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Research Paper

Genus Sida – The plants with ethno medicinal & therapeutic potential

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ABSTRACT

India has rich heritage of use of medicinal plants in clinical practices since ancient times. It is also common in countries like China, Africa, Brazil. The herbal medicines are majorly utilized in alternate, rural & modern medicinal systems worldwide. The people in rural areas know these practices traditionally. This knowledge is known as ethnomedicine. These people are using various plants for these purposes. Sida is one of such medicinally important genus of plants. Various plants of this genus are commonly used in rural areas & Ayurvedic medicines. This knowledge must be verified on the basis of modern sciences. The studies related with knowledge of common rural people &clinical practioners will help to develop new methods of treatment of diseases.

Key Words- *Medicinal plants, ethnomedicine, Ayurvedic, Sida, modern sciences*

Introduction –

India has rich heritage of use of medicinal plants in clinical practices since ancient times. In countries like China, Africa, Brazil the medicinal plants are widely used in treatment of diseases for millenniums. It is known that 80% of world population uses medicinal plants for various purposes, in traditional system as well as modern medicine1. Out of total medicines prescribed,30% of herbal medicines are prescribed by physicians. It is estimated by WHO that most of the population of developing countries uses products of medicinal plants, for primary health care. In India, various plants are commonly used in disease treatment of Ayurvedic system. Homeopathic, Siddha, Naturopathy, Unani like alternative medicine systems also comprise various products obtained from plants. There are thousands of plant species which may be employed in clinical practices. Various plant parts like roots, stem, bark, leaves, flowers, fruits, seeds & whole plants are used in various forms of medicines2. They may be used alone or in combination with other plant parts. There are very clear ancient references for utilization of these plants in clinical treatments. This information of using plants & their parts for clinical treatment is very well known to common people living in rural areas. These people are using, plants traditionally for treatment of diseases. This knowledge of common, rural & ethnic peopleis known as ethnopharmacology, ethnobotany, ethnomedicine are some allied subjects to it. These branches clearly show importance of plants. However, there are not sufficient studies describing the mechanisms correlated to activities of plants. These studies may lead development of new & cheaper kinds of treatment of many diseases. By using modern anatomical, phytochemical, biochemical, biotechnological, bioinformatics tools, the traditionally important molecules may be assessed for their activities.

Sida is one of such ethno medicinally important genus of plants. There are 1096 species of Sida out of which 100 species are medicinally important. The plants from genus Sida are used in India over 2000 years. The plants are also described in various Ayurvedic reference books like Bhav Prakash Niganthu, Niganthu Ratnakar,Charak Sanhita etc. Various species like Sida cordifolia, Sida acuta, S. rhombifolia , S. spinosa, S. carpenifolia,S. humilis, S. veronicaefolia are used in Ayurvedic system3. It is used for various purposes like diseases of respiratory system, neural diseases etc as described in Ayurveda. The plants are also quiet prone for adulteration due to availability of number of species& also due to lack of sufficient information.

Botany of genus Sida Linn.-

The plants in genus Sida show peculiar features. The plants are herbs or undershrubs, hairy and with stellate hairs. Leaves toothed; stipules linear, 6-8 mm long. Pedicels auxillary. Solitary or clustered, disarticulating in fruits at a constriction below the calyx. Involucral bracts o. Sapels 5, valvate, connate with the stamina tube. Stamina tube divided at the top into numerous antheriferous filaments. Ovary of 5-12 cells; ovule 1, in each cell, pendulus; styles as many as carpels; stigmas terminal. Fruit globose, depressed, enclosed by the calyx; carpels separating from each other and from the central axis, beaked or not. Seeds black-chestnut, smooth – species about 120.-cosmopolitan.Generally the plant is available from rainy season. The plants are flowering in October –December. Later on the plant vanishes.

There are near about 100 species of Sida. Some commonly observed & medicinally important species are studies so far.

