In Vitro Effects of Some Ethanolic Crude Extracts of Medicinal Plants against *Colletotrichum gloeosporioides*, The Pathogen of Anthracnose Disease in Chilli

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Abstract: The anthracnose disease is one of the major economic diseases in chilli production of Thailand. The present study was aimed to test and evaluate the fungicidal activity of the ethanolic crude extracts from thirty-four medicinal plants were tested against *Colletotrichum gloeosporioides* (the pathogen of anthracnose disease in chilli of Thailand) by poisoned food technique at 0, 2,000, 4,000, 6,000, 8,000 and 10,000 ppm. The inhibition of mycelial growth was evaluated. From the testing, All the used of thirty-four crude extracts showed significant antifungal activity against *C. gloeosporioides*. The result showed that the *Curcuma aromatica*, *Zingiber zerumbet*, *Piper betle*, *Kaempferia galanga*, *Rosmarinus officinalis* and *Origanum vulgare* crude extracts showed 100% inhibition of mycelial growth at all concentrations, whereas, the *Wedelia trilobata* and *Polygonum odoratum* crude extracts at 10,000 ppm gave the lowest inhibition of 70 and 82%, respectively. The study noted that the crude extracts namely *C. aromatica*, *Z. zerumbet*, *P. betle*, *K. galanga*, *R. officinalis* and *O. vulgare* showed the completely control of mycelial growth against *C. gloeosporioides* (the pathogen of anthracnose disease in chilli). These research pointed the opportunities for screening and application of some ethanolic crude extracts for a eco-friendly environmental management and exploited method as the biological control in chilli production.

Keywords: Fungicidal Activity, Anthracnose Disease, *Colletotrichum Gloeosporioides* Medicinal Plants, Ethanolic Crude Extracts, Chilli

Introduction

Anthracnose disease is one of the major economic disease in chilli production of Thailand and worldwide. Thán *et al.* (2008) reported that the anthracnose disease caused by three pathogens namely *C. gloeosporioides*, *C. acutatum* and *C. capsici*. The anthracnose disease control in chilli production in Thailand had five methods namely mechanical control, cultural control, biological control, chemical control and integrated control. For the chemical control is the best method for anthracnose disease management whereas this method as harmful for environmental condition, product residues and human health (Sawatdikarn, 2016).

Although, the management of anthracnose disease with the application of several fungicides. Filoda (2008) reported the effects of three fungicides (Sarfun 500 SC, Amistar 250SC and Gwarant 500 SC) at 0.01 0.20 and 0.40% inhibited on the colony growth of *C. gloeosporioides* and Nagaraju *et al.* (2020) reported that carbendazim (25 50 75 and 100 µl) inhibited on the mycelial growth of *C. gloeosporioides* (the pathogen of anthracnose in mango).

Fungicides can be controlled the anthracnose disease but the toxicity effects on products in human health and environmental issues are studies. Nowadays, the farmers use the biological control for anthracnose disease control in chilli. Sawatdikarn (2016) noted that the medicinal herb crude extracts for the soil and seed borne pathogen control have attracted wide interest. In general, several researches have been focused on medicinal herb crude extracts to control of plant disease management. (Sawatdikarn, 2011).

Several experiments reported of some plants crude extracts and essential oil for antimicrobial activity. Abersa *et al.* (2011) showed the ethanolic crude extracts of two species (*Eucalyptus globules* and *Eucalyptus*...
Colletotrichum citriodera) to inhibit the mycelial growth of Colletotrichum kahawae (the pathogen of berry disease in coffee) for 64–76%.

Sawatdikarn (2011) studied the antifungal activity of crude extracts of six Zingiberaceae species namely Boesenbergia pandurata, Zingiber officinale, Zingiber cassumunar, Ammon xanthioides, Kaempferia galanga and Amonum krervanh against Curvularia sp. (the pathogen of dirty panicle disease in rice), selected crude extracts of B. pandurata at 1,000 ppm showed the highest of mycelial growth inhibition for 57% and the crude extracts of A. Krervanh at 1,000 ppm showed the lowest of mycelial growth inhibition for 43%. Sawatdikarn (2016) noted the crude extract of three medicinal plants namely Curcuma aromatica Sycygium aromaticum and Origanum vulgare showed 100% inhibition on mycelial growth and spor germination of Alternaria sp. (the pathogen of dirty panicle disease in rice at all concentrations (1,000-10,000 ppm) and Palhano et al. (2008) reported that the essential oil of Cymbopogon citratus to inhibited on mycelial growth of C. gloeosporioides.

