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Antiphytophthora and antifusarium from Indonesian medicinal plants

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Phytophthora and *Fusarium* are two phytopathogenic fungi that are frequently faced by farmer. A number of Indonesian medicinal plants have been traditionally used to treat skin diseases due to fungal infection. Some of the Indonesian medicinal plants have been tested and found to be active as antifungal agents. These plants were studied for the capacity to inhibit the growth of *Phytophthora* and *Fusarium*. The medicinal plants tested included *Piper betle* leaves, *Piper crocatum* leaves, *Syzigium aromaticum* leaves and flower, *Ageratum conyzoides* leaves, *Cassia alata* leaves, *Cymbopogon nardus* leaves, *Curcuma domestica* rhizome, *Curcuma xanthorrhiza* rhizome, *Curcuma zedoaria* rhizome, *Alpinia galangae* rhizome, *Zingiber officinale* rhizome, *Acorus calamus* rhizome, *Allium sativum* bulb, *Cinnamomum cardamom* cortex, *Garcinia mangostana* fruit cortex and *Ecliptica alba* herb. Extraction was performed by macerating 10 g of medicinal plant powder with 100 mL methanol for 48 hours, and the extract obtained was evaporated to dryness. The extract was tested at 0.5 and 1% in water containing 2% Tween-80.

Agar diffusion method was employed to test the antifungal activity [1,2]. *Phytophthora palmivora* Butler was obtained from the collection of Mycology Laboratory, Life Science Center of Bandung Institute of Technology. *Fusarium oxysporum* culture was obtained from Horticultural Research Institute Lembang, Bandung. The cultures were inoculated on PDA and incubated at 25 °C–30 °C for seven days. The assay was performed by making four diffusion wells on solid PDA media using a cork

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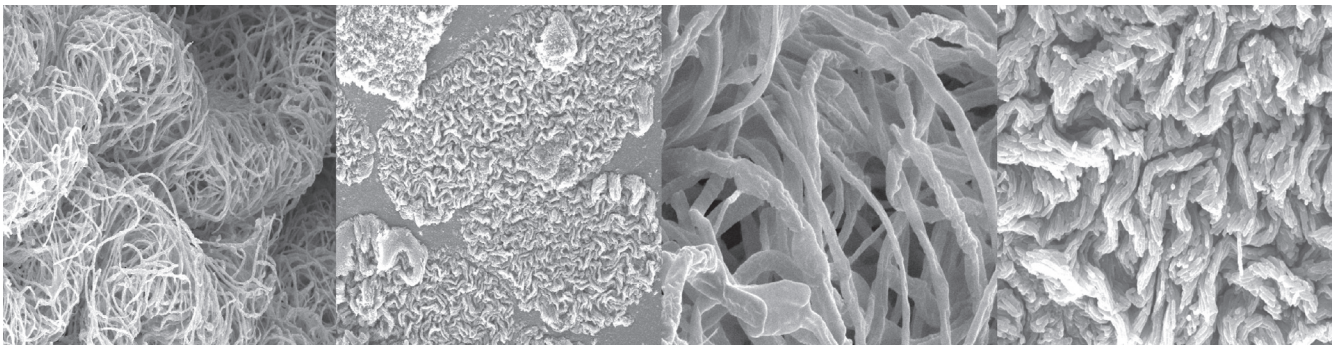

Fig. 1 – Scanning electron microscopy of normal *Fusarium oxysporum* (a) treated with eugenol from *S. aromaticum* (b) at 350× magnification (above) and at 2,000× magnification (c,d).

borer, and into each well 50 µl tested sample was added. Fungal culture with a diameter of 5 mm that was prepared using a cork borer was inoculated in the middle of the media and incubated for seven days. Inhibition diameter was measured after seven days and antifungal activity presented as inhibition percentage that was calculated by dividing the difference between the diameter of mycelial control growth and test growth toward the control growth.

Methanol extract of *C. alata* leaves, *C. xanthorrhiza*, *C. domestica*, *C. zedoaria* and *S. aromaticum* gave more than 50% inhibition at 1% toward *P. palmivora*. Extract of *S. aromaticum* flower gave the highest inhibition at 89.5%. Growth inhibitions at higher than 50% toward the growth of *F. oxysporum* were only given by the extract of *P. betle* leaf, *S. aromaticum* leaf and *S. aromaticum* flower. The highest antifusarium activity was also demonstrated by *S. aromaticum* flower extract. Identification of the antifungal compound toward both phytopathogenic fungi from *S. aromaticum* leaf and flower showed eugenol as the responsible compound for the antifungal activity.

Cell wall of fungi treated with eugenol was shrinking, indicating the disruption of cell wall structure (Fig. 1). Eugenol induces the leakage of protein and lipid from the cells at 2× MIC for 120 minutes due to the damage of bacterial cell walls [3]. Latest finding showed that eugenol block the transport of aromatic and branched chain amino acid across the cytoplasmic membrane [4].

Clove is potential to be developed as a source for natural antifungal agent to control crop infection by pathogenic fungi agents such as Phytophthora and Fusarium. It may also be developed as antifungal agent for human skin infection by fungi.

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