Sida Veronicaefolia-It is perennial much-branched herb; branches prostrate or tailing, sometimes rooting, more or hairy. Leaves 1.2-5 cm. long, cordate, ovate, acute or acuminate, serrate, sparsely clothed with stellate hairs; petioles 1.2-2 cm. long. Pedicels 1.2-3.8 cm. long, slender, axillary, solitary or twin jointed a little above the middle. Calyx 4 mm. long, 5- angled, hairy; lobes triangular, acute or acuminate. Corolla pale yellow, slightly exceeding the calyx. Carpels 5, smooth, not reticulated, muticous or with a small slightly 2-lipped beak, not cuspidate. Seeds brown, glabrous. The plant is distributed throughout the hotter parts of India, tropical and subtropical regions of the world.

Sida Spinosa Linn.It is suberect branched shrub, grey from minute stellate hairs. Leaves up to 5 cm. long, elliptic, obtuse or cuneate at the base, rounded or narrowed at the top to obtuse triangular, not acuminate, ultimately

glabrate above, grey beneath; petioles 1.2-2.5 cm. long, with often 1-3 small recurved spines beneath the petioles. Pedicels 0.2 cm. long, stellately hairy; lobes triangular. Corolla slightly exceeding the calyx, pale yellow. Carpel's 5, pubescent; awns 2, about half the length of the carpel from a conic base, slightly divergent, with spreading or erect hairs. Seeds smooth, black-brown. The plant is distributed Throughout the hotter parts of India from N.W. India to Ceylon, tropical and subtropical regions of both hemisphere.
Sida Acuta Burm The plants are shrubby, much branched; branches slender, terete, minutely stellately hairy. Leaves 2.5-6.3 cm. long, lanceolate, with rounded base sharply serrate, glabrous on both sides; petioles 0-6 mm. long; shorter than stipules. Pedicels 1-2 in each axil, shorter or longer than petiole, jointed about the middle. Calyx 6-8 mm. long; lobes triangular, acute. Corolla nearly twice as long as the calyx, yellow. Fruit 5-6 mm. diam.; carpels 5-9, puberlous not pubescent, strongly reticulated, toothed on the dorsal margins; awns 2 nearly linear, about 1/ 3 the length of the carpel. Seeds smooth, black.

They are distributed in hotter parts of India, tropics generally. The plants are very commen amongst all other species of Sida. It is observed as a weed roadside & can be used as substituent or adulterant.

Sida rhombifolia Linn- The plant is small erect undershrub. Branches rough with stellate hairs. Leaves very variable in shape, up to 5 cm. by 18 mm., glabrous or subglabrous above, grey-pubescent or hoary beneath, coarsely dentate towards the tip, entire towards the base, 3-5-nerved. Petiole up to 6 mm. long, pubescent, swollen in the upper third. Pedicels axillary or crowded towards the ends of the branches. Calyx 5-angular, hairy; lobes triangular, acuminate. Corolla yellow or white, 8-12 mm across. Carpels 7-10 with 2 short awns. Seeds smooth, black. The leaves, the relative length of pedicels, the position of the joint and the length of the carpellary awns are most variable and the many varieties which have been made are better considered as so many forms to which many others might be added. The plant show two types among it i.e.

a)var. S. retusa Linn.-Leaves obovate, retuse, or truncate, dark green and glabrous above, more or less tomentose beneath, pedicels equaling, longer or shorter than the petiole, jointed above the middle. Carpellary awns short.
b) var S.rhomboidea-Leaves rhomboid-lanceolate, serrate, hoary beneath. Pedicels more than half the length of the leaves, jointed at the base. The plant is distributed all over waste places, throughout the tropics of both hemispheres.

