ISOLATION, IDENTIFICATION AND ANTIMICROBIAL ACTIVITY OF SOIL FUNGI

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Abstract

In this study, three different soil samples were collected from three Townships (North Oakkala, Mayangone and Insein) in Yangon Region. The soil type from North Oakkala and Insein was clay loam whereas that from Mayangone was sandy clay. Twenty-four soil fungi were isolated from three different soil samples by the serial dilution method. The forms of fungal colonies were circular, irregular, filamentous and rhizoid. The elevation of colonies was raised, convex, flat, umbonate while the margins of colonies of isolated fungi were entire, undulate, filiform, curled and lobate. Antimicrobial activity of isolated fungal strains was evaluated by the agar well diffusion method with eight test organisms: *Agrobacterium tumefaciens, Escherichia coli, Staphylococcus aureus, Pseudomonas fluorescens, Bacillus subtilis, Bacillus pumilus, Malassezia furfur* and *Candida albicans.* Among 24 isolates, seventeen strains showed different levels of antimicrobial activities. Among seventeen active strains, isolated fungal strains WT-14, 17 and 24 were moderately antimicrobial activity while seven strains WT-1, 2, 4, 7, 9, 13 and 15 showed highly antimicrobial activity against all test organisms. According to the morphological and microscopical characters of bioactive seven strains, six of them (strains WT-1, 2, 4, 9, 13 and 15) were identified as *Aspergillus* sp. while strain WT-7 was *Rhizoctonia* sp.

Keywords: Antimicrobial activity, Identification, Morphological characters, Soil fungi

Introduction

Soil provides ecosystem services critical for life: soil acts as a water filter and a growing medium; provides habitat for billion of organisms, and supplies most of the antibiotics used to fight diseases (Soil Science Society of America). Biodiversity loss also occurs in soil in which there is great diversity of living organisms that depends on the vegetation, as well as on the quantity of organic material produced (Fierer and Jackson, 2006).

The microorganisms plays significant role in soil ecosystem. Estimate point to 1.5 million fungal species worldwide of which only about 99.000 has been described using classical taxonomic approaches (Hawksworth, 1991; 2001). Fungi are very vital for the soil ecosystem since they play a key role in different essential processes including organic matter decomposition (Christensen, 1998). The novel discoveries of microorganisms can produce as a potential source of new antibiotics in the recent decades (Ullah *et al*., 2017). Fungi produce many antibiotics, having antibiotics and antifungal activity, which are widely used as drugs over the world especially the penicillin, cephalosporin and fusidic acid (Dobashi *et al*., 1998).

The objectives of this paper were to isolate the soil fungi on four different media Blakeslee's Malt Extract Agar, Czapek Dox Agar, Potato Dextrose Agar and Low Carbon Agar, to study the colony morphology and the cultural characteristics of isolated soil strains, to observe the antimicrobial activity on eight test organisms and to identify possible genus of active soil fungi.

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Materials and Methods

Collection of soil samples

The soil samples (15 cm depth) were collected from three different Townships in Yangon Region, during July 2019, and put sterilized polythene bags after removing the surface soil for the isolation of fungi. Soil colour, soil type and their location were shown in Table 1.

Table 1 Collected soil samples from three different townships of Yangon Region

Sample	Place	Soil Color	Soil Type	pH	Location
1	North Oakkala	Red	Clay Loam	7.02	N16º53.665" E 96º08.257"
2	Mayangone	Brown	Sandy Clay	6.27	N16º52.307" E 96º08.412"
3	Insein	Red	Clay Loam	6.40	N16º53.080" E 96º06.608"

Isolation of soil fungi by serial dilution method (Dubey, 2002)

Each soil sample (1.0 g) was introduced into a conical flask containing 99 mL of distilled water. The flask was then shaken 30 minutes in order to make the soil particles free from each other. This solution was serial diluted from 10^{-3} to 10^{-7} dilution in separate test tubes and 0.5 mL each of the above dilution was separately transferred into sterile petri dishes under aseptic condition. The sterilized medium in conical flask was cooled down to about 45ºC and separately poured into each of the petri-dish containing the respective solid dilutions.

The inoculated plates were shaken clock-wise and anticlock-wise direction for about 5 minutes so as to make uniform distribution of the fungi inoculums. When the agar was solidified, the inoculated plates were inverted and incubated at 27º-30º C for 3-6 days at the Laboratory of Biological Development Center of Pathein University.

Four different culture media for the isolation of fungi (Ando, 2004)

1. Blankeslee's Malt Extract Agar (BMEA medium)

Malt extract 20.0 g, Peptone 1.0 g, Glucose 20.0 g, Agar 18.0 g, DW 1 L, pH 6.5

2. Czapek-Dox Agar (CzA medium)

Sucrose 30.0 g, $NaNO_3$ 2.0 g, K_2HPO_4 1.0 g, $MgSO_4.7H_2O$ 0.5 g, KCl 0.5 g, $FeSO_4 .7H_2O$ 0.01g, Agar 18.0 g, Distilled Water 1L, pH 7 .0

3. Potato Dextrose Agar (PDA Medium)

Sucrose 30.0 g, $NaNO_3$ 2.0 g, K_2HPO_4 1.0 g, $MgSO_4 .7H_2O$ 0.5 g, KCl 0.5 g, $FeSO_4 .7H_2O$ 0.01g, Agar 18.0 g, Distilled Water 1 L, pH 7

4. Low Carbon Agar (LCA) medium for first culture

Glucose 2.0 g, Sucrose 2.0 g, K_2HPO_4 1.0 g, $MgSO_4 .7H_2O$ 0.5 g, KNO_3 1.0 g, KCl 0.5 g

Agar 18.0 g, DW 1 L, pH6.

