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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : JURNAL ILMIAH

Judul Jurnal Ilmiah (Artikel) : Physiological Response and Detection of Inh2 Gene in Dieng Red Potato (*Solanum tuberosum* L.) Affected by Frost

Penulis Jurnal Ilmiah/ : Wa Ode Kamillah, Hermin Pancasakti Kusumaningrum, Rejeki Siti Ferniah, Azalia Puspa Herida, Jumlah penulis : Garinda Linggar / 5 orang

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Reviewer I

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NIP. 196105051986032003

Unit kerja : Departemen Biologi Fakultas Sains dan Matematika Universitas Diponegoro Semarang

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Reviewer II



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The Evaluation of Secondary Metabolites in *Saccharum officinarum* L. and *Mimosa invisa* Mart. as Natural Herbicides

Dyah Roeswitawati^{1,*}, Zahid Hussain^{2,3}, Asad Jan⁴, Ivar Zekker⁵, Maizirwan Mel⁶, Roy Hendroko Setyobudi^{7,8}, Muhidin Muhidin¹, and Davit Hudin¹

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Abstract

The giant sensitive plant (*Mimosa invisa* Mart.) is a major weed found in the sugarcane (*Saccharum officinarum* L.) farming areas, which dominates and adversely affects the quantity and quality of the harvest. This weed poses a threat to both the sugarcane farmers and sugar companies because it causes about a 6 % to 9 % decline in the plant's biomass and a 0.09 % reduction in the crop yield. *M. invisa* has great competitiveness against the crop plant *S. officinarum* and also an increased population efficiency of 14.08 % in the first year (plant cane) to 38.55 % in the third year (3rd ratoon). Therefore, this research aims to determine the metabolic compounds in the rhizosphere of *M. invisa* and *S. officinarum* and assess their roles as allelochemicals. Research was conducted at the Laboratory of Agrotechnology, Faculty of Agriculture and Animal Science, University of Muhammadiyah Malang, and Central Laboratory of the Indonesian Legume and Tuber Crops Research Institute, Malang. The field research was carried out in the Research Garden Krebet Baru Sugar Factory, Malang, East Java, Indonesia. The descriptive qualitative research design was used and data were arranged randomly in groups of three treatments and three replications. The treatment details were planted in different plots of land each as, T₁: *Mimosa invisa* only, T₂: *Mimosa invisa* mixed *Saccharum officinarum*, and T₃: *Saccharum officinarum* only. Furthermore, the analysis of metabolic compounds, using the Gas Chromatography Mass Spectrometry (GCMS), showed the presence of octadecanoic acid (an allelochemical compound) and methyl ester (2.06 %) in the rhizosphere of *M. invisa* and *S. officinarum*. These metabolite compounds are commonly used as herbicide activators.

Keywords: Allelochemical, Bio-herbicide, Eco-friendly technology, Giant sensitive plant, Sugarcane.

1. Introduction

According to the Central Statistics Agency (*Badan Pusat Statistik*) in 2019, the required consumption of sugar in Indonesia reached 5.1×10^6 t, while national sugar production is currently 2.36×10^6 t. In addition, there was a decline in national sugar production which was up to 2.22×10^6 t (Cindy, 2020). This decrease in sugar production was a result of the raw material, i.e. sugarcane (*Saccharum officinarum* L.), facing challenges such as competition with weeds which has, in turn, impacted the yield of sugarcane production. This weed poses a threat to both the sugarcane farmers and sugar companies because it causes about a 6 % to 9 % decline in the plant's biomass and a 0.09 % reduction in the crop yield. Additionally, the presence of this weed during the vegetative growth stage of the sugarcane crops results in a yield reduction of up to

40 %. Conversely, the weed competition at the growth stages of 3 wk, 6 wk, and 9 wk after planting the crop resulted in a decrease of 77.6 %, 50.6 %, and 4.7 % in the yield (Concenço *et al.*, 2016; Faheem and Muhammad, 2015; Fanny *et al.*, 2019; Gulshan and Bhagirath, 2020; Peng 2012; Sugar Research Australia, 2021).