Sida cordifolia Linn- It is shrubby, branched, softly hairy and with much stellate hair nearly all over and sub persistent. Leaves 2.5-5 cm. long, cordate, 1.2-3.8 cm. long, Pedicels solitary or few together, short, some up to 1.2-2 cm, long, jointed much above the middle. Calyx 6-8 mm. long; lobes ovate, acute. Corolla slightly exceeding the calyx. Yellow. Fruit 6-8 mm. diam.; carpels 7-10, strongly reticulated, ciliate on the upper margins, the two dorsal margins almost scabrid; awns 2, nearly as long as the carpels, linear, retrorsely scabrid-hairy.It is distributed tropical and subtropical regions of both hemispheres. Majorly it is observed at costal areas. It is highly essential in practices. Hence the plant is irradiating due to its frequent collection & becoming rare4.

Ethnomedicinal Usage-

The people living in rural area are possessing knowledge about the clinical practices. They are very commonly using various substances for the treatment of disease. This practice is known as ethno medicine. It is very diverse information among illiterate folklore people. This information may be studied on scientific basis. It can be used as references for scientific studies. This knowledge is found in countries like in India, Brazil, Africa, Nepal, China, Mexico etc. The botanical and pharmacological studies of ethno medicine are essential. The ethnomedicinal data reviewed is as follows:

Table 1.Ethnomedicinal Data

Sr. No	Location/ Ethnic groups	Plant	Uses
1	Santals	Leaves of *S. veronicafolia*	Cuts & bruises, diarrhea
2	Mohammadans	*S. acuta*	Aphrodisiac
3	Mundas	Leaves of *S.rhombifolia*	Swelling
4	Konkan	*S. acuta*	In boils
5	Bengal	Juice of leaves *of S. acuta*	In intestinal worms
6	Assam	Roots of *S.rhombifolia*	For childbirth
7	Konkan	*S.cordifolia*	In ophthalmic, for healing wounds
8	Gold cost	*S. acuta*	Abortificient,
9	Portuguese	*S. acuta*	Diuretic, demulcent in gonorrhea
10	India	*S. acuta*	Stomachic, used in bowel complaints
11	Europe	*S.rhombifolia*	In rheumatism & tuberculosis
12	Gold cost	*S. acuta*	Veneral disease, Abortificient, In paralysis
13	Madagaskar	*S.rhombifolia*	Emollient, dysentery
14	Portugese	*S.cordifolia*	Child's remedy
15	Combodia	*S.cordifolia*	Diuretic,in gonorrhea
16	Trininad & Tobago	*S. acuta*	Leaf in Eczema
17	China	*S. acuta* *S. cordifolia*	As like Ephedra Nutrient
18	India	*S.cordifolia*	Neuro generative diseases Parkinson's disease[4]
19	Colombia	*S. acuta*	Snake bite
20	Burkina Faso	*S.acuta*	Antimalerial[5]
21	Ivory Costa	*S. acuta*	Antimalerial
22	Mexico	*S. acuta*	Antimalerial
23	Brazil	*S.cordifolia*	Oral inflammation of mucosa Blennarheea, asthamatic bronchitis, nasal congestion[6]
24	Kenya	*S.cordifolia*	Dental hygiene
25	Nigeria	*S.acuta*	Antipyretic, used in wounds[7]

Chemical Constituents-

The plants of genus Sida are very important. This importance is due to their chemical constituents .Main chemical content of Sida is alkaloid- ephedrine, due to which it has become as significant as Ephedra. The chemical constituents found in review of literature of various plant species of Sida are as follows.

