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Phytochemical and pharmacological analysis of *Lepidagathis cristata*, Willd. (Acanthaceae)

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Abstract

Medicinal plants are expensive gift from nature to human. The use of plants and plant products as medicines could be traced as far back as the beginning of human civilization. The earliest mention of medicinal use of plants in Hindu culture is founds in "Rigveda", which is said to have been written between 4500-1600 B.C. and is supposed to be the oldest repository of human knowledge. The herbal medicines serve the health needs of about 80% of the world's population, especially for millions of people in the vast rural areas of developing countries; more than 65% of the global population uses medicinal plants as a primary health care modality. India is one of the world's 12 biodiversity centers with the presence of over 45,000 different plant species. Of these, about 15,000 to 20,000 plants have immense medicinal value. Everyday new inspiring information is being added to folklore medicine for the development of drugs. The present study was carried out to determine the vast pharmacological applications of *Lepidagathis cristata*, Willd (Acanthaceae), a multipurpose medicinal plant. Traditionally this herb is used for the treatment of fever, eczema, psoriasis, epilepsy, skin abscess, burns, mouth ulcer, snake bites, wounds, anti-inflammatory, hypoglycaemic, immunosuppressive, skin itching and other skin diseases. The present article highlights the phytochemical screening and pharmacological properties of *Lepidagathis cristata.* Taking great concern of the useful benefits of the plant it can be used as safe drug for mankind.

Key words: *Lepidagathis cristata, anti-inflammatory, analgesic , immunosuppressive*

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INTRODUCTION

Medicinal plants are the richest bio-resources of folk medicines and traditional systems of medicines, food supplements, pharmaceutical and clinical entities for synthetic drugs (Ncube *et al*., 2008).The World Health Organization reported that about 75%- 95% of world population of developing countries were chiefly rely on traditional medicines and major part of traditional therapies involve the use of plant extract products on their active constituents (WHO, 2011). Researchers are increasingly turning their attention to folk medicine and looking for new leads to develop better drugs against cancer, as well as viral and microbial infection (Hoffman *et al*., 1993).

India is a varietal emporium of medicinal plants and it is one of the richest countries in the world as regards genetic resources of medicinal plants. It exhibits a wide range in topography and climate, which has a bearing on its vegetation and floristic composition. About 2,500 plant species are known to be useful and more than 6,000 manufactures produce about 1,500 Ayurvedic, Unani and Siddha medicinal preparations from plants. South India in particular blessed with diverse medicinal taxa. In the recent past, the Ethno botanical survey has been triggered to gather the medicinal knowledge of tribal as well as non-tribal groups (Madhu *et al*., 2010). Hence the present study was designed to throw light on a medicinal herb *Lepidagathis cristata,*Willd, belonged to the family Acanthaceae for its ethnomedicinal uses, phytochemical constituents and pharmacological activities.

L.cristata (Figure-1) is commonly known as 'Nakkapidi', 'Lankapindi' (Yanadi tribal), 'Mullabanthi'(Telugu), 'Karappanpoondu' (Tamil), 'Karappanundu' (Malayalam) and 'Otdhompo' (Santhal tribe) (Purma Aravinda Reddy and Venkatesh war Rao, 2013). It is distributed in the central and eastern peninsular India; Konkan, Deccan North Circars, Carnotic and other regions. Usually it appears in dry places and waste lands. It is a perennial herb with branched – sessile, linear-lanceolate leaves, globose headed flower, crowded at the base of the stem, hairy calx, white with brown or purple spoted corella, didynamous anther two celled and exerted stamens, fruit capsule with seeds. Flowering seasons is January – March (Gamble, 1967).

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Fig. 1.

cristata has a lot of traditional uses. The shade dried powder of *L.cristata* plant mixed with honey in two spoonfuls is administered twice a day for about twenty days for asthma disease (Madhu *et al*., 2010). Whole plant powder is mixed with coconut oil to treat itchy infections in ethnic groups of Kurnool, Andhra Pradesh (Venkata Subbaiah and Savithramma, 2012), ash of entire plant is boiled with coconut oil and the infusion is applied externally on chronic wounds of pet animals twice a day up to 6-8 days (Salave Ashok Punjaji, 2012), dried shoot ash used for skin infections (Jagtap *et al*., 2010) and the whole plant paste is used for itching infections (Sinha *et al*., 2013).

