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“A REVIEW OF PUNARNAVA (BOERHAAVIA DIFFUSA LINN)”

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ABSTRACT:

Punarnava, Boerhaavia diffusa Linn. is one of the well-known plant used in Ayurveda. Whole plant is used as medicine in the traditional medicinesystem. The herb has registered its importance in various formulations and as a single drug. As per Ayurveda, *Punarnava* has been significantly found to be effective in diseases like *Shotha* , *Pandu*, *Ashmari* , *Vidradhi*, *Amvata*, *Jwar*, *Netraroga*, *Vatkantak*, *Yonishool*, *Gulma*, *Shukrarogetc.*

In this article, summarization of the various synonyms, morphological properties , pharmacological activities, uses, dosage form of *Boerhaavia diffusa* is attempted. The review indicates that this indigenous drug has wholesome references in various ancient and modern texts. This plant has proved itself to be beneficial in the past, is drug of choice nowadays and seems to be effective in future.

Key words: *Punrnava, Boerhaavia diffusa Linn.,*

INTRODUCTION:

The genus *Boerhaavia diffusa* Linn. is from *Nyctaginaceae* family. Some species of this family are annuals and others are perennials. In habit generally herbaceous¹. Geographically the genus *Boerhaavia* has several species and it is distributed in the tropical, subtropical and temperate regions of the world. It is found in Australia, China, Egypt, Pakistan, Sudan, Sri Lanka, South Africa, USA, and several countries of the middle East². In India, the genus is represented by 4 species viz. *B. crispa* Heyne ex Hook f., *B. diffusa* L., *B. erecta* L. and *B. rubicunda* Steud³. *Boerhaavia diffusa* Linn., *Punarnava* means “*Punar jivati eti*”, one that has rejuvenative property. As the top of plant dries up during the summer seasons and regenerates again during rainy season^{4,5}. It is perennial spreading hogweed, commonly occurring abundantly in waste places, ditches and marshy places during rains⁶. It has *Katu*, *Tikta*, *Kashay rasa* with *Katu vipak*. This plant is being *Laghu* and *Ushna* in *Guna* act as a *Kaphaghna* and *Vata Shama*⁷.

In Ayurvedic classical text the *Punarnava* is mentioned under different *Ganas*; in *Charak samhita* it mentioned under *Kasahar*, *Swedopag*, *Vayasthapan Gana*⁸; in *Sushrut samhita* it mentioned under *Vidarigandhadi Gana*, *Saka Vraga and Tikta Varga*⁹; in *Ashtanga Hriday* it is mentioned under *Madhyam Panchmoola*¹⁰.

11-16 Synonyms –

Punarnava - It is a plant which is fresh for a long term or it praised by the vaidyas due to its *Gunas* which is useful to treat diseases like *Pandu* etc.

Varshabhū - Grows in rainy season.

Vishakha - Means less branches.

Mandalpatrika - leaves in oval shape

Raktakanda - stem is in red color

Varshaketu - sign of rainy season.

Lohita - due to its red color

Rakta patrika - red leaves

Pravrushenya - grows in rainy season

Shon - red in color

Vikswara-Prafullita (fresh)

Nava - newly growing

Shophaghni - anti-inflammatory

Shwetmūla - roots are white

Jatila - Guntagunta (entangled)

¹⁷Regional Names:

Sanskrit - *Kathilla, Shophaghni, Shothaghni, Varshabhū*

English - *Horse purselene,*

Hogweed

Assamese - *Ranga Punarnabha*

Bengali - *Rakta Punarnava*

Gujarati - *Dholisaturdi, Motosatodo*

Hindi - *Gadpurna, Lalpunrnava*

Marathi - *Ghetuli Vsucimuli,*

Satodimula, Punarnava, khaparkhuti

Panjabi - *Itcit, Khattan*

Oriya - *LalPairuni, Nalipurani*

Malayalam - *Chuvanna, Tazhutawa*

Kashmiri - *Vanjula Punarnava*

Kannada - *Sanadika Komnebera, Komana,*

¹⁸⁻²⁷Gana and Varga according to different Acharyas :