Table 2.Chemical Constituents

Sr No	Plant	Chemical Constituents
1	*S.acuta*	M-ecdysterone ,heradenol, B-sitosterol, acanthoside, B daucoglycanide, cyclopropenoid, fatty acids, mucilage.
2	*S.rhombifolia*	M-B phenylethylamine, vasicine,vasicinone , betaine, o-methylethylamine, tryptophan ,methyl ether, vasicinol, choline, ephedrine[9]
3	*S.cordifolia*	Ephedrine,psudoehedrine, B-phenylamine,vasicine,vasicione, α-amyrin,eclysterone,β-sitosterol[10]
4	*S.cordifolia*	Flavonol glycosides[11]
5	*S.cordifolia*	Asparagin, phytosterols[12]
6	*S.cordifolia*	Mavalic acid,palmitic acid,stearic acid[13]
7	*S.cordifolia*	Phytosterol,ecdysterone.
8	*S.acuta*	Ecdysterone
9	*S.acuta*	Alkaloids-cryptoleprine,quindoline
10	*S.rhombifolia*	Cyclopropandid, fatty acid in seed oils.
11	*S.rhombifolia*	Heradenal,β sitosterol,acanthaside
12	*S.rhombifolia*	Phytoecdysterol
13	*S.cordifolia*	Cryptolepine

Clinical Usage-

The Ayurvedic system of medicine uses Sida as an important content in their medicines. Various Ayurvedic & rurally used formulations contain plant parts of Sida .The study of mentioned therapeutic uses of Sida also show its clinical importance. They are as follows.

Table 3.1.Clinical Use

Sr No	Plant	Uses
1	*S.spinosa*	Kapha, Vata, astringent , cooling
2	*S. acuta*	Removes Tridosha, useful in fever, urinary discharges
3	*S. acuta*	Snake bite, scorpion bite
4	*S.rhombifolia*	Removes Tridisha,strangury, in fever
5	*S.cordifolia*	In Vata & Pitta, piles,aphrodisiac

Table 3.2.Clinical Use

Sr. No	Plant	Parts	Uses
1	*S.acuta*	Leaf Juice	Urinary infection, emollient. swelling, elephantiasis.
2	*S.cordifolia*	Root Bark Juices of Plant with water Juice of roots Seeds	Astringent, stomachic, tonic, aromatic, bitter, demulcent, diuretic, piles, flatulence, antiviral, antifungal, febrifuge, cardio tonic in asthma, sources of fibers. Facial paralysis, sciatica, tenesmus, hemophlegia, Beauty enhancer. Spermatorrhoea. Wound healing. aphrodisiac, in gonorrhea, colic, tenesmus.
3	*S.rhombiffolia*	Stem Root	Applied on swelling, pulmonary T.B. leucorrhoea. hepatoprotective , restorative. emollient, demulcent, rheumatism.
4	*S.veronicafolia*	Flowers & Fruits Leaves	Burning sensation and micturition. Pregnancy, cuts, bruiser. useful in urinary discharges, scalding urine, leprosy, and skin infections removes “tridosha”; digestive and diuretic
5	*S.spinosa*	Root bark Roots Leaves	Bladder irritation, gonorrhea. tonic, diaphoretic, fever, debility. gleets, scalded urine

