IN VITRO SCREENING OF ANTIMICROBIAL ACTIVITY OF SELECTED MYANMAR MEDICINAL PLANTS

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Abstract

The global burden of microbial infection is very high and antibiotic resistance leads to failed treatment of infections, which can ultimately lead to death. To overcome antibiotic resistance, it is necessary to find new antimicrobial agents. In this study, twenty medicinal plants which are traditionally used for the treatment of various diseases in Kalonehtar village tract, Yebyu Township were selected to examine their antimicrobial potential against five pathogenic microorganisms such as *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Bacillus subtilis, Candida albicans*. This research was performed at Department of Botany at University of Yangon in 2019. The extraction of phytopharmaceuticals from twenty medicinal plants was performed by using Ultrasound assisted solvent extraction technique. The polar solvent, methanol (80%) was employed for extraction process. The result showed that phytopharmaceuticals from *Symphorema involucratum* (20.6%) and *Portulaca oleracea* (20.2%) were the most soluble in methanol where as *Peperomia pellucida* (3.2%) was the least soluble in methanol. The antimicrobial activity of selected medicinal plants was conducted by paper disc diffusion method. It was revealed that the methanol extract of selected medicinal plants such as *Piper cubeba, Amomum subulatum* showed the higher antimicrobial activity on *Escherichia coli* (20 mm), *Dracaena angustifolia*, *Emilia sonchifolia*, *Pittosporum glabratum* showed the highest inhibitions (22mm-32mm) on *Pseudomonas aeruginosa* whereas *Melastoma malabathricum* exhibited the significant activity (32mm) on *Staphylococcus aureus ,the plants Amomum subulatum , Glycosmis pentaphylla , Portulaca oleracea , Homonoia riparia* showed the activity (20 mm-28 mm) on *Bacillus subtilis.* Moreover, the result showed that *Homonoia riparia Lour.* posses antifungal activity (30mm) on *Candida albicans.* The present findings indicated that the active chemical compound responsible for the antimicrobial action must be a polar soluble compound.

Keywords: antimicrobial activity, methanol extract, *Pittosporum glabratum* Lindl.

Introduction

Medicinal plants have long been used to treat many infectious diseases (Mohanta *et al*., 2014). The use of medicinal plants as complementary and alternative medicine has increased dramatically in the last 20-25 years (Rios & Recio, 2005). According to a WHO report, 80% of the world's inhabitants depend on traditional medicines as their main source of health care (Ballabhet *et al*., 2007).

Worldwide research for antimicrobial agents continued to focus on flowering plants, non-flowering plants, fungi and bacteria (Fabry *et al*., 1998). Myanmar is one of richest countries in the world with regards to the genetic resource of medicinal plants. The country has a wide range of topography and climate which influences its vegetation and floristic composition (DeFlipps, 2018). Although a great potential of the plants to be studies and developed into commercial products there are many species are unknown and their useful functions are still undiscovered (Thet Thet Mar Win, *et al*., 2019).

The secondary metabolites can be identified through random, ethno (including ethnobotanical, ethnomedical and ethnopharmacological) and ecological searches. (Fabricant *et al.*, 2001). The random collection of plant samples from certain habitats (eg. Tropical rain forest) can be very useful for identification of novel chemical entities. However, this method is time consuming and labor intensive (Vuorela *et al*., 2004).

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Previous studies have provided evidence that antimicrobial compounds isolated from different solvent extracts never provided the expected final output based on the activity of crude extracts and fractions (Eloff *et al*., 2008). This is probably because different plant metabolites often work in combination with other compounds to regulate microbial infections and may therefore not be effective alone (Lewis *et al*., 2006). The solvent (extraction agent) used to prepare phytopharmaceuticals must be able to dissolve all key phytoconstituents (Pauw *et al*., 2014).

In this study, methanol (80%) extract was used in the preliminary screening (paper disc diffusion method). It is believed that the organic solvent methanol could efficiently penetrate the cell membranes, permitting the extraction of high amounts of endocellular components in contrast to low polarity solvents which can only extract extracellular material. Methanol (methyl alcohol) primarily dissolves polar constituents together with median and low polarity compounds extracted by cosolubilization. Therefore, the present investigation was conducted to evaluate methanol (80%) extracts of selected plants belonging to a wide range of families based on random sampling.

Materials and Methods

Study area

Ye-Byu Township is located in the district of Dawei. The region is extended over 2447.0 sq.km between 97° 50′ 00″ E to 98° 20′ 00″ E and 14° 15′0″ N to 15° 0′ 0″N. The region is known to have a rich floral diversity with many of them having medicinal values Fig. (1). The tribal communities residing around the study area are Htar wai, Kayen, and Mon. This place offers unique opportunities to study indigenous medicinal plants used by populations. It is estimated that more than hundred plant species are collected from that area during the flowering period of 2017-2018. In this research, twenty medicinal plants were randomly selected for antimicrobial activity screening. The authors samples mostly leaf materials, unless ethnomedicinal information was available regarding other parts in Table (1), because leaves are renewable and resource and it is easier to recollect leaves from the same plant for follow-up work.