The mixture of root paste is mixed with seed powder of *Abrus precatorius* and karanj oil is applied for leucoderma (Varghese, 1996). The root of the herb also used as antidysenteric and reduces heat in stomach and fumigation of the herb inhaled for the treatment of epilepsy (Nitin Dongarwar *et al*., 2012). In Chhattisgarh, the leaf extract is used for malarial fever and to clean the cattle in rainy season, and it is also used for skin itchy affection, burns and wounds. The leaf juice with copper sulphate is given during snakebite for gaining consciousness (Sikarwar *et al*., 2008). The aqueous extract of leaves mixed with *Ocimum* juice in 10:1 ratio is used to cure fever by 'Yanadi' tribal of Andhra Pradesh (Purma Aravinda Reddy and Venkatesh war Rao, 2013). Leaf extract is externally applied for ring worm and skin diseases (Sathya Bama *et al*., 2013).

The inflorescence ash is mixed with coconut oil and applied on the affected part for a week to treat inflammation, skin abscess and tumors (Hamambarareddy *et al*., 2000). The tuberous flower ash mixed with coconut oil is applied externally for burns and wounds (Sudhakar Reddy *et al.,* 2009) and smoke of flower head is used to treat mouth ulcer (Pawar Shubhangi, 2011). Inflorescence ash is mixed with oil applied externally for black batches on face (Vijigri Dinesh, 2013).

Chloroform, ethyl acetate and methanolic flower extract of *L.cristata* showed analgesic activity. This is screened by hot plate and tail immersion methods (Aravinda Reddy Purmaand RaoVenkateshwar, 2013). The antiemetic activity was reported in chicks using ethanolic extract of the herb (Rachapalli Sowjanya Kumar Reddy *et al*., 2014). Methanol, ethyl acetate and chloroform root extracts of *L.cristata* showed anti-inflammatory activity by carrageenan induced paw edema method and formalin induced paw edema method (Vijaya Narasimha Reddy *et a*l., 2014). The hypoglycaemic activity was studied and reported in ethanolic extract of *L. cristata* in alloxan induced diabetic rats (Srinija *et al*., 2013). In *L. cristata* , alkaloid-I (cristain) showed immunosuppressive activity against con-A (2 µg / ml, T-cells) and LPS- induced (B-cells) proliferation of mouse splenic lymphocytes, and con- A and LPS were used as controls and cyclosporine A was used as standard drug (Ravikanth *et al*., 2001).

MATERIALS AND METHODS

Collection and identification of plant material

Fresh plants of *L. cristata*, Willd. (Acanthaceae) were collected from Pachhaimalai Hills, Tiruchirappalli District. The taxonomic identify of the plant was confirmed (Gamble, 1967). The plant material was washed under running tap water, air dried in shade and then the inflorescence was homogenized to fine powder and stored in sterile air tight bottles for the experimental use.

Preliminary Phytochemical analysis

The active principles of many drugs found in plants are secondary metabolites (Dobelis, 1993; Ghani, 1990). Therefore , basic phytochemical investigation of *L.cristata* extract for their major phytoconstituents is also vital. Hence, a preliminary phytochemical screening of the plants was conducted following the standard protocols (Brindha *et al.,* 1981). In the present investigation, maximum emphasis was given to alkaloids, flavonoids, phenolics, saponins, tannins and terpenoids.

Gas chromatography and mass spectroscopy (GC-MS)

GC-MS analyses were performed using a GC Clarus 500 Perkin Elmer equipment, equipped with a flame ionization detector and injector MS transfer line temperature of 230 °C, fused silica capillary column Elite-5 MS (5% diphenyl / 95% dimethyl polysiloxane), 30.00×0.25 ìLdf, film thickness, carrier gas helium at a flow rate of 28 cm / s was used. A volume of 1 mL of the extract mixed with methanol (80%) at a split rate 10:1 was injected (Reyes-Chilpa *et al*., 2004). The compound identification was accomplished by comparing the GC relative retention and mass spectra to those of authentic substances analyzed under the same conditions, by their retention indices and by comparison to reference compounds.