After autoclaving (121ºC for 30mins), Chloranphenicol was added into the medium.

Morphological characters of isolated fungi (Ando, 2004)

After incubating fungi on the plate cultures for 5 days, colony morphological characters such as the surface color and the reverse color, the elevations of colonies and the margins of colonies of all isolated fungi were photographed and measured.

Antimicrobial activities by agar well method (Collin, 1965)

Isolated stains were tested by agar well method for their preliminary antimicrobial activities. Cork borer was used to make the wells (8 mm in diameter) in the autoclaved basal antimicrobial test-medium. Wells impregnated with 3-6 days old culture fermented broth ($20\mu L$) were incubated at room temperature for 24-28 hours. After 24-28 hours of incubations, the clear zones (inhibitory zones) were measured. Therefore, the diameter of clear zones had been observed as potent activity as shown by respective strain. Clear zones surrounding the wells indicated the presence of antimicrobial activities which inhibit the growth of the test organisms selectively (Table 2).

Table 2 Eight kinds of test organisms used for antimicrobial activity

Test Organisms	Code Numbers	Disease
Agrobacterium tumefaciens	NITE 09678	Crown gall disease
Escherichia coli	AHU 5436	Diarrhoea, abdominal pain
Staphylococcus aureus	AHU 8456	Boil and food poisoning
Pseudomonas fluorescens	IFO 94307	Septicemia
Bacillus subtilis	IFO 90571	Fever
Bacillus pumilus	IFO 90571	Fever
Malassezia furfur	AUS 01020	Dandruff, Dermatitis
Candida albicans	NITE 09542	Candidasis, Skin disease

NITE = National Institute of Technology Evaluation

Results

Isolation of fungi from soil samples

In present research work, the soil samples were collected from three different places: North Oakkala, Mayangone and Insein Townships in Yangon Region. The soil type of North Oakkala was clay loam and pH value of 7.02. Mayangone Townships was sandy clay and pH value of 6.27, and Insein Townships was clay loam and pH value of 6.40 respectively.

All isolated fungal strains were temporarily named as WT-1 to WT-24. These total of 24 fungal isolates were obtained; five strains from soil sample 1, seven strains from soil sample 2 and twelve strains from soil sample 3. Soil fungal strains were isolated on four different media: 11 strains were isolated on BMEA Medium, 8 strains on PDA Medium, 4 strains on LCA Medium and 1 strain on CzA.

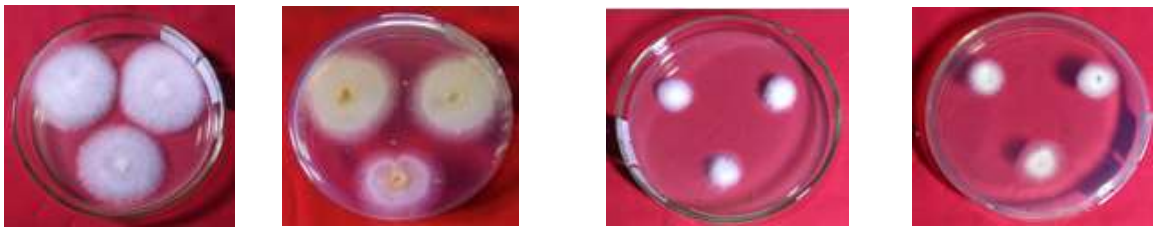
Morphological characters of isolated fungi

The surface color of strains WT-1, 11, 17, 18, 19, 22 and 23 was white. The surface colors of other strains were green, greenish white, dark green, pale green, black, white black and yellow. The reverse color of WT-1 was white and the other strains were white black, green, greenish white, pale green, black and cream. The forms of colonies were circular, irregular, filamentous and rhizoid. The elevations of fungal colonies were raised, convex, flat, and umbonate. The margins of

fungal colonies were entire, undulate, filform, curled and lobate. These results were shown in Table 3 and Figures 1 to 12.

