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Review Article

**ETHNOBOTANICAL ASSESSMENT OF INDIGENOUS
KNOWLEDGE OF PLANTS USED AS UTEROTONIC:
AN OVERVIEW**¹Udmale Akashdeep Rohidas*, ²Aiman Mohd. Sharif Shaikh¹TMV'S Lokmanya Tilak Institute of Pharmacy Kharghar, Navi Mumbai
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Abstract:

The herbal products, today, symbolize safety, in contrast to the synthesis that are regarded as unsafe to human and environment. However, the blind dependent on synthesis is over and people are returning to the naturals, with the hope of safety and security. Herbal medicine is still the mainstay of about 75-80% of the world population, mainly in the developing countries, for primary healthcare, due to better cultural acceptability, better compatibility with the human body and lesser side effects in their study. Uterotonic agents increase the uterine tone and contractions. These agents intensify uterine muscle contractions at the beginning and during labor, and during the postpartum period. Current available uterotonics include oxytocin, ergot derivatives and prostaglandins. Due to resent life style, diet, working environment, nature there is major issue of development of complication in child birth and regulation of menses. For this issue a doctor prescribes synthetic drugs, which are costly and have so many side effects. Nature's diversity has always been, and still is, one of the biggest resources of therapeutic lead compounds. Various plants and plants derived constituents have the uterotonic potential with less or minimum side effect.

Key Words: Herbs, Uteri tonic, Complementary medicine, Contraction, Labour.

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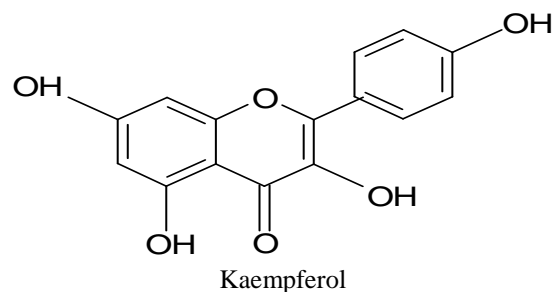
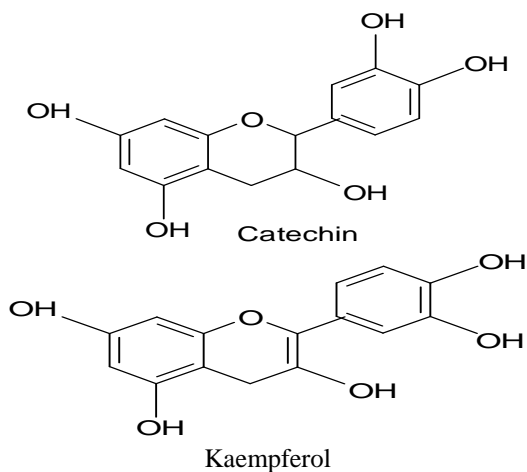
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INTRODUCTION:

According to the World Health Organization, however, most of the population of developing countries still relies on medicinal plants as primary medicines due to poverty and lack of access to modern medicine (Heinrich, 2000). Many medicinal plants have been used in the treatment of menstruation-, pregnancy- and birth-related problems (Westfall, 2001; Born et al. 2005; Zhu et al. 2008), with varying amounts of success (Gruber & O'Brien, 2011). Some of these medicines have harmful side effects and when taken in large quantities can lead to the death of the unborn baby and/or uterine rupture, and other longer term effects on the mother or baby. In this review we will provide an overview of uterotonic herbs and their active constituents. This includes traditionally-used as well as recently identified plants or isolated plant compounds, which have reportedly shown uterine smooth muscle-stimulating activities.

Herbs as uterine tonic**1. ASHOKA (*Saraca indica*)**

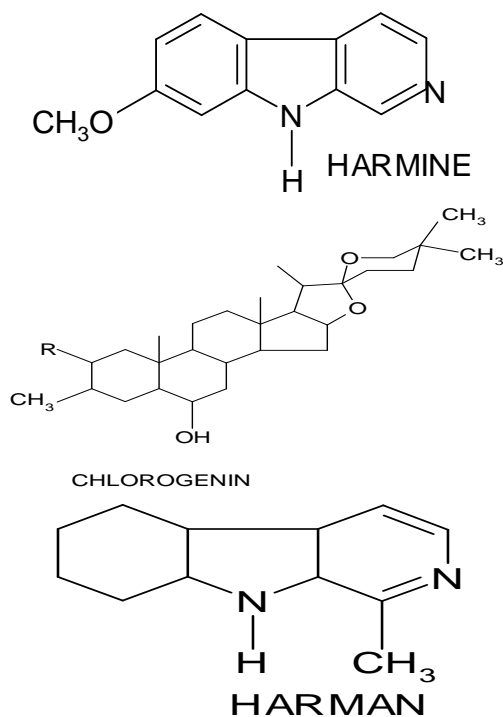
Ashoka consist of dried stem bark of plant *Saraca indica* Linn. Belonging in to family Leguminosae. It is distributed in south Asia Malaysia, Indonesia, Sri Lanka and India. Ashoka contain about 6% of condensed type of tannins such as haematoxylin, Ketosterol, saponin, and organic calcium and iron compound. Bark of plant shows the presence of (-) epicatechin, procyanidin p2, 11'-deoxyprocyanidin B, (24, £) - 24- methylcholesta-5-en-3p-ol (22 E, 21£)-24ethylcholesta-5, 22 dien-33-ol, (24£)-24ethylcholesta-5-en-3-p-ol, leucopelargonidin-3O-p-D glucoside, leucopelargonidin and leucocyanidin, (+) catechin., Kaempferol, Epicatechin.