Jun-Young et al. (2006) noted that the antifungal activity of crude extracts from Curcuma longa against three red pepper anthracnose (Colletotrichum coccodes, C. gloeosporioides and C. acutatum). Rahman et al. (2011) reported that the seed extracts and the pulp extracts from Jatropha curcas had higher antifungal activity than whole fruit extracts against C. gloeosporioides (the pathogen of anthracnose in papaya).

Haron et al. (2013) showed that the fungicidal activity of Allamanda spp. crude extracts against C. gloeosporioides (the pathogen of anthracnose in papaya). Meng et al. (2013) impressed that the antifungal activity of crude extracts from Camellia semiserrata against C. musae and C. gloeosporioides. Marinho et al. (2018) noted that the fungicidal activity of soapberry (Sapindus saponaria) against C. gloeosporioides (the pathogen of anthracnose in papaya). Biju and Paveena (2018) showed that the antifungal activity of some crude extracts (Jatropha curcas, Ricitus communis, Chromolaena odorata and Wedelia chinensis) against C. gloeosporioides (the pathogen of anthracnose in black pepper).

Karunarathna et al. (2018) reported that the antifungal activity of six crude extracts (Mikania micrantha, Tithonia diversifolia, Lantana camara, Clusia rosea, Chromolaena odorata and Clidemia hirta) against C. gloeosporioides (the pathogen of anthracnose of ornamental plants).

For the management on some pathogens (C. capsici; the pathogen of anthracnose disease in chili in Thailand), Sawatdikarn (2016) showed that the three crude extracts namely Curcuma aromatica, Piper betle and Origanum vulgare showed 100% inhibition of mycelial growth at all concentrations, whereas, the Wedelia trilobata and Polygonum odoratum crude extracts at 10,000 ppm gave the lowest inhibition of 62 and 77%, respectively.

Little information of thirty-four medicinal herb crude extracts on inhibition of mycelial growth of C. gloeosporioides (the pathogen of anthracnose disease in chilli). The objective of this research was to evaluate of thirty-four medicinal herb crude extracts on the mycelial growth of C. gloeosporioides.

3 Material and methods

This work was conducted at Department of Applied Science, Faculty of Science and Technology, Phranakhon Si Ayuthaya Rajabhat University, Phranakhon Si Ayuthaya province during 2017-2018 to determine the fungicidal activity of crude extract of thirty-four medicinal plants including; Kaempferia parviflora, Curcuma aromatica, Cymbopogon nardus, Etingera littorilis, Anethum graveolens, Sorghum bicolor, Tinospora crispa, Eucatypus camaldulensis, Carthamus tinctorius, Curcuma longa, Zingiber zerumbet, Chrysanthemum indicum, Wedelia trilobata, Piper betle, Polygonum odoratum, Laurus nobilis, Coscinium fenestratum, Astragalus mongolicus, Piper sarmentosum, Moringa oleifera, Kaempferia galanga, Codonopsis pilosula, Cinnamomum verum, Capsicum annuum, Glycyrrhiza glabra, Paeonia lactifolia, Rosmarinus officinalis, Erythriana variegata, Cymbopogon citratus, Alpinia galangal, Boesenbergia pandurata, Origanum vulgare, Caesalpinia Sappan and Curcuma manga against C. gloeosporioides (the pathogen of anthracnose disease in chilli) in sterile distilled water and ethanol treatments by using food poisoned technique (Prasad et al., 2010).

