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Evaluation of antimicrobial activity of aqueous extracts of *Acalypha indica*

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Abstract

Acalypha indica is a small herb which is distributed in most of Asian countries such as Sri Lanka, India, and Pakistan. It is commonly known as Indian Copper leaf and it is used in traditional medicines for bacterial and fungal diseases. Aqueous extraction of plant materials such as leaf and whole plant were investigated for anti-microbial property without changing concentration. Results of this study revealed that all extracts had good inhibitory activity against gram positive and gram negative bacteria. The clear zone for Staphylococcus aureus and Klebsiella were found with the diameter of 1.85cm and 1.9cm respectively, though the inhibitory diameters of these bacteria were smaller than the streptomycin control. Antifungal activity of whole plant and leaf extract of Acalypha indica against all fungal species showed the inhibitory growth less than 20%. The findings exhibit that aqueous extracts have broad spectrum activity and there is a possibility in treatment of infectious diseases.

Key words: *Acalypha indica, leaf and whole plant extracts, antimicrobial activity*

1. INTRODUCTION

Acalypha indica (family: Euphobiaceae) is a small annual herb grows up to 60cm along the road sides having medicinal properties (Burkill, 1985). It is distributed in Asian countries such as Sri Lanka, India, Pakistan,Africa and South America (Ramachandran, 2008; Parveen et al, 2007; Mohan et al, 2012). It is commonly known as Indian Copper leaf (T- Kuppaimeni, S- Kuppameniya) (Kirtikar et al, 1975). Leaves are little triangular and ovate. Leaf stalks are longer than the 3-5 cm long blades. Flowers are borne on erect of axillary spikes which are stalkless. Male flowers are minute where the female flowers are scattered along the inflorescence axis (Kirtikar and Basu, 1994; Prajapati et al, 2003; Nadkarni,1995).

Human have worthy remedy from the nature for health and life. Practice of indigenous treatment is the leading edge of medicinal science (Kaushik and Dhiman, 1999; Jain, 1996). The different parts of plant such as leaf, stem, root, flower and seed are used in a variety of ailment in Ayurvedic medicine. The leaves of the plant are used for the treatment of scabies (Gurib-Fakim et al, 1993), as purgative, diuretic, antihelmintic (Varier, 1996), syphilitic ulcer (Dhar et al, 1968), rheumatoid arthritis. The roots are used as a laxative (Panthong et al, 1991). It has the properties of wound healing (Reddy et al, 2002), as an anti-snake venome (Siddiqui and Husain, 1990; Shirwaikar et al, 2004; Mahishi et al, 2005; Samya et al, 2008), anti-inflammatory effect (MohanaVamsi et al, 2008), anti-oxidant activity (Ruche et al, 2007) and anti-estrogenic activity (Hiremath et al, 1999). Microbial infectious diseases are a global issue in human health (Hamer et al, 2010; Khan et al, 2013) and leads death (Avery, 2006; Tekwu et al, 2012). The plant extract is used for treating pneumonia, jaundice, piles, asthma, rheumatism, bedsores, wounds, skin infections and eczema. It has been stated to have wound healing activity, snake venom neutralizing properties, antibacterial activity and antiurolithiatic activity (Reddy et al, 2002; Suresh; Govindarajan et al, 2008; Sathya et al, 2011; Jain, 1987; Jain, 1996; Sumathi and Puspha, 2005). The whole plant is diuretic, expectorant, emetic, anthelmintic. (Oudhia, 2003; Valsara, 1994).

The previous findings of Suresh et al, revealed that *A. indica* showed considerable antibacterial activity against *S. aureus and E. coli*. The aqueous extracts of *A. indica* showed the inhibitiaon against E.coli and alcoholic extact show inhibition *tow*ards *Staphylococcus aureus* and *Salmonella typhi* (Divya et al, 2014). The present study is to investigate the anti-microbial properties of the aqueous extracts of *A.indica* leaves and whole plant.