In this situation, the giant sensitive plant — *Mimosa invisa* Mart (also referred to in the literature as *Mimosa diplotrica*, C Wright) is a field crop weed that causes a decrease in the quality and quantity of crop production (Dania and Bamidele, 2006; Osariyekemwen, 2020; Prajal *et al.*, 2020; Rao *et al.*, 2018). It has been shown in previous research that *M. invisa* has great competitiveness against the crop plant *S. officinarum* and also an increased population efficiency of 14.08 % in the first year (plant cane) to 38.55 % in the third year (3rd ratoon) (Aekrathok, *et al.* 2021; Jayasree, 2006; Phil and Emilie, 2017; Zainol, 2017). Additionally, the mechanism of competition

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Analysis of Phytochemical Constituents by using LC-MS, Antifungal and Allelopathic Activities of Leaves Extracts of *Aloe vera*

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Abstract

This study was conducted to investigate the phytochemical compounds of *Aloe vera* leaves by using LC-MS and evaluate their antifungal and allelopathic activities *in vitro*. The ethanol extract of *Aloe vera* leaves was subjected to evaluate their antifungal activity against three plants pathogenic fungi, *Fusarium roseum*, *Fusarium oxysporum lycopersici* and *Botrytis cinerea* by using the agar plate diffusion plate method. The aqueous extract of *Aloe vera* leaves was subjected to evaluate the allelopathic potential on germination and seedling growth of durum wheat *Triticum durum* and *Amaranthus hybridus* which is an advance species of cereals. We used the bioassay of germination and seedling growth of both species. By LC-MS analysis, 11 bioactive phytochemical compounds were identified in ethanol extract: 5-((S-2'-oxo-4'-hydroxypentyl-2-(β-glucopyranosyl-oxy-methyl)chromone, isoaloerisin D, aloenin, aloeninB, aloenin-2'-p-coumaroyl ester, aloe-emodin-diglucoside, 10-hydroxyaloin B, 10-hydroxyaloin A, aloin B, aloin A, aloverside B. The antifungal activity showed that the ethanol extract has an inhibitory activity against all the mycelial strains. The allelopathic effect of different concentrations slowed the kinetics of germination of *Triticum durum* and *Amaranthus hybridus* and significantly decreased the rate of final germination of *Amaranthus hybridus* (100% at C10% and C25%), and a weak effect of inhibition of the germination was noticed for *Triticum durum* (40% at C25%). The aqueous extract has an inhibitory effect on the length of the roots (98% at C25%) and the height of the stems (100% at C25%) of *Triticum durum*. All concentrations of the aqueous extract have an inhibitory effect on the root length of *Amaranthus hybridus*. These results showed that *Aloe vera* would be suggested as a new potential source of natural herbicides and fungicides.

Keywords: *Aloe vera*, allelopathic potential, antifungal activity, extract, LC-MS.

1. Introduction

Aloe vera is a medicinal and ornamental plant belonging to *Lilaceae* family, usually originating in the dry regions of Africa, Asia, and Southern Europe, especially in the Mediterranean regions (Urch, 1999; Rodríguez *et al.* 2010). It is being cultivated in other areas with different climatic conditions (Rodríguez *et al.* 2010). Mexico is the main producer of *Aloe vera*, followed by Latin America, China, Thailand, and the United States (Rodríguez *et al.* 2010). Vitamins, enzymes, minerals, starch, lignin, anthraquinones, saponins, salicylic acid, and amino acids are among the more than 75 nutrients and 200 active compounds contained in *Aloe vera* (Park and Jo, 2006).

Previous research has revealed that phenolics such as chromone, anthrone, and phenyl pyrone are the most common secondary metabolites found in *Aloe* species' exudates. It is noteworthy that C-glycosylated chromones are found to represent a class of naturally occurring

secondary metabolites that are known to be unique compounds in *aloe*, not having been reported in other plants (Franz and Grün, 1983).

This plant has several biological properties: anti-inflammatory (Afzal *et al.*, 1991; Malterud *et al.*, 1993), immuno-stimulatory (Ramamoorthy and Tizard, 1998), antiviral (Khalon *et al.*, 1991), cell growth stimulatory activity (Tizard *et al.*, 1994), and antifungal (Kawai *et al.*, 1998).