Table no. 01

Samhita / Nighantu	Gana / varga
Amarkosha	Vanoushadhi Varga
Charak	Kasahar, Swedopag, Anuvasanopag, Vayasthapanana
Sushruta	Vidarigandhadi gana, saka varga, tikta varga
Ashtang hriday	Madhyam Panchmool
Dhanwantari Nighantu	Guduchyadi Varga
Sodhal Nighantu	Guduchyadi Varga
Hridayadipika	Dvipadi Varga
Abhidhanaratnamala	Katudravaya Skandha
Madhav Dravyaguna	Vividh aushadhi Varga
Madanphal Nighantu	Pratham varga - Abhyadi Varga

<i>Shaligram nighantu</i>	<i>Guduchyadi Gana</i>
<i>Kaiyadev Nighantu</i>	<i>Aushadhi Varga</i>
<i>Bhavaprakash Nighantu</i>	<i>Guduchyadi varga</i>
<i>Gunaratnamala</i>	<i>Guduchyadi Varga</i>
<i>Rajnighantu</i>	<i>Parpatadi Varga</i>
<i>Nighantu Adarsha</i>	<i>Punarnavadi Varga</i>
<i>Priya Nighantu</i>	<i>Shatpushpadi Varga</i>
<i>Shankar Nighantu</i>	<i>Dwitiya Bhag</i>

	entire or sub undulate, dorsal side pinkish in certain cases, thick in texture, petioles nearly as long as blade, slender.
Flowers	Very small, pink colored, nearly sessile or shortly stalked, 10-25 cm. in small umbels, arranged on slender long stalked, 4-10 corymb, axillary and in terminal panicles; bracteoles, small, acute, perianth tube constricted above the ovary, lower part greenish, ovoid, ribbed, upper part pink funnel shaped, 3mm long, tube 5 lobed, stamen 2-3.
Fruit	One seeded nut, 6mm long clavate, rounded, broadly and bluntly 5 ribbed, viscidly glandular.

Biological Names: ²⁸

Kingdom : Plantae

Sub Divison : Spermatophyta

Divison : Mangoliophyta

Class : Mangoliopsida

Order : Caryophyllales

Family : Nyctaginaceae

Genus : Boerhaavia

Macroscopic Characters : ²⁹

Table no. 02

Stem	Greenish purple, stiff, slender, cylindrical, swollen at nodes, minutely pubescent or nearly glabrous, prostrate diverticately branched, branches from common stalk, often more than meter long.
Root	Well developed, fairly long, somewhat tortuous, cylindrical, 0.2-1.5 cm in diameter; yellowish brown colored, surface soft to touch but rough due to minute longitudinal striations and root scars; fractures, short; no distinct odor; taste, slightly bitter.
Leaves	Opposite, in unequal pairs, larger ones 25-37 mm long and smaller ones 12-18mm long, ovate oblong or sub orbicular, apex rounded or slightly pointed, base subcordate or rounded, green and glabrous above, whitish below, margin

Microscopic characters : ³⁰

Stem : transverse section of stem shows epidermal layer containing multicellular, uni seriate, glandular trichomes consisting of 9-12 stalked cells and an ellipsoidal head, 150-220 u long; cortex consists of 1-2 layers of parenchyma; endodermis indistinct; pericycle 1-2 layered, thick-walled often containing scattered isolated fibers stele consisting of many small vascular bundles often joined together in a ring and many big vascular bundles scattered in the ground tissue, intra fascicular cambium present.

Root : transverse section of mature root shows a cork composed of thin-walled tangentially elongated cell with brown walls in the outer few layers; cork cambium of 1-2 layers of thin-walled cells; secondary cortex consist of 2-3 layers of parenchymatous cells followed by cortex composed of 5-12 layers of thin walled, oval to polygonal cells; several concentric bands of xylem tissue alternating with wide zone of parenchymatous tissue present below cortical regions; numbers of band vary according to thickness of root and composed of vessels, tracheid, fibers;