Figure (1): *Acalypha indica* leaf and whole plant

2. MATERIAL AND METHODS

2.1. Sample collection and extract preparation

Leaf and bark of *C. fistula* was collected from the premises of University of Jaffna, Sri Lanka. For aqueous extract preparation, 2.5g of plant material was weighed and washed well in tap water. Then they were sterilized by giving a quick dip in alcohol and washed with sterilized water again. The weighed plant material was crushed with 10mL of sterile water and it was filtrated using Whatman's filter paper No.1. The filtrate was collected in sterile beaker. Anti-microbial activity was carried out using disc diffusing method (Kirby et al, 1966).

2.2. Anti-bacterial activity

The preliminary screening of antibacterial activity was done using well in agar method. *Bacillus sp, Staphyllococcus aureus, Klebsiella, E.coli* and Pseudomonas bacteria were selected for this study. These bacteria were streaked on pure nutrient agar plates separately and stored in refrigerator at 10^0C with labelling. Plant materials were sterilized using different methods such as UV sterilization (UV light at 336nm) and wet heat sterilization (autoclave at 121^0C for 15min). Then the petri dishes were used for the experiment. Peptone broth and agar standard solution were prepared and 100ppm streptomycin standard solution was used as positive control. The inoculum was spread in nutrient agar plates with bacterial strain and incubated at 37^0C for 24 hours. Wells were prepared with UV sterile and wet heat sterile extracts, streptomycin solution and sterile water in agar plates for each bacterial species. The diameter of the clear inhibitory zone around the well was measured.

2.3. Anti - fungal activity

Candida sp, Aspergillus sp, Pencillium, Rhizopus fungus were selected for this study. Plant materials were sterilized using different methods such as UV sterilization (UV light at 336nm) and wet heat sterilization (autoclave at 121^0C for 15min). The sterilized extracts and Potato dextrose agar (PDA) media were mixed

well and poured in petridishes. They were incubated at room temperature for 2 days. After it had grown enough, disc with the diameter of 7mm were cut using the sterile cork borer. The disc of each fungus was placed on the middle of the plate, which contain herbal product with PDA by using sterile loop. Control plates were also maintained without plant extract. These plates were incubated at room temperature for 2 days. Then the diameter of the clear inhibitory zone around the well was measured.

3. RESULTS AND DISCUSSION

3.1.Anti-bacterial activity

The extract of *Cassia fistula* found to be effective against the pathogenic bacteria. The inhibition zone is shown in Table 1 has exposed the power against pathogenic bacteria.

Table (1): The diameter of the zone obtained from samples plant material under UV sterilization

Bacteria	Diameter of inhibitory zone (cm)		
	Leaf extract	Whole plant extract	Streptomycin
E.coli	1.5	1.5	3.0
Bacillus sp 1	Reduced growth	Reduced growth	2.6
Bacillus sp 2	Reduced growth	Reduced growth	1.5
Pseudomonas	0	0	1.9
Staphylococcus aureus	1.85	1.45	3.3
Klebsiella	1.75	1.9	2.4

Table (2): The diameter of the zone obtained from samples plant material under wet heat sterilization

Bacteria	Diameter of inhibitory zone (cm)		
	Leaf extract	Whole plant extract	Streptomycin
E.coli	2.0	2.0	3.0
Bacillus sp 1	Reduced growth	Reduced growth	2.7
Bacillus sp 2	Reduced growth	Reduced growth	1.5
Pseudomanas	0	0	1.95
Staphylococcus aureus	1.3	1.3	3.2
Klebsiella	1.3	1.6	2.2

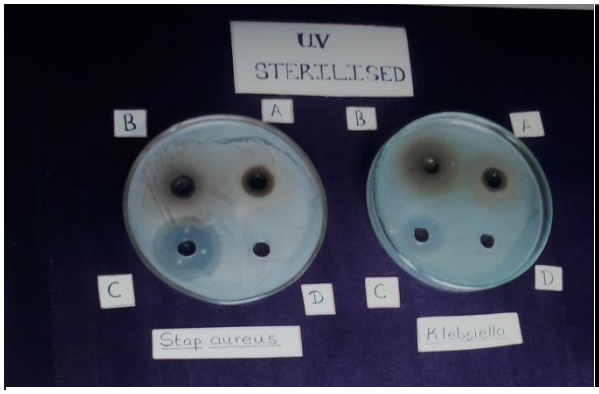

Figure (2): Effect of UV sterilised extract of leaf (A) and whole plant (B) of *Acalypha indica* on the growth of *Staphylococcus aureus* and *Klebsiella* (C- Streptomycin, D- sterile water)

