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Antifungal activity of crude extracts of some medicinal plants against *Fusarium* sp., the pathogen of dirty panicle disease in rice

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Antifungal activity of the ethanolic crude extracts of twenty-four medicinal plants namely, *Boesenbergia pandurata, Curcuma longa, Zingiber officinale, Alpinia galanga, Zingiber cassumunar, Amonum xanthioides, Kaempferia galanga, Curcuma aromatica, Curcuma xanthorrhiza, Kaemferia parviflora, Amonum krervanh, Syzygium aromaticum, Allium sativum, Allium ascolonicum, Cymbopogon citratus, Cymbopogon nardus, Leptochloa chinensis, Eupatorium odoratum, Piper betle, Synedrella nodiflora, Cassia siamea, Sorghum bicolor, Rosmarinus officinalis* and *Origanum vulgare* were tested against *Fusarium* sp. (the pathogen of dirty panicle disease in rice) by poisoned food technique at 0, 1,000, 2,500, 5,000, 7,500 and 10,000 ppm. The inhibition of mycelial growth was evaluated. All the used twenty-four crude extracts showed significant antifungal activity against *Fusarium* sp. The result showed that the *S. aromaticum* and *O. vulgare* crude extracts showed 100% inhibition of mycelial growth at all concentrations, whereas, *S. nodiflora* and *S. bicolor* crude extracts at 10,000 ppm gave the lowest inhibition of 42 and 32%, respectively.

Key words: Antifungal activity, dirty panicle disease, *Fusarium* sp., medicinal crude extract, rice.

INTRODUCTION

Fusarium species are important fungal pathogens causing seed borne diseases of many crops worldwide. The dirty panicle disease is a major disease problem caused by *Fusarium* sp. around the locations of rice production in Thailand and the tropical location in the world (Ou, 1985). Abdelmonem (2000) reported this disease from different location caused by several pathogens: *Fusarium* sp., *Alternaria* sp., *Cercospora* sp. and *Curvularia* sp. The panicle dirty disease control in rice production had five methods namely mechanical, cultural, biological, chemical and integrate method. The chemical control is the best method of control for dirty panicle disease, whereas this method is harmful toenvironmental condition, product residues and human health.

Although, with the application of several fungicides,

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disease can be controlled but the toxicity effects on products in human health and environmental issues are studies. Nowadays, the farmers use the biological control for dirty panicle control in rice. Natural plant products have the potential as safe alternatives for chemical fungicides in rice disease managements. The medicinal herb crude extracts for the seed borne pathogen control have attracted wide interest. In general, several researches have been conducted on medicinal herb crude extracts and essential oils to control plant disease (Nwachukwu and Umechuruba, 2001; Kritzinger et al., 2002; Palhano et al., 2004; Velluti et al., 2004).

Many experiments reported on some Zingiberaceae species for the antimicrobial activity, Saleem et al. (2011) studied the antimicrobial activity of essential oil of two plants (*Curcuma longa* and *Curcuma aromatica*) against *Escherichia coli*, *Pseudomonas aeroginosa* and *Staphylococcus aureus* and found that the essential oil of two plants can completely inhibit the growth of three pathogens. Husein et al. (2009) working on antimicrobial activity of crude extracts from *Curcuma xanthorrhiza* against three pathogen namely *E. coli*, *S. aureus* and *Bacillus cereus*, found that the ethanol extract inhibited *S. aureus* and *B. cereus* and ethyl acetate extract inhibited *E. coli*. Kummee et al. (2008) found that the ethanol extract of *Kaempferia parviflora* exhibited strong antifungal activity against three pathogens, *Trichophyton rubrum*, *Trichophyton mentagrophytes* and *Microsporum gypseum* with MIC values of 62.5, 125 and 250 µg/ml, respectively. Johnny et al. (2011) tested rhizome extracts of *Alpinia galanga* extracted by methanol, chloroform and acetone against *Collectotrichum capsici* at 0.01 0.10 1.00 and 10.0 µg/ml concentrations and found that methanol, chloroform and acetone extracts showed the highest of inhibition of radial growth at 10.0 µg/ml concentrations. Sawatdikarn (2011) studied the antifungal activity of crude extracts of six Zingiberaceae species namely *Boesenbergia pandurata, Zingiber officinale, Zingiber cassumunar, Amonum 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 mycelail growth inhibition of 57.8% and the crude extracts of *A. Krervanh* at 1,000 ppm showed the lowest of mycelail growth inhibition of 43.7%.

Many experiments showed that the lemongrass (*Cymbopogon citratus*) essential oil inhibited the mycelial growth of some pathogens: *Collectotrichum gloeosporioides* (Palhano et al., 2004), *Fusarium verticillioides*, *Fusarium proliferatum* and *Fusarium graminearum* (Velluti et al., 2004) and *Fusarium moniliforme* (Nwachukwu and Umechuruba, 2001). Istianto and Emilda (2011) found that the essential oil of citronella grass (*Cymbopogon nardas)* can completely inhibit the mycelial growth of *F. oxysporum*. Kritzinger et al. (2002) tested crude extracts of clove (*Syzygium aromaticum*) for antifungal activity against two plant pathogens (*F. oxysporum* and *F. equiseti*), the clove crude extract at 1,000 ppm showed 100% inhibition on mycelial growth of *F. oxysporum* and *F. equiseti*. Moghtader et al. (2011) from Iran reported that essential oil of rosemary (*Rosmarinus officinalis)* aerial parts at 1½ oil dilution inhibited the growth of *Aspergillus flavus*.

