

Morphological, Preliminary Phytochemical Examination and Antimicrobial Activities of Rhizomes of *Zingiber consuminar* Roxb.

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Abstract

Morphological study on *Zingiber consuminar* Roxb. belonging to the family Zingiberaceae was reported. In addition, this rhizome was studied by using phytochemical and antimicrobial tests. The phytochemical screening of rhizome extracts of *Zingiber consuminar* was carried out using standard methods. The phytochemical test indicated that alkaloids, steroids, terpenoids and lipophilic compounds were present in this rhizome. Furthermore, acetone, ethanol and distilled water extracts of rhizomes have been tested for their antimicrobial activities by using agar-well diffusion method against six different types of microbes such as *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumalis*, *Candida albicans* and *Escherichia coli*. Distilled water extract showed the effective activity against all microbes. According to the results of this research, distilled water extracts of rhizome of *Zingiber consuminar* will be useful in curing the diseases caused by the microbes mentioned above. The result of the morphological characters, phytochemical tests and microbial activities on the rhizomes of *Zingiber consuminar* were essentially informative in medicines. So it is hoped that, these results will be useful in medicine and public health care.

Key words: Morphological characters,

Phytochemistry, Antimicrobial characters, Zingiberaceae, Lashio area.

Introduction

Zingiberaceae is a family of 47 genera and 1400 species distributed in tropical and subtropical regions of the world. (Hutchison, 1967, Lawrence, 1964) Hooker (1894) reported that the family comprises 40 genera and 400-500 species. According to Hundley and Chit Ko Ko (1987), 125 species belonging to 18 genera were represented in the Union of Myanmar.

The family is characterized by presence of the leaves which are distichous or in spiral, the sheathing petioles usually opened, rarely closed, presence of aromatic oils, zygomorphic, flowers with differentiation of outer perianth series from the inner, single fertile stamen, petaloid staminodium, inferior ovary, and the seeds with mealy endosperm. Zingiberaceae are of considerable economic importance because of the commercial uses and medicinal products.

The phytochemistry has developed with the chemical aspects of various metabolite processes taking place in plants. The phytochemicals are plant chemicals that they have health enhancing effects. The plant produces numerous substances such as phenols, terpenoids, alkaloids, glycosides and various phytohormones. (British Pharmacopoeia, 1968)

Most of the members of Zingiberaceae have been used in worldwide as traditional medicines for the treatment of diseases. Herbal medicine is a traditional medicine based on the use of plant parts and plant extracts. The herbal medicines have been recognized as a valuable and readily available resource of primary health care. (Cruickshank, 1970)

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Finally, the aims were to provide the information of morphological characters, to observe the phytochemical findings, to interest the antimicrobial effects and to enhance the role of herbal medicine in pharmacological fields of Myanmar.

Materials and Methods

The specimens were collected during the months of July to September, 2018 in Lashio area. The collected specimens were washed and dried in room temperature for one month. After they were completely dried, they were ground to get powder and stored in air-tight containers for further uses.

Phytochemical tests for rhizome of *Zingiber consuminar* were carried out at the Laboratory of Botany Department, Shwebo University. Five grams of dried powder were added to 200 ml distilled water and then boiled on slow heat for one hour. It was then filtered, using filter paper and the filtrate was taken and used for phytochemical analysis.

Aqueous extracts of rhizome of *Zingiber consuminar* were tested for the presence or absence of active principles such as carbohydrates, tannins, saponins, flavonoids, alkaloids, phenols and proteins according to Trease & Evans, 2002.

For the determination of antimicrobial activity of various extracts, the agar well diffusion method was used because of its simplicity, speed of performance, economy and reproductibility. (Cruickshank, 1970)

The powder of rhizomes was extracted by acetone, ethanol and distilled water for about one week and then filtered. Then the extracts of powders were tested with six pathogenic microbes such as *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumalis*, *Candida albicans*, and *Escherichia coli* by using agar well diffusion method.

Nutrient agar was prepared according to the method of Cruickshank, 1970. Nutrient agar was boiled and 20-25 ml of the medium was poured into the test tube and plugged with cotton wool and sterilized at 121°C for 15 minutes in autoclave. After autoclaving, the tubes were water bathed and cooled down to 60°C and poured into sterilized petridish and 0.1-0.2 ml of test organisms were also added into the dishes. There were allowed to set the agar well. After that, about 0.2 ml of sample was introduced into the agar well and incubated at 37°C for 24 hours. The inhibition zone appeared around the agar well, indicates the presence of antimicrobial activity.

Results

Morphological characters

Zingiber consuminar Roxb. Asiat. Res. 11: 347. t. 5. 1810.

