raya Rungkut Madya Gunung
Anyar, Surabaya 60294

*Correspondence email: arika_p@upnjatim.ac.id

ABSTRACT

Bird's eye chili (*Capsicum frutescens* L.) is an important horticultural commodity classified under the nine staple foods of the Indonesian population; however, its productivity frequently declines due to pathogenic fungal attacks. *Sclerotium rolfsii* is a soil-borne pathogen responsible for stem rot disease in chili plants, which can cause yield losses ranging from 80% to 100%. Information regarding the efficacy of *Streptomyces* sp. isolated from the rhizosphere of the mangrove *Avicennia marina* against *S. rolfsii* on bird's eye chili via root dipping treatment remains limited. Therefore, this study explored the potential of *Streptomyces* sp. from the *A. marina* mangrove rhizosphere as a biocontrol agent to control *S. rolfsii*. The study employed a non-factorial Completely Randomized Design (CRD), comprising a control group and root dipping treatments in a *Streptomyces* sp. suspension for varying durations (15, 30, and 45 minutes). The observational data were analyzed using ANOVA at a 5% significance level using IBM SPSS Statistics software version 27. The results indicated that *Streptomyces* sp. was capable of inhibiting the growth of *S. rolfsii* *in vitro* by up to 52.22%, which is classified as strong inhibition. Meanwhile, *in vivo* test results demonstrated that the 45-minute root dipping treatment (SW3) prolonged the incubation period until the final day of observation, showed no disease symptoms until the end of the observation period, and enhanced the vegetative growth of the plants.

Keywords: *Streptomyces* sp.; *Sclerotium rolfsii*; biocontrol agent; antagonist

ABSTRAK

Cabai rawit (*Capsicum frutescens* L.) merupakan komoditas hortikultura penting yang tergolong dalam sembilan kebutuhan pokok masyarakat Indonesia, namun produktivitasnya sering menurun akibat serangan jamur patogen. *Sclerotium rolfsii* merupakan patogen tular tanah penyebab busuk pangkal batang pada tanaman cabai yang dapat menyebabkan kehilangan hasil panen sebesar 80-100%. Informasi mengenai efektivitas *Streptomyces* sp. asal rizosfer mangrove *Avicennia*

marina terhadap *S. rolfsii* pada cabai rawit melalui perlakuan perendaman akar masih terbatas. Oleh karena itu, penelitian ini mengeksplorasi potensi *Streptomyces* sp. asal rizosfer mangrove *A. marina* sebagai agens hayati untuk mengendalikan *S. rolfsii*. Penelitian menggunakan Rancangan Acak Lengkap (RAL) non faktorial yaitu perlakuan kontrol dan perlakuan perendaman akar dalam suspensi *Streptomyces* sp. dengan waktu yang berbeda-beda (15 menit, 30 menit, 45 menit). Data hasil pengamatan dianalisis dengan ANOVA pada taraf 5% dalam perangkat lunak IBM SPSS *Statistics* versi 27. Hasil analisis menunjukkan bahwa *Streptomyces* sp. mampu menghambat pertumbuhan *S. rolfsii* di media buatan hingga 52,22% yang tergolong penghambatan kuat. Sementara itu, hasil uji *in vivo* menunjukkan bahwa perlakuan perendaman selama 45 menit (SW3) mampu memperpanjang masa inkubasi hingga hari terakhir pengamatan, tidak menunjukkan gejala penyakit hingga akhir pengamatan, serta mampu meningkatkan pertumbuhan vegetatif tanaman.