Many experiments reported some plants crude extracts and essential oil have antimicrobial activity. Lee et al. (2001) tested essential oils of *Origanum vulgare* for their antimicrobial activities against four plant pathogens (*Botrytis cinerea, Collectotrichum gloeosporioides, Pythium altimum* and *Rhizoctonia solani*), selected essential oils of *Origanum vulgare* showed the inhibition of mycelial growth for 65 68 78 and 92% of *B. cinerea*, *R. solani*, *C. gloeosporioides* and *P. altimum*, respectively. Bansod and Rai (2008) tested plant extracts (*Allium sativum*) for their efficacy against *Aspergillus fumigatus* and found extract of *A. sativum* at 100 µg/ml to completely inhibit the mycelial growth of *A. fumigatus*. Owalabi et al. (2010) reported that the pure extract of *Eupatorium odoratum* can completely inhibit the mycelial growth of *Bacillus cereus* and *Aspergillus niger*. Ali et al. (2010) noted the inhibitory effect of extract of *Piper betle* on the mycelial growth of four pathogens namely *Aspergillus flavus, A. niger, A. fumigatus* and *A. paraciticus* and found that the extract showed maximum inhibition of the mycelial growth of the pathogens. Ogbebor and Adekunle (2005) tested 21 plants extracts on the mycelial growth against *Corynespora cassiicola* (the pathogen of leaf spot of para rubber) under laboratory condition and found extract of *Synedrella nodiflora* showed the inhibition of mycelial growth for 34.8%. Nanasombat and Teckchuen (2009) screened 20 species for their antimicrobial activity and found that the methanolic extracts of *Cassia siamea* exhibited strong antibacterial activities namely *B. cereus, Listeria monocytogenes* and *S. aureus*. Soetan et al. (2006) reported on the seed extract of *S. bicolor* on the mycelail growth of *S. aureus* under laboratory condition and found that 25 mg/ml seed extracts of *S. bicolor* showed the highest of inhibition on the mycelail growth of the pathogen.

No information was found on the inhibition of mycelial growth of *Fusarium* sp. (the pathogen of dirty panicle disease of rice). The objective of this research was to evaluate twenty-four medicinal herb crude extracts on the mycelial growth of *Fusarium* sp. in central area, Thailand.

MATERIALS AND METHODS

This work was conducted at Department of Applied Science, Faculty of Science and Technology, Phranakhon Si Ayutthaya Rajabhat University, Phranakhon Si Ayutthaya during 2010-2011 to determine the antifungal activity of 1) *Boesenbergia pandurata* 2)

Curcuma longa 3) *Zingiber officinale* 4) *Alpinia galanga* 5) *Zingiber cassumunar* 6) *Amonum xanthioides* 7) *Kaempferia galanga* 8) *Curcuma aromatica* 9) *Curcuma xanthorrhiza* 10) *Kaemferia parviflora* 11) *Amonum krervanh* 12) *Syzygium aromaticum,* 13) *Allium sativum* 14) *Allium ascolonicum* 15) *Cymbopogon citratus* 16) *Cymbopogon nardus* 17) *Leptochloa chinensis* 18) *Eupatorium odoratum* 19) *Piper betle* 20) *Synedrella nodiflora* 21) *Cassia siamea 22*) *Sorghum bicolor* 23) *Rosmarinus officinalis* and 24) *Origanum vulgare* against *Fusarium* sp. (the pathogen of dirty panicle disease in rice) in sterile distilled water and ethanol by using food poisoning technique (Prasad et al., 2010).

The plant's name is the name of the different families (8 family), the plant name in number 1-11 is the member of Zingiberaceae, number 12 is the member of Myrtaceae, number 13-14 are the members of Amaryllidaceae, number 15-17 and 22 are the members of Poacea, number 18 and 20 are the members of Asteraceae, number 19 is the member of Piperaceae, number 21 is the member of Fabaceae and number 23 and 24 are the members of Lamiaceae.

Preparation of rice seeds and isolation of pathogen

Rice seeds were obtained from three location in Central areas : Phranakhon Si Ayutthaya, Aungthong and Prathumthani Province. *Fusarium* sp. from the rice seeds were isolated and maintained on Petri dishs containing potato dextrose agar (PDA) and incubated at 25°C for 3 days before the tests.

Collection and preparation of plants samples

Twenty-four medicinal herb crude extracts namely : *B. pandurata, C. longa, Z. officinale, A. galanga, Z. cassumunar, A. xanthioides, K. galanga, C. aromatica, C. xanthorhiza, K. parviflora, A. krervanh, S. aromaticum, A. sativum, A. ascolonicum, C. citratus, C. nardus, L. chinensis, E. odoratum, P. betle, S. nodiflora, C. siamea, S. bicolor, R. officinalis* and *O. vulgare* was extracted by 90% ethanol and tested for antifungal activity on *Fusarium* sp.