Figure 1 Location Map of Study Area in Yebyu Township in Dawei District

Processing

The leaves, roots the whole plant were collected separately during field trips to different places of Ye-Phyu Township. Healthy leaves were plucked from the large plant and the herbs were washed with distilled water. Following collection, the sample were dried at room temperature for three weeks. Then, the dried sample were powdered separately and stored in airtight containers to prevent from moisture and air-borne contamination.

Preparation of plant extract

A hundred gram of each powdered sample were added to s round bottom flask (1000ml) then moistened with 80% methanol (600 ml) and the sample was sonicated in an ultrasonic bath (Power Sonic 410) for 30 min at room temperature. The obtained extract was reduced by Rotary evaporator (at 50°C, 40 rpm, for 45 min) to get methanol soluble matter. Yield of extract was calculated in mg/g and converted into percentage (Azwanida, 2015).

Yield (%) of extract = Weight of dry extract ×100 / Weight of dry powdered sample

Antimicrobial assay

The antimicrobial activity was assessed against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis Candida albicans.* using the paper disc diffusion assay (Cruickshank *et al*., 1975; Madigan *et al*., 2005). In brief, the isolated microbial strains grown on nutrient agar were inoculated into conical flasks containing 10 ml of sterile growth medium. They were incubated at 30°C for 72 hours on a reciprocal shaker at 200 rpm. Then, test organisms (0.3ml) was added to assay medium, then poured into plates. The solutions of 50mg/ml plant extract were prepared by dissolving 80% methanol. Sterile 6mm paper discs (Whatman) were impregnated with 100µL of the plant extract solutions, dried at 40°C. Then, all disc was added to the agar surface. After 48-hour incubation at 42°C, the diameters of the zones of inhibition were measured. The tests were conducted at Microbiology Laboratory, Department of Botany, University of Yangon.

Table 2 List of plant species screened for antimicrobial activity

Scientific Name	Family	Local name	Part of use
Hydrolea zeylanica (L.)Vahl	Hydroleaceae	Le-hgin tha	the whole plant
Bulbophyllum careyanum Spreng.	Orchidaceae	Kaung-say-thi	the whole plant
Cryptocoryne retrospiralis (Roxb.) Kunth	Araceae	Unknown	The whole plant
Portulaca oleracea L.	Portulacaceae	Mya-Pyit	the whole plant
Glycosmis pentaphylla (Retz.)DC.	Rutaceae	Taw-shauk	leaves
Sympheorema involucratum Roxb.	Lamiaceae	Daung-ttalaung	leaves
Peperomia pellucida (L.)Kunth	Piperaceae	Thit-yay-kyi	the whole plant
Dracaena angustifolia (Medik) Roxb.	Asparagaceae	Ein-lone-chan-thar	leaves
Melastoma malabathricum L.	Melastomataceae	Say-oh-pok	leaves
Pterospermum semisagittatum Buch-Ham	Malvaceae	Nwa-labyin	leaves
Buchanania arborescens (Blume) Blume	Anacardiaceae	Che-ti	leave
Piper cubeba L. f.	Piperaceae	Peik-chin	leaves
Hellenia speciosa (J. Koeing) SR	Costaceae	Phalan-taung-hmwe	the whole plant
Homonoia riparia (Lour.)	Euphorbiaceae	Yeta - kyi	the whole plant
Amomum subulatum Roxb.	Zingiberaceae	Chin-baung-phar-lar	the whole plant
Emilia sonchifolia (L.) DC. ex Wight	Asteraceae	Unknown	the whole plant
Getonia floribunda Roxb.	Combretaceae	Bu-nwe	leaves
Syzygium lineatum (DC).Merr & L. M. Perry	Myrtaceae	Tha-bye	leaves
Ochna integerrima (Lour.) Merr.	Ochnaceae	Indaing – say-ni	leaves
Pittosporum glabratum Lindl.	Pittosporaceae	Hin- cho- pin	leaves

Results

. In this research, twenty medicinal plants were randomly selected for antimicrobial screening. The scientific name, local name, family, plant parts used and its medicinal values are mentioned precisely in Table (1), (2) and Figure (2).

