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Bala (*Sida cordifolia* L.)- Is It Safe Herbal Drug?

Dr. Amrit Pal Singh, BAMS; PGDMB; MD (Alternative Medicine), Herbal Consultant, Ind-Swift Ltd, Chandigarh.

Address for correspondence:
Dr Amrit Pal Singh,
House No: 2101 Phase-7,
Mohali-160062, India
Email amritpal2101@yahoo.com

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Abstract

Bala is important medicinal plant of Ayurvedic system of medicine. Previous works have reported presence of ephedrine in Bala although it has not been reported in other varieties of Bala. Extracts of *Sida cordifolia* standardized to ephedrine are available in the Indian as well as international market. In western world ephedrine once upon a time was widely used for weight loss but recently it has been banned due to reported hepatotoxicity (injurious to the liver). Bala and its varieties including atibala (*Sida rhombifolia* L.) are exclusively used in Ayurvedic composite formulations. Owing to presence of ephedrine and norpseudoephedrine (PPA) in extracts of Bala the plant should be subjected to extensive pharmacological investigations (cardiovascular and CNS effects).

Key words: Bala /Ayurveda /*Sida cordifolia*/ Ephedrine

Introduction:

Madanpal Nighantu includes thirteen chapters on drugs of plant and animal origin. In *Abhyadivarga*, four drugs have been described under *bala chatusya*. They have curative effect on gout. From botanical point of view, these plants are representatives of family Malvaceae. Phytochemically they contain asparagine and potassium nitrate (Nadkarni 1976). They have demulcent, emollient and diuretic properties (Nadkarni 1976).

Monograph of *Sida cordifolia* L.

Syn: *Sida herbacea*, *Sida althaeitolia*, *Sida rotundifolia*.

English name: Country mallow.

Ayurvedic names: *Vatyalaka*, *sitapaki*, *vatyodarahva*, *bhadraudani*, *samanga*, *samamsa* and *svarayastika*.

Regional names: Bariar, Batyalaka, Beejband, Bijband, Brela, Chikana, Chiribenda, Chitimutti, Hettuti-gida, Janglimethi, Kharenti, Khareti, Kisangi, Kungyi, Mayir-manikham, Muttuva, Paniyar-tutti, Simak, Tupkaria, Tutturabenda and Velluram.

Family: Malvaceae.

Habitat: Found throughout the tropical and sub-tropical plains of India and Sri Lanka.

Habit: An erect, perennial under shrub, upto 1m. Tall. Stem ascending, terete or sulcate, softly villous and densely stellate-pubescent all over. Leaves ovate or ovate-oblong, obtuse or subacute at apex. Flowers yellow, peduncles, axillary, jointed much above the panicles, upper flowers nearly sessile and fasciculate towards the tip of the branches forming subspicate inflorescence. Fruits subdiscoid, 6-8 mm across, mericarps 10, 3 sided. Seeds trigonous, glabrous, tufted-pubescent near the hilum.

Chemical constituents: Asparagin, alkaloids: ephedrine, hypaphorine, vasicinone, vasicine and vasicinol (Ghosal, Chauhan, and Mehta 1975), phytosterols, mucin, gelatin, potassium nitrate and rutin. Ephedrine content of whole plant is 0.085 %. The seeds contain 0.32% of alkaloid. A study reported 0.112% of ephedrine in whole plant of *Sida cordifolia* (Khatoon, Srivastava, Rawat and Mehrotra 2005). The seeds contain more alkaloids that that is found in the stems, roots or leaves. Non-polar constituents have been reported from plant growing in Bangladesh (Khan, Rashid, Huq and Ahmad 1989).

Action: Tonic, astringent, emollient and aphrodisiac.

Therapeutics: *Sida cordifolia* is used in the treatment of leucorrhoea, gonorrhoea, general debility and rheumatism. Expressed juice of the whole plant is useful in premature ejaculation. The juice obtained from the roots is applied to unhealthy sores. Decoction of the root bark is given in sciatica and rheumatism.

Parts used: Roots and seeds.

Dose: Powder (1-3 G).

Bioactivity: Analgesic, anti-inflammatory and hypoglycemic: extracts of the aerial and root parts (Kanth and Diwan 1999; Franzotti *et al.*, 2000) and hepatoprotective: aqueous extract (Silva *et al.*, 2006).

Monograph of *Sida rhombifolia* L.

Syn: *Sida retusa*.

Common name: Arrow leaf Sida, Cuban jute, Indian hemp.

Ayurvedic names: Jyesthbala, katambhara, kesaruha, kesarika, mrigadani, harsapuspa, kesvardhini, purasani, devsaaha, sarini, sahadevi, pitapuspi, devahara, gandhavallari, mrga and mrgarasa.

Family: Malvaceae.

Habitat: India.

Habit: Perennial, woody, fibrous stemmed shrub, deeply rooted, grows up to 2m high with small green leaves, broad at base & tapering to a point, alternate 3-7cm long & fine hairs on both sides. Small orange, yellow flowers in clusters at end of branches or in forks of upper leaves. Pods have fine bristles breaking up into segments.

Chemical composition: Mucilage and alkaloids: pseudoephedrine, beta-Phenethylamine, vaccine and

others (web reference 2).

Action: Tonic.

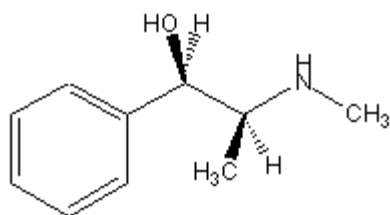
Therapeutics: In India the plant is used in the treatment of gonorrhoea. In Europe it is used as an antitubercular agent.