Twenty-four medicinal crude extracts used in this study was obtained from three locations in Phranakhon Si Ayutthaya province, Bangban, Wangnoi and Bangpa-in, where medicinal herb is produced and exported. Fresh rhizomes of 11 species namely *B. pandurata, C. longa, Z. officinale, A. galanga, Z. cassumunar, A. xanthioides, K. galanga, C. aromatica, C. xanthorhiza, K. parviflora* and *A. krervanh* were collected from Bangban, fresh stems of *C. citratus, C. nardus* and *L. chinensis* were collected from Wangnoi**,** fresh leaves of *E. odoratum, P. betle, S. nodiflora, C. siamea, S. bicolor, R. officinalis* and *O. vulgare* were collected from Bangpa-in, fresh bulbs of *A. sativum* and *A. ascolonicum* were collected from Wangnoi and fresh bud parts of *S. aromaticum* were collected from Bangpa-in. They were washed with tap water and air dried for three days to eliminate surface moisture. Then each part of the medicinal plants were packed to envelop and kept in oven at 80°C until dried. Each dried parts were grinded separately in an electic grinder to obtain powder which was then kept in plastic bags before the tests.

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 h. The ethanolic extracts were squeezed and filtered by muslin cloth. The crude extracts were placed in a wide tray to evaporate ethanol and water plant extracts were added (Prasad et al., 2010).

Mycelial growth test

Food poisoning technique

Diffusates were added in PDA and poured into Petri dishes. To the PDA medium was added only with ethanol and water served as the 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.

The screening of crude extracts for antifungal 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 treament), 1,000, 2,500, 5,000, 7,500 and 10,000 ppm. The Petri dishes were incubated at room temperature for 7 days. The efficacy of treament was assessed from all the four plates by measuring fungal colony development (cm). The mycelail growth inhibition (M) with respect to the control treament was calculated from the formula (Sheng-Yang et al., 2005)

$$M = [(A-B) / A] \times 100$$

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

Statistical analysis

For statistical analyses, Duncan multiple range test was used to compare the average.

RESULTS AND DISCUSSION

The twenty-four medicinal plant crude extracts showed inhibition on mycelial growth of *Fusarium* sp. at different concentrations (Table 1). The crude extracts of *S. aromaticum* (Figure 1) and *O. vulgare* (Figure 2) showed 100% inhibition on mycelial growth at all concentrations whereas, the *S. nodiflora* (Figure 3) and *S. bicolor* (Figure 4) crude extracts at 10,000 ppm gave the lowest inhibition of 42 and 32%, respectively.

The clove (*S. aromaticum*) and origano (*O. vulgare*) crude extracts showed 100% inhibition on mycelial growth at all concentrations (Figure 1) and the crude extracts of these species can be used for *Fusarium* sp. control (the pathogen of dirty panicle disease in rice) at all concentration (1,000-10,000 ppm). These results are in agreement with that the researches of Kritzinger et al. (2002), Lee et al. (2001) and Prasad et al. (2010). The crude extracts of *S. nodiflora* (Figure 3) and *S. bicolor* (Figure 4) showed inhibition of mycelial growth of *Fusarium* sp. Which is similar to the researches of Ogebor and Adekunle (2005) and Soetan et al. (2006).

The *Z. officinale* and *P. betle* had 100% of inhibition on mycelial growth of *Fusarium* sp. at 2,500-10,000 ppm (Table 1). These results have been confirmed by some researches, for examples Sawatdikarn (2011) noted that *Z. officinale* crude extract at 1,000-10,000 ppm inhibited mycelial growth of *Curvularia* sp. (the pathogen of dirty

Table 1. Efficacy of different concentration of some medicinal plants crude extracts on mycelial growth inhibition of *Fusarium* sp.

Medicinal herb crude extracts	Mycelial growth inhibition (%)				
	1,000 ppm	2,500 ppm	5,000 ppm	7,500 ppm	10,000 ppm
Boesenbergia pandurata	53[d]	64[d]	73[c]	100[a]	100[a]
Curcuma longa	71[b]	76[c]	82[b]	100[a]	100[a]
Zingiber officinale	62[c]	100[a]	100[a]	100[a]	100[a]
Alpinia galangal	21[f]	28[g]	43[g]	64[d]	76[c]
Zingiber cassumunar	51[c]	82[b]	100[a]	100[a]	100[a]
Amomum xanthioides	8[g]	20[g]	29h	100[a]	100[a]
Kaempferia galanga	71[b]	83[b]	86[b]	100[a]	100[a]
Curcuma aromatica	83[b]	88[b]	100[a]	100[a]	100[a]
Curcuma xanthorrhiza	76[b]	78[c]	79[c]	80[b]	100[a]
Kaempferia parviflora	46[e]	48[e]	50[e]	51[e]	54[e]
Amonum krervanh	53[d]	69[c]	80[c]	84[b]	87[b]
Syzygium aromaticum	100[a]	100[a]	100[a]	100[a]	100[a]
Allium sativum	26[f]	39[f]	52[f]	57[e]	61[d]
Allium ascolonicum	32[f]	33[f]	45[g]	50[e]	68[d]
Cymbopogon citratus	56[d]	60[d]	69[d]	76[c]	79[c]
Cymbopogon nardus	44[e]	48[e]	56[e]	65[d]	100[a]
Leptochloa chinensis	30[f]	38[f]	50[f]	53[e]	63[d]
Eupatorium odoratum	28[f]	46[e]	47[f]	57[e]	74[c]
Piper betle	58[d]	100[a]	100[a]	100[a]	100[a]
Synedrella nodiflora	33[f]	37[f]	37[g]	39[f]	42[f]
Cassia siamea	45[e]	49[e]	59[e]	70[c]	84[b]
Sorghum bicolor	11[g]	23[g]	25h	30[g]	32[g]
Rosmarinus officinalis	71[b]	73[c]	75[c]	79[b]	100[a]
Origanum vulgare	100[a]	100[a]	100[a]	100[a]	100[a]
C. V. (%)	15.64	12.85	13.26	10.25	11.26