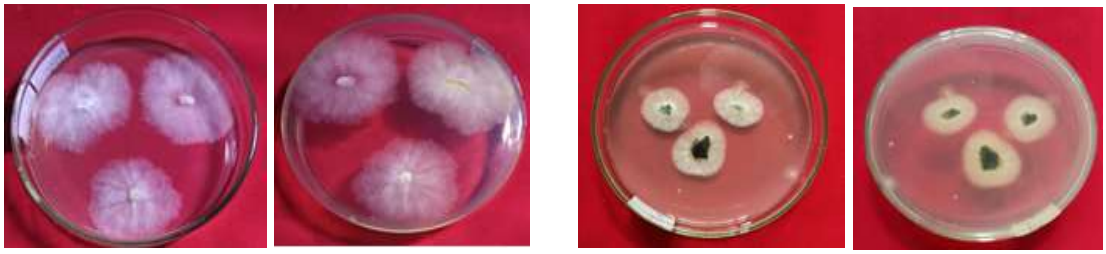
Table 3 Morphological character of isolated fungi

Strain No.	Surface color	Reverse color	Form	Elevation	Margin	Size
WT-1	White	Yellowish White	Circular	Raise	Undulate	Large
WT-2	White	White	Circular	Flat	Entire	Small
WT-3	White	Cream	Circular	Raised	Entire	Small
WT-4	Black White	Black White	Irregular	Convex	Entire	Medium
WT-5	Black White	Greenish White	Filamentous	Flat	Undulate	Medium
WT-6	Greenish White	Greensih White	Circular	Flat	Entire	Medium
WT-7	Black White	Greenish White	Circular	Raised	Entire	Medium
WT-8	White	Yellowish White	Circular	Flat	Undulate	Small
WT-9	White	Yellowish White	Circular	Raised	Undulate	Large
WT-10	Black White	Yellowish White	Circular	Flat	Entire	Large
WT-11	Black White	White	Circular	Raised	Entire	Small
WT-12	Pale Green	Pale Green	Irregular	Convex	Entire	Large
WT-13	White	Cream	Filamentous	Filamentous	Undulate	Medium
WT-14	Dark Green	Dark Green	Circular	Flat	Entire	Medium
WT-15	White	White	Circular	Raised	Entire	Large
WT-16	Greenish White	White	Circular	Flat	Undulate	Small
WT-17	Green	White	Circular	Raise	Undulate	Large
WT-18	Black	White	Circular	Flat	Entire	Small
WT-19	Black	White Black	Circular	Raised	Entire	Small
WT-20	Pale Green	White	Irregular	Convex	Entire	Medium
WT-21	Greenish White	White	Filamentous	Flat	Undulate	Medium
WT-22	Dark Green	Cream	Circular	Flat	Entire	Medium
WT-23	Black White	Cream	Circular	Raised	Entire	Medium
WT-24	Cream	Pale Yellow	Circular	Flat	Undulate	Small



Front view (WT-1) Reverse view Front view (WT-2) Reverse view

Figure 1 Colony morphology of isolated soil fungi WT-1 and WT-2

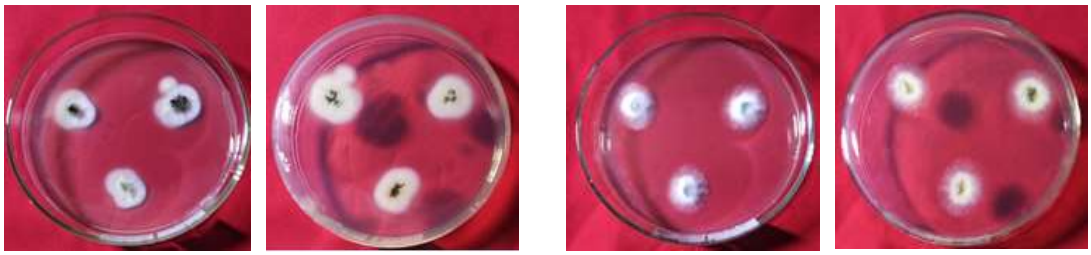


Front view (WT-3) Reverse view Front view (WT-4) Reverse view

Figure 2 Colony morphology of isolated soil fungi WT-3 and WT-4

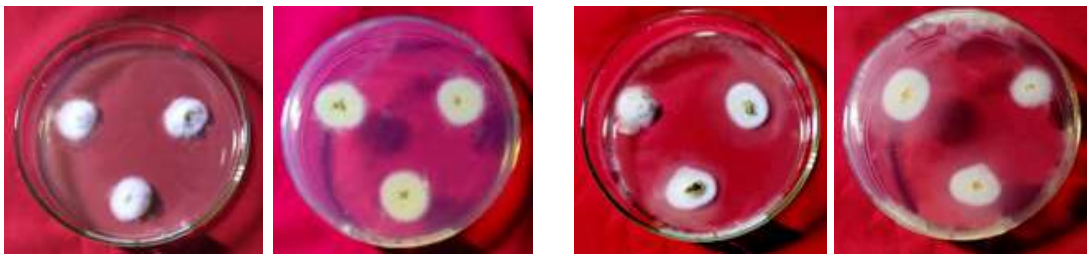
Front view (WT-5) Reverse view Front view (WT-6) Reverse view

Figure 3 Colony morphology of isolated soil fungi WT-5 and WT-6



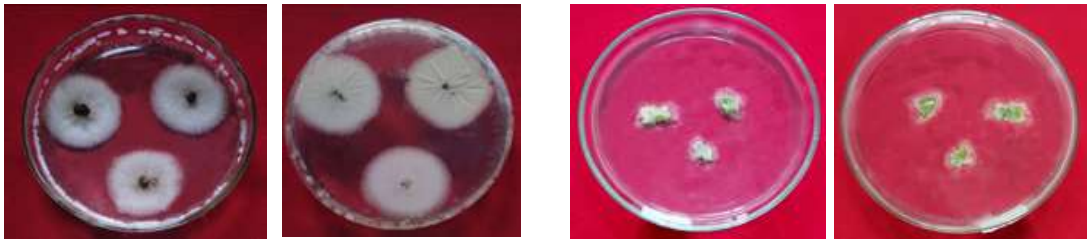
Front view (WT-7) Reverse view Front view (WT-8) Reverse view