Antifungal activity

Fungal cultures

The fungal cultures tested in this work include *Colletotrichum fulcatum* NCBT 146 (*C. fulcatum),* *Fusarium oxysporum* NCBT 156 (*F. oxysporum*) and *Rhizoctonia solani* NCBT 196 (*R. solani*). They were maintained in immobilized condition in polyurethane foam in the Microbiology Lab, Department of Biotechnology, National College, Tiruchirappalli, whereas *Curvularia lunata* MTCC 2030 (*C. lunata*) and *Microsporum canis* MTCC 2820 (*M. canis*) were obtained from Microbial Type Culture Collection and Gene Bank MTCC, Chandigarh.

Experimental procedure

Different weight of dry inflorescence, leaf and root power (2 mg, 4 mg, 6 mg and 12 mg) were mixed with different volume of Sabourand dextrose agar (SDA) medium (HI media M063) to form different concentrations (100 mg / L, 200 mg / L, 400 mg / L and 800 mg / L). The Control-1 contained only 20 mL of SDA medium and Control-2 contained 2 mg of bavistin fungicide added to 20 mL of SDA medium at 100 mg / L concentration. The powder was mixed with the medium in Petri dish (9 cm) and inoculated with 0.5 mL spore suspension of fungi prepared from 10 days old culture. The experimental Petri dishes were incubated for 8 days at 28±2°C temperature in dark. Three replicates were prepared and inoculated with fungal spores for each treatment.

Determination of the minimum inhibitory concentration (MIC)

MIC was determined by the liquid dilution method (Irobi *et al.*, 1996). Dilution series were prepared with 0.25 to 15.00 mg / mL of Sabourand dextrose broth medium. To each tube 0.1 mL of standardized suspension of fungal spores (4×10^6 spores / mL) were added and incubated at 28±2°C for 24h. The lowest concentration which did not show any growth of the tested fungi after microscopic evaluation was determined as MIC.

Table. 1. Presence of the phytochemical components of the plant extract of *L. Cristata.*

Phytochemicals	Result
Alkaloids	+
Flavonoids	+
Glycosides	-
Phenolics,	+
Saponins	+
Tannins	+
Terpenoids.	+
Volatile oil	-

+ - present; - -absent

RESULTS AND DISCUSSION

The plant extract was tested for phytochemical constituents and the results are tabulated (Table 1 and 5).

The aqueous extract of dried powder of *L. cristata* in florescence (Fig.2 and Table 2), leaf (Fig.3 and Table 3) and root (Fig.4 and Table 4) showed varied antifungal properties against both plant pathogenic as well as human pathogenic fungi tested in this work. The growth of both plant and human pathogenic fungal strains was totally inhibited at 400 and 800 mg / L concentration respectively. The total inhibition can be comparable to Control-2,a standard antifungal agent bavistin at 100 mg / L.

MIC values of the plant extracts varied from 5.50 mg / ML to 11.50 mg / mL for the fungi tested. The MIC value of *R. solani*, *F. oxysporum*, *C. fulcatum*, *C. lunata* and *M.canis* were 5.50, 7.0, 9.0, 10.50 and 11.50 mg / ml respectively. Further investigation was performed to demonstrate the action of the extract on these fungi at different concentrations. The growth of these fungi correspondingly decreased with increasing concentration of the extract and the growth was completely inhibited at their MIC values. The reduction

Table. 2. Inhibitory effect of the extract of the inflorescence of *L. cristata* on the growth of test fungi.

