International Journal of Research in Pharmacy and Pharmaceutical Sciences
www.pharmacyjournal.in
ISSN: 2455-698X
Received: 16-03-2021, Accepted: 02-04-2021, Published: 29-04-2021
Volume 6, Issue 2, 2021, Page No. 40-42

Comparative study of In vitro antibacterial activity of essential oil of two *Zingiberaceae* family species

Sapna*, Pushpa Joshi, Kirti Singh, Vandana Koshyari, Manoj Dhouni
Department of Chemistry, D.S.B. Campus, Kumaun University Nainital, Uttarakhand, India

Abstract
The studied plants in this research belongs to the family *Zingiberaceae* which is well known source of many spices and medicinal drugs. Many plants belonging to this family have been remained unexplored. Ginger and curcumin are also from this family which is used in India on regular basis as main spices due to their marvelous properties. The comparative studies helps to examine and explain if particular characteristic traits are followed by all the members belonging to same family. And also to discover the one which is best of all. The present investigation was performed to detect in vitro antibacterial activity of essential oils from leaves of *Roscoea purpurea* and *Zingiber chrysanthum*. The essential oil was obtained by hydro distillation of plants using Clevenger apparatus. The Antibacterial effect was examined by Well diffusion method against *Escherichia coli, Bacillus subtilis, Staphylococcus aureus and Pseudomonas aeruginosa.* This study has shown that both the essential oils are effective against gram positive and gram negative bacteria. The present study results that these plants can be explored as new bacteriostatic agents.

Keywords: *Roscoea purpurea, Zingiber chrysanthum*, antibacterial activity and essential oil

Introduction
Roscoea purpurea has broad leaves, very strong and thick rhizome. The plants grows upto 40-50cm of height. Generally this plants is used as ornamental plant. The tubers of this plant is being used traditionally in Nepal for the treatment of urinary infection, diabetes, fever, diarrhoea. And also the tubers are used for edible purpose. *Roscoea purpurea* is one of the main ingredients of Ashtvarga. Tubers of *R. purpurea* exhibit Antioxidant activity, antidiabetic activity, hypolipidemic activity and Immuno-modulatory [1, 6].
Zingiber chrysanthum belongs to ginger family. The studies conducted on *Zingiber officinale* (ginger) has revealed that it shows many biological activities. It is used traditionally for curing cough, cold and respiratory related problems. In India it is used as spice in daily food and tea. It possess many biological properties such as antimicrobial, diabetes, anticancer, anti-inflammatory, respiratory disorder and antioxidant activity [7, 12]. Ginger contains compounds like terpenoids, alkaloids β-carotene, ascorbic acid, flavonoids *etc* [13]. Ginger is also used as veterinary medicine for treatment of horses and cattles for Abdominal and digestion related problems [14, 15]. The leaves of *Hedychium* are boiled and used for indigestion [16, 17]. Aromatic and herbal plants are used in making cosmetics. Many cultivators grow medicinal plants and make herbal tea, herbal beauty products. Problems arising about the obtaining and use of gingers for cosmetics and Beauty care products such as sustainability, economics, reproducibility and quality control should be discussed by the industries [18].
Today we are facing problems arising due regular use of chemicals in our day today life such as food, cosmetics etc. Thus people are moving towards the use of natural and herbal products. The consumer have realised the value of products that have natural preservatives and with no artificial ingredients. The antimicrobials used traditionally for preservation of food have proven to be very effective. Thus the research is encouraging, but much more is to be studied to evaluate the importance of essential oils of *Zingiberaceae* family plants in support of their practical applications [19].

Materials and methods
The aerial part of *Roscoea pupurea* plant was collected in the month of July and the aerial part of *Zingiber chrysanthum* plant was collected in the month of October from Uttarakhand, India (above 2400m). The fresh plant leaves collected were cut into small pieces and hydro distillated in Clevenger apparatus about 7-8 h for extraction of essential oil and dried over anhydrous Na_2SO_4.