Reported Activities

The plant shows various pharmacological activities. Various workers have reported these activities. There activities indicate the importance of genus Sida. Various species of Sida, are not studied still. So there is need of scientific study of Sida. The review of literature shows potential of pharmacological activities of Sida.S.S. Swathy et al(2001) reported neuro protective activity of Ksheer bala. Ksheer bala is an Ayurvedic formulation containing S.cordifolia along with cow milk & sesame oil.It is studied for its antioxidant activity which is particularly against catalase, super oxide dismutase, peroxidase enzymes. The study included evaluation of neuroprotective activity in quinolinic acid induced toxicity in rat brain. The ksheerbala has restored normal activity of cerebral cells of rat brain. Here Sida cordifolia might have inhibited lipid peroxidation induced by quinolinic acid in rats. Baba K et al (2009) reported anatomical studies of varieties of Sida. The study was performed for identification parameters of drug from adulteration. The study showed prominent differences in anatomical properties of different varieties. K.Dhalwal (2005) studied antioxidant potential of S. cordifolia. The ethnolic extract of whole plant is used for study of antioxidant potential. The parameters like antilipid peroxidation, free radical scavenging, superoxide scavenging, antioxidant assay. nitric oxide scavenging were studied. These activities were compared with standard antioxidants like BHA,alpha tocopherol, ascorbic acid. The DPPH assay has shown potential activities. The activities are concentration dependant & found highest in root extracts. The study revealed that Sida cordifolia is potential source of natural antioxidants. K.Dhalwal also studied antioxidant activity of S. rhombifolia & revealed its potential. The root extracts has highest antioxidant activity.S.A. Adeniyi et al (2010) performed preliminary phytochemical analysis & insecticidal activity of extracts of four tropical plants including S. acuta against beans weevil. Phytochemical screening revealed presence of alkaloids, flavonoids, saponins,Steroids, tannins etc. The extracts are also studied to investigate insecticidal activity against A.obetectus. The activity is dose & concentration dependant. It also increases as per increase in time intervals. T.V. Ramanrao et al (2006) reported histo architecture of pericarp & liberation of seeds of S. rhomlofolia fruit. The study showed histological arrangement & functional relationship with fruit. Kurma Rao et al (1997) isolated & assessed hepatopratective activity of fumaric acid form S. cordifolia. The study reported method for isolation of fumaric acid first time. It is isolated from aqueous extracts of whole plant of S. cordifolia. He also reported its hepatoprotective activity in vivo as well as in vitro. In vivo, it is studied against hepatotoxicity produced by CCl4 paracetamol & rifampicin in albino rats. In vitro it is assessed in hepatic cytotoxicity in isolated rat hepatocytes. The results are compared with helatoprotective function of silymarin. S. Khatoon et al (2005) reported HPTLC method for standardization of Sida species by estimation of alkaloid ephedrine. It is developed for various Sida species from which the specific species may be identified. They developed HPTLC markers by determining various Rf values. From this study, it is reveled that S. cordifolia whole plant contain highest ephedrine where as S. cordata shows minimum out of studied species. R.K. Sultradhar et al (2006) worked to evaluate alkaloid form S. cordifolia & its analgesic & antiinflammatory activity . The alkaloid is studied in acetic acid induced writhing in mice & carrageenan induced oedema for analgesic & anti-inflammatory activity. The isolated compound showed sound analgesic and anti-inflammatory activity.Muzaffar Alam et al (1990) screened S. cordifolia & S. rhombifolia for anti-inflammatory & antipyretic activities. S. cordifolia showed excellent anti-inflammatory activity in cotton pellet formation in albino rats. The compound also reduced serum & liver proteins, serum acid phosphotase activity & ascorbic acid content. The activity is compared with phenylbutazone. S. rhombifolia also showed anti inflammatory effects. It showed significant

activity against TAB vaccine induced pyrexia in albino rats. Antiulcer activity of S. acuta is studied by P.Malairajan(2006) .The ethnolic extracts are used against aspirin plus pylorus ligation induced gastric ulcer, HCL ethanol induced ulcer & water immersion stress induced ulcer. The extract showed markedly decrease in incidence of ulcers in first two models. It also showed reduction in gastric volume, free acidity & ulcer index. It has not reduced total acidity .These activities are compared with omeprazole.Fragotti E.M.et al (2000) has studied antiflammatory, analgesic activity of S. cordifolia. The study also included acute toxicity studies in animals. The aqueous extract of S. cordifolia significantly inhibited carrageenin induced rat paw edema. It does not block the edema induced by arachidonic acid. It also inhibited writhes produced by acetic acid. The aqueous extract of S. cordifolia showed low acute toxicity in mice up oral dose of 3g/Kg.K. Dhalwal et al (2006) studied hepatoprotective activity of S. rhomrifolia ssp retusa in thioacetamide & allyl alcohol intoxication in rats. The drugs showed hepatoprotective activity. The pretreatment of aqueous extract significantly inhibit liver damage. The extract also reduced various enzymes in serum. It also restored changes in body weight ,necrosis etc.V. Ravikanth et al (1999) has reported hypoglycemic activity of methanolic extract of root of S.cordifolia. The paper also reported analgesic & anti inflammatory activity of various extracts of Sida cordifolia.Silva et al (2006) reported hepatoprotective effect of aqueous extract of S.cordifolia after partial hepatectomy.Islam E et al(2003) reported cytotoxicity & antibacterial activity of S.cordifolia.Auddy et al demonstrated antioxidant activity of S.cordifolia. Atul N. Jadhav et al (2007) reported HPTLC method for determination of 20 hydroxyecdysone in S.rhombifolia. The compound is very important anabolic substance occurring naturally. Bala Krishnan N (2006) reported antibacterial activity of S. cordifolia.The antibacterial study included activity against B. subtilies , S. aureus, K.pnumoniae, P.aeruginosa, E.coli ,S.typhi. The hydroalcololic extract of plant has shown noticeable activity against all microorganisms. Namba et al (1986) reported antiplaque activity of S.cordifolia. Maungra (1994) reported antifungal activity of Sida.