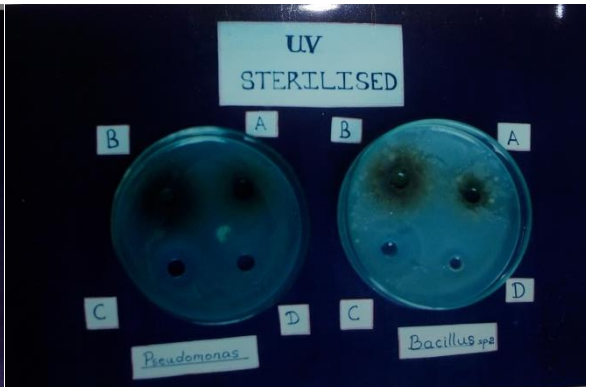

Figure (3): Effect of UV sterilised extract of leaf (A) and whole plant (B) of *Acalypha indica* on the growth of *Pseudomonas* and *Bacillus sp 2* (C- Streptomycin, D- sterile water)

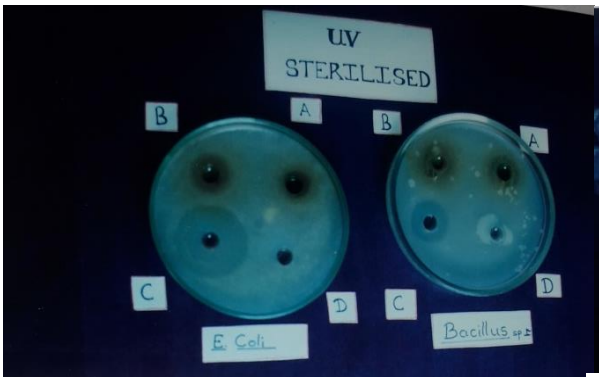

Figure (4): Effect of UV sterilised extract of leaf (A) and whole plant (B) of *Acalypha indica* on the growth of *E.coli* and *Bacillus sp 1*(C- Streptomycin, D- sterile water)

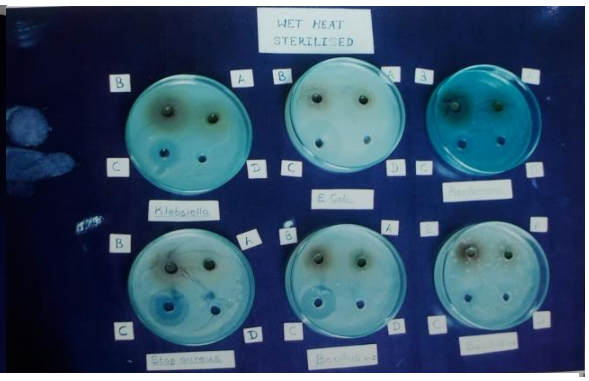

Figure (5): Effect of wet heat sterilised extract of leaf (A) and whole plant (B) of *Acalypha indica* on the growth of *Klebsiella, E.coli, Pseudomonas, Staphylococcus aureus. Bacillus sp 1* and *Bacillus sp 2* (C- Streptomycin, D- sterile water)

Madhavi Adhav, 2016 stated that water extract show strong antibacterial activity against gram positive bacteria such as *S.aureus* and *B. subtilis* and gram negative bacteria such as *Shigella dysenteriae* and *E.coli.* Another study indicated that the aqueous extract showed 1.0 – 1.3cm zone of inhibition against *Pseudomonas* and 0.8 – 1.0cm zone of inhibition against *E.coli* (Ashwini and Asha, 2017). In the present study stated: among the herbs tested *Acalphya indica* showed a considerable antibacterial activity. The leaf extract produced clear zone on *E.coli, Staphylococcus aureus* and *klebsiella* as 1.5, 1.85, 1.75cm with 0.25g/mL of extract concentrationtively. The *Bacillus sp 1* and *Bacillus sp 2* showed reduced growth but had no clear zone for Pseudomonas showed resistance to the plant.

