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Original Article

AN OVERVIEW ON THE BIOLOGICAL PERSPECTIVES OF *SIDA CORDIFOLIA* LINN

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ABSTRACT

Plants have been used since ancient times to heal and cure diseases and to improve health and well being. *Sida cordifolia* Linn belonging to family Malvaceae is widely distributed throughout the plains of India. The various parts of *Sida cordifolia* possess different biological perspectives such as antidiabetic, anti stress, anti-inflammatory, analgesic, hepatoprotective and anticancer activity. This plant has great potential for development of ayurvedic and modern medicines. The present study is focused on pharmacological review of *Sida cordifolia* L.

Keywords: *Sida cordifolia*, Anti-inflammatory, Antidiabetic, Analgesic.

INTRODUCTION

Plants are one of the most important sources of medicines. They have been used since ancient times to heal and cure diseases. India has rich heritage of use of medicinal plants in clinical practices. According to WHO, 80% of world's population rely on traditional plant based medicines for their health care. It is believed that current drugs such as NSAIDS and opiates which are analgesia inducing drugs are not useful in all cases, because of gastrointestinal irritation, liver dysfunction and many other side effects [1]. Therefore, there is still a need existing for the discovery of new drugs from medicinal plants. The crude extracts of plant parts and phytochemicals are known to contain some biological properties and can be of great significance in the therapeutic treatments [2]. *Sida* is considered to be one of the most important genuses of plants. There are nearly 1096 species of *Sida* out of which 100 species are medicinally important. Over 2000 years, in India the plants from genus *Sida* are widely used [3].

Sida cordifolia L commonly known as Country Mallow and Bala (Sanskrit) is a herb belongs to Malvaceae family is widely distributed throughout the tropical and subtropical regions of India. The plant is shrubby, branched and grows well in damp climates. The leaves are cordate or ovate oblong 2.5- 5 cm long and 2.5-5 cm broad. The shrub grows to a height of about 0.75 – 1.5 m. The flowers are small, yellow or white in color with calyx 6-8 mm long and corolla slightly exceeding the calyx. The fruits are 6-8 mm in diameter with carpels 7-8, strongly reticulated, with a pair of awns on each carpel [4]. The leaves contain both ephedrine and pseudoephedrine, whereas alkaloid, ephedrine, vasicinol, vasicinone and N-methyl tryptophan were present in roots and seeds of *Sida cordifolia* plant and hence it can be used as medicinal herb [5]. Hence the present study, review the following pharmacological activities which have been recently explored.

Antimicrobial activity

Chilakapathi Damodar Reddy *et al.,* 2012 [6] evaluated antimicrobial activity using different extracts of *Sida cordifolia* against bacteria and fungi by disc diffusion method. Solvent control dimethyl sulphoxide (DMSO) showed no effect against the tested bacteria and fungi. Aqueous extract showed highest inhibitory activity compared to other extracts [7].

Kalaiarasan A *et al.,* 2010 [8] showed that ethanolic leaf extract have significant activity than methanolic extract with zone of inhibition 9.5 mm for *Klebsiella pneumonia*, 11 mm* for *Pseudomonas aeruginosa* at 75 ml/disc concentration. Mahesh B *et al.,* 2008 [9] performed antimicrobial activity for five medicinal plants from which *Sida cordifolia* showed the highest antibacterial activity for *Bacillus subtilis* and *Staphylococcus aureus*, highest antifungal activity for *Fusarium verticillioides.* Mohammad Abdul Motalib Momin *et al.,* 2014 [10] investigated phytochemical screening of ethanolic extract of *Sida cordifolia* roots and reported antioxidant, antimicrobial and analgesic activity.

Antioxidant activity

Rajesh Singh Pawa *et al.,* 2011 [11] studied radical scavenging activity using DPPH radical and ascorbic acid was measured in terms of hydrogen donating radical. The IC_{50} value of ethanolic and aqueous extracts of *Sida cordifolia* was found to be higher than ascorbic acid. For antioxidant activity the presence of phytoconstituents such as alkaloids, flavonoids and phenolic compounds in the plant which makes ethanolic extract more significant [12]. Maurice Ouedraogo *et al.,* 2012 [13] performed free radical scavenging activity and found a decrease in the DPPH absorbance which was induced by antioxidant.