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

panicle disease of rice) and the ginger crude extracts (*Z. officinale*) inhibited mycelial growth of *T. padwickii* in rice (Shetty et al., 1989). On the other hand, Ali et al. (2010) who reported the extract of *P. betle* against four pathogens namely *A. flavus, A. niger, A. fumigatus* and *A. paraciticus* found that the extract showed the inhibition of the mycelial growth of the pathogens.

The crude extracts of *Z. cassumunar* and *C. aromatica* showed 100% inhibition on mycelial growth *Fusarium* sp. at 5,000-10,000 ppm. These results are in agreement with that the researches of Sawatdikarn (2011) and Saleem et al. (2011).

The four crude extracts, namely *B. pandurata, C. longa, A. xanthioides* and *K. galanga* showed 100% inhibition of mycelial growth at 7,500-10,000 ppm. These results have been confirmed by some researches, for examples Sawatdikarn (2011) noted that three plant crude extracts in Zingiberaceae species namely *B. pandurata, A. xanthioides* and *K. Galanga* at 10,000 ppm concentrations showed the highest inhibition on mycelial growth of *Curvularia* sp. for 100 100 and 95%, respectively. In another study, Saleem et al. (2011) who studied essential oil of *C. longa* against three pathogens, including *E. coli*, *P. aeroginosa* and *S. aureus* found that the essential oil of *C. longa* showed the highest 100% inhibition of the pathogens.

For the three plant crude extracts namely *C. xanthorhiza, C. nardus* and *R. officinalis* had 100% inhibition on mycelial growth *Fusarium* sp. at 10,000 ppm. These results are in agreement with the researches on antimicrobial activity including Husein et al. (2009) showing the antimicrobial activity of crude extracts from *C. xanthorrhiza* against *E. coli*, *S. aureus* and *B. cereus* and that the ethanol extract inhibited *S. aureus* and *B. cereus* and ethyl acetate extract inhibited *E. coli*. On the other hand, Prasad et al. (2010) found *C. nardus* essential oil as highly effective in controlling *Phomopsis azadirachtae* (the causative agent of die-back disease of neem) showed 100% inhibition of mycelial growth at 2,500 ppm. The crude extracts from citronella grass (*C. nardus*)

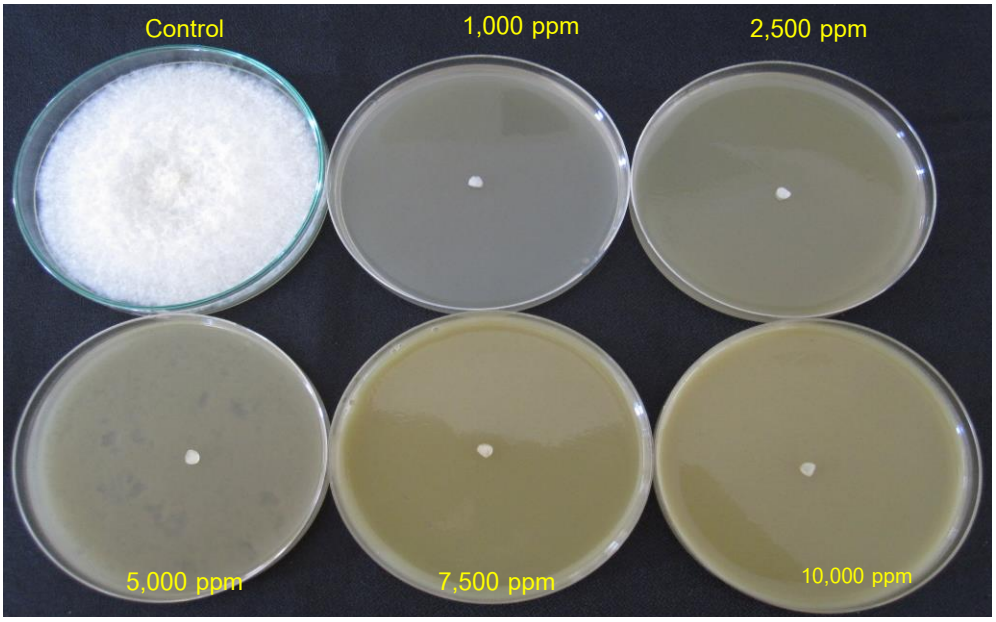

Figure 1. Effect of *Syzygium aromaticum* crude extract on the mycelial growth of *Fusarium* sp. at different concentrations (control treatment, 1000, 2000, 2500, 5000, 7500 and 10,000 ppm).

