

SUDDEN DEATH DISEASE IN SHALLOT PRODUCTION CENTERS IN INDONESIA: A STUDY ON THE ASSOCIATION OF VIRUSES AND THRIPS

I GUSTI AYU WIDYASTITI



**STUDY PROGRAM OF INTEGRATED PEST MANAGEMENT
FACULTY OF AGRICULTURE
INSTITUT PERTANIAN BOGOR
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2026**



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A3503232032



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SUMMARY

I GUSTI AYU WIDYASTITI. Sudden Death Disease in Shallot Production Centers in Indonesia: A Study on the Association of Viruses and Thrips. Supervised by SRI HENDRASTUTI HIDAYAT and WIDODO.

Shallot (*Allium cepa* var. *aggregatum*) is one of the most important horticultural commodities in Indonesia, contributing significantly to vegetable production. In 2023, a sudden death disease characterized by rapid plant collapse, leaf wilting, and straw bleaching was reported in major shallot-producing areas. This disease is known by local farmers as “penyakit janda pirang”. The disease coincided with severe outbreaks of onion thrips (*Thrips tabaci*), raising concerns regarding the possible involvement of *Iris yellow spot virus* (IYSV), an *Orthospovirus* transmitted by several thrips species, with *T. tabaci* recognized as its principal vector. However, the association between IYSV, its vector, and the occurrence of sudden death disease under Indonesian field conditions remained unclear. This study aimed to (1) determine the association of viruses with shallot sudden death disease and compare the incidence of shallot viruses between the rainy and dry seasons in Brebes, (2) confirm the occurrence and distribution of IYSV in major shallot-producing centers of Indonesia, and (3) analyze the association between weather conditions and the occurrence of shallot sudden death disease.

Field observations were conducted in Brebes during the rainy and dry seasons of 2025 to assess disease incidence and collect plant samples for molecular detection. Historical weather data, including air temperature, rainfall, and relative humidity, were analyzed to assess their association with the occurrence of shallot sudden death disease. Field surveys were also carried out in major shallot-producing areas, including Brebes and Demak (Central Java), Magetan, Nganjuk, and Probolinggo (East Java), Bangli (Bali), and Solok (West Sumatra), where both shallot leaves and thrips were collected for molecular analysis. Molecular detection by reverse transcription polymerase chain reaction (RT-PCR) was conducted on shallot samples collected during two growing seasons in Brebes using virus-specific primers targeting five viruses. The analysis detected only *Onion yellow dwarf virus* (OYDV) and *Shallot latent virus* (SLV), whereas *Garlic common latent virus* (GCLV), *Leek yellow stripe virus* (LYSV), and *Iris yellow spot virus* (IYSV) were not detected. OYDV incidence in Brebes ranged from 75%–100% during the rainy season and 50%–100% during the dry season, while SLV reached 100% incidence in both seasons, indicating that seasonal differences had little influence on the occurrence of these bulb-transmitted viruses.

IYSV was detected in shallot leaf samples and thrips collected from Magetan, Nganjuk, Probolinggo (East Java), Bangli (Bali), and Solok (West Sumatra), with disease incidence ranging from 20% – 80%. The virus was consistently detected only in locations where *T. tabaci* was present. Sequence analysis demonstrated high nucleotide identity between IYSV isolates obtained from shallot leaves and *T. tabaci*, and phylogenetic analysis clustered both isolates within the same lineage, confirming the role of *T. tabaci* as the vector of IYSV in Indonesia. Although IYSV and its principal vector, *T. tabaci*, were confirmed in several shallot-producing regions, their presence was not consistently associated with the occurrence of sudden death disease. Weather analysis indicated that the 2023 outbreak of shallot

sudden death was associated with elevated air temperatures and severe drought during the El Niño event, whereas higher rainfall during the wetter dry season of 2025 likely acted as a limiting factor for disease occurrence. Moreover, sudden death-like symptoms observed in Demak in 2025 were associated with *Colletotrichum siamense* rather than IYSV. These findings indicate that shallot sudden death is a complex disease syndrome whose occurrence is strongly influenced by environmental conditions and may involve different causal agents under different field situations, highlighting the importance of comprehensive diagnosis before disease management strategies are implemented.

Keywords: insect vector, *Iris yellow spot virus*, molecular detection, PCR, *Thrips tabaci*



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RINGKASAN

I GUSTI AYU WIDYASTITI. Penyakit Mati Mendadak di Sentra Produksi Bawang Merah di Indonesia: Studi Asosiasi Virus dan Trips. Dibimbing oleh SRI HENDRASTUTI HIDAYAT dan WIDODO.