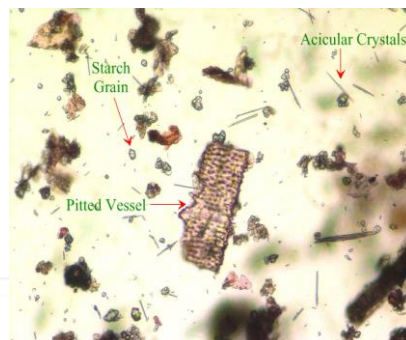
vessels mostly found in group of 2-8, in radial rows, having simple pits and reticulate thickening ;tracheid's, small, thick-walled with simple pits ; fiy bers aseptate, elongated, thick walled , spindle shaped with pointed ends ; phloem occurs as hemispherical or crescentic patches outside each group of xylem vessels and composed of sieve elements and parenchyma ; broad zone of parenchymatous tissue, in between two successive rings of xylem elements composed of thin – walled more or less rectangular cells arranged in radial rows; central regions of root occupied by primary vascular bundles ;numerous raphides of calcium oxalate, in single or in group present in cortical regions and parenchymatous tissue in between xylem tissue ; starch grains simple and compound having 2-4 components found in abundance in most of cells of cortex, xylem elements in parenchymatous tissue between xylem elements ; simple starch grains mostly rounded in shape and measure 2.75 - 11u in diameter.

Leaves : transverse section of leaf shows normocytic stomata on both sides, numerous ; a few short hairs, 3-4 celled, present on the margin and on veins ; palisade one layered ; spongy parenchyma 2-4 layered with small air spaces ; idioblast containing raphides ; occasionally cluster crystals of calcium oxalate and orange – red resinous matter present in mesophyll.

Palisade ratio 3.5 – 6.5 ; stomatal index 11-16 ; vein islet number 9-15.

Microscopic Reports Of Root:

Fig. No. 01: Characters observed in the Powder microscopy: Starch Grains, Pitted Vessels, Acicular crystals a), Pitted Vessels (b), Starch Grains, Acicular crystals (c), Parenchyma with starch grains (d).



(a) 10X



(b) 20X



(c) 10X



(d) 20X

31-35 Types Of Punarnava According To Different Nighantus :

Table no. -3

Nighantus	Bhed
Dhanwantari Nighantu	Punarnava and krura (punarnavavishesha)
Kaiyadev Nighantu	Punarnava and

	<i>kathithillak</i>
<i>Madanpal Nighantu</i>	<i>Punarnava and kruraka</i>
<i>Bhavaprakash Nighantu</i>	<i>Shweta Punarnava And Rakta Punarnava</i>
<i>Rajnighantu</i>	<i>Shweta Punarnava , Rakta Punarnava And Nil Punarnava</i>

36-37 Diffentciating Characters Of *Boerhaavia* Species:

Table No. -4

	<i>Boerhavia diffusa</i> L.	<i>Boerhavia crispera</i> Heyne	<i>Boerhavia erecta</i> L.	<i>Boerhavia rubicunda</i>
Plant	Annual herb	Annual / perennial	Perennial, erect to sub erect herb	Perennial, erect or diffuse herb or shrub
Roots	Rafusiform root	Stout, Branched, tap	Stout, white straight, downwards	Stock woody and much divided
Stem	Prostrate, decumbent or ascending, 4-10 cm long, rather slender, divaricately branched	Prostrate to erect, cylindrical, densely pubescent, pale brown base, woody	Tereby, ribbed, glabrous or shortly hairy, often purple pigmented	Terete, woody below, branches erect, diffuse green

Leaves	Opposite or sub-opposite, two of a node unequal, broadly ovate or sub-orbicular, obtuse to rounded or subcordate at the base.	Opposite either equal or unequal pairs, simple, oblong or ovate, obtuse at apex, crisped at margin	opposite in unequal pairs, simple, ovate or ovate-oblong or lanceolate, apex apiculate, undulate at margin	Opposite, whorled, lanceolate to elliptic-lanceolate or ovate oblong, obtuse, often apiculate
Flowers	Inpendunculate, glomerulate clusters arranged in slender, long stalked, axillary or terminal cory	Inflorance axillary or terminal axaly branched panicle	Mostly laxly arranged inflorescence, incomplete, bisexual flowers	Inflorance very large, lax, di- or-trichotomously much branched, flower pale pink to pinkish purple

	mbs			
Fr ui t	Ovoi d or sub- ellips oid, round ed above , slight ly cunea te, belo w, broad ly and bluntl y 5- ribbe d, very gland ular throu ghout	True indehisc ent, obvoid- obconic al to clavate or ellipsoi d, 5 ribbed	True, obconi c, 5- ribbed, groove d betwee n the ribs, longitu dinally ribbed	Simple, indehisc ent, clavate to oblong- clavate, ellipsoid al
Fl o w er in g an d Fr ui ti ng	Thro ugho ut the year in India n condi tions	August – October	May - August	Septemb er - March

CONTROVERSY OF PUNARNAVA :³⁸

Dr Bapalala Vaidya has mentioned the controversy about Punarnava .
Acharya Charak and Shushruta has mentioned Punranav as a Punarnava dve .it means it has two types Shweta and Rakta. The Boerhaavia has two varieties of white and red. Varshabhu should be

accepted as *trianthema portulacastrum* and *Boerhaavia* as *Shwetamula* and *Raktapushpa Punarnava*.