Figure 2 Twenty selected medicinal plants from Ye-phyu Township namely (A) *Hydrolea zeylanica*(L.) Vahl. (B) *Bulbophyllum careyanum* Spreng. (C) *Cryptocoryne retrospiralis* (Roxb.)Kunth (D) *Portulaca oleracea* L. (E) *Glysosmis pentaphylla (Retz.) DC.* (F) *Symphorema involucratum Roxb.* (G) *Peperomia pellucida (L.)Kunth* (H) *Dracaena angustifolia (Medik) Roxb.* (I) *Melastoma malabathricum* L.(J) *Pterospermum semisagittatum Buch-Ham.* (K) *Buchanania arborescens* (Blume) Blume (L) *Piper cubeba* L. f. (M) *Hellenia speciosa* (J. Koeing) SR (N) *Homonoia riparia* (Lour.) (O) *Amomum subulatum* Roxb. (P) *Emilia sonchifolia* (Q) *Getonia floribunda* Roxb. (R) *Syzygium lineatum* (DC).Merr & L.M.Perry (S) *Ochna integerrima* (Lour.) Merr. (T) *Pittosporum glabratum* Lindl.

Extraction yield of selected medicinal plants

In this study, Table (2) represents the results for 80% methanol soluble matter content of selected medicinal plants. It was observed that phytoconstituents in *Peperomia pellucida (L.)Kunth* were least soluble in 80 % methanol as succulent herbs.

Table 3 Yield of the methanol (80%) of twenty selected medicinal plants using Sonication method

Scientific Name	Part of use	Yield (%)
Hydrolea zeylanica (L.)Vahl	the whole plant	10.3
Bulbophyllum careyanum Spreng.	the whole plant	7.5
Cryptocoryne retrospiralis (Roxb.)Kunth	the whole plant	12.5
Portulaca oleracea L.	the whole plant	20.2
Glysosmis pentaphylla (Retz.)DC.	leaves	9.4
Symphorema involucratum Roxb.	leaves	20.6
Peperomia pellucida (L.)Kunth	the whole plant	3.2
Dracaena angustifolia (Medik) Roxb.	leaves	8.5
Melastoma malabathricum L.	leaves	15.4
Pterospermum semisagittatum Buch-Ham	leaves	8.1
Buchanania arborescens (Blume) Blume	leave	6.4
Piper cubeba L. f.	leaves	10.2
Hellenia speciosa (J. Koeing) SR	the whole plant	18.6
Homonia riparia (Lour.)	the whole plant	10.3
Amomum subulatum Roxb.	the whole plant	15.6
Emilia sonchifolia (L.) DC. ex Wight	the whole plant	7.4
Getonia floribunda Roxb.	leaves	17.5
Syzygium lineatum (DC).Merr &L.M.Perry	leaves	18.3
Ochna integerrima (Lour.) Merr.	leaves	8.4
Pittosporum glabratum Lindl.	leaves	10.1

Antimicrobial activity of twenty selected medicinal plants

The inhibitory activities of methanol extract of twenty medicinal plants obtained using paper disc diffusion assay against *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Bacillus subtilis, Candida albicans*. It was found that the methanol extract of selected medicinal plants such as., *Piper cubeba* L.f.,, *Ammomum subulatum* Roxb., showed the higher antibacterial activity on *Escherichia coli* (20 mm), *Dracaena angustifolia* (Medik.) Roxb, *Emilia sonchifolia* (L.)DC., *Pittosporum glabratum* Lindl showed the highest inhibitions (zone of inhibition between 22mm-32mm) on *Pseudomonas aeruginosa* whereas *Melastoma malabathricum* exhibited the significant activity (32mm) on *Staphyllococcus aureus, the plants Amomum subulatum* Roxb., *Glycosmis pentaphylla* (Retz.) DC., *Portulaca oleracea L., Homonia riparia* (Lour.) showed the activity (zone of inhibition between 20mm-28mm) on *Bacillus subtilis*. Moreover, the result indicated that *Homonoia riparia (Lour.)* possess antifungal activity (30 mm) on *Candida albicans* The results are shown in Table (3) and Fig. (3), (4) and (5).