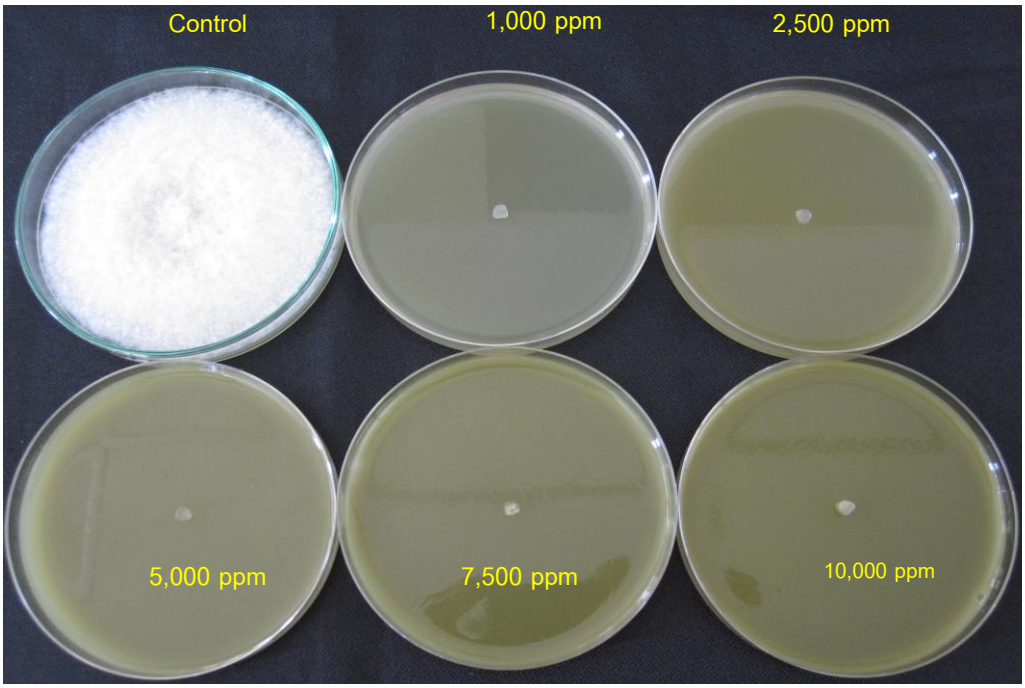

Figure 2. Effect of *Origanum vulgare* crude extract on the mycelial growth of *Fusarium* sp. at different concentrations (control treatment, 1000, 2000, 2500, 5000, 7500 and 10,000 ppm).

showed inhibition on mycelial growth of *Fusarium* sp. because of decreased wall synthesis, plasma membrane disruption, microcondrial structure disorganization and inhibitor of biodegradation and storage contaminating fungi

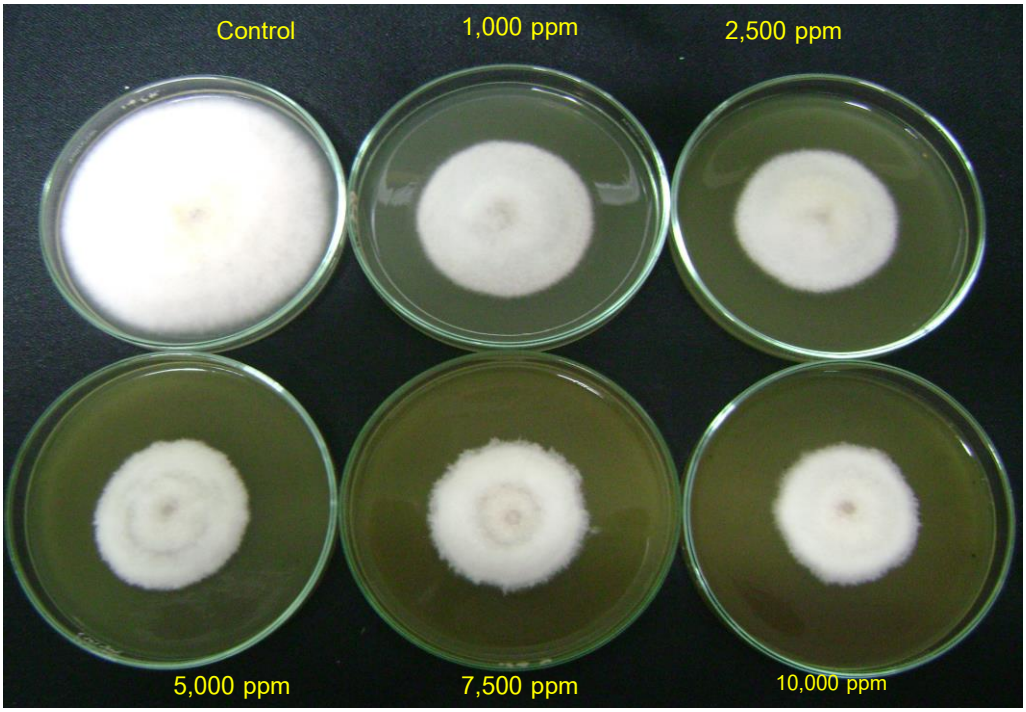

Figure 3. Effect of *Synedrella nodiflora* crude extract on the mycelial growth of *Fusarium* sp. at different concentrations (control treatment, 1000, 2000, 2500, 5000, 7500 and 10,000 ppm).

(Billerbeck et al., 2009). In another study, although, Sawatdikarn (2011) reported *R. officinalis* crude extract against *Curvularia* sp. (the pathogen of dirty panicle disease of rice) at different concentrations and showed *R. Officinalis* crude extract at 7,500-10,000 ppm, it can completely inhibit the mycelial growth of *Curvularia* sp., and showed agreement with the antibacterial activity of *R. officinalis* essential oil against *B. cereus* (Valero and Salmeron, 2003).

