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Physicochemical and Antibacterial Activity of Rhizomes of *Curcuma angustifolia* Roxb, (Zingiberaceae)

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Abstract: ***The antimicrobial properties of methanolic extract of Curcuma angustifolia Roxb. rhizomes were assayed in vitro against human pathogenic bacteria represented by Pseudomonas aeruginosa, Salmonella typhi, Staphylococcus aureus, Escherichia coli and Shigella flexneri by 96 well-plate method. The extracts studied in the present investigation exhibited varying degree of inhibitory effect against all tested bacteria. The result shows MIC at 2 µl for P. aeruginosa, S. typhi, S. arueus and S. flexneri whereas it was 8 µl for E. coli. The antibacterial activity may due to variety of secondary metabolites present in the plant, such as glycoside, flavonoid, tannin and phytosterol, which have been found in vitro to have antimicrobial properties. Physicochemical analysis of the rhizome powder showed 2.50 % total ash, 0.50 % acid insoluble ash, 2.0 % acid soluble ash, 0.50 % water insoluble ash, water soluble ash 2.0 % and 19.04% loss on drying. Rhizomes are rich source of protein, carbohydrate and minerals. This is the first report on the pharmacognostic studies of C. angustifolia Roxb. rhizome. The results of pharmacognostic analysis were helpful in developing standards for purity, quality and identification of the crude drugs.***

Keywords: *Curcuma angustifolia*, rhizome, physicochemical, antibacterial activity

1. Introduction

The natural plant materials have served as an important source of pharmaceutical products since time immemorial; the modern medicines for human use are required to meet exacting standards that relate to their efficacy, quality and safety [1]. Some of antibiotics have failed to discourage the growth of many bacteria that have genetic ability to resist to particular drugs, and these antibiotics may have the various side effects on human body which can harm to vital organs of body like kidney, liver, pancreas and their impact on the immune system [2]. Plants are rich source of natural products used to cure various kinds of diseases, as it have a wide variety of secondary metabolites, such as alkaloids, flavonoid, phenols, tannins, terpenoids, phytosterol and steroids. As per World Health Organization (WHO) report, approximately 80% of the global population relies on traditional herbal medicines as part of standard healthcare system [3].

Common names of *C. angustifolia* in English: 'narrow-leaved turmeric; Manipuri: yaipan; Hindi: tikhur; Malayalam Koova. The rhizomes of *C. angustifolia* used as ethnic food and for its medicinal values [4, 5]. It has potential antioxidant, antimicrobial and anti-cancerous activity towards human cervical cancer HeLa cells [6]. In Madhya Pradesh (India), it used in the treatment of indigestion, skin diseases, cough, bronchitis, allergy, leucoderma and as general tonic, it has also found beneficial in diarrhoea, dysentery and colitis, typhoid fever, ulceration of bowels, bladder and in painful micturation [7]. In the present investigation, an indigenous medicine *Curcuma angustifolia* Roxb is tested against various disease causing human pathogenic bacteria to prove its antibiotic efficiency and physicochemical analysis studied.

2. Material and Methods

The samples of *Curcuma angustifolia* Roxb was collected from Sitakhandi, Nanded district of Maharashtra and identified by using reliable literature [8, 9, 10, 11]. The herbarium specimen deposited in VH Herbarium, department of Botany, Vivekanand Arts, Sardar Dalipsingh Commerce and Science College, Samarth Nagar, Aurangabad.

Preparation of crude extracts

Dried rhizome powder sample (10g) was extracted in a Soxhlet apparatus with methanol used as solvent at 65^0 C for 18-24 hrs and the sample was stored in amber coloured bottle for the further study.

Test microorganisms and their sources

The authentic culture of human pathogenic gram negative and gram positive bacteria viz. *Salmonella typhi* (NCIM-2501), *Pseudomonas aeruginosa* (NCIM-5029), *Shigella flexneri* (NCIM-5265), *E. coli* (NCIM- 2931) and *Staphylococcus aureus* (NCIM-5021), were obtained from the department of Microbiology, Vivekanand Arts, Sardar Dalipsingh Commerce & Science College, Samarth Nagar, Aurangabad, Maharashtra.

