

**A DETAILED REVIEW OF THE PLANT BOERHAAVIA DIFFUSA LINN [PUNARNAVA]  
ON ITS PHYTOPHARMACOLOGY AND THERAPEUTIC USES**Irfana Asma S.\*<sup>1</sup>, Ganesh V.<sup>2</sup>, Jeevitha K.<sup>3</sup>, Mizel Francis M.<sup>4</sup>, Mohan Rao A.<sup>5</sup>, Rajaraman B.<sup>6</sup><sup>1</sup>Assistant Professor, <sup>2,3,4,5,6</sup>Students

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**ABSTRACT**

Boerhaavia diffusa Linn. (F: Nyctaginaceae) is a medicinal plant widely distributed in tropical, subtropical and temperate regions of the world. It is traditionally used to treat ailments like asthma, urinary disorders, leucorrhea, rheumatism, and encephalitis. Phytochemical screening of the root of the plant revealed that it is rich in alkaloid content, flavanoids, steroids, triterpenoids, lipids, lignins, carbohydrates, proteins, and glycoprotein. The chemical present in the whole plant of Boerhaavia diffusa can make it an amazingly useful plant. It has a long history of being used for therapeutic purposes, with anti-inflammatory, antioxidant, antiaging, anticancerous, antibacterial, antistress, hepatoprotective and antidiabetic properties. It is also used as a kidney and heart tonic, as well as to treat fever, jaundice, obesity, asthma and intestinal worms.<sup>[1]</sup>

**KEYWORDS:** Boerhaavia diffusa L., Punarnava, Phytochemistry, Pharmacology.**INTRODUCTION**

Indigenous plants are natural inhabitants and have unique properties that have been used to develop specialized drugs to save lives. Traditional herbal medicines are getting noteworthy attention in global health debate and are based on various theories, principles, benefits and experiences related to their culture. They are used for health maintenance, cure, diagnosis treatment, improvement, and for the treatment of physical and mental problems. Boerhaavia diffusa, commonly known as Punarnava in Sanskrit, is an herbaceous plant of the family Nyctaginaceae. It has medicinal properties and has been used for a long time by indigenous and tribal people in India. The leaves are used as vegetables and the roots juice is used to cure asthma, urinary disorders, leukorrhea, rheumatism, and encephalitis. The plant was named in honor of Hermann Boerhaave, a Dutch physician of the 18th century. It is also known as spiderlings as it grows low and spreads like spiderlings. It is a plant with numerous therapeutic uses. It has a long history of use by indigenous and tribal people in India, and its medicinal value is mentioned in Ayurveda,

Charaka Samhita, and Sushrita Samhita. It is native to India and is found throughout the warmer parts of the country up to an altitude of 2000 m in the Himalayan region.<sup>[2,3]</sup>

**PUNARNAVA LEAF****Names in Different Languages**

LANGUAGES	NAMES
SANSKRIT	Kahtilla, Rakatakanda, Shothaghni, Raktakanda, Varshabhu, Punarnava.
TELUGU	Atakamamidi, Erragalijerv, Punarnava.
HINDI	Snathikari, Lalpunarnava, Biskhafra, Beshakapori.
PUNJAB	khattan

BENGALI	Raktapunarnava, Punarnava.
ORIYA	Lalapuiruni, Nalipurni.
ENGLISH	Spreading hogweed, Horse purslane.
MALAYALAM	Chavanna, Tazhutawa.
ASSAMESE	Rangapunarnabha
TAMIL	Mukarate-kirei
GUJARATI	Dholisaturdi, Motosatodo.
KASHMIRI	Vanjula, Punarnava.
KANNADA	Sanadika, Kommeberu, Komma, Kommegida.
MARATHI	Tambadivasu, Ghetuli, Vasuchimuli, Satodimula. <sup>[4-12]</sup>

### TAXONOMICAL CLASSIFICATION

Kingdom	: Plantae
Subdivision	: Spermatophyta
Division	: Magnoliophyta
Class	: Magnoliopsida
Subclass	: Caryophyllidae
Subkingdom	: Tracheobionta
Order	: Caryophyllales
Family	: Nyctaginaceae
Genus	: Boerhaavia L.
Species	: Boerhaavia diffusa L.
Scientific Name	: <i>Boerhaavia diffusa</i> Linn.
Family Name	: Hog weed, Horse Purslane.
Useful Parts	: Roots, leaves and seeds. <sup>[4-12]</sup>