KARMA :³⁹

Swedopag, Virechan, Deepan, Mutravirechan

AMAYIK PRAYOG :⁴⁰⁻⁴²

According to Charak :

Kushtha : Punarnava Mula is given with *Dadhi Manda*.

According to Sushrut :

Ashmari :Punarnava is boiled with milk and its *Ksheerpaka* should be given

.Shotha : Decoction of *Punarnava* should be given with *Shunthi*.

Rat poisoing : Powder of *Shweta Punarnava* should be given with honey .

Rebes : Powder of *Shwet Punarnava* is taken with *Dhattur Beeja* with *Anupan* of warm water.

Jwar : *Ksheerpaak* of *Punarnava* is given in all types of *Jwar*.

According to Vagbhat :

Madatyay :*Ghrit* is prepared from *Punarnava* decoction, milk and *Madhuyashti Kalka* which is useful in increase in body power.

Rasayan : Powder of *Punarnava* 20gm is taken daily for 15 days/ 1 month/ 2

Month/ 6month/ 1 year with milk which improves health.

According to Chakradatta :

Shoth : *Ghrita* should prepared from *Punarnava* decoction or *Kalka*.

Vidhrati : Decoction of *Shweta Punarnava* is taken in *Vidhrati*.

Snake Poisoning:*Shweta Punarnava* is taken with *Tandulodak* on *Pushya Nakshtra*.

According to Harit :

Nidra : decoction of *Punarnava* is useful in sleeping disorders.

According to Bhavprakash

Sandhivat : Decoction of *sPunarnava* is taken with *Karpur* and *Shunthi* for Seven days.

Netra rog : *Punarnava* is useful in eye disorders in many ways with different *Anupanas*. In itching of eye it apply with milk, in watering from eyes itApply with

honey, in *Timir* and blindness it apply with tail, in Blindness it applies with *Kanji*.

According to Vangsen :

Chaturthik jwar : in *Paitik jwar* and *Chaturthik jwar* it is given with milk .

Vatkantak : tail prepared from *Punarnava* is applied in *Vatakantak Vyadhi*.

Sandhivat : *Punarnava* is taken as vegetable.

According to Shodhal :

Uterine Pain: Leaves of *Punarnava* are grind and together kept in vagins

Which reviles pain.

Prolonged labor : *Punarnava* powder is mix with oil and apply in vagina which help in labor.

Poison: *Shweta Punarnava* is taken with water on *Pushyanakshatra*.

According to Vaidyamanorama :

Gulma : *Gulma* is cures by taking *Punarnava mula* , *Kalshak* and *Saindhav Sukhprasav* – powder of *Mula* is apply with oil which leads to early Labor.

According to Rajmartand :

Plihodar - powder of *Shweta punrnava* is taken with *Tandulodak*.

Cataract –*Sweta Girikarnika*, *Shweta Punarnava Churna* is mix with custard and *Anjan* is done.

Inflammation: Decoction of *Punarnava*, *Devdar*, *Shunthi*, and *Vala* should is given the *Anupan of Gomutra*.

Hridrog : it is given with *Kutaki*, *Chirayata* ,*Shunthi* in the *Hridrog* with *Kasa*, *Shwas* and *Sweeling* all over body

CHEMICAL CONSTITUENTS :⁴³

Table No.-5

Class	Compounds
Alkaloid	Punarnavine
Rotenoids	Boeravinone A-F Hypoxanthine 9-L- arabinofuranoside Hentriacontane, β-sitosterol and ursolic acid