3.1 Preparation of chilli fruits and Isolation of pathogen

Chilli fruits were obtained from two locations in Central area of Thailand, Phranakhon Si Ayuthaya and Aungthong Province. C. gloeosporioides from the chilli fruits were isolated and maintained on petri dishes containing in Potato dextrose agar (PDA) and incubated at 25°C. for 3 days before the tests. The preparation of chilli fruits and the isolation of pathogen followed by the methods of Sawatdikarn (2016).
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3.2 Collection and preparation of plants samples

Thirty-four medicinal herb crude extracts namely, *Kaempferia parviflora*, *Curcuma aromatica*, *Cymbopogon nardus*, *Eltengera littorilis*, *Anethum graveolens*, *Sorghum bicolor*, *Tinospora crispa*, *Eucatypus camaldulensis*, *Carthamus tinctorius*, *Curcuma longa*, *Zingiber zerumbet*, *Chrysanthemum indicum*, *Wedelia trilobata*, *Piper betle*, *Polygonum odoratum*, *Laurus nobilis*, *Cocinum fenestratum*, *Astragalus mongolicus*, *Moringa oleifera*, *Kaempferia galanga*, *Codonopsis pilosula*, *Cinnamomum verum*, *Capsicum annuum*, *Glycyrrhiza glabra*, *Paonia lactifolia*, *Rosmarinus officinalis*, *Erythriana variegate*, *Cymbopogon citratus*, *Alpinia galanga*, *Boesenbergia pandurata*, *Origanium vulgare*, *Caesalpinia Sappan* and *Curcuma mangga* was extracted by 90% ethanol and tested for fungicidal activity on mycelial growth of *C. gloeosporioides*.

Thirty-four medicinal crude extracts used in this study was obtained from four locations in Phranakhon Si Ayutthaya province (Bangban, Wangnoi Bangsai and Bangpa-in) where produce and export of medicinal herb productions. There were washed with tap water and air dried for three days to eliminate surface moisture. Then each part of medicinal plants were packed in to envelop and kept in oven at 80°C temperature until dried. Dried each parts were grinded separately in an electric grinder to obtain powder which was than kept in plastic bags before the tests (Sawadatkarn, 2016).

3.3 Preparation of crude extracts

One hundred grams of the dried powdered plant were soaked in 1,000 ml of 90% ethanol. These mixtures were refluxed followed by agitation at 200 rpm for 1 hour. The ethanolic extracts were squeezed and filtered by muslin cloth. The crude extracts were placed in to a wide tray to evaporate ethanol and added with water plant extracts (Prasad et al., 2010).

3.4 Mycelial growth test ; Food poisoned technique; Diffusates were added in PDA and poured into petri dishes. PDA medium added only with ethanol and water served as control treatment. Each petri dishes was inoculated with 5 mm plug of pure isolate taken from margins of actively growing culture of pathogen. All petri dishes were incubated at 25°C. (Sawadatkarn, 2016)

The screening of crude extracts for fungicidal activity was conducted using the agar dilution method. Different crude extracts were tested using food poisoning technique. Each tested crude extracts was used at different concentrations; 0 (control treatment), 2,000, 4,000, 6,000, 8,000 and 10,000 ppm. The petri dishes were incubated in room temperature for 7 days. The efficacy of treatment was assessed from all the four plate by measuring fungal colony development (cm). The mycelial growth inhibition (M) with respect to the control treatment was calculated from the formula (Sheng-Yang et al., 2005; Sawadatkarn, 2016)

\[ M = \frac{[(A-B)]}{A} \times 100 \]

Where A is the colony diameter of the control treatment and B is the colony diameter of the treated of crude extracts.

3.5 Statistical analysis

All experiments were done for four replications. Data (inhibition of mycelial growth at 2,000, 4,000, 6,000, 8,000 and 10,000 ppm) were subjected to analysis using Duncan’s Multiple Range Tests (DMRT).

4. Results and discussion

The thirty-four medicinal plant crude extracts showed inhibition on mycelial growth of *C. gloeosporioides* at different concentrations (Table 1). The crude extracts of *C. aromatica*, *Z. zerumbet*, *P. betle*, *K. galanga*, *R. officinalis* and *O. vulgare* showed 100% inhibition of mycelial growth at all concentrations, whereas, the *W. trilobata* and *P. odoratum* crude extracts at 10,000 ppm gave the lowest inhibition of 70 and 82%, respectively.