The remaining crude extracts such as *A. galanga, K. parviflora, A. krervanh, A. sativum, A. ascolonicum, C. citratus, L. chinensis, E. odoratum, S. nodiflora, C. siamea* and *S. bicolor* showed inhibition at 10,000 ppm concentrations on mycelial growth of *Fusarium* sp. between 32% of *S. bicolor* crude extract to 88% of *A. krervanh* crude extract (Table 1). Among the crude extracts of the tested plants, eleven showed effective potentials against *Fusarium* sp., these results have been confirmed by former several researches, for examples Johnny et al. (2011) tested rhizome extracts of *A. galanga* extracted against *C. capsici* at different concentrations and found that the crude extracts showed the highest inhibition of radial growth at 10.0 µg/ml concentrations. On the other hand, Sawatdikarn (2011) who studied four crude extracts namely *K. parviflora, A. krervanh, A. ascolonicum* and *L. chinensis* against *Curvularia* sp. (the pathogen of dirty panicle disease of rice) at different concentrations found that the *K. parviflora, A. krervanh, A. ascolonicum* and *L. chinensis* crude extracts at 10,000 ppm showed inhibition of mycelial growth for 68, 88, 70, and 63%, respectively., On the other hand, Chohan et al. (2011) tested plant extracts (*Allium sativum*) for their efficacy against *F. oxysporum f. sp. gladioli* (the pathogen of corm rot of gladiolus) at different concentrations and found extract of *A. sativum* at 8% showed inhibition of the mycelial growth of 35%.

For lemongrass (*C. citratus*) crude extracts showed the inhibition on mycelial growth of *Fusarium* sp. for 56-79% at 1,000-10,000 ppm concentrations, the research is related to the lemongrass *(C. citratus*) essential oil for the inhibited on mycelial growth of some pathogen; *Collectotrichum gloeosporioides* (Palhano et al., 2004). *F. moniliforme* (Nwachukwu and Umechuruba, 2001) and *F. verticillioides*, *F. proliferatum* and *F. graminearum* (Velluti et al., 2004) and the essential oils of lemongrass showed the inhibition of microbial agent in storage of some seeds; maize and cowpea (Adegoke and Odesola, 1996) and melon (Bankole and Joda, 2004). The phytochemical from lemongrass crude extracts showed the inhibition on mycelial growth *Fusarium* sp. because of decrease of hyphal diameter and hyphal wall, plasma membrane disruption, microcondrial structure disorganization and inhibitor of biodegradation and storage contaminating fungi (Helal et al., 2006).

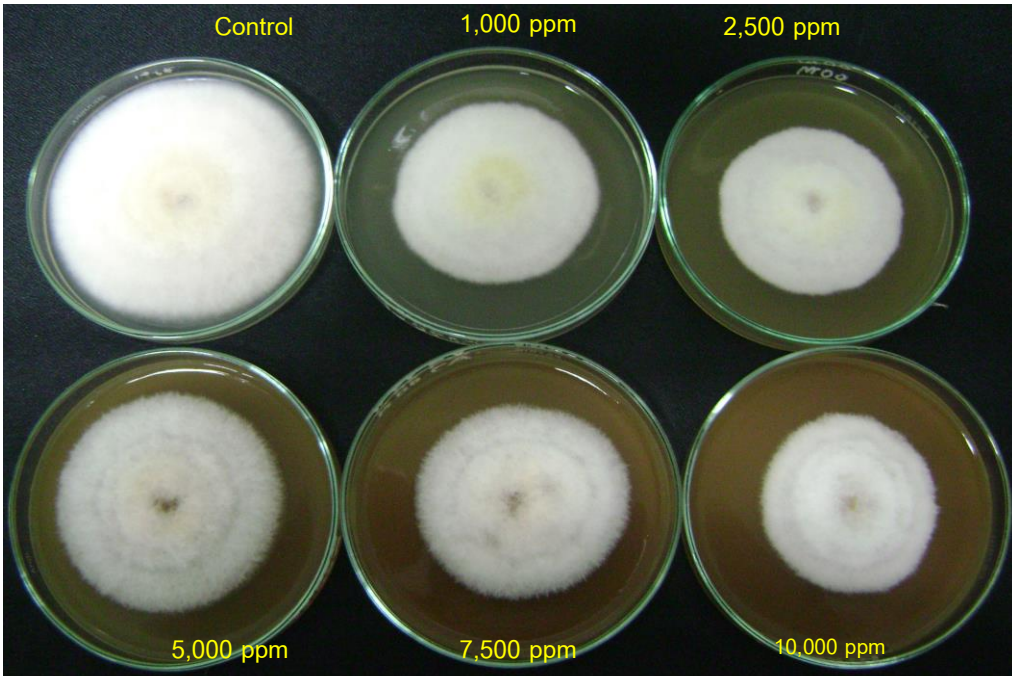

Figure 4. Effect of *Sorghum bicolor* crude extract on the mycelial growth of *Fusarium* sp. at different concentrations (control treatment, 1000, 2000, 2500, 5000, 7500 and 10,000 ppm).