Glycoside	Punarnavoside C-methylflavone 5,7- dihydroxy-3',4'-dimethoxy- 6,8- dimethylflavone β-ecdysone, triacontane β-sitosterol- β-D-glucoside
Acids	tetracosanoic, hexacosanoic, stearic, palmitic, arachidic acids Boerhavin and boerhavic acid
Lignans	Liriodendrin syringaresinol mono- β- D- glucoside Glycoprotein
Lipids	5-methyleicos-4-ene Eicos-4-ene 4-methyloctadec-3-ene 4-methylnonadecylbenzene
Phenolic compound s	3,4-dihydroxy-5- methoxycinnamoylrhamnosid e Quercetin 3- <i>O</i> -rhamnosyl (1→6) galactoside (quercetin 3- <i>O</i> -robinobioside) Quercetin 3- <i>O</i> -(2"- rhamnosyl)-robinobioside Kaempferol 3- <i>O</i> -(2"- rhamnosyl)-robinobioside 3,5,4'- rihydroxy-6,7- dimethoxyflavone 3- <i>O</i> galactosyl(1→2)glucoside [eupalitin 3- <i>O</i> galactosyl(1→2)glucoside] Caffeoyltartaric acid Kaempferol 3- <i>O</i> - robinobioside eupalitin 3- <i>O</i> -galactoside Quercetin Kaempferol 6, 9, 11-Trihydroxy-6a 12a-dehydrorotenoid (coccineone B)

PHARMACOLOGICAL ACTIONS :

Immunomodulatory, immunosuppressive and antilymphoproliferative activity
Studies have shown immunosuppressive⁴⁴,

immunomodulatory⁴⁵ activities and anti-lymphoproliferative activity⁴⁶ of various extracts, fractions and pure compounds of *B. diffusa*.

Hepatoprotective activity

B. diffusa has long been used as a popular hepatoprotective medicine. Various studies has been proven that extracts of the aerial part and roots of this plant showed hepatoprotection⁴⁷.

Anti-diabetic properties

The rapidly increasing diabetes mellitus and its associate complications is becoming a serious threat to human health. Its control and treatment mainly depend on the chemical or biochemical agents. The alternative medicines of herbal origin offer good clinical opportunities and show a bright future in the therapy of diabetes mellitus and its complications. It has been proven that *B. diffusa* has potent anti-diabetic activity. Its leaf extracts with various solvents have shown hypoglycemic activity in normal animals and antihyperglycemic activity in alloxan⁴⁸

Analgesic Activity

Boerhaavia has been used in folk medicine for its analgesic and anti-inflammatory activity. Various studies has been carried out regarding to analgesic and anti-inflammatory activity⁴⁹.

Anti-cancer properties

Various preliminary studies (*in vitro* as well as *in vivo*) with crude plant extract and its various purified fraction have shown anticancer activity against pulmonary metastases⁵⁰.

Chemo preventive action against skin carcinogenesis :

Chemo preventive action of *Boerhaavia diffusa* has been demonstrated against the skin carcinogenesis⁵¹.

Protective effect against gamma radiation induced damage

The protective effect of the hydro-alcoholic extract of the whole plant of *B. diffusa* was studied against gamma radiation induced damage in mice. Ionizing radiations though helpful in treatment of cancer has lethal side effects

like immunosuppression. *B. diffusa* with its established immunomodulatory activity was proved to be a good radioprotector⁵²

Anti-proliferative and anti-estrogenic properties in breast cancer cell lines

The anti-proliferative and anti-estrogenic properties of methanol extract of *Boerhaavia diffusa* in breast cancer cell lines has been observed⁵³.

Cytotoxic Activity

In vitro screening of the extract of *B. diffusa* indicated the crude fraction appeared to be cytotoxic against tumor cells⁵⁴.

Non-teratogenic in action

In an attempt to evaluate any possibility of teratogenic effects in *B. diffusa* administered they found that it m was devoid of any teratogenic effect as litter size and survival rate of foetuses were the same as for the normal control group and no foetal anomaly could be detected⁵⁵.

Anti-fibrinolytic activity

Root extracts of *B. diffusa* was found most effective in reducing stromal edema, inflammation, tortuosity of glands, and in increasing the degree of deposition of fibrin and platelets in the vessel lumen as revealed by endometrial histology of IUD-fitted menstruating monkeys⁵⁶

Antioxidant Activity

Antioxidant activity of *Boerhaavia diffusa* has been proven⁵⁷

Anti-bacterial activity

Studies showed that the aqueous and methanolic extracts of *B. diffusa* has significant anti-bacterial activity against a number of human pathogenic bacteria such as *Bacillus cereus*, *Bacillus subtilis*, *Escherichia coli*, *Klebsiella* sp., *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Shigella* sp., *Staphylococcus aureus* and *Yersinia enterocolitica*.⁵⁸

Anti-fungal activity

Antifungal activity of various extracts (pt. ether, chloroform, ethyl acetate, ethyl alcohol and aqueous) of aerial and root parts of *B. diffusa* was screened against

dermatophytic fungi
Microsporiumgypseum, *M. fulvum* and *M. canis*. Extracts of aerial parts failed to show any noticeable antifungal activity⁵⁹.