Fungal diseases of crops are usually controlled using resistant cultivars, fumigants and long rotations, but mainly by using fungicides (Rongai *et al.*, 2015). The widespread use of fungicides to combat plant diseases has resulted in the accumulation of toxins in both humans and the environment. (Cherkupally *et al.*, 2017).

In an effort to minimize the use of synthetic fungicides, alternative methods to combat fungal diseases have been investigated using compounds obtained from plant sources. More than 500 plant species have recently been tested for antifungal activity. (Rongai *et al.*, 2012). Just

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Biological Activities and Metabolite Profiling of *Polycarpa aurata* (Tunicate, Ascidian) from Barrang Caddi, Spermonde Archipelago, Indonesia

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Abstract

The U.S. Food and Drug Administration (FDA) has legalized several bioactive compounds from marine organisms, and two of them were isolated from tunicate (ascidians). However, the bioactive compounds from marine tunicate are less reported than other marine organisms. This study was conducted to screen biological activities and secondary metabolite of Indonesia's marine tunicate *Polycarpa aurata* from Barrang Caddi, South Sulawesi. Sample was extracted using methanol for 24 h by maceration. The bioactive compounds were characterized using phytochemical tests and HPLC-DAD. Antibacterial activity was performed against multidrug-resistant (MDR) Methicillin-resistant *Staphylococcus aureus* (MRSA), *Bacillus cereus*, *Salmonella typhi*, together with a non-MDR *Escherichia coli*, while antifungal against *C. albicans* and *T. rubrum*. Antioxidant activity was analyzed using DPPH method; and cytotoxicity against P388 murine leukemia cells using XTT method. The crude extract inhibited all pathogenic bacteria in its lowest concentration (0.5 mg) but did not show antifungal effect, toxicity at 0.08 mg/mL; antioxidant 534.60 ppm. The result of phytochemical test gave positive result for alkaloid and steroid/triterpenoid. In addition, HPLC chromatograms indicated 6 major peaks.

Keywords: antibacterial, cytotoxic, Leukemia, MDR bacteria

1. Introduction

In exploring novel medicine to treat various infections and diseases, marine natural product (MNP) has seized the world's attention through its incredible bioactive compounds (Blunt et al., 2018; Pereira, 2019). Their secondary metabolites exhibit potential biological activities such as antibacterial, anticancer, antitumor, antiviral, immunostimulant, etc (Blunt et al., 2018; Carroll et al., 2019; Hanif et al., 2019). Furthermore, Carroll et al., (2020) stated that bacteria, fungi, sponge, cnidarian, and algae were highlighted as the most productive source of new MNPs. For instance, 8 MNPs have been approved by European Medicines Agency (EMA), Japanese Ministry of Health and Australia's Therapeutic Goods Administration, and U.S. Food and Drug Administration (FDA) (Pereira, 2019). In addition, several other MNPs such as Plinabulin, Plocabulin, and Salinosporamide A are still under clinical trial before legalized and approved by authorized institutions (Jiménez, 2018; Pereira, 2019).

Prior reports stated discovering new compounds from marine tunicates (ascidian) is less reported than sponge and cnidarian (Blunt et al., 2018; Carroll et al., 2019; Carroll et al., 2020). In 2018, there were only 27 new

MNPs from tunicate (Carroll et al., 2019), while in 2019, only 12 new MNPs were recorded (Carroll et al., 2020). Despite the low number of new MNP from tunicate, the metabolites from this sessile animal exhibited outstanding biological activities (Arumugam et al., 2017; Leisch et al., 2019). Moreover, two tunicate-derived MNPs have been approved by internationally authorized institutions for drugs. Besides, other tunicate-derived compounds such as Didemnin B from *Trididemnum solidum* are examined in Phase II and Phase III for clinical trial as anticancer (Arumugam et al., 2017; Jiménez, 2018; Leisch et al., 2019). Most of the studies on biological activity from tunicate-derived MNPs are focused on anticancer; however, other properties are pretty neglected (Palanisamy et al., 2017). Hence, screening of biological properties from marine tunicate is essential.