For the *C. aromatica* crude extracts showed 100% inhibition on mycelial growth at all concentration (Table 1) can be used crude extracts of these species for *C. gloeosporioides* management (the pathogen of anthracnose disease in chilli) (1,000-10,000 ppm). These results are in agreement with the researches of Sawadatkarn (2016) noted that the *C. aromatica* crude extracts showed 100% inhibition on mycelial growth at 5,000-10,000 ppm for *F. semitectum* control (the pathogen of dirty panicle disease in rice) and related to the data of *C. aromatica* crude extracts showed 100% inhibition on mycelial growth at 5,000-10,000 ppm for *C. lunata* control (the pathogen of dirty panicle disease in rice) (Sawadatkarn, 2016) and the *C. aromatica* crude extracts showed 100% inhibition on mycelial growth at 1,000-10,000 ppm for *C. capsici* control (the pathogen of anthracnose disease in chilli) (Sawadatkarn, 2016)

The *C. aromatica* crude extracts showed the inhibition on mycelial growth of *C. gloeosporioides*, the results are in agreement with two researches, Saleem et al. (2011) reported the crude extracts of *C. aromatica* at 0.4% showed the completely inhibition on mycelial growth of three pathogen...
namely *Staphylococcus aureus*, *Enterococcus faecalis* and *Pseudomonas aeruginosa* and Harit et al. (2013) impressed that the ethanolic extract of *C. aromatica* was found to have both antibacterial activity (*S. aureus* and *Bacillus subtilis*) and antifungal activity (*Candida albicans* and *Aspergillus flavus*).

For the *Z. zerumbet* crude extracts showed 100% inhibition on mycelial growth at all concentration (Table 1) can be used crude extracts of these species for *C. gloeosporioides* control (the pathogen of anthracnose disease in chilli) (1,000-10,000 ppm). These results are in agreement with that Sawatdikarn (2016) noted that the plants species (The Zingiberaceae species), the two crude extracts namely *Z. zerumbet* and *C. longa* showed 100% inhibition on mycelial growth at 5,000-10,000 ppm for *F. semitecium* control (the pathogen of dirty panicle disease in rice).

The *Z. zerumbet* crude extracts showed the inhibition on mycelial growth of *C. gloeosporioides*, the results are in agreement with some researches, Singh et al. (2014) impressed that the the essential oil of the rhizome of *Z. zerumbet* showed the inhibition on mycelial growth of *Cryptococcus neoformans* and Kader et al. (2011) noted that the ethanolic extract from rhizome of *Z. zerumbet* showed the antifungal activity of the three pathogens (*Candida albicans*, *Aspergillus niger* and *Sacharomyces cerevaceae*).

Mukherjee et al. (2011) showed the crude extract of *Zingiber officinale* on the mycelial growth of *C. gloeosporioides* (the causal agent of anthracnose in mango) and Ademe et al. (2011) reported the fungicidal activity of *Zingiber officinale* crude extract against *C. gloeosporioides* (the pathogen of anthracnose in papaya (*Carica papaya*)).

For the *P. betle* crude extracts showed 100% inhibition on mycelial growth at all concentration (Table 1) can be used crude extracts of these species for *C. gloeosporioides* control (the pathogen of anthracnose disease in chilli) (1,000-10,000 ppm). These results are in agreement with that the researches of Sawatdikarn (2016) impressed that the *P. betle* crude extracts showed 100% inhibition on mycelial growth at 2,500-10,000 ppm for *F. semitecium* control (the pathogen of dirty panicle disease in rice) and related to the researches of *P. betle* crude extracts showed 100% inhibition on mycelial growth at 2,500-10,000 ppm for *Curvularia lunata* control (the pathogen of dirty panicle disease in rice) (Sawatdikarn, 2016)

Johnny et al. (2010) stated that the antifungal activity of *Piper betle* crude extract also showed high inhibition against *C. gloeosporioides* (the causal agent of anthracnose disease in mango). Sawatdikarn (2016) noted that the *P. betle* crude extracts showed 100% inhibition on mycelial growth at 1,000-10,000 ppm for *C. capsici* control (the pathogen of anthracnose disease in chilli).

The *P. betle* crude extracts showed the inhibition on mycelial growth of *C. gloeosporioides*, the results are in agreement with some researches, Ali et al. (2010) focused the crude extract from the leaves of *P. betle* showed the strongly inhibition on mycelial growth of *Candida albican* and *Candida glabrata* and Neela et al. (2011) showed that the ethanolic extract from the leaves of *P. betle* at 20 and 25% concentrations showed the completely inhibition of mycelial growth on *Fusarium oxysporum* (the causal agent of fusarium wilt disease in tomato).