Figure 4 Colony morphology of isolated soil fungi WT-7 and WT-8



Front view (WT-9) Reverse view Front view (WT-10) Reverse view

Figure 5 Colony morphology of isolated soil fungi WT-9 and WT-10

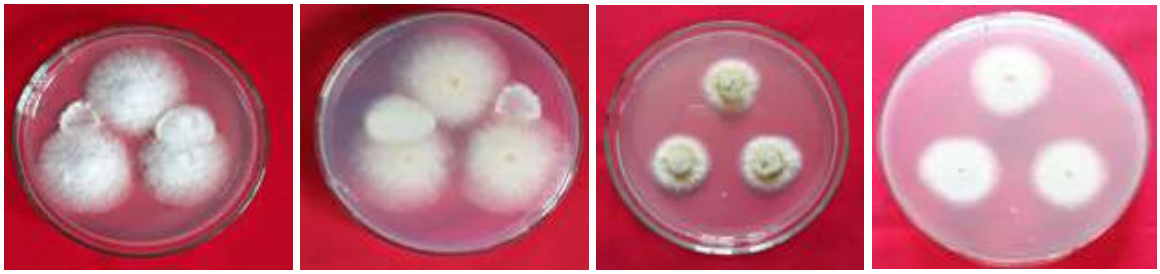


Front view (WT-11) Reverse view Front view (WT-12) Reverse view

Figure 6 Colony morphology of isolated soil fungi WT-11 and WT-12

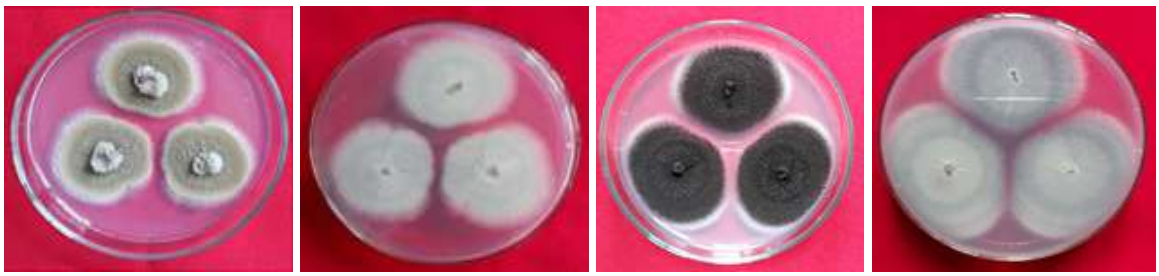
Front view (WT-13) Reverse view Front view (WT-14) Reverse view

Figure 7 Colony morphology of isolated soil fungi WT-13 and WT-14



Front view (WT-15) Reverse view Front view (WT-16) Reverse view

Figure 8 Colony morphology of isolated soil fungi WT-15 and WT-16



Front view (WT-17) Reverse view Front view (WT-18) Reverse view

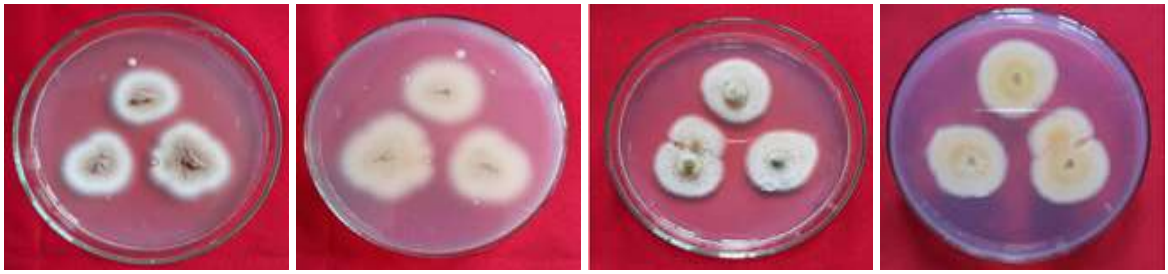
Figure 9 Colony morphology of isolated soil fungi WT-17 and WT-18

Front view (WT-19) Reverse view Front view (WT-20) Reverse view

Figure 10 Colony morphology of isolated soil fungi WT-19 and WT-20

Front view (WT-21) Reverse view Front view (WT-22) Reverse view

Figure 11 Colony morphology of isolated soil fungi WT-21 and WT-22



Front view (WT-23) Reverse view Front view (WT-24) Reverse view

Figure 12 Colony morphology of isolated soil fungi WT-23 and WT-24

Antimicrobial activity of all isolated fungal strains

All fungal strains were tested their antimicrobial activity by using eight test orgainsms. Among 24 isolates, seventeen strains showed different levels of antimicrobial activity. Among seventeen strains, seven isolated fungi (WT-1, 2, 4, 7, 9, 13 and 15) showed highly antimicrobial activity against all test organisms. Fungal strain WT-4 showed the highest antimicrobial activity (24.8 mm and 26.4 mm) on *Bacillus pumilus* and *Bacillus subtilis* respectively. Strains WT-9 and WT-13 also exhibited highly antimicrobial activity (25.1 mm) and WT-7 showed (23.6 mm) on *Bacillus subtilis.* Strain WT-15 also exhibited high antimicrobial activity (22.3 mm) against *Agrobacterium tumefaciens* respectively. Moreover, strains WT-1 and WT-2 showed highly antifungal activity (19.2 mm) and (21.9 mm) against *Candida albicans.*