Anti-Inflammatory activity

Franzotti EM *et al.,* 2000 [14] investigated aqueous extracts of *Sida cordifolia* against anti-inflammatory, analgesic and acute toxicity effects in rats. The aqueous extract also increased the latency period of mice in the hot plate method and inhibited a number of writhes produced by acetic acid at the oral dose of 400 mg/kg.

Shailender *et al.,* 2011 [15] conducted a study to screen the ethanolic extract of *Sida cordifolia* for acute and sub-acute anti-inflammatory effects. *Sida cordifolia* L showed acute inflammatory activity and it was found to be 48.83% with a concentration of 100mg/kg of extract and for 200 mg/kg of extract 53.48% was observed. The ability to inhibit the increase number of fibroblast and synthesis of collagen and mucopolysaccharides during granuloma tissue formation indicates the efficiency of anti-inflammatory agents in sub-acute inflammatory states. *Sida cordifolia* Linn showed significant ($p<0.05$) anti-inflammatory activity by reducing granulomatous tissue in cotton pellet granuloma method and thus found to be effective in sub-acute inflammatory conditions [16]. Ternikar *et al.,* 2010 [17] investigated anti-inflammatory activity from the seed oil of *Sida cordifolia* and it showed a significant activity at a dose of 400 mg/kg body weight. Swathy SS *et al.,* 2010 [18] studied the effect of ethanolic extract of *sida cordifolia* roots on quinolinic acid induced neurotoxicity and its effects were compared with standard drug deprenyl in rat brain. Cyclooxygenase and lipoxygenase are the markers of inflammatory responses which were increased in the quinolinic acid treated rats and this was decreased upon administration of plant extract and deprenyl.

Anti-ulcer activity

Akilandeshwari S *et al.,*2013 [19] studied antiulcer activity of *Sida cordifolia* Linn extracts by inducing ulcer using aspirin plus pylorus

ligation, aspirin and ethanol treatment in 36h fasted albino rats and found that the extract possessed with significant antiulcer activity against different ulcer causing agents in all the three experimental models. Binu K. Philip *et al.,* 2008 [20] investigated the anti-pyretic and anti-ulcerogenic properties of the methanolic extracts of *Sida cordifolia* (MESC) in rats.

Anti-diabetic activity

Kanth and diwan *et al.,* 1999 [21] studied hypoglycaemic, analgesic and anti-inflammatory activities with aerial and roots of *Sida cordifolia* extracts. Mahrukh Ahmad *et al.,* 2013 [22] evaluated hypoglycemic, anti-hyperlipidemic and antioxidant potential of alcoholic extract of *Sida cordifolia* at a dose of (200 and 400 mg/kg) in streptozotocin- induced diabetes rats at the dose of 55 mg/kg. At a dose of 400 mg/kg *Sida cordifolia* extracts showed significant reduction of the blood glucose level in diabetic rats and there was a decrease in total cholesterol, triglycerides, low density lipid, plasma-creatine, plasma-urea nitrogen. There was a significant increase in antioxidant enzymes such as catalase and superoxide-dismutase activity was observed.

Nephroprotective activity

Bhatia *et al.,* 2012 [23] observed that treatment with both ethanolic and aqueous extracts of *Sida cordifolia* Linn. Showed nephroprotective activity when compared to gentamicin. Due to potent antioxidant activity *Sida cordifolia* might have exhibited nephroprotective activity. Mehul V *et al.,* 2012 [24] exhibited *Sida cordifolia* as nephroprotective using aqueous extract at a dose level of 200 mg/kg and 400 mg/kg concentrations against gentamycin 100 mg/kg and cisplastin (7mg/kg). The flavonoids and phenols present in *Sida cordifolia* contribute for antioxidant potentiality that exhibits nephroprotective activity.