Karo et al (2005) reported antibaitercial activity of S. acuta.Nuwankaya (1983) reported nutritive value of Sida as an animal feed. The study included contents of various weeds in which S.acuta & S.rhombifolia were studied.

Jang D.S. et al (2003) reported activity of compounds obtained from Sida acuta against preneoplastic lesions in mouse memory organ culture model.

Karou reported antimalerial activity of Sida acuta.The activity is significant. Ic50 < 5 microgram/ml. The activity is due to alkolaidal content. Karou also reported antioxidant & antibacterial activities of S.acuta. He suggested that the activity may be due to polyphenols present in plant. The work included determination of polyphenolic compounds, antioxidant activity, antibacterial activity, MIC & MBC .S.acuta showed prominent activities against various microorganisms. Prakash A. reported presence of alkaloids in Sida species. A.S. Saganuwan also reported antimicrobial activity. Santas M R (2006) reported vasodilation induced by S.cordifolia. Franko reported effects of Sida on CNS. Mederors reported effect on respiratory system.

Philip B.K. (2008) reported antipyretic activity & antiulcerogenic activity of methanolic extract of S.cordifolia . The study utilized aerial parts of plants & effect compared with reference drugs. Matsui (2007) reported anticancer activity in human osteo sarcoma cell lines .The study showed that alkaloid present in plant, cryptolepins possesses this activity. Medeiras I A (2006) reported cardio vascular effects of S.cordifolia leaves in rats .It produced hypotension & bradycardia. Franco (2005) reported pharmacological effects on CNS of mice. The molecules reduced spontaneous activity at dose 1000mg/Kg.Homer K.A. reported antibacterial activity of extract of S.cordifolia against microorganisms responsible for oral hygiene. The extract inhibited dental plaque formation.

Toxicity Studies-

The work on use of plants from genus Sida shows its medicinal importance. But for safety & efficacy of the plant in modern perspective the overview of toxicity & dosage need to be studied.

Ayurvedic Pharmacopoeia mentioned 3-6 gm of powder of S.cordifolia is effective & safe as well. The Quality Standards of Indian medicinal Plants have also mentioned 3-6 gm as safe dose. The toxicity study of Standardization of Botanicals shows 3g/Kg dose of S, cordifolia is toxic in mice. The LD 50 of drug is not available. But the drug is considered toxic due to adulteration of S. rhombifolia. In Indian Herbal Pharmacopoeia, the dose mentioned is 1-3 gm.Dr.Amritpal Singh reported 1-3 gm dose as a safe dose of S.cordifolia.Haller reported effect of ephedrine of Sida on appetite suppression & CVS effects. He also reported adverse CVS & CNS events associated with dilatory supplement containing ephedrine.Franco et al studied effect of drug on mice. The ED 50 found is 1000mg/Kg & LD 50 did not find. Kanth reported hypoglycemic effect in animals.