Identification of Active Fungal Strains

Microscopic characters of strains WT-1, 2, 4, 9, 13 and 15

Conidiophores were upright, simple, terminating in a globose or clavate swelling, bearing phialides at the apex. Conidia 1 celled, globose, often variously colored in mass. Therefore, these strains WT-1, 2, 4, 9, 13 and 15 were identified as *Aspergillus* sp. (Figures 13−18).

Figure 13 Microscopic characters of WT-1

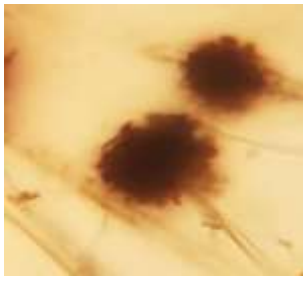


Figure 14 Microscopic characters of WT-2

Figure 15 Microscopic characters of WT-4

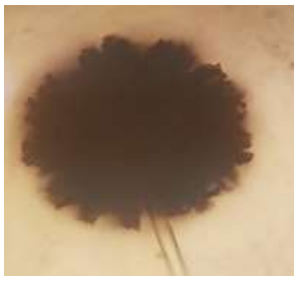


Figure 16 Microscopic characters of WT-9

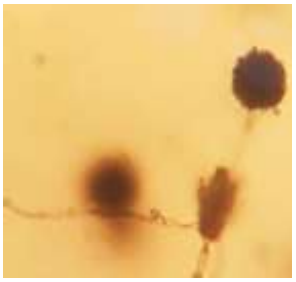


Figure 17 Microscopic characters of WT-13

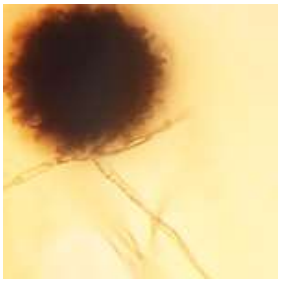


Figure 18 Microscopic characters of WT-15

Microscopical characters of strain WT-7

Mycelium hyaline was white. Cells of mycelium usually long, septa of branches and set off from the main hypae. Asexual fruit bodies, conidia absent, chlamydospore-like cells in chains. This fungus WT-7 was identified as *Rhizoctonia* sp. (Figure 19).

Figure 19 Microscopic characters strain WT-7

Antimicrobial activity of seven fungal strains

Strain WT-1 showed moderate activity at 5th, 6th and 7th day fermentation. Strain WT-2 showed high activity at 3rd, moderate activity at 4th and 5th day fermentation. Strain WT-4 showed high activity at 5th, 6th and 7th day fermentation. Strain WT-7 showed moderate activity at 3rd, 4th and 5th day fermentation. Strain WT-9 showed moderate activity at 3rd, 4th and 5th day, and high activity at 6th and 7th day fermentation. Strain WT-13 showed moderate activity at 5th, 6th and 7th day and high activity at 3rd day and 4th day. Strain WT-15 showed moderate activity at 3rd day to 7th day on *Agrobacterium tumefaciens* (Table 4 & Figure 20). All seven active strains showed antimicrobial activities on other test organisms: *Escherichia coli, Staphylococcus aureus, Pseudomonas fluorescens, Bacillus subtilis, Bacillus pumilus, Malassezia furfur* and *Candida albicans* (Tables 5-11 and Figures 21-27).

Table 4 Antimicrobial Activity of isolated fungal strains against *Agrobac. tumefaciens*

No	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	10.0	13.4	16.6	16.0	15.1
2	WT-2	20.7	17.7	17.6	13.0	12.0
3	WT-4	17.2	19.6	21.6	28.2	22.4
4	WT-7	16.9	16.4	16.1	14.0	12.5
5	WT-9	18.0	18.2	18.2	21.4	23.0
6	WT-13	19.4	19.2	17.2	16.5	16.2
7	WT-15	14.5	17.0	16.9	16.9	15.5

12-14 mm = weak activity, 15-19 mm = moderate activity, > 20 mm = high activity

A B C D

A: WT-4 against *A. tumefaciens* at 6th day of fermentation period
B: WT-4 against *A. tumefaciens* at 7th day of fermentation period
C: WT-9 against *A. tumefaciens* at 6th day of fermentation period
D: WT-9 against *A. tumefaciens* at 7th day of fermentation period

Figure 20 Antimicrobial activities of selected fungi against *Agrobacterium tumefaciens*

Table 5 Antimicrobial activity of isolated fungal strains against *Escherichia coli*