Table 4 Antimicrobial activity of methanol (80%) extract of selected plants

Scientific Name	Part Use	Zone of Inhibition in mm				
		Escherichia coli	*Pseudomonas aeruginosa*	*Staphylococcus aureus*	*Bacillus subtilis*	*Candida albicans*
Hydrolea zeylanica (L.)Vahl	WP	-	14	8	14	16
Bulbophyllum careyanum Spreng.	WP	8	10	8	16	8
Cryptocoryne retrospiralis (Roxb.)Kunth	WP	12	8	10	18	12
Portulaca oleracea L.	WP	10	16	14	26	16
Glysosmis pentaphylla (Retz.)DC.	L	8	10	10	22	18
Symphorema involucratum Roxb.	L	8	10	8	16	10
Peperomia pellucida (L.)Kunth	WP	-	10	8	20	14
Dracaena angustifolia (Medik) Roxb.	L	-	22	12	18	12
Melastoma malabathricum L.	L	-	18	32	16	8
Pterospermum semisagittatum Buch-Ham	L	-	8	16	12	8
Buchanania arborescens (Blume) Blume	L	8	8	-	14	14
Piper cubeba L. f.	L	20	8	8	14	12
Hellenia speciosa (J. Koeing) SR	WP	10	12	8	20	8
Homonia riparia (Lour.)	WP	8	12	-	28	30
Amomum subulatum Roxb.	WP	20	8	8	20	12
Emilia sonchifolia (L.) DC. ex Wight	WP	8	22	8	16	8
Getonia floribunda Roxb.	L	8	8	-	14	12
Syzygium lineatum (DC).Merr &L.M.Perry	L	12	12	8	18	10
Ochna integerrima (Lour.) Merr.	L	-	8	-	8	12
Pittosporum glabratum Lindl.	L	-	32	-	-	8