The dose of S.rhombifolia is 3-6gm & the reported LD 50 is 8.5gm/kg in rats.

Traditionally 2-4 gm is considered as safe dose of S.acuta.

These & other plants from this genus are not studied so far. This data raises some questions about toxicity studies of various plants of this genus. These studies are essential for formulation & other aspects of study of plant. This will be useful to establish the uses of genus Sida

Concluding Remarks-

This report indicates need of study of various plants of genus Sida. It also indicates clinical importance of plants of genus Sida. The plants in this genus are considered as weeds. So it also shows need of study of weeds which are considered as wastes. By their study one can find therapeutic potential of weeds. The study related with authentication of mentioned uses of Sida may be performed & new molecules may be find out. The activities related with respiratory system, nervous system, reproductive system, skin can be verified. New herbal formulations, cosmetics can be also developed from cited references.

It focuses light on importance of herbal ethno medicine and their use in folklore therapies .The studies support need of medicinal plant data base preparation. It also helps for IPR related issues of medicinal plants. There can be study of plants on the perspectives of modern methods. There may be identification of molecules, isolation, studies of activation, toxicity, microbial, biochemical and animal studies, formulation, SAR etc. This will ultimately develop molecules for treatment of various diseases on the basis of ethno medicine and Ayurvedic system. It may minimize the use of synthetic molecules for treatment of diseases.

References-

1.Karau Damintoti, Aly Savadego,Antonella Canini,Carla Montesano,Jacques Simpore,Vittorio Colizzi, Alfred S.Traore, Antibacterial activity of alkaloids from Sida acuta, African Journal of Biotechnology , December 2005,vol 4(12), 1452-1457.

2.Kokate C.K., Purohit A.P. Gokhale S.B., Pharmacognosy, Nirali Prakashan, Pune, 35, August, 2006,15-38.

3.Kirtikar K.R.,Basu B.D.,Indian Medicinal Plants, Text Vol I ,International Book Distributors,Deharadun, India,302-304,306-314

4.Karau Damintoti, Momoudou H.Dicko,Jackes Simpore, Alfred S.Tarore,Antioxidant & antibacterial activities of polyphenols from ethnomedicinal plants of Burkina Faso, African Journal of Biotechnology, Aug 2005,vol 4(8), 803-828

5.Franzotti,E.M;Santos, C.V.F.;Rodrigues,H.M.S.L.; Mourao, R.H.V.; Andrade,M.R. ;Antoniolli, A.R .Sao cordifolia L.(Malava-branca).Journal of Ethnopharmacology v.72(1,2): 273-278, 2000

6.Anu Gupta, Neeraj Tondon, Quality standardization of Indian medicinal plants, vol I ICMR, New Delhi,2006, 234-36

7 V.Rajpal, Standardization of botanicals testing and extraction method of medicinal plants, Eastern Publication New Delhi 220.

8.R.K. Sutradhar, A.K.M.M. Rehman, M.U. Ahmed- Three new flavonol C- Glycosides from S. cordifolia Linn, Journal of Iran Chemical Society, Vol. 4, No. 2, June 2007, 175-181

9.Amrit Pal Singh, Bala (S.cordifolia L) It is safe herbal drug? www.siu.edu/ebl/leaflets/bala.htm

10. Compendium of Indian Medicinal Plants Vol. 4, 675

11. Indian Herbal Pharmacopoeia. New Edition 2002, 384

12.Shankar Gopal Joshi, Medicinal plants, Oxford IBN publicity Co pvt Ltd. New Delhi- 257

13.Nagashayana N, Sankarankutty P, Nampoothiri MRV, Mohan PK, Mohankumar KP Association of L-DOPA with recovery following Ayurveda medication in Parkinson's disease, Journal of Neurological Sciences 200; 176(2):124-127.