The crude extracts of *E. odoratum* showed inhibition at 10,000 ppm for 74% of mycelail growth of *Fusarium* sp. These results are in agreement with those of Owalabi et al. (2010)**.** On the other hand, the crude extract of *C. siamea* had 84% inhibition at 10,000 ppm (Table 1) which agree with the antifungal activity of *C. siamea* crude extract against fungal growth in grain maize storage (Chatterjee, 1990) and the methanolic extracts of *C. siamea* exhibited strong antibacterial activities against *B. cereus, L. monocytogenes* and *S. aureus* (Nanasombat and Teckchuen, 2009).

The objective of this study was to screen the effect of twenty-four crude extracts on the mycelial growth of *Fusarium* sp. The usage of all crude extract was the best for *Fusarium* sp. control due to their harmless effect on enviromental condition, to user and to consumer. The study is related to several researches that noted the antifungal activity of crude extracts and essential oils including, the crude extracts in *Zingiberaceae* species namely *B. pandurata, A. xanthioides* and *K. Galanga* for *Curvularia* sp. (the pathogen of dirty panicle disease of rice) (Sawatdikarn, 2011), the lemongrass *(C. citratus*) essential oil that inhibited mycelial growth of some pathogen; *Collectotrichum gloeosporioides* (Palhano et al., 2004) *F. moniliforme* (Nwachukwu and Umechuruba, 2001) and *Fusarium verticillioides*, *F. proliferatum* and *F. graminearum* (Velluti et al., 2004) and the essential oils of citronella grass *(C. nardus)* for *Phomopsis azadirachtae* (the causative agent of die-back disease of neem) control (Prasad et al., 2010).

The phytochemical effect of each crude extracts on inhibiting the mycelial growth of *Fusarium* sp., have been confirmed by several researches, for examples alkaloids and flavanoids from the leaves of *S. nodiflora* (Bhogaonkar et al., 2010), saponins and tannins from the leaves *of S. bicolor* (Soetan et al., 2006), methoxyflavone from the rhizome of *K. parviflora* (Kummee et al., 2008), alpha-pinene and beta-pinene from the leaves *of E. odoratum* (Owalabi et al., 2010), carnosic acid and rosmarinic acid from the leaves of *R. officinalis* (Frankel et al., 1996) and curcumin from the rhizome of *C. xanthorrhiza* (Husein et al., 2009).

This study indicated that the twenty-four crude extracts can be used for *Fusarium* sp. control and two plant crude extracts can be used for dirty panicle control. The crude extracts of *S. aromaticum* and *O. vulgare* showed 100% inhibition on mecelial growth of *Fusarium* sp. at all concentrations.

Conclusion

All the used twenty-four crude extracts showed significant antifungal activity against *Fusarium* sp. The result showed that the *S. aromaticum* and *O. vulgare* crude extracts showed 100% inhibition on mycelial growth at all

concentrations, whereas, the *S. nodiflora* and *S. bicolor* crude extracts at 10,000 ppm gave the lowest inhibition of 42 and 32%, respectively.

Conflict of Interests

The author has not declared any conflict of interests.

REFERENCES

Abdelmonem AM (2000). Status of seed pathology and seed health testing in Egypt. Seed Sci. Technol. 28:533-547.

Adegoke GO, Odesola BA (1996). Storage of maize and cowpea and inhibition of microbial agents of biodeterioration using the powder and essential oil of lemongrass (*Cymbopogon citratus*). Int. Biodeterior. Biodegrad. 37(1-2):81-84.

Ali I, Khan FG, Suri KA, Gupta BD, Satti NN, Dutt P, Afrin F, Qazi GN, Khan IA (2010). *In vitro* antifungal activity of hydroxychavical isolated from *Piper betle* L. Ann. Clin. Microbiol. Antimicrob. 9:7.

Bankole SA, Joda AO (2004). Effect of lemon grass (*Cymbopogon citratus* Stapf) powder and essential oil on mould deterioration and aflatoxin contamination of melon seeds (*Colocynthis citrullus* L.). Afr. J. Biotechnol. 3:52-59.

Bansod S, Rai M (2008). Antifungal activity of essential oils from Indian medicinal plants against human pathogenic: *Aspergillus fumigatus* and *A. niger*. World J. Med. Sci. 3:81-88.

Bhogaonkar P, Dagawal Y, Ghorpade DS (2011). Pharmacognostic studies and antimicrobial activity of *Synerdrella nodiflora* (L.) Gaertn. Biosci. Discov. 2:317-321.

Billerbeck VGD, Roques CG, Manes JM, Fonvieille JL, Dargent R (2001). Effects of *Cymbopogon nardus* (L.) W. Watson essential oil on the growth and morphogenesis of *Aspergillus niger*. Can. J. Microbiol. 47:9-17.

Chatterjee D (1990). Inhibition of fungal growth and infection in maize grains by spice oils. Lett. Appl. Microbiol. 11:148-151.

Chohan S, Atiq R, Mehmood MA, Naz S, Siddique B, Yasmin G (2011). Efficacy of few plant extracts against *Fusarium oxysporum* f. sp. Gladioli, the cause of corm rot of gladiolus. J. Med. Plants Res. 5:3887-3890.

Frankel EN, Hunag SW, Aeschbach R, Prior E (1996). An-tioxidant activity of a rosemary extract and its constituents, carnosic acid carnosol and rosmarinic acid, in bulk oil and oil-in water emulsion. J. Agric. Food Chem. 44:131-135.