Paper disc - 6mm
WP - The Whole Plan
L - Leaves

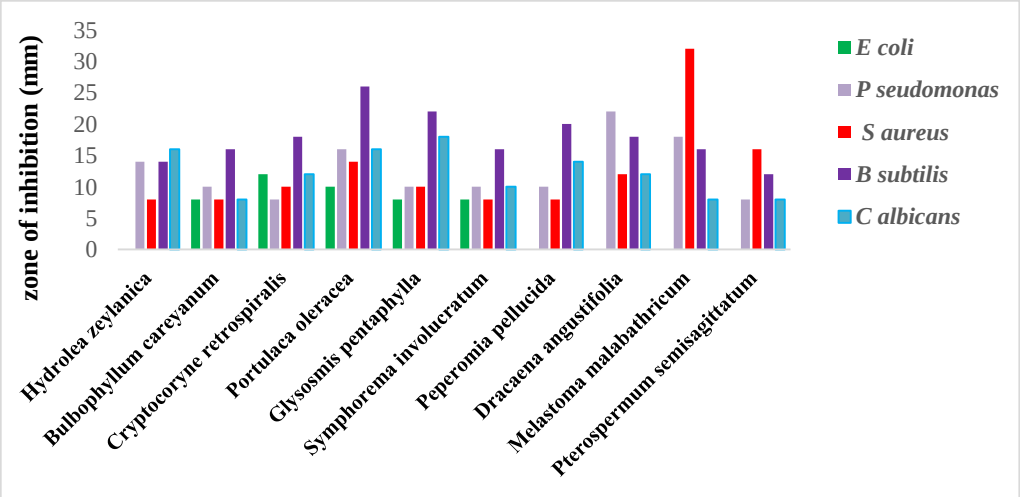


Figure 3 Effects of selected plants 80%methanol extract on Microbial growth

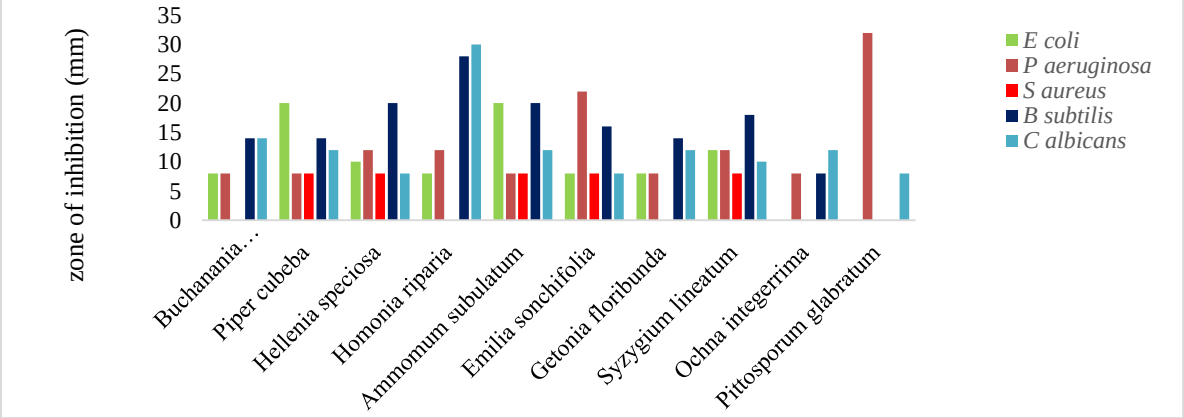
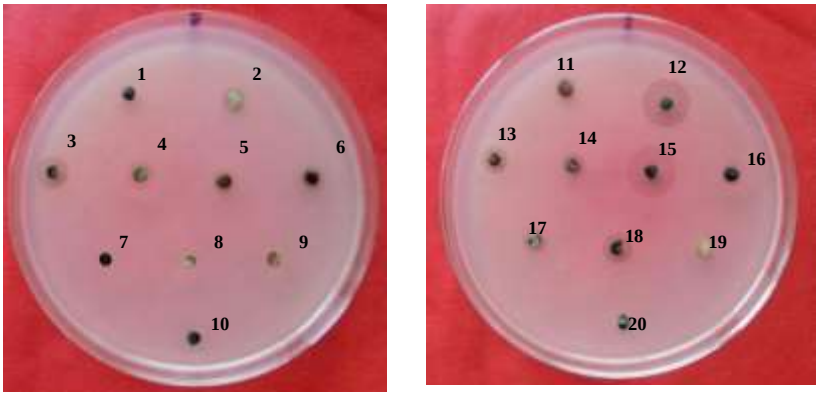
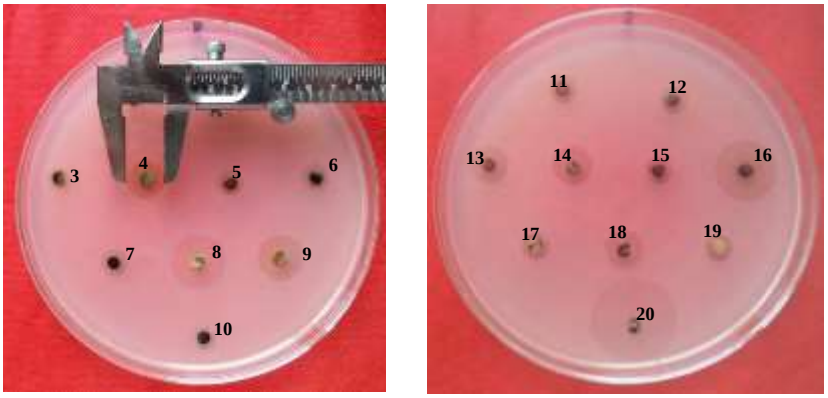


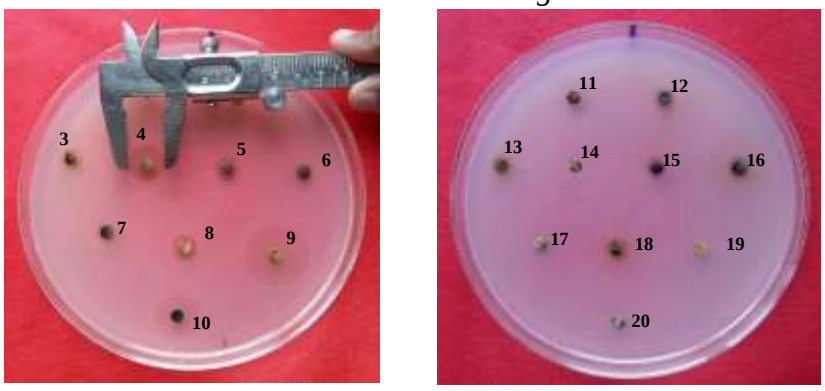
Figure 4 Effects of selected plants 80% methanol extract on Microbial growth