For the *K. galanga* crude extracts showed 100% inhibition on mycelial growth at all concentration (Table 1) can be used crude extracts of these species for *C. gloeosporioides* control (the pathogen of anthracnose disease in chilli) (1,000-10,000 ppm). These results are in agreement with in some the researches, Kochuthressia et al. (2012) reported that the ethanolic crude extract from rhizome of *K. galanga* inhibited of mycelial growth in the four fungal pathogens namely *Aspergilus niger*, *A. flavus*, *A. fumagatus* and *Candida albicans* and Umar et al. (2011) noted that the *K. galanga* crude extracts have been found to inhibit of mycelial growth in some microorganisms such as *Candida albicans*, *Escherichia coli*, *Salmonella typhi* and *Enterococcus faecalis*.

For the *R. officinalis* crude extracts showed 100% inhibition on mycelial growth at all concentration (Table 1) can be used crude extracts of these species for *C. gloeosporioides* control (the pathogen of anthracnose disease in chilli) (1,000-10,000 ppm). These results are in agreement with that the researches of Sawatdikarn (2016) impressed that the *R. officinalis* crude extracts showed 100% inhibition on mycelial growth at 2,500-10,000 ppm for *F. semitecium* control (the pathogen of dirty panicle disease in rice) and these data related to the researchs of *R. officinalis* inhibited of some pathogens, Centeno et al. (2010) noted that the crude extracts of *R. officinalis* showed 100% inhibition on mycelial growth at all concentrations (0.004-0.4%) for two pathogens control (*Aspergilus flavus* and *A. ochraceus*) and Matsuzaki et al. (2013) reported that the essetnial oil from *R. officinalis* had an effect on mycelial growth of *Candida albicans*.

In agreement with this research, Alemu et al. (2014) noted that the methanol extract of *R. officinalis* has...
focused fungicidal activity against \textit{C. gloeosporioides} (the pathogen of anthracnose disease in mango).

For the \textit{O. vulgare} crude extracts showed 100\% inhibition on mycelial growth at all concentrations (Table 1) can be used crude extracts of these species for \textit{C. gloeosporioides} control (the pathogen of anthracnose disease in chilli). These results are in agreement with that the researches of Sawatdikarn (2016) noted that the \textit{O. vulgare} crude extracts showed 100\% inhibition on mycelial growth at all concentrations for \textit{F. semitectum} (the pathogen of dirty panicle disease in rice) and related to the researches of \textit{O. vulgare} crude extracts showed 100\% inhibition on mycelial growth at all concentrations for \textit{C. lunata} control (the pathogen of dirty panicle disease in rice) (Sawatdikarn, 2016) and these results are in agreement with that the researches of Sawatdikarn (2016) noted the crude extract of \textit{O. vulgare} showed 100\% inhibition on mycelial growth and spore germination of \textit{Alternaria sp.} (the pathogen of dirty panicle disease in rice at all concentrations (1,000-10,000 ppm) and Lee et al. (2001) tested essential oils of \textit{O. vulgare} for their antimicrobial activities against four plant pathogens (\textit{Botrytis cinerea}, \textit{C. gloeosporioides}, \textit{Pythium alitimun} and \textit{Rhizoctonia solani}), selected essential oils of \textit{O. vulgare} showed the inhibition of mycelial growth for 90\% of \textit{C. gloeosporioides}.

Sawatdikarn (2016) noted that the \textit{O. vulgare} crude extracts showed 100\% inhibition on mycelial growth at 1,000-10,000 ppm for \textit{C. capsici} control (the pathogen of anthracnose disease in chilli) and the data related to the researches of \textit{O. vulgare} crude extracts showed 100\% inhibition on mycelial growth at 2.50 mL/100 mL for three pathogen control (\textit{Pencillium aurantiogriseum}, \textit{P. glabrum} and \textit{P. bracivcompactum} (Kocic-Tanackov et al., 2011).

For the \textit{E. camaldulensis} crude extracts at 2,000-8,000 ppm showed the inhibition on mycelial growth for 65-82\% (Table 1). This agreed with the results of Abera et al (2011) showed the ethanolic crude extracts of \textit{Eucalyptus globules} and \textit{Eucalyptus citriodera} to inhibit the mycelial growth of \textit{Colletotrichum kahawae} (the pathogen of berry disease in coffee) for 64-76 \%.