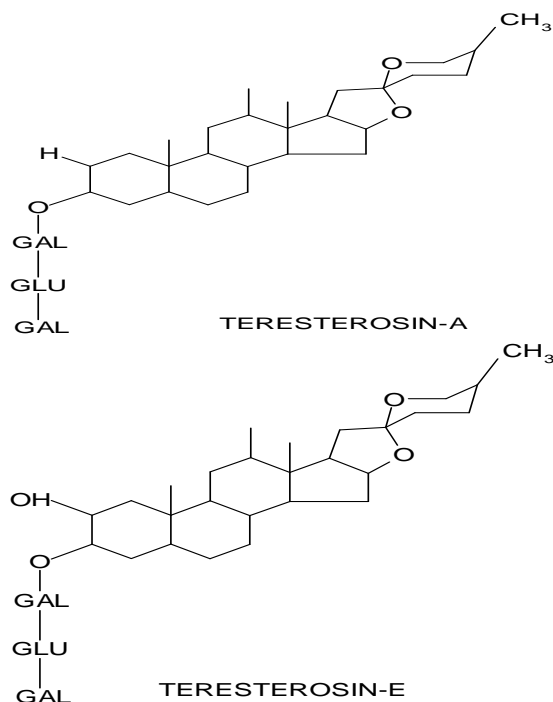
**Epicatechin**

It is reported to be used as uterine tonic and sedative. It stimulates the uterus by the Prolonged and frequent uterine contraction. It is also suggested in all cases of uterine bleeding. It is reported to have treatment for Gynecological Disorders and also shows a stimulant effect on the endometrial and ovarian tissue and useful in menorrhagia. The bark of the tree is used to cure excessive loss of blood during menstruation in presence of leucorrhoea, uterine fibroids and other reasons. The activity of drug is due to the presence of steroidal component and the calcium salt. The bark contains powerful oxytocic principle, a phenolic glycoside P₂. The bark is taken as a decoction. ^[1]

2. GOKHRU (*Tribulus terrestris*)

Gokhru is known as Puncture vine. It consist of dried fully ripe of the plant *Tribulus terrestris* Linn, belonging in to the family Zygophyllaceae. The drug is widely distributed in warmer regions of the world. Gokhru occurs throughout in India, Sri Lanka and west Tibet. ^[2]



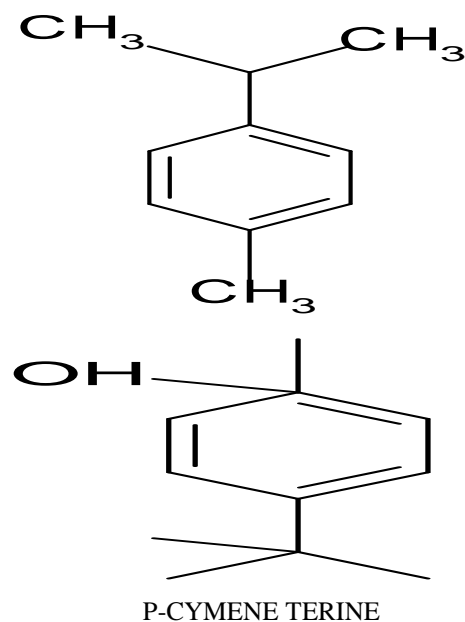
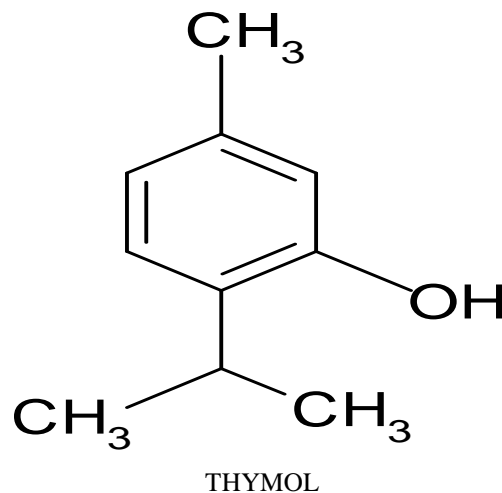


The drug contains traces of alkaloids, harmine and harman. Additionally they contain saponins Teresterosin A and Teresterosin E, Tribulosin, which on hydrolysis yield, steroidal saponins like diosgenin, gitogenin, choro-genin and ruscogenin. Basically the fruit contain Fixed oil, resin, traces of essential oil, and nitrates. Fruits are used as diuretic, tonic, and also in the treatment of calculous affection and painful micturition. Gokharu fruit basically contain Kaempferol, kaempferol-3-glucoside, kaempferol-3rutinoside and tribuloside type of flavonoids which are help in the expulsion of placental membrane in cattle. Tribulusamides A and B which are newly isolated from Gokharu fruit having ecbolic action. Terresoxazin is the novel compound in Gokharu which shows the potent uterine stimulant action. It also contain Protodioscin, Prototribestin, Pseudoprotodioscin, Dioscin, Tribestin, Tribulosin and the flavonoid like rutin. Fruits are used as diuretic, tonic and also in the treatment of calculous affection and painful micturition. They are also used as aphrodisiac and in gout. Gokharu is common ingredient of ayurvedic preparation which is used as good uterine tonic. The whole plant or aerial part of plant is used for the expulsion of retained placenta. It is well known aphrodisiac to boost libido in both sexes. [3]

3. AJOWAN (*Trichyspermum ammi*)

Ajowan is commonly known as Bishop's seed. Ajowan consist of dried ripe fruits of the plant *Trichyspermum ammi* Sprague belonging in to the

family Umbelliferae. It is said to be native of Egypt and is cultivated in Iran, Iraq, Afghanistan, Pakistan and India. In India, it is extensively cultivated in Madhya Pradesh, Uttar Pradesh, Gujarat, Rajasthan, Maharashtra, Bihar and West Bengal. Ajwain fruits contain 2-4 % of volatile oil, about 21% fat, 17% Protein, 25% carbohydrates. Traces of tannin, glycoside and steroidal substance have been reported.