Bawang merah (*Allium cepa* var. *aggregatum*) merupakan salah satu komoditas hortikultura penting di Indonesia yang memberikan kontribusi signifikan terhadap produksi sayuran nasional. Pada tahun 2023 dilaporkan munculnya penyakit mati mendadak yang ditandai oleh kematian tanaman secara cepat, layu pada daun, dan gejala *straw bleaching* pada beberapa sentra produksi bawang merah. Penyakit ini dikenal dengan istilah “janda pirang” oleh petani. Kejadian penyakit tersebut bertepatan dengan ledakan populasi trips bawang (*Thrips tabaci*), sehingga memunculkan dugaan keterlibatan *Iris yellow spot virus* (IYSV), anggota genus *Orthotospovirus* yang ditularkan oleh beberapa spesies trips, dengan *T. tabaci* sebagai vektor utamanya. Namun demikian, hubungan antara IYSV, serangga vektor, dan kejadian penyakit mati mendadak pada kondisi pertanaman bawang merah di Indonesia masih belum diketahui secara jelas. Penelitian ini bertujuan untuk (1) mengetahui asosiasi berbagai virus dengan penyakit mati mendadak pada bawang merah serta membandingkan insidensi virus bawang merah pada musim hujan dan musim kemarau di Kabupaten Brebes, (2) mengonfirmasi keberadaan dan distribusi IYSV pada sentra produksi bawang merah di Indonesia, dan (3) menganalisis hubungan antara kondisi cuaca dengan kejadian penyakit mati mendadak pada bawang merah.

Pengamatan lapangan dilakukan di Kabupaten Brebes pada musim hujan dan musim kemarau tahun 2025 untuk mengetahui insidensi penyakit serta mengumpulkan sampel tanaman yang selanjutnya digunakan untuk deteksi molekuler. Data cuaca yang meliputi suhu udara, curah hujan, dan kelembapan relatif dianalisis untuk mengevaluasi hubungannya dengan kejadian penyakit mati mendadak pada bawang merah. Survei tambahan dilakukan di beberapa sentra produksi bawang merah, yaitu Kabupaten Brebes dan Demak (Jawa Tengah), Kabupaten Magetan, Nganjuk, dan Probolinggo (Jawa Timur), Kabupaten Bangli (Bali), serta Kabupaten Solok (Sumatera Barat), dengan mengumpulkan sampel daun bawang merah dan trips untuk analisis molekuler. Deteksi molekuler menggunakan metode *reverse transcription polymerase chain reaction* (RT-PCR) dilakukan terhadap sampel bawang merah yang dikumpulkan selama dua musim tanam di Brebes menggunakan primer spesifik untuk lima jenis virus. Hasil analisis menunjukkan bahwa hanya *Onion yellow dwarf virus* (OYDV) dan *Shallot latent virus* (SLV) yang terdeteksi, sedangkan *Garlic common latent virus* (GCLV), *Leek yellow stripe virus* (LYSV), dan *Iris yellow spot virus* (IYSV) tidak terdeteksi. Insidensi OYDV di Brebes berkisar antara 75%–100% pada musim hujan dan 50%–100% pada musim kemarau, sedangkan SLV mencapai insidensi 100% pada kedua musim, yang menunjukkan bahwa perbedaan musim tidak memberikan pengaruh yang berarti terhadap kejadian kedua virus yang ditularkan melalui umbi tersebut.

IYSV terdeteksi pada sampel daun bawang merah dan trips yang dikumpulkan dari Kabupaten Magetan, Nganjuk, dan Probolinggo (Jawa Timur), Kabupaten Bangli (Bali), serta Kabupaten Solok (Sumatera Barat), dengan