Myanmar Name : Meik-thalin

Family : Zingiberaceae

Flowering period: June to September

Perennial rhizomatous herbs, 1.0-1.5m high. Leaves simple, alternate, sheathing petiolate; blades lanceolate, 6.0-8.0 cm long and 1.5-5.0 cm wide, obtuse at the base, undulate along the margin, acute at the apex. Inflorescence dense spikes, 10-20 cm long and 3.5- 4.5 cm wide. Flowers yellow, 6.0-6.5 cm long and 2.8-3.0 cm wide; the lower bracts ovate; the upper bracts lanceolate; the floral bracts ovate. Calyx 3-lobed, 1.7-1.8 cm long and 1.0-1.2 cm wide; Corolla 3-lobed, 3.5- 4.0 cm long and 2.0 -3.0 mm wide; the dorsal 2.5- 2.7 cm long and 1.4-1.5 cm wide, the laterals 2.5-2.7 cm long and 0.7- 0.9 cm wide. Fertile stamen one, anther dithecous; basal

staminodes 2, linear-acicular, labellum obovate. Ovary inferior, oblongoid, trilocular, 2 ovules in each locule on the axile placenta; style filiform; stigma subglobose.



Figure 1. *Zingiber consuminar*, plants bearing inflorescences

Phytochemical Tests

Phytochemical screening was carried out on *Zingiber consuminar*. In the results of phytochemical tests, alkaloids, steroids, terpenoids and lipophilic compounds were present; flavonoids, glycosides, phenolic compounds, sugars, proteins and carbohydrates were not found. The results were shown in table 1.

Table 1. Phytochemical investigations of rhizomes of *Zingiber consuminar* Roxb.

No	Constituents	Extract	Reagent used	Observations	Results
1.	Alkaloids	Distilled water	Dragendroff's reagent	Orange ppt	+
2.	Flavonoids	Ethanol	Hydrochloric acid, Magnesium ribbon	No pink color	-
3.	Glycosides	Distilled water	10% Lead acetate	No yellow ppt	-
4.	Steroids	Ethanol	Acetic anhydride, Conc. H ₂ SO ₄	Green color	+
5.	Terpenoids	Ethanol	Acetic anhydride, Conc. H ₂ SO ₄	Red color	+
6.	Phenolic compounds	Distilled water	10% Ferric chloride	No deep blue color	-
7.	Sugars	Distilled water	Benedict's solution	No red color	-
8.	Proteins	Distilled water	Ninhydrin solution	No violet color	-
9.	Carbohydrates	Distilled water	Iodine solution	No red ppt	-
10.	Lipophilic compounds	Distilled water	0.5 M KOH	Deep color	+