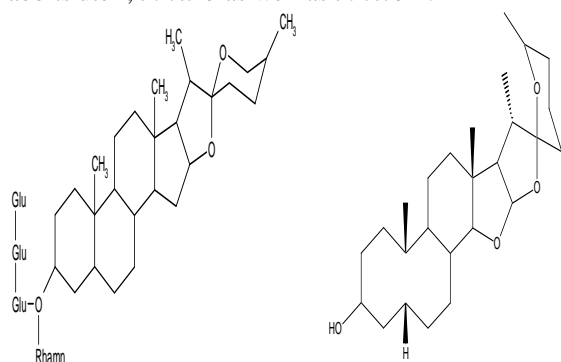


Volatile oil mainly contains (30-35%). Pinene, dipentene, etc are the other constituents in oil. Ajowan is used as antispasmodic, stimulant and carminative. It is also recommended in sore throat and bronchitis. Ajowin is used in preparation of lotion and ointment for checking chronic discharge. Ajowan oil and dethymolised ajowin oil is used as antiseptic, antiseptic, antifungal, insecticide and

anthelmintic. Traditionally is being used for retained placental membrane, about 200 gm of Jaggery and 20 gm Ajwain mixed well to prepare round ball to feed cattle just after delivery for expulsion of retained placenta in cattle. [4]

4. SHATAVARI (*Asparagus racemosus*)

Shatawari commonly known as Shatamuli. Shatawari consists of dried roots and leaves of the plant known as *Asparagus racemosus* wild, belonging to the family Liliaceae. It is found distributed throughout tropical Asia, Africa & Australia. In India, it is found in Himalayas upto an attitude of 1300 to 1400m and all tropical parts of India. Shatawari occurs as wild plant in dry and deciduous forests of Maharashtra. Shatawari roots contain 4 steroidal saponins: shatavrin I – IV (0.2%), Shatavrin I is the major glycoside with 3 glucose and rhamnose moieties attached to the sarapogenin, whereas in shatavrin IV two glucose and one rhamnose moieties are attached. Shatawari contain quercetin, rutin and hyeroside & diosgenin which are responsible for uterine stimulant activity & safe delivery in human & animal also. Shatavrin 1, isolated from the roots of *A. racemosus* has been found to be responsible for the competitive block of oxytocin induced contraction of rat, guinea pig and rabbits uteri, *in vitro* as well as *in vivo* [5].

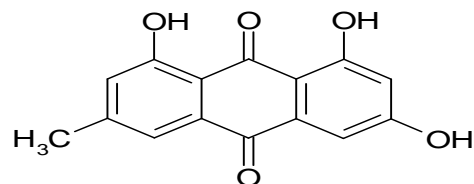


Shatavrin I

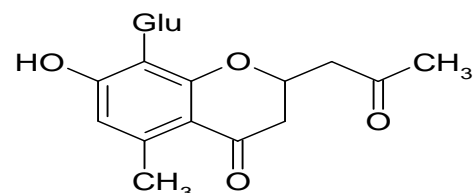
Sarsapogenin

5. ALOES (*ALOES BARBADENSIS*)

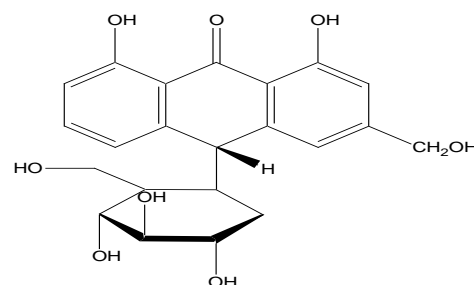
Aloe is commonly known as Musabbar or kumari. Aloe is the dried juice of the leaves of *Aloe barbadensis* Miller, known as curacao aloe; or of *Aloe perryi* Baker, known as Socotrine aloe; or of *Aloe ferox* Miller and hybrids of this species with *Aloe africana* Miller and *Aloe spicata* Baker, known as cape aloe, belonging to family Liliaceae. Aloe is indigenous to eastern and southern Africa and grown in cape colony, Zanzibar and island of Socotra. It is also cultivated in Caribbean island, and many parts of India, including North West Himalayan region. [6]



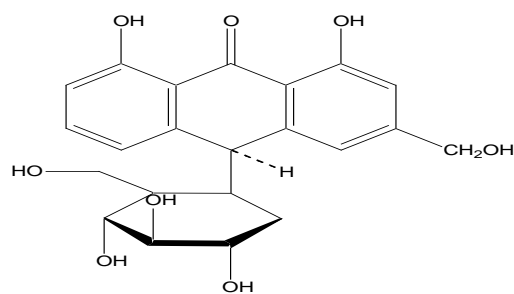
EMODINE



ALOESIN



Aloin B



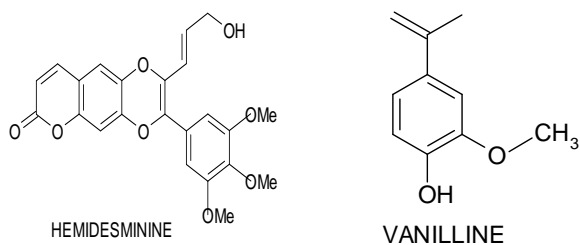
Aloin A

Aloe contains anthraquinone glycoside such as aloemodin, aloetic acid, anthranol, aloin A and B (or collectively known as barbaloin), isobarbaloin, emodin and ester of cinnamic acid. It also contains carbohydrates such as pure mannan, acetylated mannan, acetylated glucomannan, glucogalactomannan, galatan, galactogalacturan, arabinogalactan, galactoglucoarabinomannan, pectic substance, xylan, cellulose, chromones, isoaloesin-D, isoarabaichromone and neoaloesin A. Enzymes such as Phosphatase, amylase, carboxypeptidase, catalase, cyclooxygenase, cyclooxygenase, lipase, oxidase, phosphoenolpyruvate carboxylase and superoxide dismutase are present in aloe. Inorganic

compounds like Calcium, chlorine, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium and zinc and Organic compounds and lipids Arachidonic acid,- linolenic acid, triglycerides, triterpenoid, gibberellins, lignin, potassium sorbate, salicylic acid and uric acid are present. Aloe also contains non essential and essential amino acids like hydroxyproline, isoleucine, leucine, lysine, methionine, phenylalanine, praline, threonine, tyrosine and valine .Proteins Lectins and lectin-like substance.Saccharides Mannose, glucose, L-rhamnose and aldopentose . Vitamins B1, B2, B6 ,C, β -carotene, choline, folic acid, β -carotene, choline, folic acid, α -tocopherol . Sterols Campesterol, cholesterol and β -sitosterol. Aloes is used as a purgative. Its effect is mainly on colon. Aloejuice is used in placental expulsion in fetal membrane in animal. With improved the follicular development in dairy cows. Aloe barbadensis at a dose level of 300 and 500 mg /kg body weight had improved the follicular development and steroidogenic activity in cattle. [7]

6. ANATMUL (*Hemidesmus indicus*)

It is well known as Anantmool, Sariva, and Indian Sarsaparilla. It consists of dried roots of the plant known as *Hemidesmus indicus* Linn. Belonging to the family Ascleplaceae. It is found in all over India and Sri Lanka [8] Roots contain about 0.2% volatile oil. Roots also contain β sitosteriol, a& b amyryns, lueol, tannins & saponins. Roots also contain coumarino- lignoids, hemidesminine and hemidesmin I.