Helal GA, Sarhan MM, Shahla ANKA, El-Khair EAK (2006). Effects of *Cymbopogon citratus* L. essential oil on the growth, lipid content and morphogenesis of Asperillus niger ML2-strain. J. Basic Microbiol. 46:456-469.

Husein S, Parhusip A, Ramasi EF (2009). Study on antibacterial activity from Temulawak (*Curcuma xanthorrhiza* Roxb.) rhizomes against pathogenics microbes cell destruction. J. Appl. Indust. Biotechnol. Trop. Region. 2:1-4.

Istianto M, Emilda D (2011). Preliminary study of the activity of some essential oils against *Fusarium oxysporum* f. sp. c*ubense*. J. Fruit Orman. Plant Res. 19(2):111-121.

Johnny L, Yusuf UK, Nulit R (2011). Antifungal activity of selected plant leaves crude extracts against a pepper anthracnose fungus, Collectotrichum capsici (Sydow) butler and bisby (Ascomycota : Phyllachorales). Afr. J. Biotechnol. 10:4157-4165.

Kritzinger Q, Aveling TAS, Marasas WFO (2002). Effect of essential plant oils on storage fungi, germination and emergence of cowpea seeds. Seed Sci. Technol. 30:609-619.

Kummee S, Tewtrakul S, Subhadhirasakul S (2008). Antimicrobial activity of the ethanol extract and compounds from the rhizome of *Kaempferia parviflora*. Songklanakarin J. Sci. Technol. 30:463-466.

Lee SE, Park BS, Kim MK, Choi WS, Kim HT, Cho KY, Lee SG, Lee HS (2001). Fungicidal activity of pipernonaline: A piperidine alkaloid derived from long pepper, *Piper longum* L. against phytopathogenic fungi. Crop Prot. 20:523-528.

Moghtader M, Salari H, Farahmand A (2011). Evaluation of the antifungal activity of rosemary oil and comparision with synthetic bomeol and fungicide on the growth of *Aspergillus flavus*. J. Ecol. Nat. Environ. 3:210-214.

Nanasombat S, Teckchuen N (2009). Antimicrobial, antioxidant and anticancer activities of thai lacal vegetables. J. Med. Plants Res. 3:443-449.

Nwachukwu EO, Umechuruba CI (2001). Antifungal activities of some leaf extracts on seed-borne fungi of African yam bean seeds, seed germination and seedling emergence. J. Appl. Sci. Environ. Manag. 5:29-32.

Ogbebor N, Adekunle AT (2005). Inhibition of conidial germination and mycelial growth of *Corynespora cassiicola* (Berk and Curt) of rubber (*Havea brasilliensis* muell. Arg.) using extracts of some plants. Afr. J. Biotechnol. 4:996-1000.

Ou SH (1985). Rice Disease. Commonwealth Agricultural Bureaux 2nd Ed. Great Britain. 380p.

Owalabi MS, Ogundajo A, Yusuf KO, Lajide L, Villanueva HE, Tuten JA, Setzor WN (2010). Chemical composition and bioactivity of the essential oil of *Chromolaena odorata* from Nigeria. Records Nat. Prod. 4:72-78.

Palhano FL, Vichens TTB, Santos RB, Orlando MTD, Ventura JA, Fernandes PMB (2004). Inactivation of *Collectotrichum gloeosporioides* spores by high hydrostatic pressure combined with citral or lemongrass essential oil. Int. J. Food Microbiol. 95:61-66.

Prasad MNN, Bhat S, Sreenivasa MY (2010). Antifungal activity of essential oils against *Phomopsis azadirachtae*-the causative of die-back disease of neem. J. Agric. Technol. 6:127-133.

Saleem M, Daniel B, Murli K (2011). Antimicrobial activity of three different rhizomes of *Curcuma longa* and *Curcuma aomatica* on uropathogens of diabetic patients. Int. J. Pharm. Pharm Sci. 3:1-8.

Sawatdikarn S (2011). Antifungal activity of twenty-four medicinal crude extracts against *Curvularia* sp., The pathogen of dirty panicle disease in rice. *In* 37th Congress on Science and Technology of Thailand. pp 1-8.

Sheng-Yang W, Pin-Fun C, Shang-Tzen C (2005). Antifungal activities of essential oil and their constituents from indigenous cinnamon (*Cinnamomum osmophloeum*) leaves against wood decay fungi. Bioresour. Technol. 96:813-818.

Shetty SA, Prakash HS, Shetty HS (1989). Efficacy of certain plant extracts against seed-borne infection of *Trichoconiella padwickii* in paddy rice (*Oryza sativa*). Can. J. Bot. 57:1956-1958.

Soetan KO, Oyekunle MA, Aiyelaagbe OO, Rafunso MA (2006). Evaluation of the antimicrobial activity of saponin extract of *Sorghum bicolor* L. Moench. Afr. J. Biotechnol. 5:2405-2407.

Valero M, Salmeron MC (2003). Antimicrobial activity of 11 essential oils against *Bacillus cereus* in tyndallized carrot broth. J. Food Microbiol. 85:73-81.

Velluti A, Martin SP, Gonzalez, Ramos AJ, Sanchis V (2004). Initial screening for inhibitory activity of essential oils on growth of *Fusarium verticillioides*, *F. proliferatum* and *F. graminearum* on maize-based agar media. Food Microbiol. 21:649-656.