### BOTANICAL DESCRIPTION

#### Macroscopic Charater

The stems of *Boerhaavia diffusa* are greenish purple, stiff, slender, cylindrical and swollen at nodes or thick at the nodes, minutely pubescent or nearly glabrous. The roots are elongated, fusiform, tapering and somewhat

tuberous or somewhat tortuous, cylindrical, 0.2–1.5 cm in diameter, surface soft to touch but rough due to minute longitudinal striations and root scars, fracture, short. Leaves are contradictory in unequal pairs, ovate-oblong or sub orbicular, apex rounded or slightly pointed, base subcordate or rounded. Flowers are very small, lower part greenish, ovoid and upper part pink in colored, funnel-shaped, nearly sessile or shortly stalked, 10–25 cm, in small umbells, arranged on slender long stalks, 4–10 corymb, axillary and in terminal panicles, small, acute, bracteoles, perianth tube. Fruits are one seeded nut, *Boerhaavia diffusa* is a 0.5 cm long, clavate, broadly and straightforwardly 5 ribbed plant that is devoid of fragrance and tastes bitter. It is a perennial creeping weed with spreading branches, simple leaves, hermaphrodite, pedicellate flowers, two or three stamens, and achene fruit. Seeds germinate before the monsoon, grow profusely in the rainy season, and mature in October-November.<sup>[9-17]</sup>