INFLORESCENCE

Fungus	Control		Concentration of extract			
	1	2	100 mg/L	200 mg/L	400 mg/L	800 mg/L
C. fulcatum NCBT 146	++++	-	++	+	-	-
C. lunata MTCC 2030	++++	+	++	+	-	-
F.oxysporum NCBT 156	++++	+	++	+	-	-
M. canis MTCC 2820	++++	+	++	+	-	-
R. solani NCBT 194	++++	-	-	-	-	-

Control-1: Medium without inflorescence extract; Control-2: Medium with Bavistin (100 mg/L).
++++:Normal growth; +++: 25% growth inhibition; ++: 50% growth inhibition; +: 75% growth inhibition; - : Total (100%) growth inhibition.

of growth was possibly due to the interference by active principles. Therefore, the MIC determination is important in giving a guideline of the choice of an appropriate and effective concentration of antifungal

S.No 714
[GC MS study]

No.	RT	Name of the compound	Molecular formula	MW	Peak Area %
1.	4.95	Heptadecane, 9-hexyl-	$C_{23}H_{48}$	324	34.48
2.	5.54	Octadecane, 3-ethyl-5-(2-ethylbutyl)-	$C_{26}H_{54}$	366	34.48
3.	7.63	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	592	31.03

Note: *Parameters tested are not covered under the scope of NABL accreditation

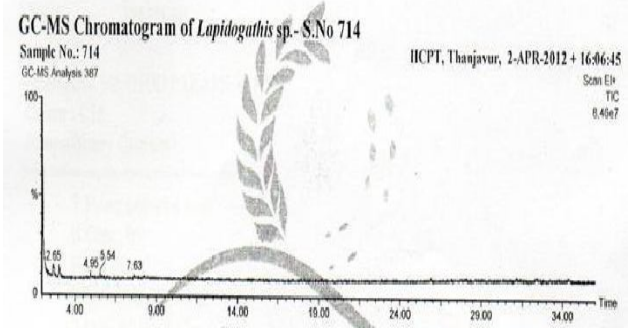

Fig. 2. GC MS Analysis of L. cristata Inflorescence shown the presence of some major phytochemical constituents

therapeutic substance.

DISCUSSION

The results of the earlier work with *L. cristata* revealed that the plant extract was significantly effective against Gram-positive bacteria (Vlietinck *et al.,* 1995). *L. cristata*, inflorescence ash with oil was applied externally to

Table. 3. Inhibitory effect of the leaf extract of L. cristata on the growth of test fungi

Fungus	LEAF					
	Control		Concentration of extract			
	1	2	100 mg/L	200 mg/L	400 mg/L	800 mg/L
C. fulcatum NCBT 146	****	-	**	**	*	-
C. lunata MTCC 2030	****	-	**	**	*	-
F. oxysporum NCBT 156	****	-	**	*	-	-
M. canis MTCC 2820	****	-	**	*	*	-
R. solani NCBT 194	****	-	**	*	*	-

Control-1: Medium without leaf extract; Control-2: Medium with Bavistin (100 mg/L). ****: Normal growth; ***: 25% growth inhibition; **: 50% growth inhibition; *: 75% growth inhibition; -: Total (100%) growth inhibition.

S.No 715
[GC MS study]

No.	RT	Name of the compound	Molecular formula	MW	Peak Area %
1.	4.96	Heptadecane, 9-hexyl-	$C_{23}H_{48}$	324	24.41
2.	5.55	Octadecane, 3-ethyl-5-(2-ethylbutyl)-	$C_{26}H_{54}$	366	9.45
3.	7.63	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	592	3.94
4.	11.61	Ethyl iso-allocholate	$C_{26}H_{44}O_5$	436	22.05
5.	14.96	Rhodopin	$C_{40}H_{58}O$	554	8.66
6.	24.67	Lycopene	$C_{40}H_{56}$	536	7.09
7.	32.32	Stigmasterol	$C_{29}H_{48}O$	412	7.87
8.	34.29	Tetrahydrospirilloxanthin	$C_{42}H_{64}O_2$	600	16.54