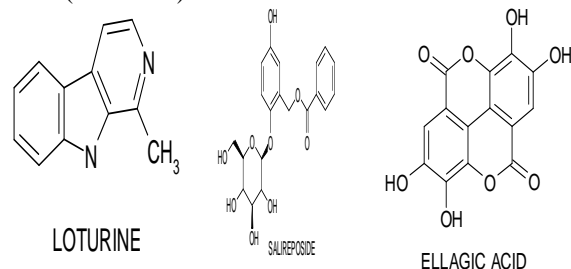


The root of *Hemidesmus indicus* are used as blood purifier. It is also used as anti-inflammatory tonic in uterine disorder in dairy cattle. Powdered roots are used for pre and post natal care and increased lactation in cows. Vanilline is the main constituent for the treatment of different uterine disorders. The plant possesses spasmodic activity on smooth muscle of uterus and also possesses the blood purifier property. [8]

7. Lodhra (*Symplocos racemosa*)

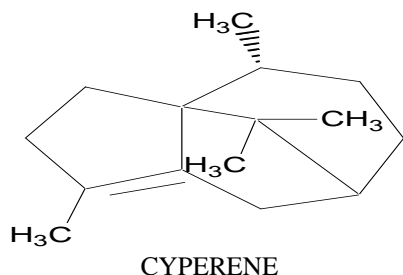
Symplocos racemosa is commonly known as Lodhra, Akshibhaishajya, Rodhra,shavaraka, Tirita, Tilva, Galava. It consists of dried bark of *Symplocos*

racemosa, belonging in to the family Symplocaceae.It is found in North & East India ascending in Himalayas, also in Bengal, Assam & chota Nagpur. The bark contains flavanol, glucoside like Symplocoside, Symoside, and Leucopelargonidin 3- digalactoside. The bark mainly contains Loturine, isototurine harmane which shows the uterine stimulant activity in cattle. It is useful in the treatment of female Reproductive disorders. The ethanolic extract of bark is useful as the uterine tonic. It is reported that aqueous extract on oral administration is significantly stimulated serum FSH level ($P < 0.0016$) along with the rise in serum LH level ($P < 0.001$). [10]



8. Nagarmotha (*Cyperus rotundus*)

It is commonly known as nagarmotha, nagarmul.It consists of dried rhizomes of *Cyperus rotundus*, belonging in to the family Cyperaceae.Phytochemical studies have shown that the major chemical components of this herb are essential oils, flavonoids, terpenoids, mono-and sesquiterpenes.[12,13] The plant contains chemical constituents like cyproterone, cypera-2, 4-diene, a-copaene, cyperene, aselinene, rotundene, valencene, ylanga-2, 4-diene, g-gurjunene, trans-calamenene, d-cadinene, g-calacorene, epi-aselinene, a-murolene, g-murolene, cadalene, nootkatene by comparison with a spectral library established under identical experimental conditions,[14] cyperotundone,[15] mustakone, cyperol,[16] isocyperol,[17] and a-cyperone.[18,19] The volatile oil constituents of *C. rotundus* are distinguished quantitatively with high amounts of sesquiterpenes (70%), with a low proportion of oxygenated monoterpenes (10%) and monoterpene compounds (5%).[20] The chemical composition of the volatile oils of *C. rotundus* has been extensively evaluated and four chemo types (H-, K-, M- sO-types) of the essential oils from various parts of Asia have been reported.[22] . It also showing the presence of another two more compounds isolated after a phytochemical investigation of the aerial parts of *C. rotundus* Linn. They are sitosteryl (6'-hentriacontanoyl)- β -D-galactopyranoside and three furochromones. It also found to contains proteins [23] and traces of Mg, Vs, Cr, Mn, and Co. [24]



It is used in treatment of painful menstruation, abnormal uterine bleeding, postpartum pain. The roots are used as diuretic, galactagogue, refrigerant and tonic. It is ingredient of popular herbal formulations such as herbal honey, chawanprash. It is used as women blood tonic and uterine regulating agent. *Cyperus rotundus* extract inhibits acetyl cholinesterase activity from animal and plant. [25]

9. MANJISHTHA (*Rubia cordifolia*)

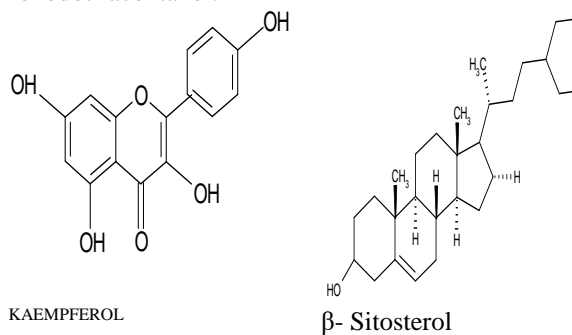
It is known as Indian madder, *Rubia cordifolia*, Rakta pushi and consists of dried stem of a climber known as Rakta pushpin *Rubia cordifolia* Linn. Belonging to family Rubiaceae. It is found in Afghanistan, Nepal, Iran & konkan of Maharashtra. [26] It contains glycosides manjisthin, pururin, resin and red dye rubiadin (1:3 dihydroxy-2-methyl anthraquinone). A new anthraquinone, Rubiacordone A (6-acetoxy-1-hydroxy-2-methylanthraquinone-3-O- α -L-rhamnopyranoside), is isolated together with the known anthraquinone, 1-acetoxy-6-hydroxy-2-methylanthraquinone-3-O-[α -L-rhamnopyranosyl-(1-2)- β -D-glucopyranoside], from the dried roots of *Rubia cordifolia*. Purpurin is the major anthraquinone present in *Rubia cordifolia*. It has an antigenotoxic activity. Manjistha is used traditionally as uterine disorder and it act as blood purifier. The roots are used internally in the treatment of abnormal uterine bleeding, internal and external hemorrhage. Mollugin is the active compound of *Rubia cordifolia*, which has been used as a traditional Chinese medicine for the treatment of various inflammatory diseases including arthritis and uteritis. [27,28, 29]