Bacterial strains
The microbial strains used were, Gram-positive *Bacillus subtilis* (MTCC 441), *Staphylococcus aureus* (MTCC 737) and Gram-negative *Pseudomonas aeruginosa* (MTCC 424), *Escherichia coli* (MTCC 443), *Salmonella typhimurium* (MTCC 531) and *Klebsiella pneumonia* (MTCC 3384) which were obtained from IMTECH Chandigarh, India which are maintained by sub-culturing on nutrient agar after a time period of every 3 months at Department of Biotechnology, Bhimtal campus, Kumaun University, Bhimtal.

Antibacterial screening
The Antibacterial activity was determined by well diffusion method against six bacterial strains. The test of antibacterial activity was performed by determining the MIC and MBC using Well diffusion method. The preliminary screening of antibacterial activity was conducted at 200 µl/ml concentration. The media was prepared and poured into sterilized petri plates. Then the media was kept until it solidify. About 1×10^6 CFU/ml of microbial strain inoculum were cultured and 50 µl of bacterial strains was taken to

spread over the solidified media. The well of diameter 6mm were made on the solidified plates. Chloroamphenicol (30µg) per disc was taken as positive control, while n-Hexane was taken as negative control for all bacterial strains. The essential oil solution of desired concentrations were prepared i.e., 50 µl/ml, 100 µl/ml, 200 µl/ml and 400µl/ml to determine MIC values. With the help of pipette essential oil with desired concentration was poured into the well on petri plates and allowed to incubate in inverted position at 37±1°C for 1 day. The diameter of the zone of Inhibition (ZOI) was measured in mm. MICs were determined as the lowest concentration of essential oil inhibiting the visible growth of organism on agar plates. All experiments were carried out in triplicates [20].

Result

Table 1 summarizes the antibacterial activity revealed by the essential oil samples of *Roscoea purpurea* and *Zingiber chrysanthum*. Both the samples have shown a broad spectrum of antibacterial test. The inhibitory effect of samples are different as per bacterial strain. The essential oil of *Roscoea purpurea* is effective against four bacterial strains i.e *Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa* and *Bacillus subtilis.* The zone of inhibition observed for essential oil from *Roscoea purpurea* leaves was maximum against *Klebsiella pneumonia* and *Bacillus subtilis*, while no activity was shown against *Salmonella typhimurium* and *Staphylococcus aureus*. The MIC values observed for different bacteria are 50(µl/ml) for *Staphylococcus aureus* and *Bacillus subtilis*, 100(µl/ml) for *Escherichia coli* and *Pseudomonas aeruginosa*. *Zingiber chrysanthum* leaves essential oil has shown antibacterial activity against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Salmonella typhimurium*. The maximum efficacy was shown against *Pseudomonas aeruginosa* followed by *Escherichia coli*, and minimum ZOI for *Salmonella typhimurium*. The MIC value for *Pseudomonas aeruginosa* and *Escherichia coli* is 50(µl/ml), *Bacillus subtilis* and *Staphylococcus aureus* is 100(µl/ml), while for *Salmonella typhimurium* is 200 µl/ml.

Conclusion

The present study indicated that essential oil of *Roscoea purpurea* is much more effective against bacterial strains than compared to essential oil of *Zingiber chrysanthum* leaves**.** Both the plants belongs to similar family, but shows different biological properties to different extent. This may be due to presence of different chemical constituents in essential oil of plants or presence of different area percentage of similar chemical compounds. The present study suggests that *Roscoea pupurea* and *Zingiber chrysanthum* can be explored as new antibacterial agents to fight pathogenic microorganisms.

Table 1: Antibacterial activity of *Roscoea purpurea* and Zingiber chrysanthum leaves by well diffusion method.