No.	Isolated Fungi	Fermentation period (Day) and Inhibitory zone (mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	-	21.6	18.0	16.1	14.4
2	WT-2	-	16.0	16.0	17.2	14.6
3	WT-4	12.9	16.6	18.3	15.7	13.7
4	WT-7	9.6	15.1	15.0	14.1	13.7
5	WT-9	14.0	16.7	14.2	13.1	13.0
6	WT-13	11.1	14.2	14.0	13.2	13.6
7	WT-15	12.7	15.7	16.0	16.2	15.8

A B C D

A: WT-9 against *Escherichia coli* at 4th day of fermentation period

B: WT-9 against *Escherichia coli* at 5th day of fermentation period

C:WT-15 against *Escherichia coli* at 6th day of fermentation period

D:WT-15 against *Escherichia coli* at 7th day of fermentation period

Figure 21 Antimicrobial activities of selected fungi against *Escherichia coli*

Table 6 Antimicrobial Activity of isolated fungal strains against *Staphylococcus aureus*

No.	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	-	16.7	12.4	-	-
2	WT-2	-	14.1	22.2	17.8	-
3	WT-4	10.8	15.2	22.5	14.3	13.3
4	WT-7	-	13.7	18.6	-	-
5	WT-9	13.3	15.2	20.0	19.0	13.7
6	WT-13	-	16.6	22.0	-	-
7	WT-15	-	12.2	19.1	16.4	13.7

A B C D

A: WT-2 against *Staphylococcus aureus* at 5th day of fermentation period
B: WT-2 against *Staphylococcus aureus* at 6th day of fermentation period
C:WT-13against *Staphylococcus aureus* at 4th day of fermentation period
D:WT-13 against *Staphylococcus aureus* at 5th day of fermentation period

Figure 22 Antimicrobial activities of selected fungi against *Staphylococcus aureus*

Table 7 Antimicrobial Activity of isolated fungal strains against *Pseudomonas fluorescens*

No.	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	14.9	22.1	18.0	16.2	14.0
2	WT-2	21.3	22.1	16.1	14.5	12.3
3	WT-4	27.1	26.4	18.2	20.6	14.7
4	WT-7	23.6	16.2	16.0	15.1	14.6
5	WT-9	25.1	23.0	18.3	18.8	16.4
6	WT-13	22.5	25.1	20.0	17.2	15.7
7	WT-15	21.4	18.7	18.1	19.4	15.2

A B C

A: WT-4 against *Pseudomonas fluorescens* at 6th day of fermentation period
B: WT-4 against *Pseudomonas fluorescens* at 7th day of fermentation period
C:WT-15against *Pseudomonas fluorescens* at 6th day of fermentation period

Figure 23 Antimicrobial activities of selected fungi against *Pseu. fluorescens*

Table 8 Antimicrobial Activity of isolated fungal strains against *Bacillus subtilis*

No.	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	-	-	-	-	-
2	WT-2	13.8	14.5	15.1	16.9	12.3
3	WT-4	-	-	-	20.6	16.3
4	WT-7	-	-	-	-	-
5	WT-9	15.7	17.1	18.5	25.1	16.4
6	WT-13	-	-	-	-	-
7	WT-15	-	-	17.0	19.4	14.7

A B C D

A: WT-2 against *Bacillus subtilis* at 3rd day of fermentation period
B: WT-2 against *Bacillus subtilis* at 7th day of fermentation period
C:WT-9against *Bacillus subtilis* at 6th day of fermentation period
D:WT-9against *Bacillus subtilis* at 7th day of fermentation period

Figure 24 Antimicrobial activities of selected fungi against *Bacillus subtilis*

Table 9 Antimicrobial activity of isolated fungal strains against *Bacillus pumilus*

No	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	15.3	13.7	17.2	12.3	12.7
2	WT-2	18.4	18.5	22.0	19.2	15.0
3	WT-4	22.0	18.5	28.4	23.2	24.7
4	WT-7	17.5	16.8	15.0	14.1	11.8
5	WT-9	19.9	16.7	22.8	23.4	30.3
6	WT-13	19.9	18.3	22.8	15.5	18.1
7	WT-15	18.0	16.7	21.4	22.2	20.8

A B C D

A: WT-2 against *Malassezia furfur* at 4th day of fermentation period
B: WT-2 against *Malassezia furfur* at 5th day of fermentation period
C:WT-9 against *Malassezia furfur* at 3rd day of fermentation period
D:WT-9 against *Malassezia furfur* at 4th day of fermentation period

Figure 25 Antimicrobial activities of selected fungi against *Bacillus pumilus*

Table 10 Antimicrobial Activity of isolated fungal strains against *Malassezia furfur*

No	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3th-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	11.9	12.6	16.7	15.0	13.9
2	WT-2	18.7	14.4	22.7	19.8	19.0
3	WT-4	18.7	19.9	19.4	19.0	18.0
4	WT-7	16.8	17.4	14.7	12.5	10.5
5	WT-9	16.8	21.4	19.7	19.0	18.1
6	WT-13	19.2	16.0	20.9	18.2	17.0
7	WT-15	19.2	16.0	20.9	18.6	18.1