Note: *Parameters tested are not covered under the scope of NABL accreditation

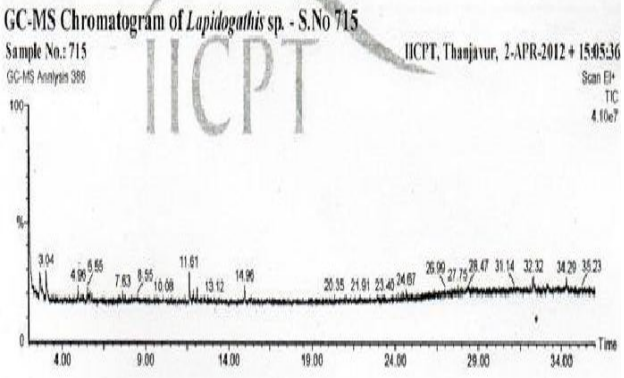

Fig. 3. GC MS Analysis of L.cristata Leaf shows the presence of phytochemical constitutent.

cure black patches on face (Dinesh *et al*., 2013). Aqueous extract of the leaves mixed with *Ocimum* juice in 10:1 ratio was used to cure fever (Rabe and Van Staden , 1997) and the leaf paste with coconut oil was applied externally on old wounds (Purma Aravinda Reddy and Venkateshwar Rao, 2013). Root extract of *L. cristata* was significantly effective in antiemetic (Rachapalli Sowjanya Kumar Reddy *et al*., 2014) and anti-inflammatory activities (VijayaNarasimha Reddy Peddireddy *et al*., 2014). Bioactive compounds oleic acid, 3-(octadecyloxy) propyl ester from inflorescence (Abubacker and Kamala Devi, 2014), Heptadecane,

Table. 4. Inhibitory effect of the root extract of *L.cristata* on the growth of test fungi

ROOT						
Fungus	Control		Concentration of extract			
	1	2	100 mg/L	200 mg/L	400 mg/L	800 mg/L
C. fulcatum NCBT 146	++++	-	++	++	+	-
C. lunata MTCC 2030	++++	+	++	++	-	-
F.oxysporum NCBT 156	++++	+	++	+	-	-
M. canis MTCC 2820	++++	+	++	+	+	-
R. solani NCBT 194	++++	-	++	+	-	-

Control-1: Medium without root extract; Control-2: Medium with Bavistin (100 mg/L). ++++: Normal growth; +++: 25% growth inhibition; ++: 50% growth inhibition; +: 75% growth inhibition; -: Total (100%) growth inhibition.

Table. 5 GC MS Analysis of *L.cristata Root*

S.No 713
[GC MS study]

No.	RT	Name of the compound	Molecular formula	MW	Peak Area %
1.	4.96	Heptadecane, 9-hexyl-	$C_{23}H_{48}$	324	34.18
2.	5.54	Octadecane, 3-ethyl-5-(2-ethylbutyl)-	$C_{26}H_{54}$	366	25.32
3.	7.63	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	592	17.72
4.	8.23	Tetracycline	$C_{22}H_{24}N_2O_8$	444	18.99
5.	10.10	Docosanoic acid, 1,2,3-propanetriyl ester	$C_{69}H_{134}O_6$	1058	3.80