In the present study, extract from \textit{Moringa oleifera} (2,000-8,000 ppm) showed the inhibition on mycelial growth for 58-75\% (Table 1). This agree with the data of Dissanayake et al. (2019) showed the crude extracts of \textit{M. oleiferato} inhibit the mycelial growth of \textit{C. gloeosporioides} (the pathogen of anthracnose disease in papaya) for 35-44\%.

The ethanolic crude extract from lemon grass (\textit{C. citratus}) showed the highest antifungal activity (100\% inhibition of mycelial growth) against \textit{C. gloeosporioides} (Table 1). This data corresponds with research done by Perez-Cordero et al. (2017) who reported that extract of \textit{C. citratus} have antifungal activity and inhibit the growth of \textit{C. gloeosporioides} (the pathogen of anthracnose disease in yam) and this agree with the data of Palhano et al. (2004) exhibited the essential oil from lemon grass (\textit{C. citratus}) inhibit the mycelial growth of \textit{C. gloeosporioides}.

For the two crude extracts (\textit{W. trilobata} and \textit{P. odoratum}) at 10,000 ppm concentration gave the lowest inhibition of 70 and 82\%, respectively (Table 1). These results are in agreement with that the researches of Sawatdikarn (2016) noted the crude extract of \textit{W. trilobata} and \textit{P. odoratum} showed 62 and 77\% inhibition, respectively on mycelial growth of \textit{C. capsici} (the pathogen of anthracnose disease in Chill) at 10,000 ppm concentration. Inaddition, Biju and Praveena (2018) reported that the crude extract of \textit{W. chinensis} showed 17-33 inhibition on mycelial growth of \textit{C. gloeosporioides} (the pathogen of anthracnose disease of black pepper) at 2.5 5 10 and 20\% concentrations.

The goal of this study was to screening of the thirty-four crude extracts on the mycelial growth of \textit{C. gloeosporioides}. The management of all crude extract was the best for \textit{C. gloeosporioides} control due to their harmless on environmental condition, to user and to consumer. The study that the related to the several researcher have noted the antifungal activity of crude extracts and essential oils including, the researches of Sawatdikarn (2016) noted the crude of plant species namely \textit{Carcuma aromatica}, \textit{Piper betle} and \textit{Origanum vulgare} crude extracts showed 100\% inhibition of mycelial growth at all concentrations.

Sawatdikarn (2016) impressed that the crude of plant species namely \textit{Carcuma aromatica}, \textit{Piper betle} and \textit{Origanum vulgare} crude extracts showed 100\% inhibition of mycelial growth of \textit{C. capsici} (the pathogen of anthracnose disease in chilli) at all concentrations.

The phytochemical compounds from the six crude extracts (\textit{C. aromatica}, \textit{Z. zerumbet}, \textit{P. betle}, \textit{K. galanga}, \textit{R. officinalis} and \textit{O. vulgare}) inhibited the mycelial growth of \textit{C. gloeosporioides}, these results have been confirmed by several researches, for examples curcumin from the rhizome of \textit{C. aromatica} (Husein et al., 2009), piperine from the leaves of \textit{P. betle} (Sawatdikarn, 2016), 1,8-cineole and camphor from the leaves of \textit{R. Officinalis} (Papajani et al., 2015), zerumbone from the rhizome of \textit{Z. zerumbet}. 

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(Singh et al., 2014), ethyl-cinnamate and 1,8-cineole from the rhizome of K. galanga (Umar et al., 2011) and carvacrol and p-cymene from the leaves of O. vulgare (Papajani et al., 2015)

This study noted that the thirty-four crude extracts can be use for C. gloeosporioides management and can be used the six plants crude extracts for anthracnose disease control. The six crude extracts (C. aromatica, Z. zerumbet, P. betle, K. galanga, R. officinalis and O. vulgare) showed 100% inhibition of mycelial growth of C. gloeosporioides (the pathogen of anthracnose disease in chilli) at all concentrations.