A B C D

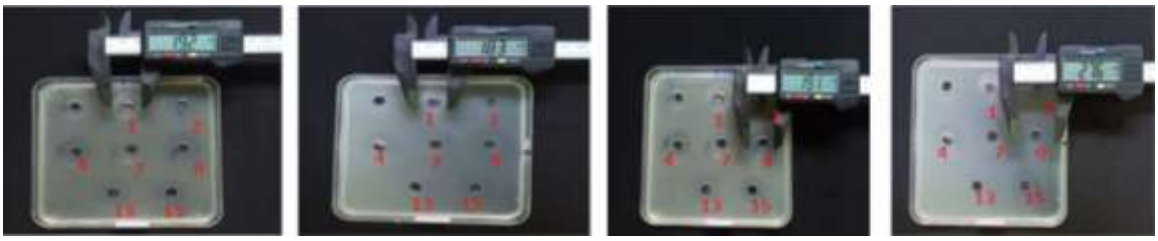
A: WT-1 against *Malassezia furfur* at 4th day of fermentation period
B: WT-1 against *Malassezia furfur* at 5th day of fermentation period
C:WT-7 against *Malassezia furfur* at 3rd day of fermentation period
D:WT-7 against *Malassezia furfur* at 4th day of fermentation period

Figure 26 Antimicrobial activities of selected fungi against *Malassezia furfur*

Table 11 Antimicrobial Activity of isolated fungal strain against *Candida albicans*

No	Isolated Fungi	Fermentation period (Day) and Inhibitory Zone(mm)				
		3rd-day	4th-day	5th-day	6th-day	7th-day
1	WT-1	9.6	18.6	19.2	18.3	13.3
2	WT-2	19.4	21.9	21.8	13.6	13.0
3	WT-4	23.3	23.3	20.6	18.7	14.2
4	WT-7	15.8	15.8	15.9	15.0	14.0
5	WT-9	17.3	18.0	19.1	27.6	16.6
6	WT-13	16.3	23.4	21.5	18.0	16.3
7	WT-15	20.7	19.6	19.6	22.2	14.7

12-14 mm = weak activity,15-19 mm = moderate activity, > 20 mm = high activity



A B C D

A: WT-1 against *Candida albicans* at 5th day of fermentation period
B: WT-1 against *Candida albicans* at 6th day of fermentation period
C:WT-9 against *Candida albicans* at 5th day of fermentation period
D:WT-9 against *Candida albicans* at 6th day of fermentation period

Figure 27 Antimicrobial activities of selected fungi against *Candida albicans*

Discussion and Conclusion

In the present study, 24 fungal strains were isolated from three different Townships in Yangon Region. Fungal strains WT-1 to WT-5 were isolated from soil in South Oakkala, WT-6 to WT-12 from soil sample in Mayangone and WT-13 to WT-24 from soil sample in Insein. A total of 24 isolated fungi, 11 strains were isolated from BMEA Medium, 8 strains from PDA Medium, 4 strains from LCA Medium and 1 strain were isolated from CzA. Moreover, physicochemical properties of soil from different locations of Yangon Area were analyzed. The soil samples were pH slightly base (6.27−7.02). The temperature of the soil was high (30- 45ºC), with great variation

in moisture content (2.28 – 2.64), organic carbon (0.58- 4.07) and organic nitrogen (0.18 – 0.27), and texture.

Among 24 isolates, 7 strains showed highly antimicrobial activity. These six active strains were identified as *Aspergillus* sp. and the other one was *Rhizoctonia* sp. Morphological and microscope characters of isolated strains were investigated according to Barnett (1998) and other literatures. Seth *et al*., (2016) isolated and identified soil fungi such as *Aspergillus* spp., *Penicillum* spp., *Fusarium* spp., and *Rhizoctonia* spp. from cultivated area in India. Moira (1961) isolated soil fungi and identified these strains to study their growth in pure culture. Gaddeya, *et al.*, (2010) isolated soil mycoflora in different crop fields for producing bioactive compounds. Farid and Nareen (2013) isolated and identified *Aspergillus* sp., and other fungi from soil and some medicinal plants. Ana et al., (2010) isolated several soil borne microbes such as mycorrhizal fungi. Azaz (2003) also isolated *Aspergillus* sp., *Penicillum* sp., and *Rhizoctonia* sp., from the fields.

All isolated strains showed different antimicrobial activity on eight test organisms. According to the results of antimicrobial activity, bioactive strains WT-1, 2, 4, 7, 9, 13 and 15 showed highly antimicrobial activity on eight test organisms. Prabavathy and Nachiyar (2012) stated that the fungus *Aspergillus* sp., had antimicrobial activity. Many others researchers isolated soil fungi for producing bioactive agents. Devi & Joshi (2012) stated that most of soil fungi (e.g., *Aspergillus* sp. and *Rhizoctonia* sp.) had antimicrobial activity on some test organisms (*Escherichia coli*, *Pseudomonaous aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis*, *Aspergillus niger*, *Aspergillus flavus*, *Candida albicans* and *Candida krusei*). Srividya, *et al.* (2010) stated that the soil fungus showed antimicrobial activity against *Escherichia coli*, *Pseudomonaous aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis*, *Aspergillus niger*, *Aspergillus flavus*, *Candida albicans* and *Candida krusei*. Yee Yee Thu (2006), Kyawt Kyawt Aung (2014), Hnin Wit Mhone (2018) and Soe Soe Yu Hnin (2018) have also isolated many fungi including *Aspergillus* and *Rhizoctonia*, etc. from soil fungi and endophytic fungi.