The whole plant extract also showed the similar result, it produced clear zone with *E.coli, Staphylococcus aureus* and *Klebsiella* with diameter of 2.0, 1.3 and 1.9cm respectively and it reduced the growth of *Bacillus sp* 1 and *Bacillus sp* 2. Pseudomonas showed resistance. The wet heat sterilised extracts of whole plant and leaf extracts of *Acalypha indica* showed a small difference in inhibition.

Infectious diseases are caused by pathogenic bacteria. The issue raised is to be developed of multi drug resistant microorganisms. So, the studies focused on new therapeutic alternatives using medicinal plants against especially *Staphylococcus aureus* and *Pseudomonas sp.* (Lakshmanan and Sankaranarayanan, 1990; Reynolds , 2009*;* Anuradha et al, 2010). Cholapandian, (2013) stated water extract of *A. indica* showed the inhibitory zone against *Staphylococcus aureus* (0.8cm) and *Pseudomonas* sp. (0.75cm). No zone was observed to water extract against *Klebsiella* sp. The mean range of antibacterial activity *Pseudomonas* sp were estimated for leaf extracts of *Acalypha indica in* methanol , ethanol and water 1.0±0.022, 1.2±0.015 and 0.7±0.035 respectively. As like of Pseudomonas, the antibacterial activity of plant extract for *Klebsiella* sp were estimated in methanol extract methanol , ethanol and water 0.50±0.67, 0.50±0.076 and 0.50 respectively (Arulraj , 2017).

3.2.Anti-fungal activity

Table 3: the diameter of the Mycelial disc in cm and % of growth reduction of samples obtained from *A. indica* under UV sterilization

Fungus	Diameter of inhibitory zone (cm)			% of growth reduction in leaf extract	% of growth reduction in bark extract
	Leaf extract	Bark extract	Control (without plant extract)		
Yeast	2.65	1.2	3.3	19.69	19.69
Rhizopus	7.5	7.5	9.0	16.60	16.60
Aspergillus	2.5	2.5	3.0	16.60	16.60
Pencillium	1.2	1.2	1.2	0	0

Table 4: the diameter of the Mycelial disc in cm and % of growth reduction of samples obtained from *A. indica* under wet heat sterilization

Fungus	Diameter of inhibitory zone (cm)			% of growth reduction in leaf extract	% of growth reduction in bark extract
	Leaf extract	Bark extract	Control (without plant extract)		
Yeast	2.8	2.8	3.3	15.15	15.15
Rhizopus	7.5	7.5	9.0	16.60	16.60
Aspergillus	2.5	2.5	3.0	16	16.00
Pencillium	1.2	1.2	1.2	0	0

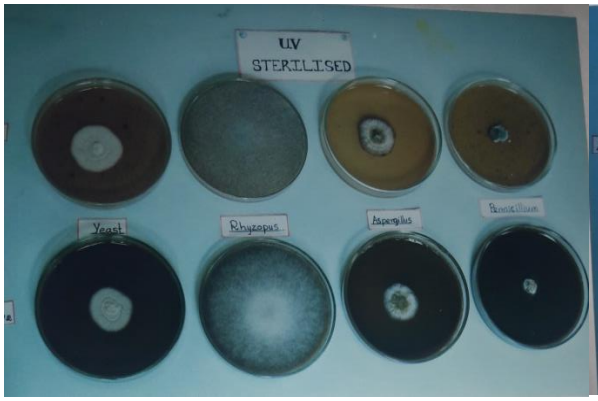

Figure (6): Effect of UV sterilised leaf extract of *Acalypha indica* on the mycelial growth of Yeast, *Rhizopus, Aspergillus* and *Pencillium* (A- Control, B- extract added)

Figure (7): Effect of UV sterilised whole plant extract of *Acalypha indica* on the mycelial growth of Yeast, *Rhizopus, Aspergillus* and *Pencillium* (A- Control, B- extract added)

Figure (8): Effect of UV sterilised whole plant extract of *Acalypha indica* on the mycelial growth of Yeast, *Rhizopus, Aspergillus* and *Pencillium* (A- Control, B- extract added)