10. SHANKHPUSHPI (*Convolvulus pluricaulis*)

It is known as Shankhvel, Shankhini and consists of aerial part of the plant known as *Convolvulus pluricaulis* belonging to family convolvulaceae. Shankhpushi is found throughout India, Sri Lanka and Myanmar. [30]

Shankhushi contain bitter substances and oleoresin. Shankhpushi is found to contain triterpenes, alkaloids and xanthenes. The chemical constituents in

Shankhpushi consist of carbohydrate-D-glucose, rhamnose, maltose, sucrose and starch. It also contains proteins, amino acids and the alkaloids convolvine, convolamine, confoline, phyllabine, convolidine, convoline, convosine, subhirsine and convolidine along with fatty acid and wax constituents, hydrocarbons, aliphatic and sterol. and certain other biochemicals which include scopoletin, glacial acetic acid, three coumarins, β -sitosterol, kaempferol, tropane alkaloids, linoleic acid, palmitic acid and straight chain hydrocarbon hextriacontane, 20-oxodotriacontanol, tetratriacontanoic acid and 29-oxodotriacontanol.

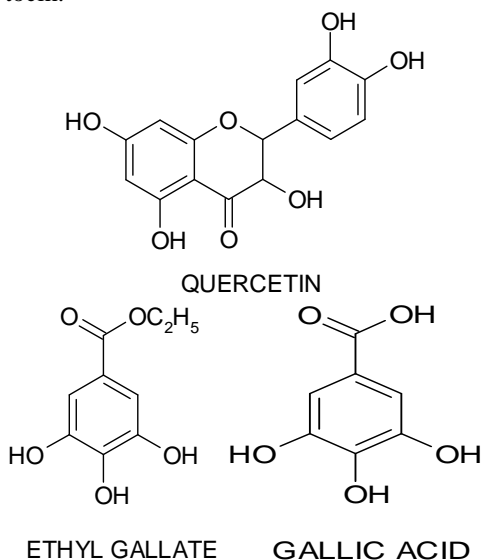


Entire Plant, as well as, fresh juice is used in medicine. It is regarded as bitter alternative and uterine tonic. Alcoholic extract possesses antiviral as well as antibacterial action for the Pretreatment of retained in fetal membrane related infection in cow. [31]

11. WATER LILY (*Nymphaea alba*)

It is known as European White Waterlily, White Lotus. It is an aquatic flowering plant of the *Nymphaea alba* family Nymphaeaceae. Globally distributed in Europe, North Africa, South West Asia, India, China and Russia. [32, 33] The plant is found to contain tannic acid, gallic acid, alkaloids, sterols, flavonoids, glycosides, hydrolysable tannins and high-molecular weight polyphenolic compounds. Delphinidin, Nupharin and Nymphaeine, Cyanidin, Myricetin, Quercetin, Kaempferol, Myricetin - 3'-o-(6''-p-coumaroyl) glycoside, Nympholide A, Nympholide B, 7, 3',4'-Trihydroxy 5-o- β -D-(2''-acetyl) xylopyranosylisoflavone, 7, 3', 4'-Trihydroxy 5-o- α -L-rhamnopyranosylisoflavone, (S)-Naringenin 5-o- β -d-glucoside, 1, 2, 3, 4, 6 - Pentagalloyl glucose, Methyl gallate, Ethylgallate, Gallic acid, Gerannin, β -Sitosterol, Gerannin, Campesterol, Nymphaeoside A, Nymphyol α & β -Amyrin, Friedlin, Erythrodiol, Lupeol, 4-Methoxy benzoic acid, 24-Methylene cholesterol palmitate, 4a-Methyl-5a-ergosta-7, 24 (28)-diene, 4 β -diol p-coumaric acid, 2S, 3S, 4S-trihydroxy pentanoic acid, Isosalipurposide, Methyl oleanolate - 3-o- β -D-glucopyranoside, Icariside E4. [32, 33] The ethanol

extract of *N. alba* produced a dose related increase in the force of uterine contraction similar to Oxytocin.^[34]



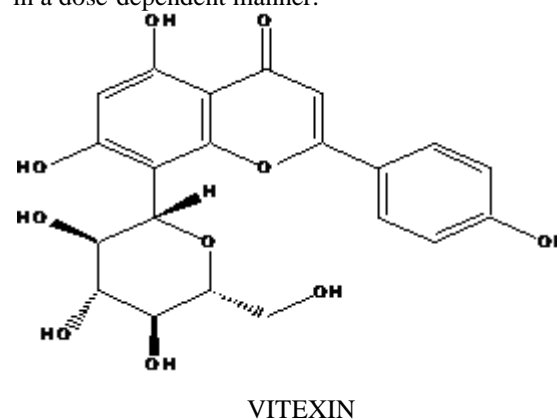
12. PIPAL (*Ficus asperifolia*):

It is commonly known as Peepal tree, Pipal, Pipali. It consists of dried fruit of *Ficus asperifolia* Linn belonging to the family Moraceae. It is frequently found in the savannah regions, especially along river banks as well as marshy areas at an altitude of up to 1100m. It is a large perennial tree, glabrous when young, found throughout the plains of India up to 170 m altitude in the Himalayas and is one of the most revered trees in Asia.^[35,36] Root of this plant contains tannins, wax, saponin, leucoanthocyanins, delphinindin-3-O- α -L-rhamnoside (II), Pelargonidin-3-O- α -L-rhamnoside, Leucocyanidine-3-O- β -D-galactosyl-cellobioside (III), Leucoanthocyanidin-20-tetratriaconten-2-one, pentatriacontan-5-one, 6 heptatriaconten-10-one, mesoanisotol. Bark contains Phenols, tannins, steroids, alkaloids, flavonoids, β -sitosterol-d-glucoside, vitamin K, noctacosanol, methyl oleanolate, lanosterol, stigmasterol, lupen-3-one. Fruits of *Ficus asperifolia* reported to contain proteins (4.9 %), essential amino acids (isoleucine and phenylalanine), flavonols (kaempferol, quercetin, myricetin), also contain good amount of total phenols, total flavonoids, asparagine, tyrosine, undecane, tridecane, tetradecane, (e)- β -ocimene, α -thujene, α -pinene, β -pinene, α -terpinene, limonene, dendrolasine, α -ylangene, α -copaene, β -bourbonene, β -caryophyllene, α -trans bergamotene, aromadendrene, α -humulene, alloaromadendrene, germacrene, δ -cadinene, γ -cadinene. Seeds show the presence of Phytosteroline, β -sitosterol and its glycoside, albuminoids, carbohydrates, fatty matter, colouring matter, caoutchou 0.7-1.5%. Campesterol,

