Journal of
Patchouli and Essential Oil Products

JPEOP

Vol. 1, No.1, Page 1- 4, June 2022

The Ability of Patchouli Waste Compost with *Trichoderma* spp as Biodecomposer in Inhibiting the Development of Budok Disease (*Synchtrium pogostemonis*) in Patchouli Seedlings

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Received : 10 October 2021; Accepted : 8 December 2021; Published online : 29 April 2022

Abstract

Patchouli waste (LAN) from the essential oil distillation process has a high nutritional content and has the potential to be used as a raw material for organic fertilizer. Patchouli pulp was used as compost in this study, along with bio-decomposers from several *Trichoderma* species (*T. harzianum*, *T. asperellum, T. hamatum*, *T. virens*, and *T. atroviride*), in order to inhibit the development of budok disease in patchouli seedlings. The mature LAN compost was added to the growing media in a 2:1 ratio prior to artificial inoculation with the pathogen *Synchtrium pogostemonis*. The incubation period and disease intensity were measured. Patchouli seedlings planted in media containing LAN compost and the biodecomposer *T. harzianum* did not exhibit symptoms of budok disease until the observation period was complete (42 days). Additionally, it was demonstrated that LAN compost containing *T. asperellum* bio-decomposer was capable of extending the incubation period from 2.5 days (control) to 5.5 days. The greatest reduction in disease intensity was 6.25 % when LAN compost was treated with *T. asperellum*, *T. virens*, and *T. atroviride* biodecomposers. The results of this study indicate that patchouli dregs composted with the decomposer *Trichoderma* spp. has the potential to suppress the infection of *S. pogostemonis* on patchouli plants.

Keywords: incubation time, disease intensity, organic fertilizer

1. INTRODUCTION

Patchouli (*Pogostemon cablin*) is an essential oil-producing plant that contributes significantly to the country's foreign exchange earnings. Indonesia supplies up to 90% of the world's patchouli oil requirements (Direktorat Jenderal Perkebunan, 2019). Patchouli oil is extracted from all parts of the plant except the roots.

Patchouli cultivation began in one of Aceh Province's districts, namely South Aceh, and quickly spread to Sumatra's east coast and Java. Numerous patchouli plants are cultivated in various regions of Indonesia at the moment (Akhmad et al., 2015).

Aceh's patchouli cultivation is being harmed by the pathogen *Synchytrium pogostemonis*, which causes budok disease. This pathogen attack alters plant growth, resulting in production losses of up to 87.56 percent (Nurmansyah 2011).

The use synthetic pesticides to control Budok disease is still the primary option for field farmers. However, in light of the negative impact on the environment and in order to promote sustainable agriculture in Aceh, it is necessary to explore more natural control alternatives, such as agricultural waste.

Patchouli farmers in Aceh, on the whole, do not repurpose patchouli waste (LAN). Patchouli waste is known to contain significant amounts of nutrients and may be used as a raw material for organic fertilizers such as compost and liquid fertilizer (Santi, 2008). As a result, LAN was used as a raw material for compost in this study, with the assistance of several *Trichoderma* species acting as bio-decomposers to expedite the composting process. *Trichoderma* sp. has been used to degrade agricultural wastes including rice straw, wheat straw, sugarcane waste, and empty oil palm fruit bunches (Sharma et al., 2012; Siddiquee et al., 2017). Apart from its role as a bio-decomposer, *Trichoderma* sp. also acts as a disease control agent by producing a variety of enzymes capable of degrading pathogen cell walls, competing with pathogens for nutrients and space, and performing mycoparasitism (Nusaibah & Musa, 2019).

According to Sukamto et al. (2014), *Trichoderma* sp. capable of suppressing the budok disease by 2.0%. In another study, *Trichoderma* sp. addition in compost has been shown to be capable of eradicating pathogens that cause strawberry wilt disease with 0% disease intensity. (Suryawan et al., 2017).

The purpose of this study was to determine the ability of LAN compost containing bio-decomposers from several *Trichoderma* species (*T. harzianum*, *T. asperellum*, *T. hamatum*, *T. virens*, and T. *atroviride*) to inhibit the development of budok disease on patchouli seedlings caused by *S. pogostemonis*.

2. MATERIALS AND METHODS

2.1 LAN composting with *Trichoderma* spp. as bio-decomposer

Patchouli waste collected from farmers' patchouli gardens in Aceh Jaya was chopped and then combined in a 1:1:1 ratio with bran and cow manure. As a composting site, the mixed materials are placed in a 50 kg plastic-lined container. *Trichoderma* spp. in the form of pellets for this study were provided by the Laboratory of Plant Diseases, Faculty of Agriculture, Universitas Syiah Kuala. *T. harzianum* pellets were dissolved in 2 L of water and then poured into the compost material at a dose of 1.5 g/kg. The container is closed and stirred weekly for four weeks during the composting process.

