



Original Article

Pest and Disease Control Strategies to Increase the Productivity of Shallot Plants (*Allium ascalonium* L.)

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Abstract:

This study reviews the impact of pest and disease attacks on shallot plants (*Allium ascalonium* L.) and control strategies to increase plant production. Pests such as *Spodoptera exigua* (onion caterpillar), *Thrips tabaci* (thrips), *Spodoptera litura* F. (armyworm), *Liriomyza* spp. (leaf slitting fly), and *Grylotalpa* spp. (orong-orong), as well as diseases such as troto or purple spot (Purple blotch), anthracnose (Anthrachnose), downy mildew, molder or fusarium wilt (Twisting disease), leaf blight (*Stemphylium* leaf blight), and leaf spot (*Cercospora* leaf spot) cause a significant decrease in production. Pest and disease control still relies heavily on chemical pesticides, which pose a risk to the environment and health. Alternative sustainable control such as the use of biopesticides from mahogany seed extract (*Swietenia mahagoni*), Japanese papaya leaf extract (*Cnidioscolus aconitifolius*), and legundi weed extract (*Vitex trifolia* L.), as well as the application of Plant Growth Promoting Microorganisms (PGPM) from bamboo root can have a very good influence on controlling pests and diseases of shallot plants and can help in increasing plant productivity.

Keywords: Shallots, Pests, Plant Diseases.

Introduction

Shallot plants (*Allium ascalonicum*) are one of the horticultural commodities that have an important role in meeting domestic needs and export markets in Indonesia. Shallots are not only used as the main cooking spice in various traditional dishes, but also have high economic value for farmers. According to the central statistics agency (2024), shallot production data in Indonesia in 2021 is 2,004,590 tons, in 2022 production is 1,982,360 tons, and in 2023 production is 1,985,233 tons. If you look at the production data, it can be concluded that the production of shallots in Indonesia is decreasing every year. One of the obstacles in the production of shallots is the attack of Plant Disrupting Organisms (OPT). Pest and disease attacks are times ah that cannot be ignored in the



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cultivation of shallot plants, both from the seedling stage to the harvest stage, even after harvest. The existence of pest and disease attacks is one of the factors that often cause crop failure or a decrease in productivity ([Widhiarto et al., 2022](#)). The potential for yield loss due to pest and disease attacks on old and young plant stadia can reach 20-100% depending on the management of shallot cultivation ([Triwidodo & LISTIHANI, 2020](#)). The main pests that often attack shallot plants include the onion caterpillar *Spodoptera exigua* (Lepidopera: Noctuidae), the armyworm *Spodoptera litura* (Lepidopera: Noctuidae), the leaf slitting fly *Liriomyza chinensis* (Diptera; Agromyzidae), trips *Tabaci* Trips (Thysanoptera: Thripidae), and Orong-orong *Gryllotalpa* spp. (Orthoptera: Gryllotalpidae). Meanwhile, the main diseases that often infect marang onion plants include *Purple blotch* (sidewalk disease or purple spot), *Anthrachnose* (automatic disease or anthracnose), *Downy mildew* (downy mildew or feather dew disease), *Twisting disease* (moler disease or fusarium wilt), *Stemphylium leaf blight* (leaf blight or lull, and *Cercospora leaf spot* (Sarcospora leaf spot disease) ([Aldo, 2020](#); [Khamdani et al., 2021](#)).

Symptoms of a pest attack on onion plants vary depending on the type of pest that attacks. For example, *Spodoptera exigua* is characterized by the presence of holes in the leaves, both on the edges of the leaves and on the upper or lower surface ([Pratiwi & Haryanto, 2022](#)). Armyworm (*Spodoptera litura* F.) causes the leaves of the plant to appear clear because the tissues in the leaves are eaten, which can ultimately lead to plant death due to inhibition of the process of photosynthesis and distribution of nutrients to the tubers. Trips (*Thysanoptera*) symptoms of the attack are seen on the leaves that change color to silvery white. In severe attacks, the entire area of the plant turns white and eventually dies. Great attacks occur at higher-than-average air temperatures and humidity of more than 70%. The leaf borer fly (*Liriomyza* spp.) infestation symptoms indicate that the leaves dry out in severe infestation, almost the entire leaf is covered in damage, dries out, and turns brown like a burn. The larvae of the leek borer can enter the onion bulb, this distinguishes it from other types of leaf borers. People or ground dogs (*Gryllotalpa* spp.) This pest is highly polyphageal, feeding on roots, bulbs, young plants, and small insects such as aphids. This pest attacks plants that are 1-2 weeks old after planting. Symptoms of attack are characterized by plant wilting due to damage to the [roots](#) ([Aldo, 2020](#); [Khamdani et al., 2021](#)).