Table 1 Efficacy of different concentration of some medicinal plants crude extracts on mycelial growth inhibition of C. gloeosporioides (the pathogen of anthracnose disease in chilli)

| Medicinal herb crude extracts | 2,000 ppm | 4,000 ppm | 6,000 ppm | 8,000 ppm | 10,000 ppm |
|-------------------------------|-----------|-----------|-----------|-----------|-----------|
| 1. Kaempferia parviflora      | 70c       | 80c       | 89b       | 95b       | 100a      |
| 2. Curcuma aromatica          | 100a      | 100a      | 100a      | 100a      | 100a      |
| 3. Cymbopogon nardus           | 60e       | 77c       | 86b       | 89b       | 100a      |
| 4. Eltingera littoralis        | 50f       | 60e       | 77c       | 88b       | 96ab      |
| 5. Anethum graveolens          | 60e       | 80c       | 88b       | 92b       | 100a      |
| 6. Sorgum bicolor              | 57e       | 70d       | 78c       | 82c       | 98ab      |
| 7. Tinospora crispa            | 40f       | 55e       | 68d       | 78c       | 89b       |
| 8. Eucalyptus camaldulensis    | 65d       | 70d       | 82c       | 95b       | 100a      |
| 9. Carthamus tinctorius        | 45f       | 67d       | 76c       | 85b       | 100a      |
| 10. Curcuma longa              | 75c       | 88b       | 94b       | 100a      | 100a      |
| 11. Zingiber zerumbet          | 100a      | 100a      | 100a      | 100a      | 100a      |
| 12. Chrysanthemum indicum      | 70d       | 80c       | 95b       | 100a      | 100a      |
| 13. Wedelia trilobata          | 20h       | 30b       | 55e       | 60e       | 70d       |
| 14. Piper betle                | 100a      | 100a      | 100a      | 100a      | 100a      |
| 15. Polygonum odoratum         | 40f       | 59e       | 72d       | 79c       | 82c       |
| 16. Laurus nobilis             | 67d       | 78c       | 89b       | 100a      | 100a      |
| 17. Coscinium fenestratum      | 80b       | 100a      | 100a      | 100a      | 100a      |
| 18. Astragalus mongollicus     | 40g       | 60e       | 70d       | 82c       | 91b       |
| 19. Piper sarmentosum          | 42g       | 65d       | 70d       | 85b       | 97b       |
| 20. Moringa oleifera           | 58e       | 67d       | 75c       | 92b       | 100a      |
| 21. Kaempferia galanga         | 100a      | 100a      | 100a      | 100a      | 100a      |
| 22. Codonopsis pilosula        | 50e       | 65d       | 78c       | 82c       | 96b       |
| 23. Cinnamomum verum           | 48f       | 64e       | 78c       | 81c       | 100a      |
| 24. Capsicum annuum            | 51e       | 62e       | 77c       | 82c       | 94b       |
| 25. Glycyrrhiza glabra         | 55e       | 60e       | 72d       | 85b       | 100a      |
| 26. Paeonia lactifolia         | 40g       | 52f       | 64e       | 77c       | 88b       |
| 27. Rosmarinus officinalis     | 100a      | 100a      | 100a      | 100a      | 100a      |
| 28. Erythrina variegata        | 58e       | 60e       | 67d       | 75c       | 89b       |
| 29. Cymbopogon citratus        | 55e       | 67d       | 77c       | 82c       | 100a      |
| 30. Alpinia galanga            | 70d       | 80c       | 92b       | 100a      | 100a      |
| 31. Boesenbergia pandurata     | 75c       | 92b       | 100a      | 100a      | 100a      |
| 32. Origanum vulgare           | 100a      | 100a      | 100a      | 100a      | 100a      |
| 33. Caesalpinia Sappan         | 57e       | 68d       | 77c       | 90b       | 100a      |
| 34. Curcuma mangga             | 85b       | 88b       | 100a      | 100a      | 100a      |

C.V. (%) 8.64 9.82 7.65 5.86 10.24

In the same column, mean followed by a common letter are not significantly different at the 5% level by DMRT.

5 Conclusion
All the used of thirty-four crude extracts showed significant antifungal activity against C. gloeosporioides. The result showed that the C. aromatica, Z. zerumbet, P. betle, K. galanga, R. officinalis and O. vulgare crude extracts showed 100% inhibition of mycelial growth at all concentrations, whereas, the W. trilobata and P. odoratum crude extracts at 10,000 ppm gave the lowest inhibition of 70 and 82%, respectively.

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