It was concluded that the 24 soil fungi were isolated on four different media. Seven strains of them possessed highly antimicrobial activity on eight test organisms caused serious diseases and infections on man and plants. Therefore, these seven active strains will be chosen to continue fermentation studies for extraction and isolation of the bioactive compounds.

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References

Ando K.M, stuto and Inada S**.** (2004). **Sampling and isolation methods of fungi,** workshop University of Pathein.

Ana Pineda, Si-Jun Zheng, Joop J.A. van Loon, Corne M.J. Pieterse and Marcle Dicke. (2010). **Helping plants to deal with insects: the role of beneficial soil- borne microboes.** Trends in Plant Science 15 (2010) 507-514.

Azaz A. D. (2003). Isolation and identification of soilborne fungi in fields irrigated by gap in harran plain using two isolation methods. Turk J Bot 27 (2003) 83-92.

Barnett, H.L. (1998). **Illustrated Genera of Imperfect Fungi.** 4 ed. Burgress Publishing.

Christensen, M. (1989). **A view of fungal ecology**. Mycologia 81, 1-19.

Collin, C.H. (1965). **Microbiological Methods**. Buffer worth and Co., Publishers Ltd., Landon.

Devi. L. S. and Joshi S. R. (2012). **Antimicrobial and synergistic effects of silver nanoparticles synthesized using soil fungi of high altitudes of eastern Himalaya**.ISSN:1229-8093(Print)2092-9323.

Dubey R. C. and Maheshwari D.K. (2002). **Practical Microbiology.**

Farid M. and Nareen Q. (2013). **Isolation and identification of fungi spices and medicinal plants.** ISSN: 2041-0484; e-ISSN:2041 -0492

Fierer N., Jackson R.B. (2006). **The diversity and biogeography of soil bacterial communities,** PNAS 103: 625-631.

Gaddeyya, G., P. Shiny Niharika, P. Bharathi and P. K. Ratna Kumar. (2012). **'Isolation and identification of soil mycoflora in different crop fields at Salur Mandal",** ISSN:0976-8610. Advances in Applied Science Research, p 2020-2026.

Hawksworth,D.L. (1991). **The fungal dimension of biodiversity; magnitude, significance, and conservation.** Mycological Research 105: 1422 -1432.

Hawksworth, D.L. (2001). **The magnitude of fungal diversity: The 1.5 millionspecies estimate revisited.**

Hnin Wit Hmone. (2018). **Bioactive Compounds Produced by Endophytic Fungal Strain Isolated from the Leaves of *Psidium guajava* L.**

Kyawt Kyawt Aung. (2014). **Investigation of Bioactive Compound Produced by Endophytic Fungal Strain Isolated from *Coccinia indica* Wight. & ARN** Phd Dissertation. Department of Botany, Universtiy of Yangon.

Moira E. K. Henderson. (1961). **Isolation, identification and growth of some soil *hypomycetes and yeast-like* fungi which utilize aromatic compounds related to lignin.** J. gen. Microbiol. (1961), 26, 149-154.

Prabavathy D. and C. Vali Nachiyar. (2012). **Study on the antimicrobial activity of *Aspergillus sp.*, isolated from Justicla adathoda**. Indian Journal of Science and Technology. Vol. 5 No. 9. ISSN: 0974- 6846.

Rajendra Kumer Seth, Shah Alam and Shukla DN. (2016). **Isolation and identification of soil fungi from wheat cultivated area of uttar pradesh**. J. PlantPatholMicrobial 2016,7:11, DOI:10.4172/21577471.1000384. ISSN:2157-7471.

Soe Soe Yu Hnin. (2018). **Investigation of The Antimicrobial Compounds Isolated from Bioactive Fungal Strain Produced from the Rhizome of *Zingiber cassumunar* Roxb.**

Srividya, A.R., S.P. Dhanabal, V. K. Misra, and G. Suja. (2010). **Antioxidant and Antimicrobial activiy of Alpinia officinarum.** Indian J Pharm Sci.2010 Jan-Feb; 72 (1): 145-148. Articles from Indian Journal of Pharmaceutical Sciences are provided here courtesy of Wolters Kluwer– Medknow Publications.

Ullah, I., Khan, N.A., Jadoon., M. A., Hameed, U. R., Khan., M.A., Maqood, A., Anwar, S. (2017). **Isolation and Identification of different *rhizopheres* fungi of Mansehra region, Pakistan.** J. Entomol . Zool. Stud. 5 (2), 437 -442.

Yee Yee Thu. (2006). **Novel Antimicrobial Metaboites Produced by *Trichoderma* sp., *Streptomyces* sp., and *Chaetomium* sp. Isolated from *Mimusops elengi* L., Soil and *Tamarix cananriensis* Willd.,** Ph.D Thesis; Department of Botany, University of Yangon.