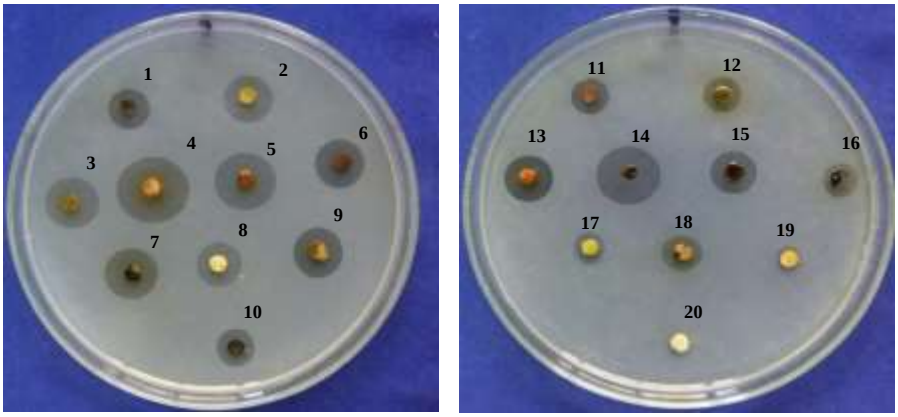
Escherichia coli



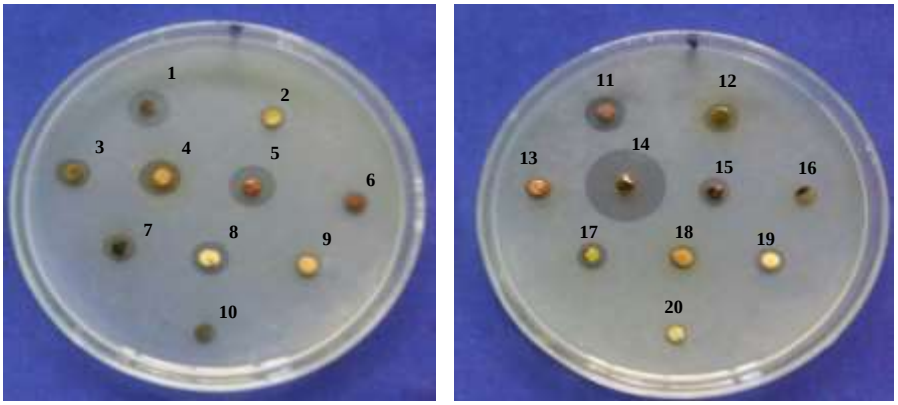
Pseudomonus aeruginosa



Scaphylococcus aureus



Bacillus subtilis



Candida albicans

1. *Hydrolea zeylanica* (L.)Vahl.
2. *Bulbophyllum careyanum* Spreng.
3. *Cryptocoryne retrospiralis* (Roxb.)Kunth.
4. *Portulaca oleracea* L.
5. *Glycosmis pentaphylla (Retz.)DC.*
6. *Symphorema involucratum Roxb.*
7. *Peperomia pellucida (L.)Kunth.*
8. *Dracaena angustifolia (Medik) Roxb.*
9. *Melastoma malabathricum* L.
10. *Pterospermum semisagittatum Buch-Ham*
11. *Buchanania arborescens* (Blume) Blume
12. *Piper cubeba* L. f.
13. *Hellenia speciosa* (J. Koeing) SR
14. *Homonoia riparia* (Lour.)
15. *Amomum subulatum* Roxb.
16. *Emilia sonchifolia* (L.) DC. ex Wight
17. *Getonia floribunda* Roxb.
18. *Syzygium lineatum* (DC). Merr & L. M. Perry
19. *Ochna integerrima* (Lour.) Merr.
20. *Pittosporum glabratum* Lindl

Figure 5 Effect of Antimicrobial activity of twenty selected medicinal plants on six pathogenic microorganisms

Discussion

The total of twenty species (twenty genera, twenty families) were tested on four species of bacteria and one species of fungus mostly involved in common infections such as gastroenteritis, diarrhea, dysentery, skin diseases, food and water contamination.

In total of seven plant species were unable to inhibit the tested organism (*Escheria coli*) namely *Hydrolea zeylanica* (L.) Vahl, *Peperomia pellucida (L.) Kunth, Dracaena angustifolia (Medik) Roxb., Melastoma malabathricum* L., *Pterospermum semisagittatum Buch-Ham, Ochna integerrima (Lour.) Merr., Pittosporum glabratum* Lindl. whereas four species namely *Buchanania arborescens*, *Homonia riparia* (Lour.), *Getonia floribunda* Roxb, *Ochna integerrima*

(Lour.) Merr., did not show any activity on *Staphyllococcus aureus* and the plant, *Pittosporum glabratum* Lindl did not exhibit on *S aureus* as well as on *Bacillus subtalis*.

However, nine methanol extracts of selected medicinal plants showed strong inhibition on different test organisms (zones of inhibition ≥ 20 mm). The methanol extract of other plants also showed weakly inhibitions (zone of inhibition in between 8-18 mm).The different results concerning with antimicrobial activity might be due to different secondary metabolites of each plant (Cowan,1999)

The antimicrobial activities of some of these plants such as *Hydrolea zeylanica*(L.), Vahl. (L.)Vah, *Bulbophyllum careyanum* Spreng., *Cryptocoryne retrospiralis* (Roxb.)Kunth, *Portulaca oleracea*, *Glysosmis pentaphylla (Retz,)DC.* , *Symphorema involucratum Roxb.*, *Peperomia pellucida (L.)Kunth*, *Dracaena angustifolia (Medik) Roxb.*, *Melastoma malabathricum* L., *Pterospermum semisagittatum Buch-Ham*, *Buchanania arborescens* (Blume) Blume, *Piper cubeba* Lf. , *Hellenia speciosa* J Koenig) SR , *Homonoia riparia* (Lour.), *Ammomum subulatum* Roxb., *Emilia sonchifolia*, *Getonia floribunda* Roxb., *Syzygium lineatum* (DC).Merr &L.M.Perry, *Ochna integerrima* (Lour.) Merr., were previously described by other researchers (Qureshi *et al*., 2017; Manna *et al*.,2017; Oraibi *et al.*, 2017; Khan *et al*., 2012; Idris *et al*.; Bapat *et al*., 2014; Abbas Ali *et al*., 2011; Saeed *et al*., 2013; Wadkar *et al*., 2017; Roy *et al*., 2019; Pavithra *et al*., 2009). However, the antimicrobial activity of selected plants such as *Buchanania arborescens* (Blume) Blume and *Pittosporum glabratum* Lindl leaves methanol extract have not mentioned in previous studies.