Microbial strain	Plant	Zone of inhibition (mm) CA	Zone of inhibition at concentration (µl)			
			400	200	100	50
Escherichia coli (MTCC 443)	R.P	21.15±0.1	14.13±0.30	11.96±0.15	9.96±0.15	8.76±0.20▲
	Z.C	19.18±0.33	13±0.20	10.43±0.20	9.26±0.15	9.03±0.25▲
Bacillus subtilis (MTCC 441)	R.P	25.12±0.15	19.86±0.20	17.76±0.15	14.53±0.15	12.10±0.20▲
	Z.C	20.08±0.20	N/O	N/O	N/O	N/O
Klebsiella pneumonia (MTCC 3384)	R.P	24.80±0.15	18.06±0.15	16.46±0.15	13.06±0.15	9±0.10▲
	Z.C	23.20±0.20	N/O	N/O	N/O	N/O
Staphylococcus aureus (MTCC 737)	R.P	26.08±0.25	N/O	N/O	N/O	N/O
	Z.C	20.19±0.10	11.10±0.10	9.66±0.15	7.76±0.15▲	N/O
Pseudomonas aeruginosa (MTCC 424)	R.P	18.90±0.25	10±0.10	8.96±0.15▲	N/O	N/O
	Z.C	25.12±0.20	19.63±0.15	15.60±0.10	14.10±0.20	12.26±0.15▲
Salmonella typhimurium (MTCC 531)	R.P	23.40±0.21	N/O	N/O	N/O	N/O
	Z.C	20.30±0.15	10.8±0.10	9.16±0.15▲	N/O	N/O

CA: Chloroamphenicol
R.P: *Roscoea pupurea*,
Z.C: *Zingiber chrysanthum*
▲: Minimum inhibitory concentration (MIC)
N/O: Not Observed

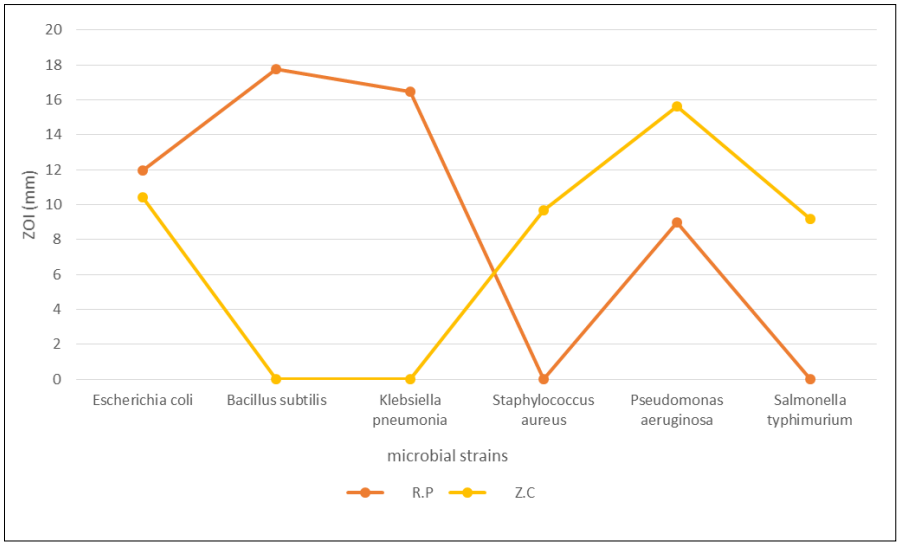

Fig 1: Antibacterial activity of R.P and Z.C leaves Essential oil samples against bacteria at 200 µL/mL

Acknowledgment
We are thankful to the Department of Biotechnology, Bhimtal campus, Kumaun University, Bhimtal for providing lab facility to perform biological activity.