Cytotoxicity

Joseph *et al.,* 2011 [25] conducted a study to identify the bioactive compounds from the *Sida cordifolia* plant and observed the cytotoxic effect on hela cell lines. The results from GCMS analysis showed mainly four different compounds such as Vasicinol, Ephedrine, Vasicinone and Hypaphorine based on retention time and peak observation. The results of cytotoxic activity on hela cells treated with *Sida cordifolia* extracts showed cells with uncontrolled growth has been arrested and there is decline level of cancerous cells.

Anti-Hypercholestrolemic activity

Gangadeep Kaur *et al.,* 2011 [26] reported that the methanol and ethanol extracts of *Sida cordifolia* at a dose level of 500, 750 and 1000mg/kg was administered orally to normal rats. There was a decrease in the serum glucose level in streptozocin induced diabetic rats. The rats which were treated with extract (1000 mg/kg) showed a significant reduction in cholesterol, triglyceride, LDL and VDL. HDL was increased by treatment with the extract of *Sida cordifolia*. It may be due to the presence of alkaloids and flavonoids in the extract that inhibits the pathway of cholesterol synthesis and activates LDL receptors of hepatocyte which is responsible for the uptake of LDL into the liver.

Hepatoprotectivity

Kumar S. Rao and Mishra 1997 [27] studied the hepatoprotective activity with *Sida cordifolia* powdered roots, aerial parts and their extracts against carbon tetrachloride, paracetamol and rifampicin induced hepatotoxic rats. It was observed that the powdered aerial and root parts showed a significant hepatoprotective activity against carbon tetrachloride followed by methanolic and aqueous extracts. Silva *et al.,* 2006 [28] demonstrated that the *Sida cordifolia* leaf extracts had the potential to regenerate the liver cells. Rejitha S *et al.,* 2011 [29] studied the hepatoprotective activity of 50% ethanolic extract of the roots of *Sida cordifolia* L against alcohol intoxication. Alcohol induced toxicity is mediated through oxidative stress and it can be monitored by detecting lipid peroxidation products. Malondialdehyde, hydroperoxides and conjugated dienes were significantly reduced in liver and protein carbonyls in the serum which was observed in the rats that were administered with ethanolic extracts of *Sida cordifolia*. The mRNA level of cytochrome P450 2E1, NF-KB, TNF-α and transforming growth factor-β were found to be increased in the alcohol treated rats and their expressions were found to be decreased in the *Sida cordifolia* extracts treated rats.

Analgesic activity

Ranajith kumar sutradhar *et al.,* 2006 [30] reported analgesic and anti-inflammatory activities of a new alkaloid (5' - hydroxymethyl - 1'- (1, 2, 3, 9 -tetrahydro - pyrrolo) [2, 1- b] quinazolin -1- yl) - heptan - 1 - one) (compound1) isolated from *Sida cordifolia* was investigated in rats. The analgesic activity of compound1 was determined by acetic acid induced writhing inhibition method and the result showed a significant reduction. The anti-inflammatory activity was studied using carrageenan induced rat paw edema and the alkaloid produced significant ($p < 0.01$) activity. These results indicated that compound1 possessed analgesic and anti-inflammatory activities.

Konate k *et al.,* 2012 [31] conducted a study on aqueous extracts of *Sida acuta* and *Sida cordifolia* for toxicity and analgesic activity. The extracts were administered intraperitoneally at a dose of 6 mg/kg for 14 days. It was analyzed for analgesic properties using writhing which was induced by acetic acid on mice. The extracts produced significant inhibition by acetic acid. Thus the result showed that *Sida cordifolia* produced high inhibition values when compared to extracts of *Sida acuta.* Similarly, for formalin induced nociception the extracts of *Sida cordifolia* produced higher inhibition than *Sida acuta.*

Antistress and adaptogenic activity

Sumanth *et al.,* 2009 [32] demonstrated about the adaptogenic activity in *Sida cordifolia* Linn. The extracts were prepared and administered orally in rats. Ashwagandha which was in water-soluble powder form was used as reference standard antistress drug. The result showed that *Sida cordifolia* extracts reduced plasma cortisol level as well as blood glucose.