PURNARNAVA PLANT

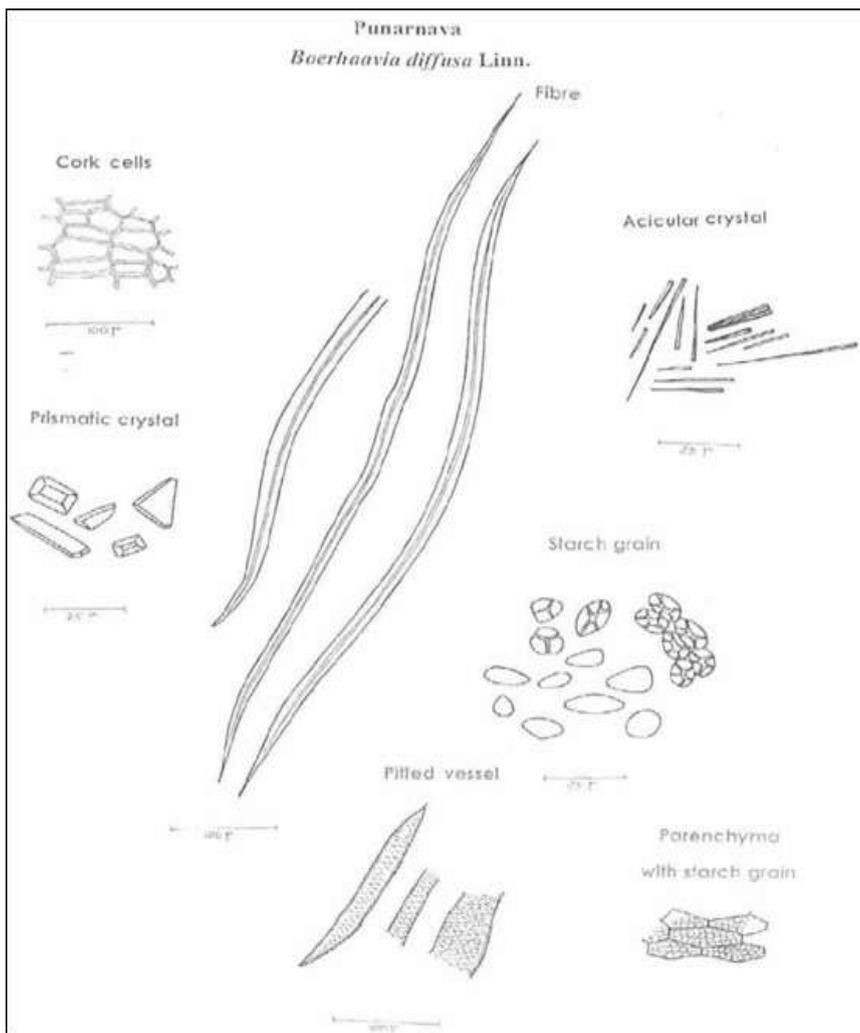


PURNARNAVA ROOTS

### MICROSCOPIC STRUCTURES

Microscopic structures include a transverse section of the stem, a cork composed of thin-walled cells with brown walls in the outer few layers, a secondary cortex composed of 2–3 layers of parenchymatous cells followed by cortex composed of 5–12 layers of thin-walled, oval-to-polygonal cells and several concentric bands of xylem tissue alternating with wide zone of parenchymatous tissue present below cortical regions. The root is composed of a cork composed of thin-walled

agilely elongated cells with brown walls in the outer few layers, a secondary cortex composed of 2–3 layers of parenchymatous cells followed by cortex composed of 5–12 layers of thin-walled, oval-to-polygonal cells and several concentric bands of xylem tissue alternating with wide zone of parenchymatous tissue. *Boerhaavia diffusa* leaf has anomocytic stomata, hairs, palisade, parenchyma, and idioblasts clustering calcium oxalate and orange-red resinous substance in mesophyll. Palisade ratio 3.5– 6.5, stomatal index 11-16, and vein islet number 9-15.<sup>[13-17]</sup>

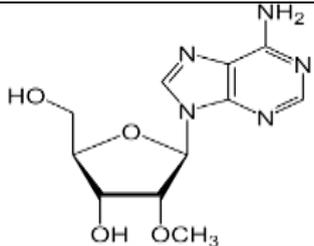
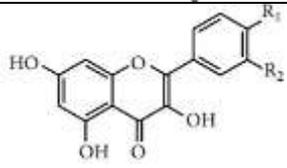
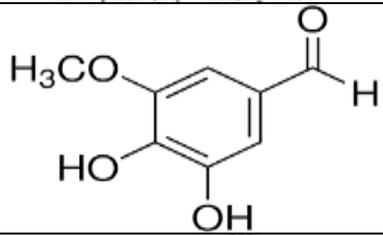
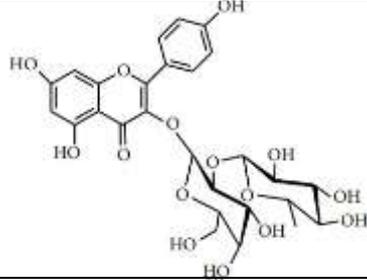
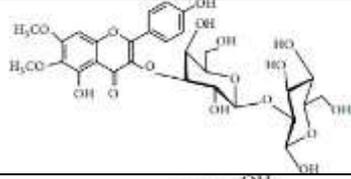
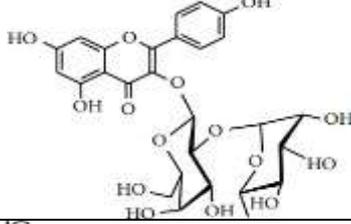
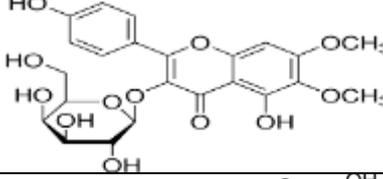
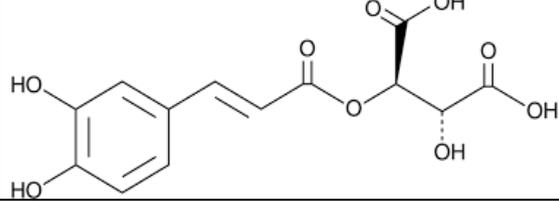