Kata Kunci: *Streptomyces* sp.; *Sclerotium rolfsii*; pengendalian hayati; antagonis

PREFACE

Praise and gratitude be to Allah *Subhanahu Wa Ta'ala* who has bestowed His blessings and guidance, which have enabled the author to complete this undergraduate thesis entitled “Potential of *Streptomyces* sp. from Rhizosphere of Mangrove *Avicennia marina* as a Biological Agent of *Sclerotium rolfsii* Causing Plant Southern Stem Blight on Bird’s Eye Chili (*Capsicum frutescens* L.)”. The completion of this thesis would not have been possible without the support and assistance of many individuals. Therefore, the author would like to express sincere gratitude to:

1. Dr. Ir. Arika Purnawati, M.P., as the Main Supervisor, for kindly dedicating her time, patience, attention, knowledge, and valuable suggestions throughout the preparation of this thesis.
2. Dr. Ir. Tri Mujoko, M.P., as the Co-Supervisor and Coordinator of the Agrotechnology Study Program, Faculty of Agriculture, Universitas Pembangunan Nasional “Veteran” Jawa Timur, for his guidance and support during the writing of this thesis.
3. Prof. Dr. Ir. Wanti Mindari, M.P., as the Dean of the Faculty of Agriculture, Universitas Pembangunan Nasional “Veteran” Jawa Timur.
4. The author’s beloved parents, Suprayitno and Suhartini, the greatest heroes and the gate to heaven in the author’s life. They are the two people who have contributed immensely to the author’s journey, becoming the source of strength in every step and continuously striving to provide their first daughter with the highest possible education. Endless gratitude is extended to both Father and Mother for their love, support, motivation, and heartfelt prayers throughout every stage of this process. The author hopes that the completion of this thesis will become the first step toward making them proud and happy.
5. The author’s younger brother, Rafif Fahrudin. Thank you to my beloved brother, who may not always have been present in every long story of this journey, but has always been a reason for the author to continue demonstrating perseverance and determination. Thank you for being a small light that made

exhausting days feel lighter. Hopefully, every step the author takes today will someday inspire you to pursue your own dreams.

6. All members of the extended family who cannot be mentioned individually, thank you for the support, motivation, encouragement, prayers, and advice given to the author.
7. The author's closest friend, Nurizma Izdihar Mahdyah and Bima Abriansyah, whom the author considers as family. Thank you for accompanying the author through both joyful and difficult times, for accepting both the strengths and weaknesses of the author without judgment, and for all the prayers, support, and encouragement during the completion of this thesis.
8. The author's college friends, Salma Alfiani Nadiva, Aullyvia Putri Nabiella, Azzura Talitha Maulidya Irawan, and Resty Regita Rahmadhani, who have been part of this journey since the early semesters of university life. Thank you for being present not only during moments of laughter, but also during times when the author almost gave up. Thank you for becoming a place to share worries and fears, and for holding on when the author's steps began to falter. Thank you for being part of this journey, turning exhaustion into meaningful stories, and making every struggle feel less lonely.
9. All parties who have provided motivation, suggestions, support, and assistance to the author during the preparation of this thesis.

Finally, the author hopes that this thesis will be beneficial to readers and all related parties. Constructive criticism and suggestions are sincerely welcomed in order to improve and perfect this thesis in the future.

Surabaya, June 2nd, 2026

Author

TABLE OF CONTENTS

	Page
PREFACE	ii
TABLE OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF IMAGES	ix
I. INTRODUCTION	1
1.1. Background	1
1.2. Problem Statement	5
1.3. Research Objective	5
1.4. Research Significance	5
II. LITERATURE REVIEW	6
2.1. Bird's Eye Chili Plant (<i>Capsicum frutescens</i> L.)	6
2.1.1. Classification and Morphology of Bird's Eye Chili Plant	6
2.1.2. Growth Requirements of Bird's Eye Chili Plant	8
2.2. Southern Stem Blight Disease on Bird's Eye Chili Plant	9
2.3. Causal Pathogen of the Disease (<i>Sclerotium rolfsii</i>)	10
2.3.1. Classification and Morphology <i>Sclerotium rolfsii</i>	10
2.3.2. Life Cycle of <i>Sclerotium rolfsii</i>	12
2.3.3. Attack Mechanism <i>Sclerotium rolfsii</i>	13
2.3.4. Factors Affecting the Infection Rate	13
2.4. <i>Streptomyces</i> sp.	14
2.4.1. Classification and Morphology of <i>Streptomyces</i> sp.	14
2.4.2. Life Cycle of <i>Streptomyces</i> sp.	16
2.5. Mangrove <i>Avicennia marina</i>	18
2.6. Potential of <i>Streptomyces</i> sp. against <i>Sclerotium rolfsii</i>	19
2.7. Hipotesis	20
III. RESEARCH METHODOLOGY	21
3.1. Time and Place of Research	21
3.2. Tools and Materials	21
3.3. Experimental Design	21
3.4. Research Preparation	22