Cardiovascular activity

Mediroset IA *et al.,* 2005 [33] studied the cardiovascular activity of the hydroalcoholic extract of *Sida cordifolia* at a concentration of (5, 10, 20, 30 and 40 mg/kg) induced hypotension and bradycardia in normotensive non-anaesthetized rats. It could be due to indirect cardiac muscarinic activation and direct activation of endothelial vascular muscarinic receptors by using atropine (2mg/kg). Asdaqad *et al.,* 2008 [34] studied the effect of hydroalcoholic extract of *Sida cordifolia* (HESC) on serum lipid profile. It was concluded that administration of HESC at dose of 500 mg/kg has cardio protective potential.

Kubavat JB and Asdag SMB *et al.,* 2009 [35] studied about the biochemical and antioxidant profile using *Sida cordifolia* extracts against myocardial infraction (MI) in albino rats. The rats were administered with *Sida cordifolia* extracts (100 and 500 mg/kg) and propranolol (10 mg/kg). MI was induced by isoprotenolol or by ischemia reperfusion injury (IRI). The endogenous markers and antioxidant were estimated in serum/ perfusate and heart tissue homogenate. The activities of endogenous markers were elevated in heart tissue homogenate and depleted in serum/ perfusate of *sida cordifolia* extracts and propranolol.

Anticancer activity

Mallikarjuna G *et al.,* 2013 [36] evaluated the ethanolic extract of *Sida cordifolia* against Aflotoxin B_1 (AFB_1) induced hepatocellular carcinoma (HCC) in winstar rats (250µg/ kg/ dose). The ethanolic extracts of *Sida cordifolia* was administered at a dose of 250 and 500 mg/kg orally. The results showed a significant restoration of abnormal serum and tissues indicating the protective effect. Takaaki *et al.,* 2007 [37] investigated anticancer activity for the plant alkaloid cryptolepine from *Sida cordifolia*. The results showed that cryptolepine induces growth arrest in MG63 cells through the p53-independent activation mediated through specific Sp1site in promoter region. It indicates the possibility that treatment with cryptolepine can be used as chemotherapy for osteosarcoma.

CONCLUSION

Plants are the most important source for exploring potentially useful structural compounds for developing new therapeutic drugs. *Sida cordifolia* Linn is a versatile and widely available plant grown in the plains of India, has been used to treat various diseases for more than hundreds of years. The present review reports the various pharmacological potentials which are explored by various researchers. Yet more biological potentials are still untapped. The leaves, aerial parts and roots are used in the traditional system of medicine for various diseases related to the human race.

CONFLICT OF INTERESTS

Declared None.