Symptoms of disease in shallots such as *Purple blotch* caused by the pathogen *Alternaria porri* include small white concave patches with purple centers on the leaves, which in humid conditions enlarge into a ring with a purple center, reddish edges, and are surrounded by yellow, causing the tips of the leaves to dry out and break and spread to the bulbs that change color to blackish-brown. *Anthrachnose* disease, caused by the fungus *Colletotrichum gloeosporioides*, is characterized by white spots on hollow and broken leaves, and at high humidity, pink conidia colonies turn dark brown and blackish, with white mycelia spreading from leaf to bulb, resulting in tuber rotting and leaves drying out. *Downy mildew* is caused by the fungus *Peronospora destructor* forming purple spores on leaves and stems in humid conditions, systemic and local infections cause stunted growth and brownish-green leaves, with patches of infection spreading to the tubers, causing rot and black mycelium weaving on the leaves. *Twisting disease* is caused by the fungus *Fusarium oxysporum* attacking the base of the layered tubers, causing the leaves to turn yellow and twist, the plant to be easily pulled off, and the tubers rot with whitish mildew ([Hikmahwati et al., 2020](#)). *Stemphylium leaf blight* is caused by the fungus *Stemphylium vesicarium* characterized by yellowish-white patches on the leaves, this fungus can kill the plant simultaneously in humid and windy areas. *Cercospora leaf spot* is caused by the

fungus *Cercospora duddiae* with pale yellow chlorosis patches 3-5 mm in diameter at the tips of the leaves, which in advanced attack cause brown spots in the center and conidiophore spots when the weather is humid ([Aldo, 2020](#); [Khamdani et al., 2021](#)).

Pest control and disease of shallot plants are generally carried out by spraying chemical pesticides. Farmers often use pesticide doses that exceed the recommendation, with the frequency of spraying reaching 2-4 times a week. However, excessive use of pesticides can cause various negative impacts, such as pest resistance, pest resurgence, declining populations of natural enemies, and environmental pollution ([Satyani et al., 2019](#)). Therefore, more sustainable and effective pest and disease control is needed to increase the productivity of shallot plants

Method

This study employed a qualitative research design to explore various pest and disease management strategies on shallot (*Allium ascalonicum*) productivity in Indonesia. Data were collected through interviews, observations, and documentation involving farmers and agricultural experts. Key management techniques examined included biopesticides like mahogany seed extract and Japanese papaya leaf extract, biological controls using celery plants and *Trichoderma* spp., and plant growth-promoting microorganisms (PGPM) derived from bamboo roots. These methods were found to effectively reduce pest and disease impacts while promoting environmentally sustainable farming practices. The study highlighted the importance of integrating biological and plant-based approaches to improve shallot yield and reduce reliance on chemical pesticides.

Results

The review of shallot plant pest and disease control strategies aims to identify shallot pests and diseases as well as control efforts to increase plant productivity.

Mahogany Seed Extract (*Swietenia mahagoni*) to control onion caterpillar (*Spodoptera exigua* Hubner) infestation. ([Pabutungan & Nasir, 2022](#))

The process of making mahogany seed extract begins by drying the mahogany seeds that have been harvested for one week. Once the seeds are dry, they are mashed using a blender or ground until they become a fine powder. The mahogany seed powder is then soaked in methanol solvent for 48 hours, then the mixture is stirred daily for 15 minutes to ensure that all the oil in the mahogany seeds is dissolved in methanol. After soaking, the mixture is filtered and the rest of the pulp is washed with half the volume of methanol. The filtrate obtained from filtration is then evaporated using a rotary evaporator until a thick extract remains. This extract is then stored in the refrigerator at a temperature of 5°C until use.