Conclusion

The twenty selected medicinal plants from Kalonehtar village tract, Ye-Pyu Township showed antimicrobial activity. These plants contained active antimicrobial agents which may use as a good source for antibiotics. Further study is required to identify the active compounds, synergetic affects, toxicity and safety of these plants and eventually clinical evaluations.

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References

Abbas Ali, M., A.M.A. Sayeed, S. Ahmed, M.S. Yeasmin, A.M. Khan, M.A. Hanif. (2011). **An evaluation of antimicrobial activities of *Glycosmis pentaphylla***. Research Journal of Agriculture and Biological Sciences, **7**(2): 328-331. ISSN: 1816-1561.

Azwanida, N.N. (2015). **A Review on the extraction methods Use in Medicinal Plants, Principles, Strength and Limitation.** Med Aromat Plants 4:196.

Ballabh B. and O.P. Chaurasia (2007). **Traditional Medicinal plants of Cold Desert Ladakh useinTreatment of Cold, Cough and fever**. *J. Ethnopharmacol*, **112**(2):31-9.

Bapat, U.C. and D.P. Mhapsekar (2014). **Phytochemical investigations and antimicrobial and anticancer activities of *Homonoia riparia* Lour.** *International Journal of Pharmacy and Pharmaceutical Sciences*, Vol. 6, Issue 11. ISSN: 0975-1491.

Cruickshank, R., J.P. Duguid,, B.P. Marmior and R.H.A. Swain. (1975). **Medical Microbiology**. Pp. 196-203. Churchill Livingstone Ltd. London.

Defilipps RA. and G.A. Krupnick (2018). **The medicinal plants of Myanmar**. Phytokeys ,102:1-341

Eloff, J.N., D.R. Katerere, L.J. McGaw. (2008). **The biological activity and chemistry of the southern African Combretaceae**. *J. Ethnopharmacol*. **119**, 686-699.

Fabry, W.;Okemo, P.O.; Ansorg,R.(1998). **Antibacterial activity of East African medicinal plants.** *J. Ethnopharmacol*, **60**, 79-84.

Fabricant, D.S.; Farnsworth, N.R. (2001). **The value of plants used in Traditional Medicine for Drug Discovery.** Environ. Heal., **109**, 69-75.

Idris, O.O., B.P. Olatuji, P. Madufor. (2015). **In vitro Antibacterial Activity of the extracts of *Peperomia pellucida* (L.)**, British Microbiology Research Journal 11(4): XX-XX. ISSN: 2231-0886.

Khan, M. and M. Siddiqui. (2007). **Antimicrobial activity of Piper fruits.** Natural Product Radiance, 6(2): pp. 111-113.

Manna, A.K., U. Nanda, S. Kar. (2017). **Preparation and Evaluation of antimicrobial herbal formulation of *Pterospermum acerifolium* Willd.** *International Journal of Pharmaceutical Sciences and Research*, Vol. 8, Issue 11.

Mohanta,T. K., Y. Tamboli, P.K. Zubaidha. (2014). **Phytochemical and medicinal importance *Ginkgo biliba* L.** Nat. Prod. Res., **28**,746-752.

Madigan, M. and J. Martinko. (2005). **Brock Biology of Microorganisms** (11th ed.). Prentice Hall. ISBN 0-13-144329-1.

Oraibi, A.G., A.A. Alshammari, A.M. Rana, J.W. Obaid. (2017). **Investigation the antibacterial activity of *Portulaca oleraces* L.** *Journal of Pharmaceutical Research International*, **18**(5): 1-7.

Pauw,E. and J. Eloff . (2014) **Which tree orders in southern Africa have the highest antimicrobial activity and selectivity against bacterial and fungal pathogens of animals? BMC Complement**. Altern. Med. 14.

Pavithra P.S., N. Sreevidya., R.S. Verma. (2009). Antibacterial and antioxidant activity of methanol extract of *Evolvulus nummularius*. *Indian Journal Pharmacol*, vol. 41, issue 5, 233-236.