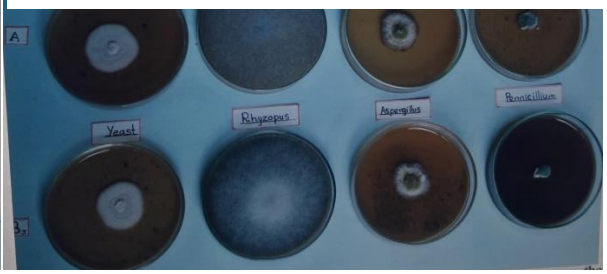

Figure (9): Effect of UV sterilised whole plant extract of *Acalypha indica* on the mycelial growth of Yeast, *Rhizopus, Aspergillus* and *Pencillium* (A- Control, B- extract added)

Considering the *Acalypha indica* there is no distinct difference in the reduction by whole plant and leaf extract. Yeast was reduced by 21.2% on its growth while *Rhizopus* and *Aspergillus* showed 16.60% and 16% respectively. *Pencillium* showed resistant to extrcts of *A. indica.* The results showed a similar inhibition zones in wet heat and UV sterilization.

Sudhakar et al, 2018 stated that the methanol extract was more effective against *Candidatropicalis* and *Candida albicans* and ethanol extract was more effective against *Candida albicans* and *Aspergillus niger* (Aushi Nag1a et al, 2018). The antifungal activity of *Acalypha Indica* L. is similar to antifungal drug ketaconazole. This is able to use for curing of of transmittable disease cause through veteran strain as well as latent anti-microbial agent can exist prepared. (Mahesh et al, 1984).

Leaves of *Acalypha indica* contain Alkaloids, Tannins, Saponins and Proteins. The qualitative analysis of *A.indica* showed the presence of biomolecules such as *alkaloids, catechols, flavonoids, phenolic compounds,*

saponins and *steroids* respectively (Komathy et al, 2013). *Family* Euphorbiaceae showed the elevated concentration of phenols, alkaloids and flavonoids (Mahesh Vk et al., 1984). Phenolic, Flavonoids (quercetin, kaempferol, isorhamnetin, isoquercetin) derivatives have strong anti-fungal activity.

4. CONCLUSION

The present study revealed that the extracts obtained from leaf and bark of *Acalypha indica* figure out strong activities against the gram negative and gram positive bacteria. And it has a little range of anti-fungal activities. This study leads to the possibility for the treatment of infectious diseases, however further studies need to be conducted to find isolation and antimicrobial active constituents from the plant.

5. References

i. *Anuradha S.D, Simit H.K and Sujata M.B: Prevalence of metallo-β-Lactamase Producing Pseudomonas aeruginosa and Acinetobacter species in a tertiary care hospital. Indian Journal of Critical Care Medicine 2010; 14(4): 217-219.*

ii. *Arulraj, P. Bavatharini, A. Manikandan, V. Sam Johnson, U. D. (2017). A Typical Review on Antimicrobial Activity of Acalypha indica, World Journal of Pharmaceutical And Medical Research. 3(11): 61-65*

iii. *Ashwini, U. and S. Asha. (2017). In vitro antibacterial activity of Acalypha indica Linn leaves extract against gram negative bacteria. International Journal of Research. In. Ayurveda Pharm. 8(Suppl 3):195-198. http://dx.doi.org/10.7897/2277-4343.083198*

iv. *Aushi Nag1a, D. Anoop, M. Komal Sharma. Khushbu Verma. (2018). Acalypha Indica L. an Important Medicinal Plant with Antimicrobial agents: a Review. International Journal of Research and Analytical Reviews. 5 (4): 2349 – 5138.*

v. *Avery, G. (2006). Infectious diseases, a resurgent problem: developing effective public health responses. In: Charney W, editor. Emerging infectious diseases and the threat to occupational health in the U.S. and Canada. Boca Raton: Taylor & Francis 223.*

vi. *Burkill, H.M. (1985). The useful plants of West Tropical Africa. Royal Botanic Gardens, Kew, UK 2: 246.*

vii. *Caius, J.E. (1986). The Medical and Poisonous Plants of India. Scientific Publishers, Jodhpur. 264-313.*

viii. *Chandra Mohan, S. Dinakar, S, Anand, T. Elayaraja, R. SathiyaPriya, B. (20140. Phytochemical, GC-MS analysis and Antibacterial activity of a Medicinal Plant Acalypha indica, International Journal of PharmTech Research. 4(3) : 1050-1054.*