The application of mahogany seed extract on shallot plants is carried out by spraying the extract evenly on all parts of the plant. The spraying process begins 14 days after planting (HST) and is carried out every 7 days. This application is carried out six times during the growth period of the plant. The results of administration of mahogany seed extract showed that the intensity of onion caterpillar (*Spodoptera exigua*) attack decreased significantly with increasing extract concentration. At the highest concentration (40%), the intensity of the attack was recorded at only 1.34%, compared to 9.51% in the control (0% concentration). In addition, the increase in the concentration of mahogany

seed extract also has a positive influence on onion production. The highest production was obtained in a treatment with a 40% extract concentration resulting in higher wet weight and dry weight of shallots compared to lower concentrations and controls.

Biopesticides from Japanese Papaya Leaves (*Cnidioscolus aconitifolius*) to Control Grayak Caterpillar Pests. (*Spodoptera litura* F). (Plant, 2019)

The process of making Japanese papaya leaf extract as a biopesticide to control armyworm pests in shallot plants begins with the manufacture of fresh Japanese papaya leaves. The leaves are washed thoroughly to remove impurities, then soaked in water to soften the tissues. After soaking, the leaves are drained and then mixed with distilled water until smooth and homogeneous. The mixed results are then filtered using filter paper to separate the pulp from the extract liquid. This extract liquid is then mixed with ethanol in various concentrations (55%, 65%, 75% and 85%) and stirred until well mixed. The saponin and tannin content in the extract has been tested to ensure its quality and effectiveness as a biopesticide. The finished extract is put into a spray bottle and sprayed evenly on the leaves of onion plants that are infested by armyworm pests. Its application is carried out periodically as needed to control the pest population effectively and environmentally friendly.

The results of the study showed that Japanese papaya leaf extract stopped armyworm pests from attacking onion plants very well. The number of dead armyworms increases with the concentration of the extract. Japanese papaya leaf extract has great potential as an effective natural biopesticide, with the mortality rate of armyworms reaching 60% at 55% concentration and 80% at 85% concentration. The significant increase in armyworm mortality at higher concentrations suggests that this extract can be used as a safer and more environmentally friendly substitute for chemical pesticides. This study provides a scientific foundation for the further development of the use of Japanese papaya leaf extract as a safe and sustainable method to control pests of shallot plants.

Celery Plant (*Apium graveolens* L.) as a Population Reference Plant and Attack of *Spodoptera litura* F. (Rohmah et al., 2023)

The purpose of this study is to find out how effective celery (*Apium graveolens* L.) as a repellent plant against the population and pest attack of *Spodoptera litura* F. on the cultivation of shallots (*Allium ascalonicum* L.) in Pesanggrahan Village, Lamongan Regency. The research was conducted on farmers' land with a random group design. Four different treatments were used in this process: control (without celery), PTS 4 (planted four weeks before the shallot), PTS 2 (planted two weeks before the shallot), and PTS 0 (planted two weeks before the shallot). with shallots). A week before planting, the soil is cleaned and allowed to cool for a week. Then, a five-centimeter deep hole was made for planting celery and shallots, and the distance between the celery and shallots was set according to the research protocol. The results showed that the use of celery plants was effective in reducing the population and pest infestation of *Spodoptera litura* F. PTS 4 treatment showed the most effective results, with an average number of larvae of only 1.66 per clump and an attack rate of 0.13%. Compared to the control, which had an average larval count of 6.33 per clump and an attack rate of 0.50%, there was a significant decrease in population and pest infestation intensity.

This study showed that the cultivation of celery as an intercrop with shallots was very effective in reducing the population and pest infestation of *Spodoptera litura* F.

Treatment with planting celery 4 weeks before shallots gave the best results, with a significant decrease. the number of pests and the intensity of the attack, provide an environmentally friendly pest control method and possibly increase the productivity of shallots.