Quershi, M.S., A. Venkateshwar Reddy, G.S. Kumar, L. Nousheen. (2017). **Chemical composition and wound healing activity of methalnolic leaf extract of *Hydrolea zeylanica* Vahl. By in vivo excision and incision models**. *International Journal of Green Pharmacy*. **11** (2)116.

Rios, J.L. and M.C. Recio (2005). **Medicinal Plants and Antimicrobial Activity**. *J. Ethnopharmacol*. 2005;**100**(1-2)80-4.

Roy D.S., S. De, S. Maity,W. Maity, D.C. Das. (2019). **Phytochemical screening, Isolation of flavonoids from *Hellaenia speciosa* (J.Koenig) S.R Dutta and study of its antibacterial activity *In Vitro*** *International Journal of Pharmacy and Biological Science*, **9**(3) : 641-647.

Saeed M., M. Nadeem, M.R. Khan, M.A. Shabbir, A. Shehzad, R.M.Amir. (2013). **Antimicrobial activity of *Syzygium aromaticum* extracts against food spoilage bacteria.** *African Journal of Microbiology Research*, Vol.7(41), pp.4848-4856. (ISSN 1996-0808)

Thet Thet Mar Win, Aye Pe, Swe Swe Aye, Sang mi Eum, Sangho Choi. (2019). **Useful flowering plants in Myanmar Vol. I**, Cresseed Co. Ltd. Daejeon, Republic of Korea,1-226. (ISBN: 978-89-6709-135-4)

Vuorela, P., M. Leinonen, P. Saikku, P. Tammela Rauha, T. Wennberg, H. Vuorela. (2004). **Natural Product in the Process of Finding New Drug Candidates.** Curr.Med. Chem.**11**,1375-1389.

Wadkar SS., CC. Shete, FR. Inamdar, R.V. Gurav, K.S. Patil, J.S. Ghosh. (2017). **Phytochemical screening and Antibacterial activity of *Cryptocoryne spiralis* var. *sprialis* and *Cryptocoryne retrospiralis* (Roxb.) Kunth**. Medicinal and Aromatic Plants, Volume 6, Issue 2. ISSN: 2167-0412.

APPENDIX I

Table 1 List of plants and their medicinal uses by indigenous communities in Ye–Phyu Township, Dawei District

Scientific Name	Family	Local name	Part of use	Ethno Medicinal uses
Hydrolea zeylanica (L.)Vahl	Hydroleaceae	Le-hgin tha	leaves	callous ulcers, skin diseases
Bulbophyllum careyanum Spreng.	Orchidaceae	Kaung-say-thi	pseudobulb	tuberculosis, tonic
Cryptocoryne retrospiralis (Roxb.)Kunth	Araceae	Unknown	rhizome	diarrhea, jaundice,
Portulaca oleracea L.	Portulacaceae	Portulacaceae	Whole plant	use as vegetable
Glycosmis pentaphylla (Retz,)DC.	Rutaceae	Taw shauk	leaves	leaves extract possess a healing effect
Symphorema involucratum Roxb.	Lamiaceae	Daung-ttalaung	Roots	ear diseases , wounds and burns
Peperomia pellucida (L.)Kunth	Piperaceae	Thit-yay-kyi	the whole plant	urinary troubles
Dracaena angustifolia (Medik) Roxb.	Asparagaceae	Ein-lone-chan-thar	leaves	cure for swelling of joints
Melastoma malabathricum L.	Melastomataceae	Say-oh-pok	leaves	skin diseases
Pterospermum semisagittatum Buch-Ham.	Malvaceae	Nwa-labyin	barks	used as a replacement for Areca nut
Buchanania arborescens (Blume) Blume.	Anarcardiaceae	Che-ti	leave	to treat headache
Piper cubeba L.f.	Piperaceae	Peik-chin	leaves	antiseptic, expectorant
Hellenia speciosa (.J Koeing) SR	Costaceae	Phalan-taung-hmwe	shoot	Used as vegetable
Homonoia riparia (Lour.)	Euphorbiaceae	Yeta - kyi	the whole plant	cure for pile
Amomum subulatum Roxb.	Zingiberaceae	Chin-baung-phar-lar	seeds	digestive disorders
Emilia sonchifolia (L.)DC.ex Wight	Asteraceae	Unknown	the whole plant	Used for febrifuge, anthelmintic
Getonia floribunda Roxb.	Combretaceae	Bu-nwe	flowers	Cure for abdominal menstruation
Syzygium lineatum (DC).Merr & L.M.Perry	Myrtaceae	Tha-bye	fruits	edible for tonic
Ochna integerrima (Lour.) Merr.	Ochnaceae	Indaing – say-ni	bark	Used for blood dysentery
Pittosporum glabratum Lindl.	Pittosporaceae	Hin- cho- pin	roots	Cure for arthritis, insomnia

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