Note: *Parameters tested are not covered under the scope of NABL accreditation

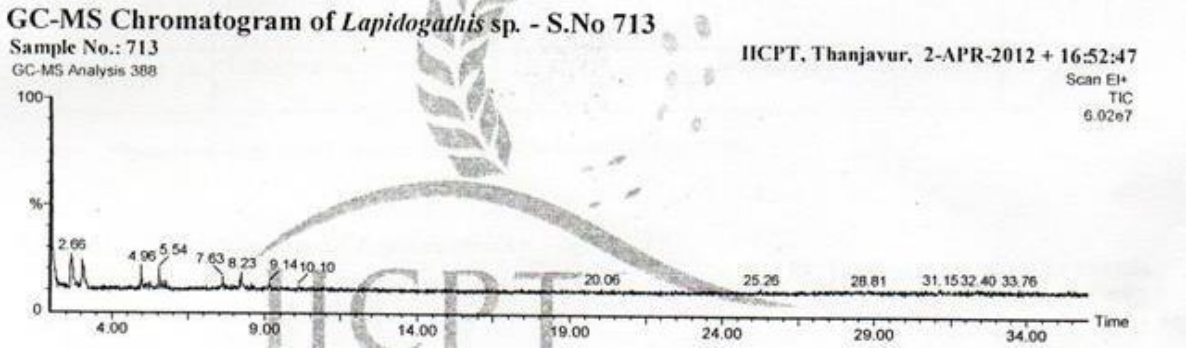

Fig. 4. GC MS Analysis of *L. cristata* root shows the presence of phytochemical constituents

9- hexyl , Ethyl iso-allocholate from leaf (Abubacker and Kamala Devi, 2015) and Heptadecane, 9- hexyl , Octadecane, 3-ethyl-5-(2-ethylbutyl)from root (Abubacker and Kamala Devi, 2015) were analyzed from L.cristata by using GCMS procedure, and these compounds are found to be highly effective to plant pathogenic fungi *Colletotrichum fulcatum* NCBT 146, *Fusarium oxysporum* NCBT 156 and *Rhizoctonia solani* NCBT 196 as well as for the human pathogenic fungi *Curvularia lunata* MTCC 2030 and *Microsporum canis* MTCC 2820.

CONCLUSION

On the basis of the perusal of literature and experimental results, it can be concluded that

Lepidagathis cristata is a traditional remedy for fever, eczema, psoriasis, epilepsy, skin abscess, burns, mouth ulcer, snake bites, wounds, skin itching and other skin diseases. The various bioactive compounds present in this herb are highly responsible for its antifungal activities against both plant and human pathogens. It has also various pharmacological activities like analgesic, antimicrobial, antiemetic, anti-inflammatory and hypoglycaemia, and immunes up presents. Taking great concern of the useful benefits on the plant, it can be fortified as a safe and highly important medicinal plant for human beings and pet animals.

REFERENCES

Abubacker, M.N. and Kamala Devi, P. 2014. *In vitro* antifungal potentials of bioactive compound oleic acid, 3-(octadecyloxy) propyl ester isolated from *Lepidagathis cristata* Willd. (Acanthaceae) inflorescence. *Asian Pac J Trop Biomed*. 4(2): S661-S664. doi: 0.12980/APJTB.4.201414B189
https://doi.org/10.12980/APJTB.4.201414B189

Abubacker, M.N. and Kamala Devi, P. 2015. *In Vitro* antifungal Efficacy of bioactive compounds Heptadecane, 9-Hexyl and Octadecane, 3-Ethyl-5-(2-Ethylbutyl) from Lepidagathis cristata, Willd. (Acanthaceae) root extract *European Journal of Pharmaceutical and Medical Research***.** 2(5): 1779-1787.

Abubacker, M.N. and Kamala Devi, P. 2015. *In vitro* antifungal potentials of bioactive compounds Heptadecane, 9-hexyl and Ethyl iso-allocholate isolated from *Lepidagathis cristata* Willd. (Acanthaceae) leaf. *British Biomedical Bulletin*. 3(3): 336-343.

Aravinda Reddy Purma, VijayaNarasimha Reddy Peddireddy and Venkateshwar Rao, J. 2013. Anti-inflammatory activity of *Lepidagathis cristata* flower extracts. *Int.J. Res. Ayurveda Pharm.* 4(6): 903-905. DOI: 10.7897/2277-4343.04626
https://doi.org/10.7897/2277-4343.04626

Aravinda Reddy Purma and Venkateshwara Rao, J. 2013. Evaluation of analgesic activity of *Lepidagathiscristata*Willd leaf extracts. *International Research Journal of Pharmacy*.4(4):132-134. DOI: 10.7897/2230-8407.04426.
https://doi.org/10.7897/2230-8407.04426

Brindha, P., Sasikala, K. and Purushoth, K. 1981. Priliminary phytochemical studies in higher plants. *Ethanobotany.* 3: 84-96.