*Plant Biofungicide from Legundi Weed (*Vitex trifolia* L.) Fermented with *Trichoderma Fungi*. (Sudantha et al., 2020).*

Plant-based fungicides made from Legundi weeds and fermented with the fungus *Trichoderma* spp. function to control diseases caused by fungi, especially *Fusarium* wilt disease on shallot plants. This fungicide can also stimulate the growth of onion plants in addition to controlling diseases. The process of making vegetable fungicides from legundi leaves fermented with *Trichoderma* spp mushrooms. Starting with the manufacture of ingredients, namely 10 kg of legundi leaves which are mashed using a blender. The crushed legundi leaves are then put into a basin containing 5 liters of water and squeezed to produce an extract. Legundi leaf extract is then put into a jerry can with *Trichoderma* spp. The jerry cans are covered with opaque paper or porous paper and tied with rubber, then stored in a cool place away from direct sunlight for 7 days for the fermentation process. After 7 days, the jerry can is opened and filtered to separate the fermented solution from the legundi leaf pulp. This filtered solution becomes a plant-based biofungicide. How to use, a solution of vegetable biofungicide is mixed with plain water in the ratio of 1 ml of vegetable biofungicide mixed with 1 liter of clean water before spraying on onion plants.

The results of vegetable fungicide application from legundi leaves fermented with *Trichoderma* spp. mushroom showed a significant increase in onion production. In the Harapan II Farmer Group, the application of this plant-based biofungicide has succeeded in increasing the yield of shallots up to 14 tons per hectare for the Keta Monca variety and 16 tons per hectare for the Bali Karet variety compared to the initial target of 12 tons per hectare. In addition, this group also managed to make 100 liters of vegetable biofungicide, exceeding the initial target of only 50 liters. The application of this biofungicide is not only effective in controlling *Fusarium* wilt disease in shallot plants, but also plays a role in stimulating plant growth so that it produces higher production than the expected target. The results show that the use of plant-based biofungicides made independently by farmers can increase efficiency and productivity in shallot cultivation.

Plant Growth Promoting Bamboo Root Microorganisms to Control Fusarium Wilt Disease. (Batalipu et al., 2023)

The control of *Fusarium* wilt disease in shallot plants was carried out using bamboo root-based plant growth promoting microorganisms (PGPM). In this study, the method of applying PGPM includes soaking seeds and watering PGPM twice during the planting period. The results of the study showed that the use of PGPM was able to reduce the incidence of *Fusarium* wilt disease by up to 62%. PGPM plays a role in increasing plant resistance to the pathogen *Fusarium oxysporum* that causes wilt disease in shallots. This disease is usually characterized by symptoms of yellowing of leaves, bent leaves, and root rot, which in severe conditions can cause the plant to dry out and die.

The method of making Plant Growth Accelerator Microorganisms (PGPM) based on bamboo root to control *Fusarium* wilt disease in shallots includes several stages. First, prepare materials and tools such as bamboo root, young coconut water, bran, shrimp paste, betel lime, brown sugar, scales, stoves, containers, pH meters and bottles. Bamboo

roots are soaked in young coconut water for three days to provide nutrients and a preliminary medium for microorganisms. Meanwhile, boil 500 grams of bran together with shrimp paste, a tablespoon of betel lime, and 200 grams of brown sugar until the ingredients are homogeneous and sterile from contamination of unwanted pathogens. After the bran solution has cooled, mix it with a liter of bamboo root soak water. This mixture is stored in a tightly closed container and left for one to two weeks for the fermentation process. This fermentation allows microorganisms to multiply and produce compounds that are beneficial for plant growth and pathogen control. The PGPM produced is then ready to be applied to shallot plants by soaking seeds or watering the soil around the roots of the plant. The use of bamboo root-based PGPM is not only effective in controlling diseases, but also contributes to increasing the growth and production of shallots. This makes PGPM an effective and environmentally friendly alternative to the use of chemical fungicides that have short-term effects and can damage the environment.