3.4.1. Equipment Sterilization	22
3.4.2. Preparation of Potato Dextrose Agar (PDA) Medium	23
3.4.3. Preparation of GNA (Glucose Nitrate Agar) Medium	23
3.4.4. Preparation of EKG (Potato Sugar Extract) Medium.....	23
3.4.5. Isolation of the Fungus <i>Sclerotium rolfsii</i>	24
3.4.6. Identification of the Fungus <i>Sclerotium rolfsii</i>	24
3.4.7. Purification Identification of the Fungus <i>Sclerotium rolfsii</i>	25
3.4.8. Koch's Postulates Test for <i>Sclerotium rolfsii</i>	25
3.4.9. Rejuvenation of <i>Streptomyces</i> sp. Isolates	25
3.4.10. Antagonism Test of <i>Streptomyces</i> sp. against <i>Sclerotium rolfsii</i> .	26
3.4.11. Preparation of the <i>Streptomyces</i> sp. Suspension	27
3.4.12. Colony Density Calculation of <i>Streptomyces</i> sp.	27
3.4.13. Preparation of the <i>Sclerotium rolfsii</i> Inoculum	28
3.4.14. Sterilization of the Planting Medium and Sowing of Bird's Eye Chili Plants.....	28
3.5. Implementation of the Research	29
3.5.1. Antagonism Test of <i>Streptomyces</i> sp. against <i>Sclerotium rolfsii</i> on Bird's Eye Chili Plants	29
3.6. Observation Parameters	31
3.7. Data Analysis	32
IV. RESULTS AND DISCUSSION	33
4.1. Eksplorasi and Identification of <i>Sclerotium rolfsii</i>	33
4.2. Koch's Postulates Test of <i>Sclerotium rolfsii</i>	35
4.3. Rejuvenation of <i>Streptomyces</i> sp.	36
4.4. Result of the Antagonism Test of <i>Streptomyces</i> sp. against <i>Sclerotium rolfsii</i>	37
4.5. Preparation of <i>Sclerotium rolfsii</i> Inoculum and Inoculation into the Planting Medium.....	39
4.6. Result of the Antagonism Test of <i>Streptomyces</i> sp. against <i>Sclerotium rolfsii</i> on Bird's Eye Chili Plants.....	41
4.6.1. Incubation Period	41
4.6.2. Disease Intensity	42
4.6.3. Plant Growth Parameters	46
V. CONCLUSIONS AND RECOMMENDATIONS.....	51
5.1. Conclusions.....	51

5.2. Recommendations	51
REFERENCES.....	52
APPENDICES	64

LIST OF TABLES

No	<u>Text</u>	Page
3. 1	Inhibition Categories of <i>Sclerotium rolfsii</i> Growth.....	27
4. 1	Percentage Inhibition of in Vitro Antagonism Assay.....	38
4. 2	Disease Intensity of Stem Rot on Bird's Eye Chili Plants	43
4. 3	Plant Height of Bird's Eye Chili Plants.....	47
4. 4	Leaf Count of Bird's Eye Chili Plants.....	48