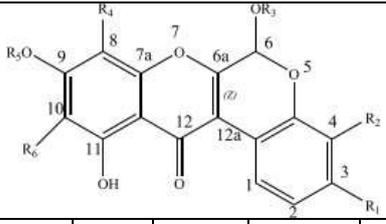
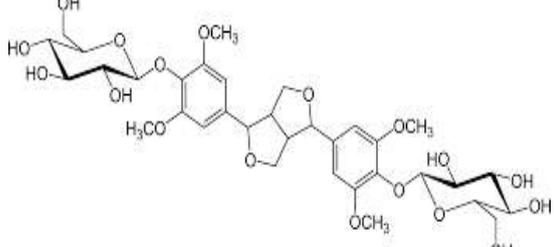
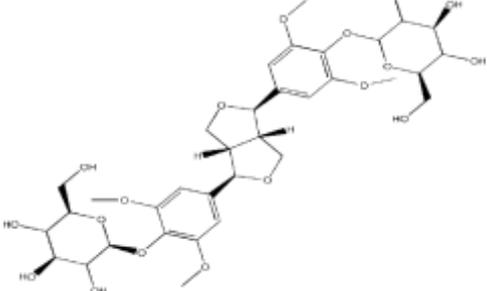
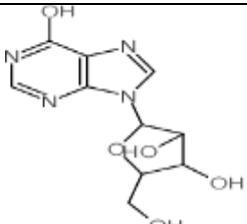
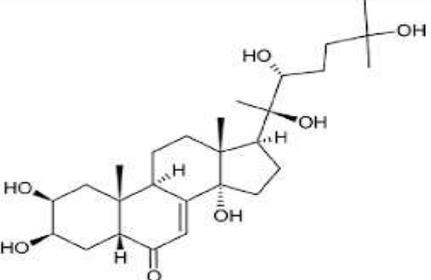
**GEOGRAPICAL DISTRIBUTION**

Boerhaavia diffusa (Nyctaginaceae) is a perennial species growing prostrate or ascending upward in habitats such as grasslands, agricultural fields, fallow lands, wastelands, residential compounds, ditches and marshy places during rains. It is found in Pakistan, Ceylon, Australia, Sudan and Malay Peninsula, extending to China, Africa, America and Islands of the

Pacific. Six species of *Boerhaavia diffusa* are found in India, including *B.diffusa*, *B.erecta*, *B.rependa*, *B. chinensis*, *B.hirsute* and *B. rubicunda*. It is a continuous, widespread hogweed, mostly in waste sites, ditches, and marshy sites after rainfall, and is also cultivated in West Bengal. It is abundant in rainy season.<sup>[4-12]</sup>

CHEMICAL CLASS	NAME OF THE COMPOUNDS	CHEMICAL STRUCTURES	ACTIVITY REPORTED	PLANT PART
Phenolic glycoside	Punarnavoside	<chem>O=C(Oc1ccc(cc1)C2=CC=C(C=C2)O)O[C@@H]3O[C@H](OC4=CC=C(O)C=C4)[C@@H](O)[C@H](O)[C@H]3O</chem>	Antifibrinolytic	Roots
C-Methyl flavone	Borhaavone	<chem>COc1ccc(cc1)Oc2c(O)c(O)c(C)c2C(=O)c3cc(OC)cc(OC)c3</chem>	Antifibrinolytic	Roots

<b>Isoflavone</b>	2'-O-Methyl abronisoflavone		Antifibrinolytic	Roots
<b>Flavonol</b>	Quercetin, kaempferol	 Quercetin, R <sub>1</sub> = OH, R <sub>2</sub> = OH Kaempferol, R <sub>1</sub> = OH, R <sub>2</sub> = H	Antifibrinolytic	Leaves
<b>FLAVONOID GLYCOSIDE</b>	3,4-Dihydroxy-5- methoxycinnamoyl rhamnoside		Antifibrinolytic	Leaves
	Quercetin 3-O- rhamnosyl (1→6) galactoside (quercetin 3-O- robinobioside)		Antifibrinolytic	Leaves
	Eupalitin 3-O- galactosyl (1→2) glucoside		Antifibrinolytic	Leaves
	Kaempferol 3-O- robinobioside		Antifibrinolytic	Leaves
	Eupalitin-3-O-β- D- galactopyranoside		Antifibrinolytic	Leaves
<b>Phenolic acid</b>	trans-caftaric acid		Antifibrinolytic	Roots