ix. *Cholapandian, K. Bleesy Jesubell, R. Arunkumar, R. and Boopalan, K. (2013). Antibacterial activity of Acalypha indica extracted with various solvents. International Journal of Ethnomedicine and Pharmacological Research. 1 (1) :1-6.*

x. *Divya, N. Thenmozhi, S. Sureshkumar, B.T. and Selvan, M. (2014). Antibacterial Activity Of Medicinal Plant Against Wound Infected Pathogens. International Journal of Pharmaceutical Sciences and Research. 5(11): 4942-4947*

xi. *Dhar, M.L. Dha, M.M. Dhawan, B.N. Mehrotra, B.M. Ray, B.N. (1968). Screening of Indian plants for biological activity: Part I. Indian Journal of Experimental Biology. 6: 232-247.*

xii. *Govindarajan, M. Jebanesan, A. Reetha, D. Amsath, R. Pushpanathan, T. Samidurai, K. (2008). Antibacterial activity of Acalypha indica L. Eur Rev Med Pharmacol Sci, 12: 299-302.*

xiii. *Gurib-Fakim, A. Sewraj, M. Gueho, J. Dulloo, E. (1993). Medicalethnobotany of some weeds of Masuritius and Rodrigues. J Ethnopharmacol 39:175-85.*

xiv. *Hamer, D. Griffiths, J.K. Maguire, J.H. Heggenhougen, H.K. Quah, S.R. (2010). Public health and infectious diseases. 1st ed. San Diego: Academic Press of Elsevier*

xv. *Hiremath, S.P. Rudresh, K. Badami, S. Patil S.B. Patil, S.R. (1999). Post coital antifertility activity of Acalypha indica L. J Ethnopharmacol 67: 253-8.*

xvi. *Jain, S.K. (1996). Medicinal Plants Pub. National Book Trust India, New Delhi.*

xvii. *Jain, S.K. (1987). A Manual of Ethnobotany Scientific Publishers, Jodhpur.*

xviii. Kaushik, P. Dhiman, A.K. (1999). Medicinal plants and Raw Drugs of India. Bishan Singh Mahendra Pal Singh, Dehradun.

xix. Khan, U.A. Rahman, H. Niaz, Z. Qasim, M. Khan, J. Tayyaba. (2013). Antibacterial activity of some medicinal plants against selected human pathogenic bacteria. Eur J Microbiol Immunol. 3: 272–4.

xx. Kirby, M.D.K. Sherris, J,C. Turck, M. (1966). Antibiotic susceptibility testing by standard single disc diffusion method. American Journal of Clinical Pathology. 45: 493-496.

xxi. Kirtikar, K.R. Basu, B.D. (1994). Indian Medicinal Plants, Volume I, 2nd edition. Dehradun pp 314-317.

xxii. Kirtikar, K.R. Basu, B.D. (1975). Indian Medical Plants. Volume II, 2nd Edition. New Delhi, Jayyed Press 1975; 30-45.

xxiii. Komathi, S. Rajalakshmi, G. and Rekha, R. (2013). Phytochemical Analysis And In Vitro Antibacterial Activity of Leaf Extract of Acalypha Indica Linn. International Journal of Engineering Research & Technology. 2 (1).

xxiv. Lakshmanan, K.K and Sankaranarayanan, A.S. (1990). Antifertility herbs used by the tribal in Anaikatty hills, Coimbatore District, Tamilnadu. J.Econ.Jax.Bot. 14(1): 171-173.

xxv. Madhavi Adhav. Antimicrobial activity of Acalypha indica L. (2016). A medicinally important plant. The Pharma Innovation Journal 2016; 5(5): 104-106.

xxvi. Mahesh VK, Rashmi, S.and Singh, R.S. (1984). Anthraquinones and Kaempferol from Cassia Species Section Fistula. Journalof Natural Products. 47(4): 733-751.

xxvii. Mahishi, P. Srinivasa, B.H. Shivanna, M.B. (2005). Medicinal plant wealth of local communities in some villages in Shimoga District of Karnataka, India. J. Ethnopharmacol. 98: 307-12.

xxviii. MohanaVamsi, N. Venkatasunil Kumar, M. Kodandaram, N. Padmanbha Reddy, Y. (2008). Evaluation of Anti-inflammatory activity of Acalypha indica. Ind Pharm. 7: 89 – 91.