Conflict of interest
We declare that there is no conflict of interest**.**

References
1. Misra A, Srivastava S, Verma S, Rawat AKS. Nutritional evaluation, antioxidant studies and quantification of poly phenolics, in *Roscoea purpurea* tubers, BMC Res Notes, 2015: 8:324.
2. Singh G, Rawat GS. Ethnomedicinal survey of Kedarnath wildlife sanctuary in Western Himalaya, India, Indian J Fundamen App Life Sci, 2011:1(1):35-36.
3. Bag BG, Dash SS, Roy A. Study of Antioxidant Property of the Rhizome Extract of *Roscoea purpurea* Sm. (Kakoli) and its Use in Green Synthesis of Gold nanoparticles, Int. J Res. Chem. Environ, 2014:4(2):174-180.
4. Bairwa R, Basyal D, Srivastav B. Study of antidiabetic and hypolipidemic activity of *Roscoea purpurea* (*Zingiberaceae*), Int J Institut Pharm Life Sci,2012:2(4):130-137.
5. Sahu MS, Mali PY, Waikar SB, Rangari VD. Evaluation of immuno modulatory potential of ethanolic extract of *Roscoea procera* rhizomes in mice, J Pharm Bioallied Sci, 2010:2(4):346-349.
6. Kumar NV, Murthy PS, Manjunatha JR, Bettadaiah BK. Synthesis and quorum sensing inhibitory activity of key phenolic compounds of ginger and their derivatives, Food Chem,2014:159:451-457.
7. Wei C, Tsai Y, Korinek M, Hung P, El-Shazl M, Cheng Y *et al*. 6-Paradol and 6-shogaol, the pungent compounds of ginger, promote glucose utilization in adipocytes and myotubes, and 6-paradol reduces blood glucose in high-fat diet-fed mice, Int. J Mol. Sci,2017:18:168.
8. Citronberg J, Bostick R, Ahearn T, Turgeon DK, Run MT, Djuric Z *et al*. Effects of ginger supplementation on cell-cycle biomarkers in the normal-appearing colonic mucosa of patients at increased risk for colorectal cancer: Results from a pilot, randomized, and controlled trial, Cancer Prev. Res, 2013:6:271-281.
9. Zhang M, Viennois E, Prasad M, Zhang Y,Wang L, Zhang Z *et al*. Edible ginger-derived nanoparticles: A novel therapeutic approach for the prevention and treatment of inflammatory bowel disease and colitis-associated cancer, Biomaterials, 2016:101:321-340.
10. Townsend EA, Siviski ME, Zhang Y, Xu C, Hoonjan B, Emala CW. Effects of ginger and its constituents on airway smooth muscle relaxation and calcium regulation, Am. J Resp. Cell Mol,2013:48:157-163.
11. Nile SH, Park SW. Chromatographic analysis, antioxidant, anti-inflammatory, and xanthine oxidase inhibitory activities of ginger extracts and its reference compounds, Ind. Crop. Prod, 2015:70:238-244.
12. Bartley J, Jacobs A. Effects of drying on flavour compounds in Australian grown ginger (*Zingiber officinale*), J Sci Food Agric, 2000:80:209-215.
13. Blumenthal M. (Ed.) The complete German Commission E Monographs. In Therapeutic Guide to Herbal Medicine, American Botany Council: Austin, TX, USA, 1999.
14. Pakrashi SC, Pakrashi A. Ginger; Vedams: New Delhi, India, 2003.
15. Ujang Z, Nordin NI, Subramaniam T. Ginger Species and Their Traditional Uses In Modern Applications, Journal of Industrial Technology, 2015.
16. Ibrahim H, Hedychium J Koenig. In Plant Resources of South-East Asia Medicinal and Poisonous Plants 2. (Eds. van Valkenburg, J.L.C.H and Bunyapraphatsara, N.) Backhuys Publishers, Leiden, the Netherlands, 2001:12(2):290-295.
17. Barbara MS. Responsible Use of Medicinal Plants for Cosmetics, In Hort Science, 2001, 47(8).
18. Mehdi SR, Elena MV, Bahare S, Javad SR, Karl RM, Seyed AA *et al*. Plants of the Genus Zingiber as a Source of Bioactive Phytochemicals: From Tradition to Pharmacy, Molecules,2017:22:2145.
19. Bauer AW, Kirby WMM, Sherris JC, Turek M. Antibiotic susceptibility testing by standardized single disc method, Am. J Clin. Pathol, 1966:45(4):493-496.
20. Leelasuphakul W, Himmanae P, Chuentchitt S. Growth inhibitory properties of Bacillus subtilis strains and their metabolites against the green model pathogen (*Penicellium digitatum* Sacc.) of citrus fruit. Postharvest Biol Technol, 2008:48:113-21.