Adoptogenic activity
 Adaptogens seem to be useful during both adrenal hyperstress as well as adrenal hypofatigue. By definition, an adaptogen implies the capability for bi directional or normalizing effects⁶⁰.

Anti-convulsant activity
B. diffusa was found to be widely used in epilepsy in folk medicine. It was concluded in the previous study that the observed anti-convulsant activity was due to its calcium channel antagonistic action⁶¹.

Pulmonary tuberculosis
 In multi-drug-resistant tuberculosis, antibiotic resistance is becoming a growing problem. For these the study is carried out which result revealed that the group of patients who received *Punarnava* along with chemotherapy showed significantly faster and earlier clinical recovery, radiological clearing, sputum conversion and more weight gain and increase in T lymphocyte count as compared to those who received chemotherapy alone⁶².

Anthelmintic activity
 Dried root powders of *Boerhaavia diffusa* showed curative efficiency against helminthic infections⁶³

Diuretic And Nephroprotective Activity:
 Many research workers studied the effect of *Boerhaavia Diffusa* extract on the kidney and are in agreement that it has diuretic effect. The diuretic activity is attributed to increased sodium exertion rate. However the maximum diuretic effect observed if root are taken and for as collection of season is concerned maximum activity obtained in plants of rainy season.⁶⁴

Anti osteoporatic Activity:
 It has evidence for presence of compounds with antiosteoporatic immune suppressive and anti-inflammatory activities approves its use in rheumatic disorders⁶⁵.

ETHANOMEDICAL USES :⁶⁶

Table NO.-6

Brazil	For albuminuria, beri-beri, bile insufficiency, cystitis, edema, gallbladder problems, gonorrhea, guinea worms, hepatitis, hypertension, jaundice, kidney disorders, liver disorders, nephritis, renal disorders, sclerosis, snakebite, splenomegaly, urinary disorders, urine retention.
Guatemala	For erysipelas, guinea worms.
India	For abdominal pain, anaemia, ascites, asthma, blood purification, cancer, cataract, childbirth, cholera, constipation, cough, debility, digestive sluggishness, dropsy, dyspepsia, edema, eye problems, fever, gonorrhea, guinea worms, heart ailments, heart disease, haemorrhages, haemorrhoids, inflammation, internal parasite, jaundice, kidney disorders, lactation aid, liver disorders, menstrual disorders, renal insufficiency, rheumatism, snake bite, spleen, urinary disorders, weakness and as a diuretic and expectorant.
Iran	For oedema, gonorrhea, hives, intestinal gas, jaundice, joint pain, lumbago, nephritis and as an appetite stimulant, diuretic and expectorant.
Nigeria	For abscesses, asthma, boils, convulsions, epilepsy, fever, guinea worms, and as an expectorant and laxative.
West Africa	For abortion, guinea worms,

	menstrual irregularities, and as an aphrodisiac.
Philippines	For diuretic, fever, purgative and vermifuge.
Ghana	For Asthama and boils.
Elsewhere	For childbirth, guinea worms, jaundice, sterility, yaws.

FORMULATIONS :⁶⁷

Punarnavasava, Punarnavarishta, Punarnavadi Mandur, Punarnavashtak Kwath , Punarnava Kshar , Punarbnava Guggula, Punarnavaghritam, Punarnavadasha Kwatha, Punarnavadikalka, Punarnavadikashay, Punarnavaditailam, Punarnavadiyog, Punarnavadileha.

CONCLUSION –

These article gives us the traditional knowledge about *Punarnavawith* its properties and formulation being used in various conditions like inflammation, anemia, jaundice, heart diseases, renal disorders, eye diseases, joint pains etc.Numerous investigations on *B. diffusa* have now established that it is an important medicinal plant having a plethoraof chemical constituents effective against a large number ofailments. So it is necessary to take clinical trials according to its studies carried out and the exploit the full medicinal potential of *Boerhaavia diffusa Linn.*

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