									
		R1	R2	R3	R4	R5	R6		
Rotenoids	Boeravinones A	H	H	CH <sub>3</sub>	H	OH	OCH <sub>3</sub>	Antifibrinolytic	Roots
	Boeravinones B	H	H	H	H	CH <sub>3</sub>	CH <sub>3</sub>	Antifibrinolytic	Roots
	Boeravinones D	OH	H	CH <sub>3</sub>	H	H	CH <sub>3</sub>	Antifibrinolytic	Roots
	Boeravinones E	OH	H	H	H	H	CH <sub>3</sub>	Antifibrinolytic	Roots
	Boeravinones F	OH	H	O	H	H	CH <sub>3</sub>	Antifibrinolytic	Roots
	Boeravinones G	H	OH	CH <sub>3</sub>	H	CH <sub>3</sub>	H	Anticancer, spasmolytic	Roots
	Boeravinones H	H	OH	CH <sub>3</sub>	H	CH <sub>3</sub>	CH <sub>3</sub>	Anticancer, spasmolytic	Roots
	Boeravinones I	H	H	H	OH	H	CH <sub>3</sub>	Anticancer, spasmolytic	Roots
	Boeravinones K	H	H	CH <sub>3</sub>	H	H	H	Anticancer, spasmolytic	Roots
	Boeravinones L	H	H	CH <sub>3</sub>	OCH <sub>3</sub>	H	CH <sub>3</sub>	Anticancer, spasmolytic	Roots
	Boeravinones M	H	H	H	OCH <sub>3</sub>	H	CH <sub>3</sub>	Anticancer, spasmolytic	Roots
	Boeravinones P	H	H	CH <sub>3</sub>	H	H	H	Anticancer, spasmolytic	Roots
	Boeravinones Q	H	H	CH <sub>3</sub>	OCH <sub>3</sub>	H	CH <sub>3</sub>	Anticancer, spasmolytic	Roots
	Boeravinones R	H	H	H	OCH <sub>3</sub>	H	CH <sub>3</sub>	Anticancer, spasmolytic	Roots
Boeravinones S	OH	H	H	H	H	H	Anticancer, spasmolytic	Roots	
Lignan	Liriodendrin							Ca <sup>2+</sup> channel antagonist	Roots
	Syringaresinol mono-β-D-glucoside							Ca <sup>2+</sup> channel antagonist	Roots
Purine nucleoside	Hypoxanthine-9-L-arabinofuranoside							Cardiotonic	Roots
Ecdysteroid	β-Ecdysone							Increases protein synthesis, antidepressant, antistress and immunomodulation, antihyperglycemic, hepatoprotective	Roots

<b>Fatty acid</b>	Triacot-24-en-1-oic acid		Increases protein synthesis, antidepressant, antistress and immunomodulation, antihyperglycemic, hepatoprotective	Roots
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## FORMULATIONS AND USES

Formulations	Uses
Punarnavadyarishta	Heart Disease, Anaemia, Inflammation, Vertigo, Asthma, Diseases Of Skin & Itching
Punarnavaguggulu	Gout, Rheumatism, Pain InBladder Region
Punarnavasava	Dyspepsia, Inflammation, Disorder Of Spleen&Liver
Prnarnavadi Kvatha Curna	Cough, Asthma, & Anaemia
Punaravastaka KvathaCurna	Cough, Asthma & Colicky Pain
Punarnavadi Mandura	Anaemia, Inflammation, Splenic Disease, Helminthiasis.
Sukumara Ghrita	Constipation, Diseases of Abdomen, Pain In Female Genital Tract, Disease Due to Vata Dosha and Gout
Varuni	Rhinitis&pain. <sup>[18]</sup>

## PHARMACOLOGICAL ACTIVITY OF PUNARNAVA

### 1) ANTI-DIABETIC ACTIVITY

In this study, the effects of a 200 mg/kg wt/day oral aqueous extract of Boerhaavia diffusa Linn leaves extract on hepatic enzymes and blood glucose concentration in normal and alloxan-induced diabetic albino wistar rats were examined. After being exposed to streptozotocin for 48 hours, a chloroform extract of Boerhaavia diffusa leaf caused a dose-dependent drop in blood sugar, which significantly increased the number of MCF-7 cells in the G0-G1 fraction.<sup>[19-21]</sup>

### 2) ANTI-BACTERIAL ACTIVITY

Boerhaavia diffusa leaves have strong antibacterial properties against Gram-positive bacteria, including *S. aureus*, *Bacillus subtilis*, *Streptococcus faecalis*, and *Micrococcus luteus*. The ethanol extract shows inhibitory effects against these bacteria, with the exception of *V. cholerae*.<sup>[22]</sup>