stigmasterol, isofucoesterol, α -amyrin, lupeol, tannic acid, arginine, serine, aspartic acid, glycine, threonine, alanine, proline, tryptophan, tyrosine. The effects of aqueous and methanol extracts of the dried fruits of *F. asperifolia* were evaluated on estrogenized isolated rat uterus in the presence and absence of atropine, pyrillamine maleate, indomethacin or hexamethonium.^[37]

13. MAS COTEK (*Ficus deltoidea*)

It is commonly known as mistletoe fig and also as Mas Cotek, Telinga Beruk, or Serapat Angin by Malays. Malays is dried leaves of *Ficus deltoidea* Jack, belonging in to the family Moraceae.^[38, 39] It contain flavonoid compounds like (rutin, quercetin, and naringenin) Gallocatechin, Epigallocatechin, Catechin, (Epi)afzelechin-(epi)catechin, (Epi)afzelechin-(epi)afzelechin, (Epi)catechin, Epicatechin, Luteolin-6,8-C-diglucoside(lucenin-2), Apigenin-6,8-C-diglucoside(vicenin-2), Luteolin-6-C-hexosyl-8-C-pentoside, Luteolin-6-C-glucosyl-8-C-arabinoside, Apigenin-6-C-arabinosyl-8-C-glucoside(isoschaftoside), Luteolin-6-C-arabinosyl-8-C-glucoside, Apigenin-6-C-glucoside-8-C-arabinoside(schaftoside), Luteolin-8-C-glucoside(orientin), Apigenin-6-C-pentosyl-8-C-glucoside, Apigenin-8-C-glucoside(vitexin), Apigenin-6-C-glucosyl-8-C-pentoside, Apigenin-6,8-C-dipentosideisomer, Apigenin-6-C-glucoside(isovitexin). It is used to treat the uterine infection in the cows as it is having antibacterial effect against *Helicobacter pylori*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Candida albicans*. *F. deltoidea* aqueous extract (FDA) induced in-vitro contraction of the isolated rats uteri in a dose-dependent manner.^[40]

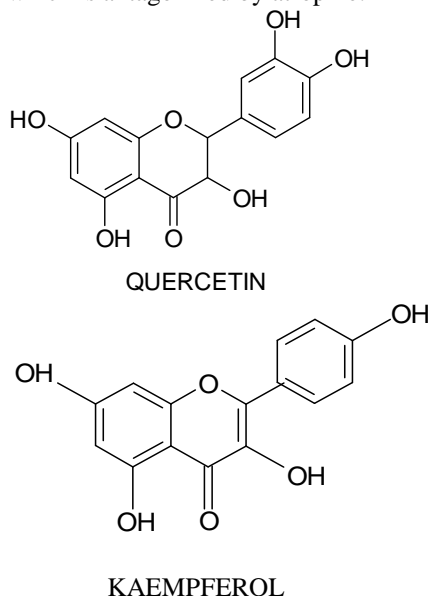


14. GABI-GABI (*Jussiaea repens*)

It is well known with common name Gabi-gabi, Sigang-dagat. It consists of dried plant of *Jussiaea repens* Linn belonging in to the family Onagraceae. It is widely distributed in all over India and China,

Malaysia, New Guinea and other countries. Study of aerial parts of *J. repens* L. reports new acylated avicularin, avicularin 2''-(4'''-O-n-pentanoyl)-gallate (1) along with 12 metabolites, viz., trifolin 2''-O-gallate, quercetrin, guaijaverin, reynoutrin, juglanin, avicularin, hyperin, trifolin, hyperin 2''-O-gallate, rutin, kaempferol and quercetin. Leaves, stems and flower petals yield flavonoid glycosides, kaempferol-3-glucoside, quercetin-3-O-rhamnoglucoside (rutin), quercetin-3-galactoside, mericetin-3-rhamnoside and isosalipurposide. Plant also yields terpenes, triterpenoids, flavonoids, anthraquinones, phenols, tannins, alkaloids, ursolic acid, carbohydrates, and proteins.

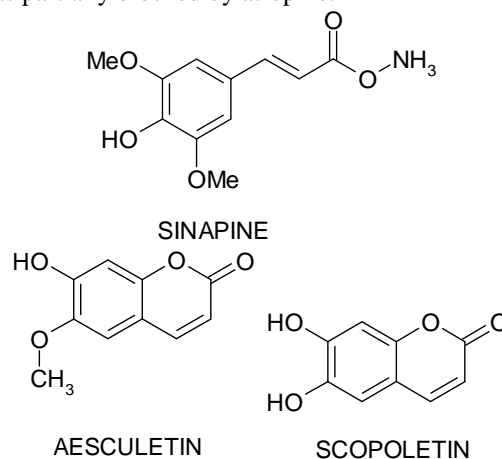
It is reported that aerial parts of the plant is composed of various metabolites like, rutin, kaempferol, quercetrin, quercetin, terpenes, triterpenes etc. One in-vitro study shows that the crude aqueous extract of *Jussiaea repens* causes significant increase of force and frequency of contraction than normal on isolated non pregnant uterus of adult female rats. The results (as percentage) were compared with the effect of oxytocin in presence of atropine (oxytocin blocker) which shows that the extract may act as oxytocin which is antagonized by atropine. [41]