+ = present, - = absent

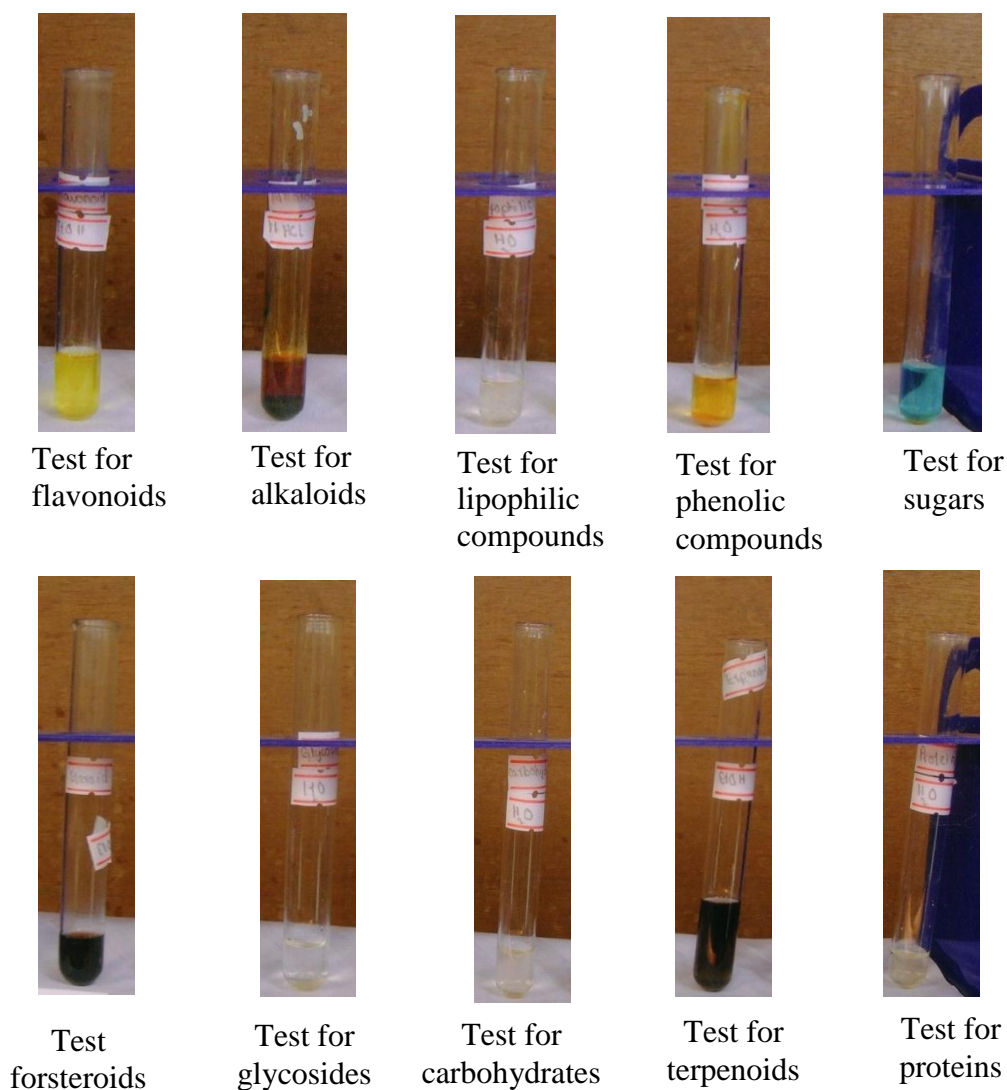


Figure 2. Phytochemical tests for *ZingiberconsuminarRoxb.*

Antimicrobial Tests

In vitro screening on antimicrobial activities of various solvent extracts of powdered samples (rhizomes) of *Zingiber consuminar* Roxb.(Meik-thalin)plant was tested.

In this experiment, antimicrobial activities of the extracts were carried out by using the solvents of acetone, ethanol and distilled water.

Distilled water extract showed the effective activity against all microbes. But acetone and ethanol extracts did not showed the activity on *Bacillus subtilis*. These results were described in Table 2.

Table 2. Antimicrobial activities of acetone, ethanol and distilled water extracts from powdered rhizomes of *Zingiber consuminar* Roxb

Samples	Solvents	Organisms					
		<i>Bacillus subtilis</i>	<i>Staphylococcus aureus</i>	<i>Pseudomonas aeruginosa</i>	<i>Bacillus pumalis</i>	<i>Candida albicans</i>	<i>Escherichia coli</i>
<i>Zingiber consuminar</i>	Acetone	-	10 mm (+)	9 mm (+)	9 mm (+)	10 mm (+)	10 mm (+)
	Ethanol	-	10 mm (+)	12 mm (++)	10 mm (+)	11 mm (+)	11 mm (+)
	Distilled water	10 mm (+)	11 mm (+)	10 mm (+)	10 mm (+)	11 mm (+)	11 mm (+)

Agar well - 7 mm
 7 mm - 11mm (+)
 12 mm - 16 mm (++)
 17 mm - above (+++)

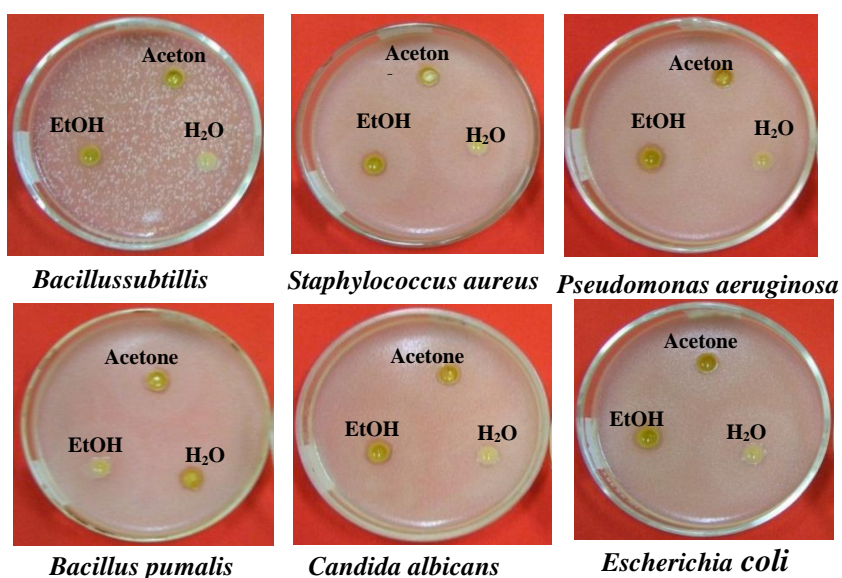


Figure 3. Treatment of different extracts of *Zingiberconsuminar* rhizome on test organisms