Parts used: Leaf.

Bioactivity: Anti-inflammatory: the methanolic extract of the aerial parts and hepatoprotective: the powdered roots aerial parts and their aqueous extract (Kumar & Mishra 1997). Note: The ethyl acetate extract of the plant growing in Bangladesh has cytotoxic and antibacterial activities (Islam, Haque and Mossadik, 2003).

Comparison of *Sida cordifolia* and *Ephedra* sp

Ephedrine, a 2-aminophenylpropane alkaloid was first isolated from *Ephedra sinica* Stapf. (Ma-Huang). *Ephedra gerardiana* Wall. ex Stapf is widely used in the Ayurvedic system of medicine. Ephedrine is a potent bronchodilator. Another alkaloid reported from *Ephedra* sp is pseudoephedrine which seems to be present in lower concentrations in *Sida cordifolia* (web reference 1).



Structure of Ephedrine

Ephedrine content of *Sida cordifolia* is less as compared to *Ephedra sinica*. This suggests feeble analeptic and central nervous system stimulating effects of *Sida cordifolia*. However *Sida cordifolia* contains other bronchodilator alkaloids like vasicinone, vasicine and vasicinol which are absent in *Ephedra sinica*. In terms of presence of alkaloids like vasicinone, vasicine and vasicinol, *Sida cordifolia* resembles with *Adhatoda vasica* Nees. N.O.: Acanthaceae.

Ayurvedic formulations containing *Sida cordifolia* should not be prescribed with cardiac glycosides, monoamine oxidase inhibitors (Dawson, Eamshaw and Graham 1995) and ergot alkaloids. Although no drug interactions have been reported with *Sida cordifolia* preparations but owing to great variation of active constituent, great care should be taken while prescribing *Sida cordifolia* with cardiac glycosides (can cause disturbance of heart rhythm), monoamine oxidase inhibitors (as it can potentiate the sympathomimetic activity) and ergot alkaloids (can cause hypertension).

Although little data is available on active constituent of *Sida cordifolia* but according to one study a minute dose of *Sida cordifolia* given intravenously, causes a sharp and well marked rise of blood pressure in anaesthetized or decerebrated animals which is maintained for some time (Chopra 1982). This pharmacological activity of *Sida cordifolia* resembles with ephedrine. According to Mark

Blumenthal effects of ephedrine should not be confused with *Ephedra sinica*. This is a typical example of difference in pharmacological activities of whole herb and isolated constituents. Similar concept applies when we compare *Sida cordifolia* with ephedrine.

***Sida cordifolia* and weight loss**

Ephedra sinica is widely used in the treatment of weight loss (Boozer, Naseer, Hemsfield, et al 2001). However the challenge is to get standard formulation on account of seasonal variation of alkaloids like ephedrine, pseudo ephedrine, nor ephedrine, norpseudoephedrine, methyl ephedrine and methylpseudo ephedrine. *Ephedra* species are well known for thermogenic activity on account of alkaloids ephedrine and nor ephedrine.

Ephedrine and nor ephedrine suppresses the appetite resulting in weight loss. Other alkaloids like norpseudoephedrine are less potent as compared to ephedrine and norephedrine (also known as phenylpropanolamine) and can cause serious ill effects. Therapy with nor ephedrine has been linked with stroke in young age group. Food drug administration has restricted the use of nor-ephedrine in States. Here it is not worthwhile to mention that nor is ephedrine used in common cold preparations also.

Today numbers of companies are promoting *Sida cordifolia* for anti-obesity effect. Experts are of the opinion that anti-obesity effect is not limited to ephedrine content; other constituents may play a synergistic role. Further chemical analysis reveals that seasonal variation of alkaloids in *Sida cordifolia* less as compared to *Ephedra* sp. *Sida cordifolia*, thus may be useful substitute to *Ephedra* sp.

However safety of *Sida cordifolia* extract will be always objectionable on basis of:

1. Appetite suppression and cardiovascular effects as these are associated with ephedrine (Haller and Benowitz 2000).
2. Hypoglycemic effect in animal models (Kanth and Diwan 1999).

These two effects may be utilized therapeutically but on the whole are serious side effects. Keeping in mind the fate of *Ephedra sinica*, *Sida cordifolia* extracts should be screened for pharmacological studies. Hepatotoxicity with herbals is another burning topic. Recently acute hepatotoxicity was reported with *Ephedra sinica* (Nadir et al., 1996). Here *Sida cordifolia* has something to cheer about. Fumaric acid isolated from *Sida cordifolia* was reported to be hepatoprotective (Kurma and Mishra, 1997). Recent work has reported hepatoprotective effect of aqueous extract of *Sida cordifolia* after partial hepatectomy (Silva et al., 2006).

Conclusion:

Sida cordifolia is widely used for its medicinal applications. Presence of ephedrine and ban on *Ephedra sinica* has highlighted the utility of the plant. However it is too early to say about benefit of the plant in treating obesity as negligible data has accumulated in term of its efficacy. Further the plant has hypoglycemic and appetite suppressant activity (if we compare mode of action of *Sida cordifolia* and *Ephedra sinica*). Animal experiments however report hepatoprotective effect of *Sida cordifolia* (in contrast with *Ephedra sinica*, which is reported to be hepatotoxic).

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