REFERENCES

1. Kushagra Nagori, Mukesh Kumar Singh, Dhansay Dewangan, VK Verma, DK Tripathi. Anti-inflammatory activity and chemo profile of plants used in traditional medicine: a review. J Chem Pharm Res 2010;2(5):122-30.
2. Selvamohan T, Ramadas V, Shibila Selva Kishore S. Antimicrobial activity of selected medicinal plants against some selected human pathogenic bacteria. Adv Appl Sci Res 2012;3(5):3374-81.
3. Rajesh Wake, Narhari Patil. Genus Sida–The plants with ethno medicinal & therapeutic potential. Golden Res Thoughts 2011;1:1-4.
4. Ankit J, Shreya C, Singour PK, Rajak H, Pawar RS. *Sida cordifolia* Linn-A Review. J Appl Pharm Sci 2011;01(02):23-3.
5. Pramod V Pattar, Jayaraj M. Pharmacognostic and phytochemical investigation of *Sida cordifolia l*.-a threatened medicinal herb. Int J Pharm Pharm Sci 2011;4(1):114-7.
6. Chilakapati Damodar Reddy, Challa Krishna kumara, Serasanambati Mamatha Reddy, Chilakapati Shanmuga Reddy, Yakkanti Raja Ratna. Antimicrobial activity of leaf extracts of *Sida codifolia*. Int J Pharm 2012;3(9):309-911.
7. Cowan MM. plant products as antimicrobial agents. Clin Microbiol Rev 1999;12:564-82.
8. Kalaiarasan, Ahmed John S. Phytochemical screening and Antibacterial activity of *Sidacordifolia* Linn. (Malvaceae) leaf extract. Int J Medicobiol Res 2011;1(2):94-8.
9. Mahesh B, Satish. Antimicrobial activity of some important medicinal plant against plant and human pathogens. World J Agric Sci 2008;4(S):839-43.
10. Mohammad Abdul Motalib Momin, Sm Faysal Bellah, Sarder Mohammad Raussel Rahman, Ahmed Ayedur Rahman, Gazi Mohammad Monjur Murshid, *et al*. Phytopharmacological evaluation of ethanol extract of *Sida cordifolia* L. roots. Asian Pac J Trop Biomed 2014;4(1):18-24.
11. Rajesh Singh Pawa, Ankit Jain, Preeti Sharma, Pradeep Kumar Chaurasiya, Pradeep Kumar Singour. *In Vitro* Studies on *Sida cordifolia* Linn for anthelmintic and antioxidant properties. Chin Med 2011;2:47-52.
12. Ranajit K Sutradhar, AKM Matior Rahman, Mesbah U Ahmad, Sitesh C Bachar. Bioactive flavones of *Sida cordifolia*. Phytochem Lett 2011;1:179-82.
13. Maurice Ouédraogo, Kiessoun Konaté, Alexis Nicaise Lepengué, Alain Souza, Bertrand M'Batchi, Laya L Sawadogo. Free radical scavenging capacity, anticandicidal effect of bioactive compounds from *Sida Cordifolia* L., in combination with nystatin and clotrimazole and their effect on specific immune response in rats. Ann Clin Microbiol Antimicrob 2012;11:33.
14. Franzotti EM, Santos CVF, Rodrigues HMSL, Moura˜o RHV, Andrade MR, Antoniolli AR. Anti-inflammatory, analgesic activity and acute toxicity of Sida cordifolia L. (Malva-branca). J Ethnopharmacol 2000;72:273–8.
15. Shailender Singh, Praveen Panchaksharimath, Siddappa Devaru. Evaluation of anti-inflammatory activities of *Sida cordifolia* in Albino rats. J Chem Pharm Res 2011;3(6):136-42.
16. Arrigoni ME. Inflammation and anti-inflammatory. Spectrum publication: New York; 1988. p. 119-20.
17. Ternikar SG, Alagawadi KR, Ismail Pasha, Khatib NA, Dwivedi sandeep, Sharma Tarun. Anti-Inflammatory activity of *sida cordifolia* linn. seeds extract. Pharmacologyonline 2010;2:763-7.
18. Swathy SS, Seema Panicker, Nithya RS, Anuja MM, Rejitha S, Indira M. Antiperoxidative and antiinflammatory effect of *sida cordifolia* linn. on quinolinic acid induced neurotoxicity. Neurochemical Res 2010;35:1361-7.
19. Akilandeswari S, Valarmathi R, Indulatha VN, Senthamarai R. Screening of gastric antiulcer activity of *Sida cordifolia.* Int J Pharm Chem Sci 2013;2(3):1288-92.
20. Binu K Philip, Muralidharan A, Natarajan B, Varadamurthy B, Venkataraman S. Preliminary evaluation of anti-pyretic and anti-ulcerogenic activities of *Sida cordifolia* methanolic extract. Fitoterapia 2008;79:229–31.