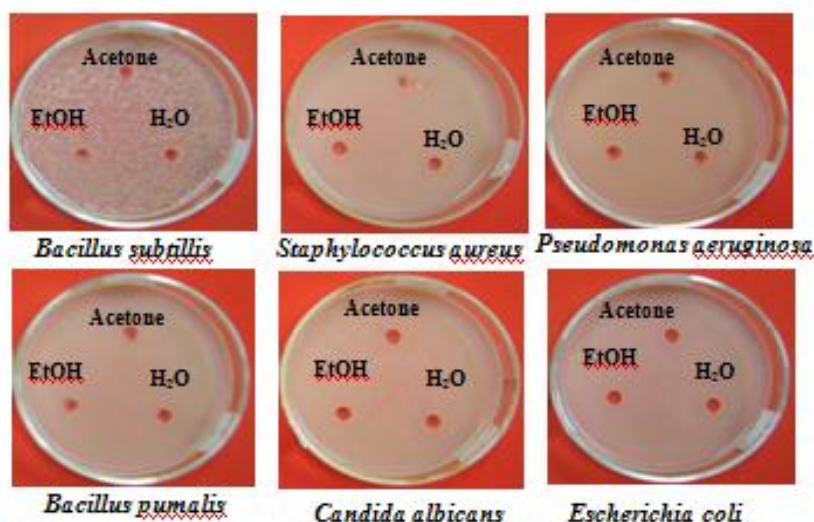


Figure 4. Control system of different solvents on test organisms

Discussion

Zingiber consuminar belonging to the family Zingiberaceae was collected in Lashio area. Morphological characters, phytochemical tests and microbial activity were investigated with six different types of bacteria, viz. *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus pumalis*, *Candida albicans* and *Escherichia coli*.

This species were characterized by perennial underground stems (rhizomes), leaves simple and distichous, the sheathing petioles usually opened, rarely closed. The flowers are irregular, trimerous, with single fertile stamen and two to five petaloid staminodes. The ovary was inferior, trilocular, axile placentation. These morphological characteristics were in accordance with those described by Rendle (1930), Lawrence (1964), Nyunt Nyunt San (1992).

In phytochemical test of this species, alkaloids, steroids, terpenoids and lipophilic compounds were present; glycosides, flavonoids, phenolic compounds, sugars, proteins and carbohydrates were not found.

Distilled water extract showed the effective activity against all microbes. But acetone and ethanol extracts did not show the activity on *Bacillus subtilis*.

Cruickshank (1970) stated that soft tissue infections and skin diseases are caused by *Bacillus* species. Urinary tract infection, diarrhea and dysentery caused by *E. coli*. *Pseudomonas aeruginosa* can cause burns and wound infections. Inflammation is caused by *Staphylococcus aureus*. *Candida albicans* can also cause sores and many skin diseases.

According to the results of this research, distilled water extract of rhizomes of *Zingiber consuminar* will be useful in curing the diseases caused by the microbes mentioned above.

Conclusion

The results of the morphological characters, phytochemical tests and microbial activities on the rhizomes of *Zingiber consuminar* were essentially informative in medicines. So, it is hoped that these results will be useful in medicines and public healthcare. The further researches on the members of family Zingiberaceae in various fields are still being needed.

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References

- British Pharmacopoeia. 1968. The Pharmaceutical Press. London and Bradford, London W.C.I.
- Cruickshank, R., J.P. Duguid, B.P. Marinion and R.H.A Swain, 1970. Medical Microbiology. Churchill Livingstone Ltd.
- Harborne, I.B. 1993. "Phytochemical Method" 1993, "A Guide to Modern Techniques of Plant Anatomy", U.S.A.
- Hundley, H.G. and Chit Ko Ko. 1987. List of Trees, Shrubs, Herbs, and principle Climbers, etc. Government Printing Press, Yangon.
- Hutchison, J., 1967. The Families of Flowering Plants. Macmillan and Co. Ltd., London.
- Kress, J., W. Robert Defilippis, A Ellen Farr and Yin Yin Kyi, 2003. Checklist of Trees, Shrubs, Herbs and Climbers of Myanmar. Department of Systematic Biology-Botany, National Museum of Natural History, Washington D.C, U.S.A.
- Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants, 9th printing, 1964. The Macmillan Company, New York.
- Rendle, A.B. 1930. The Classification of Flowering Plants. Vol. I Cambridge at the Nagar, New Delhi.
- Trease and Evans. 2002. Pharmacognosy, 15th ed. W.B. Sanders, Edinburgh, London, New York.