Trichoderma to control anthracnose disease (*Colletotrichum gloeosporioides*). ([Diastari & Soedijo, 2021](#))

Application of *Trichoderma* spp. Anthracnose disease control in shallots was carried out by in vitro method, where *Trichoderma* spp. isolate was cultured together with the pathogen *Colletotrichum gloeosporioides* to observe the ability to inhibit the growth of the pathogen. In this study, twelve isolates of *Trichoderma* spp. from various regions in South Kalimantan were tested to determine the effectiveness of each isolate in inhibiting the growth of anthracnose disease. The results showed that the level of growth inhibition of *Colletotrichum gloeosporioides* by *Trichoderma* spp. varied, with the highest percentage of inhibition reaching 23.93% by isolates from Sinar Baru, Rantau Badauh, South Kalimantan. On the other hand, the isolate from Margasari, Tapin Regency, South Kalimantan showed the lowest inhibition at 7.31%. These results show that some isolates of *Trichoderma* spp. have higher potential as biological control agents than other isolates. For field application, these results indicate the need for further field tests to confirm the effectiveness of *Trichoderma* spp. under the natural growth conditions of shallots. Thus, farmers can choose *Trichoderma* spp. isolate which is most effectively applied in shallot cultivation, so that it can reduce losses due to anthracnose disease and increase crop yields sustainably.

Microbial Consortium in an Effort to Reduce the Intensity of Leaf Blight (*Botrytis squamosa* Walker). ([IRMAWATIE et al., n.d.](#))

A microbial consortium is a combination of several types of microbes, such as bacteria and fungi, that are used to control diseases in plants. In this study, a microbial consortium was used to suppress leaf blight (*Botrytis squamosa* Walker) in shallot plants (*Allium ascalonicum* L.). To create a microbial consortium, the step that can be taken is to choose several types of microbes that have different functions and can interact well. Examples of microbes that can be selected are bacteria such as *Bacillus subtilis* Cohn., *Pseudomonas fluorescens* Migula., *Bacillus megaterium* de Barry, *Azotobacter* sp. Beijerinck., as well as fungi such as *Trichoderma harzianum* Rifai., *Trichoderma* sp., *Gliocladium* sp., and *Beauveria bassiana* Balsamo.

This microbial consortium functions to suppress the development of diseases by inhibiting the growth of other disease-causing microbes. Antagonist microbes such as *Trichoderma* sp. and *Gliocladium* sp. can act as a biodecomposer and improve plant roots.

Other microbes such as *Bacillus subtilis* Cohn. and *Pseudomonas fluorescens* Migula. It can act as a pathogen control agent and produce compounds that inhibit the growth of other microbes. The use of microbial consortiums in this study shows that the use of antagonistic microbes can effectively control leaf blight in shallot plants. The results showed that the microbial consortium package C containing several types of microbes had the best influence in reducing the intensity of leaf blight. In addition, the microbial consortium package D contains microbes such as *Pseudomonas* sp., *Bacillus megaterium* de Barry, *Azotobacter* sp. Beijerinck., and *Actinomycetes* sp. It can also promote plant growth and reduce the intensity of disease.

In creating a microbial consortium, the first step is to choose several types of microbes that have different functions and can interact well. Then the selected microbes are diluted in an appropriate medium, such as agar media, nutrient media, or other media that can support microbial growth. Furthermore, the microbial consortium created was given to plants to be tested to determine their effectiveness in controlling the disease. The advantage of using a microbial consortium is that antagonist microbes can act as biodecomposers, improve plant roots, and inhibit the growth of other disease-causing microbes. In addition, microbial consortiums can also increase plant growth and reduce disease intensity. Therefore, the use of microbial consortiums can be an effective alternative in controlling plant diseases and improving overall plant growth.

Conclusion

Pests and diseases on onion plants, such as thrips, armyworms, bulb rot, and leaf spot, have caused a significant decrease in yield. Through the analysis of various studies, it was found that effective control strategies involve a combination of biological, technical, and chemical approaches. The use of plant-based biofungicides, *Trichoderma* spp., and PGPM has shown promising results in reducing the impact of pathogens without damaging the environment. Crop rotation and good land management also contribute to pest population control and increased soil fertility. The implementation of this sustainable farming technique can significantly improve the yield and quality of shallot crops, while reducing dependence on chemical pesticides.

Suggestion

To improve the yield and quality of shallot crops, it is recommended to adopt integrated pest and disease control methods. The use of plant biofungicides and biological agents such as *Trichoderma* spp. and PGPM can reduce dependence on harmful chemical pesticides. In addition, good crop rotation and land management practices need to be implemented to maintain the balance of ecosystems and soil fertility. Conducting regular monitoring of plant and environmental conditions is also very important to detect and control pest and disease attacks early.

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