Dinesh, V., Bembrekar, S.K. and Sharma, P.P. 2013. Traditional knowledge of medicinal plants used for the treatment of skin diseases in Nizamabad District, Andhra Pradesh. *Int J Pharm ChemSci*.2 :1488-1490.

Dobelis, I.N., *Magic and medicine of plants*. 1993. The Readers Digest Association Inc. Pleasant, New York, Montreal.

Gamble, J.S. 1967. *Flora of the presidency of Madras.* Calcutta: Botanical Survey of India.

Ghani, A. 1990. Introduction to Pharmacognosy, Ahmadu Bello University Press, Ltd. Zaria, Nigeria, 45: 187-197.

Hamambarareddy, M., Eswara Reddy, K. and Venkataraju, R. 2000. Medicinal Plant-Lore of Sugali Tribe of Anantapur District, Andhra Pradesh. *Ancient Science of Life.* XIX (3&4): 146-154.

Hoffman, J.J., Timmerman, N., Melanghlin, R. and Punnapayal, R. 1993. Potential antimicrobial activity of plants from the South-west United States. *Int. J. Pharm*.31: 101-115.
https://doi.org/10.3109/13880209309082926

Irobi, O.N., Moo-Young, M. and Anderson, W.A. 1996. Antimicrobial activity of annatto (Bixaorellana) extract. *Pharm Biol*. 34: 87-90.
https://doi.org/10.1076/phbi.34.2.87.13201

Jagtap, D.K., Patil, H.S. and Jakhi, P.S. 2013. Ethno-medicinal survey of some plants from villages of KhatavTahashil (M.S.) India. *Int. J. of Life Science*..1(4): 264-269.

Madhu, V.B., Chinnaiah. and Swamy, T.N. 2010. Traditional herbal remedies to cure asthma in Adilabad district, Andhra Pradesh, India. *International Journal of Pharmacy and Life Sciences.* 1(4):217-221.

Ncube, N.S., Afolayan, A.J. and Okoh, A.I. 2008. Assessment techniques of antimicrobial properties of natural compounds of plant origin: Current methods and future trends. *African J. Biotechnol*.7:1797-1806. DOI: 10.4314/ajb.v7i12.58804
https://doi.org/10.5897/AJB07.613

Nitin Dongarwar ,Umathakur , Shivanidongarwar and Mohanwadeka, 2012. Ethnomedicines among some tribes of Nandurbar District oF M.S. (INDIA.*). Life sciences leaflets*, vol.4, pp.48-53.

Pawar Shubhangi, D.A., Patil, 2011. Ethnomedicinal plants in Jalgaon Dist.: Current status. *Curr. Bot*. 2(4):15-21.

PurmaAravinda Reddy and JVenkatesh war Rao, 2013. A review of *Lepidagathis cristata. International Research Journal of Pharmacy*. 4(11):6-8. DOI: 10:7897/2230-8407.041102.
https://doi.org/10.7897/2230-8407.041102

PurmaAravinda Reddy, Venkateshwar Rao, J.2013. Analegsic activity of *Lepidagathis cristata* Willd. Flower extracts. *Int. J Res. Ayurveda Pharm*. 4(4):.510-518. http://dx.doi.org/10.7897/2277-4343.04410.
https://doi.org/10.7897/2277-4343.04410

Rabe, T. and Van Staden, J. 1997. Antibacterial activity of South African plants used for medicinal purposes. *J Ethnopharmacol*. 56: 81-87.
https://doi.org/10.1016/S0378-8741(96)01515-2

Rachapalli Sowjanya Kumar Reddy, Battineni Jainendra Kumar, Vasudha Bakshi, 2014. Phytochemical screening and antiemetic activity of *Lepidagathis cristata* root extract. *Int. J. of Res in Pharmacology and Pharmaceutics.* 3(4): 269-272.