xxix. Nadkarni, A.K. (1995). Indian Materia Medica, Popular Prakashan (Pvt) Ltd, Bombay, 8-9.

xxx. *Oluwakayode Odeja, Christiana Ene Ogwuche, Elias Emeka Elemike and Grace Obi. (2016). Phytochemical screening, antioxidant and antimicrobial activities of Acalypha ciliate Plant. Clinical Phyto science. 2:12.*

xxxi. Panthong, A. Kanjanapothi, D. Taesotikul, T. Taylor, W.C. (1991). Ethno botanical review of medicinal plants from Thai traditional books, part II: Plants with antidiarrheal, laxative and carminative properties. J Ethnopharmacol. 31: 121-56.

xxxii. Parveen, B. Upadhyay, S.R. Ashwani, K. (2007). Traditional uses of medicinal plants among the rural communities of Churu district in the Thar Desert, India. Journal of Ethnopharmacol 2 (113): 387-9.

xxxiii. Prajapati, N.D. Purohit, S.S. Sharma, A. K. Kumar, T.A. (2003). Handbook of Medicinal Plants, AGROBIOS, (India) Jodhpur. 3.

xxxiv. Ramachandran J. (2008). Herbs of Siddha Medicine. The First 3D Book On Herbs. Murugan Patthipagam, Chennai, India, 156.

xxxv. Reddy, J.S. Rao, P.R. Reddy, M.S. (2002). Wound healing effects of Helio tropiumindicum, Plumba gozeylanicum and Acalypha indica in rats. J Ethnopharmacol. 79: 249–251.

xxxvi. Reynolds R: Antimicrobial resistance in the UK and Ireland. Journal of Antimicrobial Chemotherapy 2009; 64(Suppl 1): 19-23

xxxvii. Ruche, G.M. Majekodunmi, O.F. Ramia, Gouri, B.V. Hussain, A. SuadKhamis, S.B. (2007). Antioxidant capacity of some edible and wound healing plants in Oman. Food chem. 101: 465-70.

xxxviii. Samya, R. Thwina, P.M.M. Gopalakrishnakone, P. Ignacimuthu, S. (2008). Ethnobotanical survey of folk plants for the treatment of snakebites in Southern part of Tamilnadu, India. J Ethnopharmacol. 115: 302–12.

xxxix. Sathya, M. Kokilavani, R. Teepa, K.S. Balakrishnan, A. (2011). Bio potency of Acalypha indica Linn on membrane bound ATPases and marker enzymes urolithic rats. Anc Sci Life 2011; 31(1): 3-9.

xl. Shirwaikar, A.K. Rajendran, K,.Bodla, R. Kumar, C.D. (2004). Neutralization potential of Viper russellirusselli (Russell's viper) venom by ethanol leaf extract of Acalypha indica. J Ethnopharmacol 94: 267–73.

xli. Siddiqui, M.B. Husain, W. (1990). Traditional antidotes of snake poison in Northern India. Fitoterapia 61(1): 41-44.

xlii. Sumathi, G. and Puspha, B. (2005). Evaluation of antibacterial activity of some India Medicinal plant. Asian Journal of Microbiology, Biotechnology and Environmental Sci. 9:201-205.

xliii. Sudhakar Chekuri, Arun Jyoti B, Saraswathi Sompaga, Shivaprasad Panjala, Roja Rani Anupalli. (2018). Evaluation of Anti Microbial and Anti Fungal Activity of Acalypha indica. International Journal of Pharmacognosy and Phytochemical Research. 10(1); 48-5110.25258/phyto.10.1.9

xliv. Suresh Mickymaray, Mohammad Saleh Al Aboody, Pradipta Kumar Rath, Panneerselvam Annamalai, Thajuddin Nooruddin. Asian Pacific Journal of Tropical Biomedicine

xlv. Tekwu, E.M. Pieme, A.C. Beng,V.P. (2012). Investigations of antimicrobial activity of some Cameroonian medicinal plant extracts against bacteria and yeast with gastrointestinal relevance. J Ethnopharmacol. 142: 265–73.

xlvi. Varier, V.P.S. (1996). Indian medicinal plants: a compendium of 500 species Orient Longman.Publication, Madras, India. 134.