Antibacterial Assay

96-well plates method:

About 100µl sterile Mueller-Hinton broths was added onto each well along with 2µl serial diluted human pathogenic bacteria suspension in each well, next different concentrations of methanol extracted samples as 2, 4, 6, 8 and 10µl was loaded to each well. Control was prepared by nutrient broth and bacterial suspension without adding plant extract. The prepared 96-well plate was sealed with parafilm and incubated at 37°C for 24 hours in incubator. Finally, the optical density was measured at 540 nm on the spectrophotometer.

Physicochemical study

The methods of [12, 13, 14, 15, 16] were adopted for the study of dried powder and methanolic extract of rhizome of *Curcuma angustifolia* Roxb.

3. Results and Discussion

The methanolic rhizome extract of *C. angustifolia* Roxb., in various concentrations were tested against human pathogenic bacteria, it was cleared from the results, that maximum inhibition of *P. aeruginosa*, *S. typhi*, *S. arueus* and *S. flexneri* were found in 2µl concentration, whereas in case of *E. coli* it was 8µl. Regarding minimum inhibitory concentration (MIC) it was 2 µl for bacterium *P. aeruginosa*, *S. typhi*, *S. arueus* and *S. flexneri* while it was 8 µl for *E. coli* (table 1).

Table 1: Antibacterial activity of C. angustifola Roxb against human pathogens

Sr. No	***C. angustifola*** (conc. µl)	Human pathogenic Bacteria (2µl)				
		P. aeruginosa	*S. typhi*	*S. arueus*	*E. coli*	*S. flexneri*
1	2 µl	0.28	0.28	0.26	0.29	0.29
2	4 µl	0.39	0.32	0.27	0.31	0.48
3	6 µl	0.45	0.50	0.37	0.39	0.45
4	8 µl	0.45	0.56	0.56	0.25	0.46
5	10 µl	0.42	0.52	0.43	0.43	0.37
	MIC	**2** µl	**2** µl	**2** µl	**8** µl	**2** µl
	S. E	± 0.031	± 0.056	± 0.054	± 0.033	± 0.035

Quantitative chemical parameters

The different physicochemical tests were carried out for the determination of dry matter (DM), total ash (TA), acid insoluble ash (AIA), acid soluble ash (ASA), nitrogen (N), crude protein (CP), calcium (Ca) and phosphorus (P) and results are given in (table 2). The various phytochemical tests were done for the detection of chemical constituents (table 3).

Table 2: *Physicochemical analysis of C. angustifolia Roxb rhizome*

D M (%)	T A (%)	A I A (%)	A S A (%)	WIA (%)	WSA (%)	Ca (%)	P (%)	N (%)	Protein (%)
19.04	8.00	0.75	7.25	0.50	2.00	0.041	0.224	9.83	61.43

Table 3: Phytochemical group test for the rhizome extract of *C. angustifolia* Roxb.

Sr. no.	Phytoconstituents	Rhizome extract of *C. angustifolia* Roxb.
1	Carbohydrate	++
2	Protein	++
3	Starch	++
4	Amino Acid	--
5	Steroid	--
6	Glycoside	++
7	Flavonoid	++
8	Tannin	++
9	Alkaloid	--
10	Phenol	--
11	Terpenoids	--
12	Phytosterol	++

++ Presence, -- Absence

4. Conclusion

The rhizome of *Curcuma angustifolia* has potential antibacterial agent as it shows significant activity against bacterial pathogens and physicochemical properties has great importance in the nutrition and medicine. The present results will form the basis for selection of *Curcuma angustifolia* for further investigation in the potential discovery of new herbal bioactive compounds. However, further studies are needed to better evaluate the potential effectiveness of the crude extracts.