15. RADISH (*Raphanus sativus*)

It is commonly known as radish, is an edible root vegetable grown and used throughout the world. It consists of dried root of *Raphanus sativus* belonging to the family Brassicaceae. Radishes are rich in ascorbic acid, folic acid, potassium and are considered as a rich source of vitamin B, magnesium, copper and calcium. Alkaloid and nitrogen compounds present in the roots were pyrrolidine, phenethylamine, N-methylphenethylamine, 1,2-

pyrrolidin-tion-3-il-3-acid-carboxylic-1,2,3,4-tetrahydro- β -carboline, and sinapine. Cytokinin (6-benzylamino-9-glucosylpurine) is a major metabolite of 6-benzylaminopurine (6-BAP) in the root radish. A minor metabolite of 6-BAP from radish has been identified as 6-benzylamino-3- β -D-glucopyranosylpurine. It also contains 3-(E)-(methylthio)methylene-2-pyrrolidinethione, 4-methylthio-3-butenyl isothiocyanate, 4-(methylthio)butyl isothiocyanate, β -sitosterol, β -sitosteryl-3 β -glucopyranoside-6'-O-palmitate, monoacylglycerols, α -linolenic acid, linoleic acid. Study reports the gastrointestinal and uterine tone modulatory activities of the crude extract of radish leaves. Crude extract of radish leaves, shows the presence of saponins and alkaloids, exhibited spasmogenic effect (0.03-10 mg/mL) in isolated rabbit jejunum, rat stomach fundus and uterus which was partially blocked by atropine. [42, 43, 44]



16. KESARDAM (*Jussiaea repens*)

Locally known as Kesardam is water creeping prime rose. Different authors reported that aerial parts of this plant is composed of different metabolites like, rutin, kaempferol, Quercetin, terpenes, triterpenes etc. Again, purified rutin, kaempferol, quercetin and triterpenes are potent antifertile compounds as reported by different investigators. A new acylated avicularin, namely avicularin 2''-(4'''-O-n-pentanoyl)-gallate (1) along with 12 metabolites have been isolated from the ethyl acetate extract of the aerial parts of *Jussiaea repens* L. (Onagraceae). Their structures were established as trifolin 2''-O-gallate, quercetrin, guaijaverin, reynoutrin, juglanin, avicularin, hyperin, trifolin, hyperin 2''-O-gallate, rutin, kaempferol and quercetin on the basis of their chromatographic properties, chemical and spectroscopic evidence. [45, 46, 47, 48, 49] Aqueous extract of root was tested on uterine muscle strips of pregnant and non-pregnant, young female rats. The plant's extract increases in the baseline tone (basal

tension), and caused powerful spontaneous, rhythmic, myogenic contractions of the oestrogen-dominated uterine muscle strips taken from stilboesterol pretreated, non-pregnant female rats. The aqueous extract of *J. repens* (except root) has uterotonic effects on uterine contraction in rats. Study justified the use of the extract of *J. repens* in traditional medicine to facilitate childbirth, milk ejection, placental expulsion, abortion etc. ^[50]

17. AGAPANTHUS (*Agapanthus africanus*)

This species have flowers with dark blue-violet to milky white colors and commonly called 'agapanthus' or 'lily of the Nile'. ^[51] It contains dimeric dihydrochalcone, $\text{rel-(1}\beta, 2\alpha\text{)-di-(2,4 - dihydroxybenzoyl)-rel-(3}\beta, 4\alpha\text{)-di-(4-hydroxyphenyl)-cyclobutane}$. Infusions or decoctions of *A. africanus* are traditionally used by Xhosa women during pregnancy to induce labour. It is also frequently used for the treatment of constipation in pregnancy, as antenatal or post-natal treatment of the mother and also for high blood pressure. The effect of an aqueous extract of *A. africanus* leaves was tested on the isolated rat uterus preparation. The extract of *A. africanus* leaves was found to exhibit agonist activity on uterine muscarinic receptors and to promote the synthesis of prostaglandins in the oestrogenized rat uterus. ^[52] Aqueous extracts of *A. africanus* have been shown to possess uterotonic activities in the isolated whole uterus preparation. It causes a direct contractile response by the isolated tissue. ^[53]

18. DEVIL'S CLAW (*Harpagophytum procumbens*)

Commonly known as Devil's Claw, is a herbaceous plant species which has the high level of medicinal use. Several biologically active compounds have been isolated from Devil's claw including: iridoid glycosides, harpagide, pagide, harpagoside, and procumbide; flavonoids; different types of terpenoids; phenolic acids; cinnamic acid; harpaquinone; acteoside; and other miscellaneous compounds including triterpenes, triterpenoid glycoside, sterols, oleanolic and ursolic acid derivatives, gum resin, esters bitter principles and sugars. However, Iridoid glycosides were recorded to be the main active compounds of Devil's claw. Harpagoside is used in quality control studies of Devil's claw pharmaceutical preparations and the presence of 1.2% harpagoside is the required limit. Secondary root aqueous extract (HPE) of *Harpagophytum procumbens* was studied on isolated uterine muscle strips of pregnant and non-pregnant, young female rats. The plant's extract increases in the baseline tone (basal tension), and caused powerful

spontaneous, rhythmic, myogenic contractions of the oestrogen-dominated uterine muscle strips taken from stilboesterol pretreated, non-pregnant female rats. ^[54, 55, 56]

19. GRAY NICKER (*Caesalpinia bonduc*)

It is a wild highly thorny shrub commonly known as the Gray Nicker Bean. It is a free flowering and free-fruited plant without periodicity. ^[57] It is widely distributed all over the world especially in India, Sri Lanka and Andaman and Nicobar Islands. In India, it is specially found in tropical regions. ^[58]

Whole plant of *Caesalpinia bonducella* contain all major chemical constituents such as Steroidal Saponin, Fatty Acids, Hydrocarbons, Phytosterols, Isoflavones, Aminoacids, and Phenolics. Diterpenoids as neocaesalpin H, cordylane A, caesalpinin B, bonducellpin E, caesalpinolide A, and 17-methylvouacapane-8(14),-9(11)-diene, new homoisoflavonoids, caesalpinianone, and 6-*O*-methylcaesalpinianone along with five known natural products, namely, hematoxylool, stereochoenol A, 6'-*O*-acetylloganic acid, 4'-*O*-acetylloganic acid, and 2-*O*- β -D-glucosyloxy-4-methoxybenzenepropanoic acid are reported. ^[59] All parts of the plant is considered to have medicinal properties so it is a very important medicinal plant which is used in traditional system of medicine. The leaf extract of *Caesalpinia bonduc* Roxb was studied in isolated pregnant rat myometrium preparations. The extract of *Caesalpinia bonduc* increased the contractile force in the isolated strips in a concentration dependent manner. The effects were comparable to those obtained with acetylcholine. Contractions induced by *Caesalpinia bonduc* or acetylcholine were inhibited in the presence of atropine. ^[60]