### 3) ANTI-VIRAL AND ANTI-FUNGAL ACTIVITY

Boerhaavia diffusa has anti viral and antifungal activity, with an extract from the roots inhibiting the infection of plant viruses and in vitro antifungal activity against *Microsporon nanumi*.<sup>[23]</sup>

### 4) ANTI-STRESS ACTIVITY

The study investigated the effects of a polyherbal formulation (Punarnava mandur) PHF-09, containing Boerhaavia diffusa and a hydro ethanolic extract, on cold restraint stress in animals. Results showed close to normal biochemical markers and strong anti-stress activity.<sup>[22]</sup>

### 5) DIURETIC ACTIVITY

Rats with acute pyelonephritis caused by *E. coli* are

affected by the aqueous ethanolic extract of *B. diffusa*. The extract reduced the number of animals and renal abnormalities by 42.85%. The ethanolic extract of Boerhaavia diffusa Linn root has potential as a natriuretic and diuretic agent due to its alkaloids and amino acids.<sup>[22]</sup>

### 6) IMMUNOMODULATORY ACTIVITY IMMUNOSTIMULATION

Compared to ashwagandha extract, BD extract considerably prolongs swimming time in mice and elevates plasma cortisol levels.<sup>[24]</sup> Alkaloid activity is transformed metabolically into an active state during immunomodulatory activity.<sup>[25]</sup>

### IMMUNOSUPPRESSANT

BD's ethanolic extract improves immunomodulation by suppressing cytotoxicity, NO generation, and mRNA measurement in vitro, enhancing traditional rheumatism treatment.<sup>[26]</sup>

### 7) ANTI TUMOR

The cancer chemopreventive efficacy of Boerhaavia diffusa was evaluated on 7, 12 dimethyl benz anthracene-induced skin papillomagenesis in male Swiss albino mice. It modulated the activities of enzymes correlated with drug metabolism, and bi functional modulators decreased the availability of carcinogen metabolites in the epithelial stage. Immunomodulation produced Anticancer Activity.<sup>[22]</sup>

### 8) ANTI CONVULSANT

The methanolic extract of Boerhaavia diffusa roots demonstrated anticonvulsant activity in pentylenetetrazol Ghosh and Rai-induced seizures, with liriiodendron-rich fraction showing dose-dependent protection and significant protection against BAY k-8644-induced

seizures.<sup>[27]</sup>

### 9) ANTI PROLIFERATIVE AND ANTI ESTROGENIC

Boerhavia diffusa methanol extract's antiproliferative and antiestrogenic effects on MCF-7 breast cancer cell lines. The antiestrogenic actions of Boerhavia diffusa extracts are mediated by ER and showed a strong inhibitory effect on the proliferation of human breast cancer cells in vitro. Alkaloids, flavonoids, phenols, and saponins have all been found in phytochemical studies of BME. These several compounds may be to blame for the extract's antiestrogenic activity.<sup>[28]</sup>

### 10) CYTOLOGY

The mitosis of *Crinum jagus* roots was significantly reduced by the Boerhaavia diffusa extract. The extract was used for cytological activity, and the control experiment's mitotic index was 5.27. The concentrations of the test extracts and the mitotic indices were found to be negatively correlated. With an increase in treatment solution concentration, the mitotic index inhibition increased noticeably.<sup>[22]</sup>

### 11) ANTI HYPERTENSIVE ACTIVITY

The antihypertensive activity of Boerhaavia diffusa roots was examined in rats with hypertension brought on by adrenaline. Weekly blood pressure readings and tests for vascular reactivity with phenylephrine, noradrenaline, and adrenaline were performed. The outcomes revealed that Boerhaavia diffusa's methanolic extract has strong antihypertensive efficacy.<sup>[22]</sup>

### 12) ANTI OXIDANT ACTIVITY

Antioxidant activity in *B. diffusa* leaves is higher than in roots. Strong antioxidant activity was evident in both ethanol and methanol extracts, with ethanolic extract outperforming methanolic extract in this regard.<sup>[29]</sup>