Ravikanth, V., Niranjan Reddy, V.L., Ramesh, P., PrabhakarRao, T., Diwan, P.V., Ashok Khar and Venkateswarlu, Y.2001. An immunosuppressive tryptophan-derived alkaloid from *Lepidagathiscristata*, *Phytochemistry*. 58:1263-1266. http://dx.org/10.1016/S0031-9422(01)00383-1.
https://doi.org/10.1016/S0031-9422(01)00383-1

Reyes-Chilpa, R., Rivera, J., Oropeza, M., Mendoza, P., Amekraz, B. and Jankowsko, C. 2004. Methanol extracts of Hamelia patens containing oxindole alkaloids relax KCl induced concentration in rat myometrium. Biol Pharm Bull. 27: 1617-1620. https://doi.org/10.1016/S0031-9422(01)00383-1PMid:15467206

Salave Ashok Punjaji, 2012. Some less known herbal remedies against wounds from JamkhedTahasil areas In Ahmednagar District (M.S) India. *Journal of Pharmaceutical Research and Opinion.* 2(6): 58 – 62.

SathyaBama, S., Sankaranarayanan, S., Bama, P., Ramachandran, J., Bhuvaneswari, N. and Jayasurya Kingsley, S. 2013. Antibacterial activity of medicinal plants used as ethnomedicine by the traditional healers of MusiriThaluk, Trichy District, Tamilnadu, *India. J. Med. Plants Res.*7(20):1452-1460. DOI: 10.5897/JMPR12.851

Sikarwar, R.L.S., Bharat Pathak and Anil Jaiswal, 2008. Some unique ethnomedicinal perceptions of tribal communities of Chitrakoot, Madhya Pradesh. *Indian Journal of Tradional Knowledge*.7(4): 613-617.

Sinha, M.K., Patel, D.K. and Kananga, V.K. 2013. Medicinal plants used in the treatment of skin diseases in Central Bastar of Chhattisgarh, India. Glo.*Adv. Res. J. Med. Plants.* 2(1): 001-003.

Srinija, A.V., Yanadaiah, J.P., Ravindra Reddy, K., Lakshman Kumar, D. and Siva Shankar Prasad, K. 2013. Hypoglycaemic activity of ethanolic extract of *Lepidagathis cristata*. Willd in alloxan induced diabetic rats. *Journal of Global Trends in Pharmaceutical Sciences.* 4(2):1091-1098.

Sudhakar Reddy, C., Reddy, K.N., Murthy, E.N. and Raju, V.S. 2009. Traditional medicinal plants in Seshachalam hills, Andhra Pradesh, India. *Journal of Medicinal Plants Research.* 3(5): 408-412.

Varghese, E. 1996. *Applied ethnobotany- A case study among the Kharias of Central India* Deep Publications, New Delhi.

Venkata Subbaiah, K.P. and Savithramma, N.2012. Bio-prospecting and documentation of traditional medicinal plants used to treat itching, psoriasis and wounds by ethnic groups of Kurnool district, Andhra Pradesh, *India. Asian Journal of Pharmaceutical and clinical Research.* 5(2): 127-131.

Vijaya Narasimha Reddy Peddireddy, Aravinda Reddy Purma, Narothvam Reddy Kavalakuntla and Rajendra Channa, 2014. Anti-inflammatory activity of *Lepidagathis cristata* root extracts. *World Journal of Pharmacy And Pharmaceutical Sciences*.3(5): 566-573.

Vijigri Dinesh, Shivraj Kashinath Bembrekar and Sharma, P.P.2013. Traditional knowledge of medicinal plants used for the treatment of skin diseases in Nizamabad District, Andhra Pradesh. *International journal of pharmaceutical and chemical sciences.*2(3):1488-1489.

Vlietinck, A.J., Van Hoof, L., Totté, I., Lasure, A., VandenBerghe, D. and Rwangabo, P.C. 1995. Screening of hundred Rwandse medicinal plants for antimicrobial and antiviral properties. *J Ethnopharmaco* l46: 31-47. https://doi.org/10.1016/0378-8741(95)01226-4

WHO, 2011, *Molly Meri Robinson Classifications, Terminology and standards, WHO,* Geneva: Xiaorui Zhang Medicines, traditional medicines: global situation, issues and challenges. 3rd Edition.