20. *Clivia miniata* (*Amaryllidaceae*)

The genus *Clivia* is a group of perennial herbaceous plants. The most commonly cultivated species is *Clivia miniata* Regel that is cultivated in many parts of the world, especially in Europe, the USA, Japan, China, Australia, New Zealand and Belgium. Carotenoids, flavonoids and betalains are reported as chemical constituents. Boiling water extracts of *C. miniata* leaves were found to cause concentration-dependent contractions in both the isolated uterus and ileum. Aqueous extracts of *A. africanus* and *C. miniata* leaves have been shown to possess similar uterotonic effect in the isolated whole uterus preparation. Both herbal extracts caused a direct contractile response by the isolated tissue. ^[61]

21. *Ekebergia capensis* (*Meliaceae*)

It is evergreen tree, medium sized to large, 7-20 meters tall and widely distributed in Africa. *E. capensis* extracts are used to relieve heartburn, coughs and respiratory complaints, and decoctions made from the wood of this plant are used by the Zulus in KwaZulu-Natal as oxytocic agents. It has been reported to contain bioactive chemical compounds such as glycosides, polyphenols, tannins, triterpenes and saponin. The uterotonic properties of extracts from *Ekebergia capensis* were evaluated by using both pregnant and non-pregnant guinea pig uterine smooth muscle *in vitro*. The extracts were prepared by using water modified supercritical carbon dioxide at 400 atm and 80 degrees C. The results of this study show that two compounds from the extract of the tree possess varying degrees of agonist activity on uterine smooth muscle.^[61]

22. *Rhoicissus tridentate*

It grows in bushy areas and develops underground tumors.^[62] Decoctions of the roots and lignotubers of *Rhoicissus tridentate* are used by southern African women in ethnic herbal remedies for delayed childbirth and to facilitate childbirth. It has been found *R. tridentate* leaves to contain anthocyanins, coumarins, essential oils, flavanoids, saponins, sterols and triterpenes. Delphinidin and cyanidin are reported as anthocyanin pigments. Isolated rat uterus tissue was used to compare the contractile activity of crude aqueous extracts of *R. tridentate* made from plant material harvested every 3 months over a period of 2 years. The activity of the plant extracts from those plants which are harvested in summer and autumn were 4-5 fold higher than extracts from those plants harvested in winter or spring. The tubers were found to stimulate the greatest degree of contractions, followed by the stems, roots and leaves.^[61, 63]

23. *Sesamum radiatum* (Pedaliaceae)

It is a leafy vegetable belongs to the group of indigenous vegetable that grow in small quantity in the rural areas. It is one of the neglected leafy vegetables of the tropics despite its nutritional contribution. This plant occurs in the tropical Africa mainly as weed, where it is gathered in the wild and used as a potherb.^[64] The effects of the aqueous leaf extract were examined on the contractile activity of uterine smooth muscle isolated from pregnant Wistar rats (19-21 days). *S. radiatum* aqueous leaf extracts (ESera, 1×10^{-4} $\mu\text{g/ml}$ - $100 \mu\text{g/ml}$) showed uterotonic properties. These uterotonic effects were characterized by the increase of the amplitude, the frequency and the basal tone of the uterine smooth muscle strips in normal Mac Ewen solution and by the development of contracture in depolarizing solution and in solution without calcium. Similar

effects were observed with Oxytocin (OT, 2.5×10^{-14} $\mu\text{g/ml}$ - 2.5×10^{-9} $\mu\text{g/ml}$) and misoprostol (Miso, 1×10^{-3} $\mu\text{g/ml}$ - $0.08 \mu\text{g/ml}$).^[65]

24. *Byrsocarpus coccineus* (Connaraceae)

It is a shrub widely dispersed in tropical Africa. A report has been shown to contain compounds like alkaloids, tannins, saponins, reducing sugars, glycosides and anthraquinones. It is widely used in ethnomedicine for the treatment of various ailments like mouth and skin sores, swellings, tumors, earache, muscular and rheumatic pains, venereal diseases, jaundice, pile and dysentery. The plant extract has also been shown to possess oxytocic, antioxidant, antidiarrheal activities *In-vivo* uterotonic effects of the ethylacetate leaf extract of *Byrsocarpus coccineus* in pregnant rat uterus was studied. Ethylacetate leaf extract of *Byrsocarpus coccineus* potentiated the delivery of pregnant rats on days 21 of pregnancy. The results of the abortifacient effect of the ethyl acetate extract on the pregnant rats showed no significant difference between the treatment groups compared with the control ($p > 0.05$).^[61]

25. *Monechma ciliatum* (Acanthaceae)

It is a small herb. In Arabic language it is known as 'El-Mahlab, El-Aswad.^{53,54} It was used in remedy to relieve body pain, liver, cold, diarrhea and sterility in women.⁵⁴ The oxytocic activity of the hot methanol extract (HME) of the leaves of *Monechma ciliatum* was compared with other uterine stimulants like ergometrine, oxytocin, 5-hydroxytryptamine (5-HT), acetylcholine (ACh) and prostaglandins (PGs) E2 and F2alpha (PGE2 and PGF2alpha) in the presence of some antagonists in an attempt to explain the mechanism of action of the extract. Results suggest that the HME may be acting by more than one mechanism to contract the uterus and explains the mechanism of the anti-implantation activity of the plant.^[66]

CONCLUSION:

The above-mentioned herbs have been studied for their possible uterotonic effects. More experimental studies required to finally conclude all these as uterotonic herb and before the assessment of clinical efficacy, studies must be needed first to provide evidence for the mechanism of action of herbs as uterotonic as well as their safety through phytochemical and pharmacokinetic

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