insidensi penyakit berkisar antara 20%–80%. Virus tersebut secara konsisten hanya terdeteksi pada lokasi yang ditemukan keberadaan *T. tabaci*. Analisis sekuens menunjukkan tingkat kesamaan nukleotida yang tinggi antara isolat IYSV yang berasal dari daun bawang merah dan *T. tabaci*, sedangkan analisis filogenetik mengelompokkan kedua isolat tersebut ke dalam satu garis keturunan yang sama, sehingga mengonfirmasi bahwa *T. tabaci* merupakan vektor IYSV di Indonesia. Meskipun keberadaan IYSV dan vektor utamanya, *T. tabaci*, berhasil dikonfirmasi pada beberapa sentra produksi bawang merah, keberadaannya tidak selalu berasosiasi dengan kejadian penyakit mati mendadak. Analisis cuaca menunjukkan bahwa ledakan penyakit mati mendadak pada bawang merah pada tahun 2023 berasosiasi dengan suhu udara yang tinggi dan kekeringan yang parah selama fenomena El Niño, sedangkan curah hujan yang lebih tinggi pada musim kemarau basah tahun 2025 diduga menjadi faktor pembatas perkembangan penyakit. Selain itu, gejala menyerupai mati mendadak yang ditemukan di Kabupaten Demak pada tahun 2025 berasosiasi dengan *Colletotrichum siamense*, bukan dengan IYSV. Hasil penelitian ini menunjukkan bahwa penyakit mati mendadak pada bawang merah merupakan suatu sindrom penyakit yang kompleks, yang kemunculannya sangat dipengaruhi oleh kondisi lingkungan dan dapat disebabkan oleh agens penyebab yang berbeda pada kondisi lapangan yang berbeda, sehingga diagnosis yang komprehensif sangat diperlukan sebelum menentukan strategi pengendalian penyakit.

Kata kunci: deteksi molekuler, *Iris yellow spot virus*, PCR, serangga vektor, *Thrips tabaci*



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SUDDEN DEATH DISEASE IN SHALLOT PRODUCTION CENTERS IN INDONESIA: A STUDY ON THE ASSOCIATION OF VIRUSES AND THRIPS

I GUSTI AYU WIDYASTITI

Thesis
as a partial fulfilment of the requirement for
Magister Sains in
Study Program of Integrated Pest Management

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External Examiner:
Dr. Sari Nurulita, S.P., M.Si.



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Student ID : A3503232032

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Approved by

Principal Supervisor:
Prof. Dr. Ir. Sri Hendrastuti Hidayat, M.Sc.

Co-Supervisor:
Prof. Dr. Ir. Widodo, M.S.

Acknowledged by

Head of Study Program:
Dr. Ir. Ali Nurmansyah, M.Si.
NIP. 196302121990021001

Dean of Faculty of Agriculture:
Prof. Dr. Ir. Suryo Wiyono, M.Sc.Agr.
NIP. 196902121992031003

Examination Date: 30 June 2026

Conferral Date: 13 AUG 2026



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PREFACE

All praise and gratitude to God Almighty for enabling the completion of this thesis, entitled “Sudden Death Disease in Shallot Production Centers in Indonesia: A Study on the Association of Viruses and Thrips” as a partial fulfillment of the requirements for obtaining a Magister Sains (M.Si.) degree in the Study Program of Integrated Pest Management, specialization in Phytopathology, Faculty of Agriculture, Institut Pertanian Bogor.

The completion of this thesis would not have been possible without the assistance and support of various parties throughout the author’s coursework and research. Therefore, the author would like to express sincere gratitude, particularly to Prof. Dr. Ir. Sri Hendrastuti Hidayat, M.Sc. and Prof. Dr. Ir. Widodo, M.S., as the Thesis Supervisor Committee, for their invaluable guidance, knowledge, and support, as well as to Dr. Sari Nurulita, as the external examiner, for her constructive suggestions and valuable feedback toward the improvement of this thesis. The author also extends sincere appreciation to all lecturers and educational staff of the Graduate Program in Study Program of Integrated Pest Management, as well as colleagues in the Plant Virology Laboratory and Plant Mycology Laboratory, for their cooperation and assistance. In addition, the author gratefully acknowledges the Ministry of Agriculture for providing the recommendation for study leave, as well as the Indonesia Endowment Fund for Education (LPDP) (registration number LPDP 0005416/TRP/M/ASN-2023) and the Australian Centre for International Agricultural Research (ACIAR) via ACIAR Project SLAM/2018/145 for providing funding during the author’s study and supporting the research expenses. The author also expresses heartfelt gratitude and respect to the author’s parents, brother, and family for their continuous support and prayers, as well as to those closest to the author throughout the completion of the study and research. The author would also like to thank all other parties who provided assistance throughout the completion of this research.

The author recognizes that this research still has limitations and shortcomings; therefore, constructive criticism and suggestions are welcomed as valuable input for future improvement. It is hoped that the results of this research will be beneficial to readers and future researchers and contribute to the advancement of agriculture in Indonesia.

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