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References

[1] **Rahumadhunisha Begam S., Karthikeyan S., Arumugamand S. and Ahmed John (2014),** Antibacterial activity of *Curcuma pseudomontana* with Special Reference to Multi Drug Resistant Pathogens, *International Journal of Pharmacological Screening Methods*, Vol. 4(3)127-130.

[2] **Neamah Sukaina R., Maytham T. Qasim, Lamees M. Al-Janabi and Amany Sh. Jaber (2016),** In Vitro Evaluation Antimicrobial Activities of Two Medicinal Plant Extracts and Compared With Some Antibiotics, *European Journal of Pharmaceutical and Medical Research*, Vol. 3(8) 676-684.

[3] **Chachad D. P., Talpade M. B. and Jagdale S. P. (2016)** Antimicrobial Activity of Rhizomes of *Curcuma zedoaria* Rosc. *International Journal of Science and Research*, Vol. 5(11) 938-940.

[4] **Sharma, Anjali (2012).** Traditional processing of Shotti (*Curcuma angustifolia* Roxb.)-A rhizome based ethnic weaning food. *Indian Journal of Traditional Knowledge*, Vol. 11(1): 154-155.

[5] **Devi, A. D., Singh, T. C., Devi, O. I., Singh, S. S., Singh, A. R. and Singh, E. J. (2015).** Phytochemical analysis of some traditional aromatic plant species of Thoubal district, Manipur. *Asian Journal of Pharmaceutical Science & Technology*, Vol. 5(1): 50-53.

[6] **Nayak, S., Jena A. K. and Sucharita, S. (2013).** *In vitro* bioactivity studies of wild *Curcuma angustifolia* rhizome extract against (Hela) Human Cervical Carcinoma cells**.** *World Journal of Pharmacy and Pharmaceutical Sciences*, Vol. 2(6): 4972 - 4986.

[7] **Quamar, M. F. and Bera, S. K. (2014).** Ethno-medico-botanical studies of plant resources of Hoshangabad district, Madhya Pradesh, India: Retrospect and Prospects. *Journal of Plant Science & Research*, Vol. 1(1): 101.

[8] **Cooke, T.** (1958) The Flora of The Presidency of Bombay, Vol. 3, *Botanical Survey of India*, Calcutta. pp. 235-239.

[9] **Naik, V. N. (1998)**. Flora of Marathwada. Vol. II, *Amrut Prakashan*, pp. 830 - 832.

[10] **Sharma, B. D., Karthikeyan, S., Singh, N. P. and Lakshminarsimhan, P.** (1996) Flora of Maharashtra state Monocotyledons. *B.S.I.* pp. 72-77.
[11] **Sabu, M. (2006).** Zingiberaceae and Costaceae of South India. *Indian Association for Angiosperm Taxonomy, Calicut University, India,*
[12] **Thimmaiah, S. R. (1999),** Standard methods of biochemical analysis. *Kalyani Publishers:* 1-435.
[13] **Edeoga, H. O., Okwu, D. E. and Mbaebie (2005),** phytochemical constituents of some Nigerian medicinal plants. *African Journal of Biotechnology,* Vol. 4 (7): 685-688.
[14] **Tiwari, P., Kumar, B., Kaur, M., Kaur, G. and Kaur, H. (2011),** phytochemical screening and extraction: A Review. *Internationale Pharmaceutica Sciencia,* Vol. 1(1): 98 -106.
[15] **Sahu, Rajeshwari and Saxsena Jyoti (2012),** Evaluation of phytochemical constituents in conventional and nonconventional species of *Curcuma, International Research Journal of Pharmacy,* 3(8): 203-204.
[16] **Deb Nilanjana, Majumdar Purba and Ajoy Kumar Ghosh (2013)** Pharmacognostic and Phytochemical Evaluation of the Rhizomes of *Curcuma longa* Linn., *Journal of Pharma SciTech*, Vol. 2(2) 81-86.

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