21. Kanth VR, Diwan PV. Analgesic, anti-inflammatory and hypoglycaemic activities of *Sida cordifolia* L. Phytother Res 1999;13(1):75–7.
22. Mahrukh Ahmad, Shahid Prawez, Mudasir Sultana, Rajinder Raina, Nrip Kishore Pankaj, Pawan Kumar Verma, Shafiqur Rahman. Anti-Hyperglycemic, Anti-Hyperlipidemic and antioxidant potential of alcoholic-extract of *sida cordifolia* (areal part) in streptozotocin-induced-diabetes in wistar-rats. Proc Natl Acad Sci 2014;84(2):397–405.
23. Bhatia Lovkesh, Bhatia Vivek, Grover Manav. Nephroprotective Effect of fresh leaves extracts of *sida cordifolia linn* in gentamicin induced nephrotoxicity in rats. Int J Res Pharm Sci 2012;2(2):151-8.
24. Mehul V, Makwana, Nilesh M, Pandya, Dharmesh, Darji N, Sarav A Desai, *et al*. Assessment of nephroprotective potential of *Sida cordifolia Linn.* In experimental animals. Scholars Res Library 2012;4(1):175-80.
25. Baby Joseph, Ajisha AU, Satheesna Kumari, Sujatha S. Effect of bioactive compounds and its pharmaceutical activities of *sida cordifolia (Linn.)*. Int J Biol Med Res 2011;2(4):1038-42.
26. Gagandeep Kaur, Pradeep Kamboj, Kalia AN. Antidiabetic and anti-hypercholesterolemic effects of aerial parts of *Sida cordifolia* L. on Streptozotocin induced diabetic rats. Indian J Nat Prod Resour 2011;2(4):428-34.
27. Kumar S Rao, Mishra SH. Isolation and assessment of hepatoprotective activity of fumaric acid obtained for the first time from *Sida cordifolia* Linn. Indian Drugs 1997;34(12):702-6.
28. Silva Rl, Melo GB, Melo VA, Antoniolli AR, Michellone PR, Zucoloto S, *et al*. Effect of the aqueous extract of *Sida cordifolia* L. on liver regeneration after partial hepatectomy. Acta Cirúrgica Brasileira 2006;21(1):37–9.
29. Rejitha S, Prathibha P, Indira M. Amelioration of alcohol-induced hepatotoxicity by the administration of ethanolic extract of *Sida cordifolia* Linn. Br J Nutr 2012;108:1256–63.
30. Ranajit Kumar Sutradhar, AKM Matior Rahman, Mesbahuddin Ahmad, Sitesh Chandra Bachar, Achinto Saha, Samar Kumar Guha. Bioactive Alkaloid from *Sida cordifolia* Linn with analgesic and anti-inflammatory activities. Iran J Pharmacol Ther 2006;5:175-8.
31. Kiessoun Konate, ImaelHeri Nestor Bassole, AdamaHilou, Raissa RR, Alain Souza, Nicolas Barro, *et al*. Toxicity assessment and analgesic activity investigation of aqueous acetone extracts of *Sida acuta* Burn f. and *Sida cordifolia* L. (*Malvaceae*), medicinal plants of Burkina Faso. Bio Med Cent Complementary Alter Med 2012;12:120.
32. Sumanth Meera, Mustafa SS. Antistress and adoptogenic activity of *Sida cordifolia* roots in mice. Indian J Pharm Sci 2009;71(3):323–4.
33. Medeiros IA, Santos MRV, Nascimento NMS, Duarte JC. Cardiovascular effects of *Sida cordifolia* leaves extract in rats. Fitoterapia 2006;77:19-27.
34. Syed Mohammed, Basheeruddin Asdaq, Niara Nayeem, Amit Kumar Das. Effect of hydroalcoholic extracts of *sida cordifolia l.* Leaves on lipid profile in rats. Pharmacologyonline 2008;3:227-39.
35. Kubavat JB, Asdaq SMB. Role of *Sida cordifolia* L. leaves on biochemical and antioxidant profile during myocardial injury. J Ethnopharmacol 2009;124:162–5.
36. Mallikarjuna G, Jaya Sankar Reddy V, Prabhakaran. Evaluation of anticancer activity of *sida cordifolia* l. against aflatoxin b1 induced hepatocellular carcinoma. Int J Pharm Sci Rev Res 2013;23(2):126-32.
37. Takaaki Matsui, Yoshihiro Sowa, Hiroaki Murata, Koichi Takagi, Ryoko Nakanishi, Shunji Aoki, *et al*. The plant alkaloid cryptolepine induces p21*WAF1/CIP1* and cell cycle arrest in a human osteosarcoma cell line. Int J Oncol 2007;31:915-22.