The same method was used to inoculate *T. asperellum*, *T. hamatum*, *T. virens*, and *T. atroviride* on compost material. Treatment in the absence of bio-decomposers was used as control. Each treatment was carried out three times.

2.2 Patchouli seedling and planting

The nursery was held at Nilam Innovation (NINO) Park Universitas Syiah Kuala. Patchouli cultivar Lhokseumawe stems 15–20 cm in length with at least four buds were cut. To minimize evaporation, the cuttings' leaves are removed, leaving only the top leaves. The cuttings are then planted to a depth of 5-7 cm in a planting medium made up of sifted and dried top soil and LAN compost in a 2:1 ratio. Cuttings that have been planted are covered with plastic for three weeks to prevent seedling failure due to evaporation. Throughout the nursery, the experimental area was shaded to avoid direct sunlight exposure. Patchouli plants were transferred to 5 kg polybags with the same growing media composition after four weeks in nurseries. Treatment in the absence of LAN was used as control. Each treatment was carried out three times.

2.3 *S. pogostemonis* inoculation

S. pogostemonis inoculum was obtained from infected plants in the patchouli nursery at NINO Park Universitas Syiah Kuala. Plant parts that exhibit budok symptoms was cut and weigh to 100 g and crushed with 1 L of water and filtered to form a suspension. The suspension was sprayed onto the leaves of six-week-old plants that had been harmed by a sterile needle.

2.4 Pathogen incubation period

The incubation period was calculated from the inoculation of the pathogen until the appearance of the first symptoms which were marked by small purple nodules and purple spots on the leaves.

The percentage of disease intensity was determined on day 28 and 42 following infection with the *S. pogostemonis* pathogen using the formula below:

$$P = a/b \times 100\%$$

where :
P = Disease intensity
a = The number of plant attacked
b = The number of plant observed

3. RESULTS AND DISCUSSIONS

3.1 Incubation time of budok diseasae

Table 1 summarizes the average value of observations made during the incubation period of budok disease on patchouli.

Table 1. Incubation time of budok diseasae on patchouli with LAN compost and *Trichoderma* spp treatment

Treatment	Incubation time
control	2,5
LAN+*T.harzianum*	no symptom
LAN+*T.asperellum*	5,5
LAN+*T.hamatum*	3
LAN+*T.virens*	4
LAN+*T.atroviride*	3,5

As shown in Table 1, compost treatment of LAN and *Trichoderma* spp. as a bio-decomposer significantly prolong the disease's incubation period by up to 5 days. Even patchouli grown on medium including LAN compost and *T. harzianum* bio-decomposer remained symptom-free until the monitoring period ended (day 42). As a result, the data collected during the incubation phase could not be examined statistically.

Without compost treatment, LAN and *Trichoderma* spp. (control) showed the first signs of budok disease on the second day of observation. Budok disease is identified by the formation of brownish purple nodules on the leaf surface, which subsequently spreads to the leaf stalks, gradually stiffening or thickening the stems until the plant becomes stunted and dies (Figure 1). This symptom is nearly identical to that reported by Wahyuno et al., (2007) and Nurmansyah (2011), who stated that budok symptoms include swelling or the formation of warts on patchouli plants in the form of small bumps on the surface of the leaves and at the base of the stem, which develop into the stem, branches, twigs, and leaf bones, giving the surface a rough, purple-brown appearance.

Incubation period is highly correlated with the presence of antagonist drugs (Soesanto et al., 2013). According to Yudha et al. (2016), incubation period inhibition occurs as a result of competition between diseases and antagonist chemicals, resulting in viruses infecting host plants taking a longer time to infect. *Trichoderma* sp. inhibits pathogen development through competition and the production of antibiosis (Sriwati et al., 2015).

Figure 1. Development of budok disease on patchouli plant from 2nd day after transfer planting (A) to the 42nd day of observation (B)

3.2 Disease Intensity

The average percentage of budok disease observed following the application of LAN compost containing the biodecomposer *Trichoderma* spp. is shown in Table 3.

Tabel 3. Disease intensity of budok on patchouli plant with LAN compost and *Trichoderma* spp treatment

Treatment	Disease intensity
control	12,0
LAN+*T.harzianum*	0
LAN+*T. asperellum*	6,5
LAN+*T.hamatum*	18,75
LAN+*T.virens*	6,25
LAN+*T.atroviride*	6,25

Statistictically, LAN compost with *Trichoderma* spp. had no effect on the percentage of disease attacks on patchouli plants. However, the addition of LAN and *Trichoderma* spp compost to the growing media had a tendency to suppress the percentage of disease intensity. What is notable in this study is that the percentage of disease intensity is highest with LAN and *T. hamatum* treatments. To the author's knowledge, no researcher has documented that *T. hamatum* is capable of controlling *S. pogostemonis*. It is thought that these antagonists' efficacy is insufficient to inhibit the growth of the pathogen *S. pogostemonis*. However, additional testing is required to establish this.