Appendices

1.	Normality Test for the Incubation Period Parameter of <i>S. rolfsii</i> Southern Blight	64
2.	ANOVA for the Incubation Period Parameter of <i>S. rolfsii</i> Southern Blight	64
3.	Tukey's HSD Post Hoc Test for the Incubation Period Parameter of <i>S. rolfsii</i> Southern Blight.....	65
4.	Normality Test for the Disease Intensity Parameter.....	65
5.	ANOVA for Disease Intensity at 7 DAP	66
6.	Tukey's HSD Post Hoc Test for Disease Intensity at 7 DAP	66
7.	ANOVA for Disease Intensity at 14 DAP.....	67
8.	Tukey's HSD Post Hoc Test for Disease Intensity at 14 DAP	67
9.	ANOVA for Disease Intensity at 21 DAP.....	68
10.	Tukey's HSD Post Hoc Test for Disease Intensity at 21 DAP	68
11.	ANOVA for Disease Intensity at 28 DAP	69
12.	Tukey's HSD Post Hoc Test for Disease Intensity at 28 DAP	69
13.	Normality Test for the Plant Height Parameter	70
14.	ANOVA for Plant Height at 7 DAP	70
15.	Tukey's HSD Post Hoc Test for Plant Height at 7 DAP.....	71
16.	ANOVA for Plant Height at 14 DAP	71
17.	Tukey's HSD Post Hoc Test for Plant Height at 14 DAP.....	72
18.	ANOVA for Plant Height at 21 DAP	72
19.	Tukey's HSD Post Hoc Test for Plant Height at 21 DAP.....	73

20. ANOVA for Plant Height at 28 DAP	73
21. Tukey's HSD Post Hoc Test for Plant Height at 28 DAP.....	74
22. Normality Test for the Number of Leaves Parameter	74
23. ANOVA for the Number of Leaves at 7 DAP.....	75
24. Tukey's HSD Post Hoc Test for the Number of Leaves at 7 DAP	75
25. ANOVA for the Number of Leaves at 14 DAP.....	76
26. Tukey's HSD Post Hoc Test for the Number of Leaves at 14 DAP	76
27. ANOVA for the Number of Leaves at 21 DAP.....	77
28. Tukey's HSD Post Hoc Test for the Number of Leaves at 21 DAP	77
29. ANOVA for the Number of Leaves at 28 DAP.....	78
30. Tukey's HSD Post Hoc Test for the Number of Leaves at 28 DAP	78

LIST OF IMAGES

No	<u>Text</u>	Page
2. 1	Symptoms of <i>Sclerotium rolfsii</i> on plants.....	10
2. 2	Morphology of <i>Sclerotium rolfsii</i>	11
2. 3	Life cycle of <i>Sclerotium rolfsii</i>	13
2. 4	Colony morphology of <i>Streptomyces</i> spp. isolates (Hamid et al., 2020).....	15
2. 5	Morphology of <i>Streptomyces</i> sp. bacteria (Isrianto et al., 2024)	16
3. 1	Experimental layout of the antagonism assay on bird's eye chili.....	22
3. 2	Schematic representation of the dual culture assay.....	26
3. 3	Schematic representation of the barley seed inoculation method (Qiu et al., 2024).....	29
4. 1	Symptoms of stem rot disease on bird's eye chili plants.....	33
4. 2	Morphology of <i>Sclerotium rolfsii</i> isolated from Kampungbaru, Kediri City	34
4. 3	Microscopic morphology of <i>Sclerotium rolfsii</i> isolated from Kampungbaru, Kediri City.	35
4. 4	Results of Koch's postulates test on bird's eye chili plants	36
4. 5	Morphology of <i>Streptomyces</i> sp. isolated from the rhizosphere of the mangrove <i>Avicennia marina</i>	37
4. 6	In vitro antagonism test of <i>Streptomyces</i> sp. against <i>Sclerotium rolfsii</i>	37
4. 7	Hyphal morphology of <i>S. rolfsii</i> under normal growth conditions.	38
4. 8	Abnormal hyphal growth of <i>S. rolfsii</i> in the antagonism test against <i>Streptomyces</i> sp.	39
4. 9	<i>Sclerotium rolfsii</i> inoculum on barley grains	40
4. 10	Growth of <i>Sclerotium rolfsii</i> in the planting medium.	41
4. 11	Histogram of the incubation period of the fungus <i>Sclerotium rolfsii</i>	41
4. 12	Growth of bird's eye chili plants at 28 DAT	46