Although Indonesia harbors various tunic species, a survey by Hanif et al. (2019) indicated a lack of MNP data from this animal. Palanisamy et al. (2017) stated that among all reported MNPs from marine tunicate, only 12% of them were isolated from family Styliidae. *Polycarpa aurata* is one of marine tunicate from family Styliidae that is scattered in the center and eastern part of Indonesia nevertheless, only a few studies reported its biological

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A comparative Study of Onion Purple Blotch (Caused by *Alternaria porri*) and Tomato Early Blight (Caused by *A. solani*) Diseases in Southern Ghors of Jordan

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Abstract

Two species of *Alternaria* were collected from southern Ghors of Jordan, isolated and characterized: *A. porri*, the causal agent of purple blotch of onion, and *A. solani*, the causal agent of early blight of tomato. Among planted onion cultivars, Beit Alpha was found to be highly susceptible to purple blotch, and Tebal was highly resistant under field conditions. Morphologically, there were distinct differences in conidia and mycelial growth rates between *A. porri* and *A. solani*. *Alternaria porri* was able to infect tomato and cause severe symptoms on its leaves; however, *A. solani* was not able to infect onion *in vitro*. Copper sulfate was the most effective salt in reducing the growth of both species *in vitro* and completely inhibited their fungal growth.

Keywords: Disease management, fungal diseases, plant pathogens, vegetable crops.

1. Introduction

Alternaria is a fungal genus that belongs to class Ascomycetes (formerly, classified in domain Eukaryota, kingdom Fungi, phylum Deuteromycota, class Hyphomycetes, order Hyphales, series *Porosporae* (Ellis & Gibson, 1975) and includes 299 species (saprophytic and pathogenic species). They are environmentally ubiquitous and are a part of common fungal flora that act as natural agents of decay and decomposition. About 20% of agricultural spoilage and decay are caused by *Alternaria* species. Crop losses caused by *Alternaria* species may reach up to 80% of the yield (Kirk *et al.*, 2008; Nowicki *et al.*, 2012). Variability is a well-known phenomenon in genus *Alternaria* and was noticed as changes in spore shape and size, mycelial growth, sporulation and pathogenicity (Mohsin *et al.*, 2016). Based on phylogenetic and morphological studies, *Alternaria* is currently divided into 26 sections (Woudenberg *et al.*, 2015). *Alternaria* sect. *porri* is the largest section containing most *Alternaria* species that have medium to large conidia and long beaks, some of which are important plant pathogens. The *porri* clade includes *A. porri* (Ellis) Cif. which causes purple blotch disease of onion as well as *A. solani* which causes early blight disease of tomato (Simmons, 1995).

Tomato (*Solanum lycopersicum* L.) is an economic solanaceous vegetable crop of high importance worldwide. Tomato is grown in an area of more than 5 million hectares around the world (WPTC, 2018) and of about

24500 hectares in Jordan with a local production of about 1.7 million tons (Anonymous, 2016). Onion (*Allium cepa* L.) is an important bulbous vegetable crop of a high global importance grown in an area of 3.7 million hectares (FAO, 2010). In Jordan, onion occupies an area of 5700 hectares that produce about 12200 tones of yield (Anonymous, 2016).

Early blight (target leaf spot) disease of tomato caused by *A. solani* is one of the world's most destructive diseases which affect tomato crops. The causal organism is air-borne and soil inhabiting. It is responsible for early blight, collar rot and fruit rot of tomato (Datar and Mayee, 1981). Symptoms of the disease usually appear on leaves, stems, petioles, twigs and fruits under favorable conditions resulting in defoliation, drying off of twigs and premature fruit drop; thus, the disease causes 50-86% loss in fruit yield (Mathur and Shekhawat, 1986).

Purple blotch of onion is a major disease throughout the world including Jordan, which is caused by *A. porri* (Islam *et al.*, 2001). This disease can cause 30-50% yield reduction (Pascua *et al.*, 1997). It causes extensive damage to bulb- as well as seed-crops. It is also a major limiting factor in the cultivation of onion (Savitha *et al.*, 2014; Priya *et al.*, 2015, Ramesh *et al.*, 2017).

Conidia, chlamydospores mycelia of *A. solani* and *A. porri* survive on plant debris and in soil. Both species have typical dry-dispersed conidia that are produced away from the host surface on aerial conidiophores (Fitt *et al.*, 1989; Everts and Lacy, 1996). Atmospheric temperature, humidity, wind speed and conidial spore concentration are the factors that are closely correlated with *A. solani* and *A.*

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