Additionally, the fungus *Trichoderma* spp. produces secondary compounds that act as inhibitors of plant pathogens (Vinale et al., 2014). According to Ainy et al., (2015), the fungus *T. harzianum* can reduce the percentage of budok disease by competition and antibiotics, hence preventing plants from exhibiting symptoms.

4. CONCLUSIONS

Rresults of this study indicate that patchouli dregs composted with the aid of the decomposer *Trichoderma* spp. has the potential to suppress the attack of *S. pogostemonis* on patchouli plants.

REFERENCES

Ainy E., Q, R. Ratnayani, dan L. Susilawati. 2015. Uji Aktivitas *Trichoderma* harzianum 11035 terhadap Colletotrichum capsici TCKR2 dan Colletotrichum acutatum TKC1 Penyebab Antraknosa pada Tanaman Cabai. Jurusan Biologi, Fakultas Sains dan Teknologi, UIN Sunan Kalijaga. Yogyakarta.

Akhmad C., B. Haasler, Syahwalita, N. Hardiana. 2015. Budidaya Tanaman Nilam (Pogostemon Cablin Benth) dan Produksi Minyak Atsiri. Balai Penelitian Lingkungan Hidup dan Kehutanan, Palembang.

Direktorat Jenderal Perkebunan. 2019. Nilam. Statistik Perkebunan Indonesia 2017-2019. Direktorat Jenderal Perkebunan, Departemen Pertanian, Jakarta.

Nurmansyah. 2011. Pengaruh penyakit budok tehadap produksi tanaman nilam. Bul. Littro. 22 (1) : 65-73.

Nusaibah S A., Musa H. 2019. A review reposrt on the mechanism of *Trichoderma* spp. as biological control agent of the basal stem rot (BSR) disease of Elaeis guineensis. Chapter in book: *Trichoderma*- The most widely used fungicide. Shah MM & Buhari T R (Eds.). p 1-12

Santi, S.S. 2008. Kajian pemanfaatan limbah nilam untuk pupuk cair organik dengan proses fermentasi. Jurnal Teknik Kimia.2 (2) : 170-175.

Sharma B. L., Singh S.P., Sharma M.L. 2012. Biodegradation of Crop Residues by *Trichoderma* Species vis-à vis Nutrient Quality of the Prepared Compost. Sugar Tech 14(2):174-180.

Siddiquee S., Shafawati S N., Naher L. 2017. Effective composting of empty fruit bunches using potential *Trichoderma* strains. Biotechnol Rep (Amst) 13 : 1-7.

Soesanto, L., D.S. Utami, dan Rahayuniati. 2013. Uji kesesuaian 4 isolat *Trichoderma* spp. dan daya hambat in vitro terhadap beberapa patogen tanaman. Jurnal Hama Penyakit Tumbuhan tropika 13(1) : 117-123.

Sriwati, R., Melnick, R.L., Muarif, R., Strem, M. D., Samuels, G.J., dan Bailey, B.A. 2015. *Trichoderma* from Aceh Sumatra reduce Phytophthora lesions on pods and cacao seedlings. Biological Control, 89 :33-41.

Sukamto,S., Muhammad, dan D. Muhamad, 2014. Pengendalian penyakit budok pada tanaman nilam dengan agensia hayati dan pembenah tanah. Balai Penelitian Tanaman Rempah dan Obat, Bogor.

Suryawan L, N. A., Gusti, S. Putu.2017. Penggunaan *Trichoderma* sp. yang ditambahkan pada berbagai kompos untuk pengendalian penyakit layu tanaman stroberi (Fragaria sp.). E-Jurnal Agroekoteknologi Tropika 6 (4): 2301-6515

Vinale, F., K. Sivasithamparam, E. L. Ghisalberti. S.Woo. 2014. *Trichoderma* secondary metabolites active on plants and fungal pathogens. The open Mycology Journal. 8(1) : 127-139.

Wahyuno D, Sukamto, D Manohara, A Kusnanta, C Sumardiyono, dan S Hartono. 2007. Syinchitrium a potential threat of patchouli in Indonesia. Proceeding international Seminar on Essential Oil. Jakarta. Hlm, 92-99.

Yudha, M K, L Soesanto dan E Mugiastuti. 2016. Pemanfaatan empat isolat *Trichoderma* sp. untuk mengendalikan penyakit akar gada pada tanaman caisin. Jurnal Kultivasi. 15 (3) : 143-149.