### 13) BRONCHIAL ASTHMA ACTIVITY

Dried leaves are used in dhoomapana for treating bronchial asthma, with a leaf decoction being an effective expectorant when combined with punarnava, ginger juice, and black pepper.<sup>[30]</sup>

### 14) ANTHELMINTHIC ACTIVITY:

Boerhaavia diffusa dried root powders demonstrated curative efficacy against helminth infections, causing worm-freeness in five days when administered orally to children or adults.<sup>[31]</sup>

### 15) ANTI SPASMODIC ACTIVITY:

The results of the study show the antispasmodic ability of methanolic root extract of BD root extracts by reducing the involuntary muscle spasms brought on by various spasmogen.<sup>[32]</sup>

### 16) ANTI INFLAMMATORY ACTIVITY:

In rat paw edoema models, ethanol extract of leaves demonstrated the most anti-inflammatory effects, with

carrageen exhibiting a 32% and 100ng/ml COX-1 detectability, respectively. The plant's anti-inflammatory effectiveness was tested using models of inflammation brought on by carrageenan.<sup>[33]</sup>

### 17) ANTI GENETIC ACTIVITY

*B. diffusa*, a widely used herbal medicine, has anti-genetic activity and is used to measure genetic diversity among accessions from different geographical origins in India.<sup>[34]</sup>

### 18) HEPATOPROTECTIVE ACTIVITY

BD roots extract reduced liver damage by 50% in vivo studies, lowering serum parameters, SGPT, SAP, triglycerides, and total lipid levels. It also restored cholesterol levels and showed minimal fatty cysts in liver. This suggests an additional antilipidemic activity.<sup>[35]</sup>

### 19) ANTI FIBRINOLYTIC ACTIVITY:

The study examines the effects of anti-fibrinolytic medicines, anti-inflammatory medications, and BD root extracts on endometrial histology in IUD-fitted menstrual monkeys. The results reveal a decrease in stromal edoema, inflammation, and tortuosity while increasing fibrin and platelet deposition in the artery lumen.<sup>[36]</sup>

### 20) ANALGESIC ACTIVITY:

For its analgesic and anti-inflammatory effects, the decoction or juice of Boerhaavia diffusa leaves is utilised in folk medicine. Researchers looked at the antinociceptive potential of two crude extracts: one made from the juice (JE) of fresh leaves, the other from a lyophilized decoction (DE). Standard mouse models of analgesia and inflammation were used to evaluate the DE and JE of *B. diffusa*.<sup>[37]</sup>

## CONCLUSION

In traditional and ethano botanical medicine, BD is a well-known plant having a variety of chemical constituents that have medicinal effects such as diuresis, anti-cancer, anti-inflammatory, hepato protection and immunomodulation. Although BD has promise in the herbal industry, it is yet unclaimed. It can be valuable and inexpensive resource for hepato protective, diuretic and immune modulatory purposes as well as a source of structurally unique retonoid molecules, providing the opportunity to develop a new semi-synthetic compound for novel uses.

## REFERENCE

1. Plant Review Phytopharmacological Review of Boerhaavia diffusa Linn. (Punarnava) Sahu A N\*1, Damiki L1, Nilanjan G1, Dubey S2 Pharmacognosy Reviews [Phcog Rev.], Dec, 2008; 2: 14-22 © 2008.
2. G.L. Chopra, *Angiosperms. Systematics and Life Cycle*, (S.Nagin & Co., Punjab, India, 1969; 361-

- 365.
3. A.K. Wahi, V.K. Agrawal and R.C. Gupta. Phytochemicals and pharmacological studies on *Boerhaavia diffusa* Linn.(punarnava) alkaloids. *National Academy of Science Letters*, 1997; 20(9&10).
  4. Mahesh A.R., Harish Kumar, Ranganath M.K., Detail Study on *Boerhaavia Diffusa* Plant for its Medicinal Importance- A Review. *Research Journal of Pharmaceutical Sciences*, 2012; 1(1): 28-36.
  5. Pranati Nayak, Thirunavoukkarasu M., A review of the plant *Boerhaavia diffusa*: its chemistry, pharmacology and therapeutical potential. *The Journal of Phytopharmacology*, 2016; 5(2): 83-92.
  6. Laxmi Banjare, Anand kumar Prasad and Naik M.L., *Boerhaavia diffusa* from Traditional Use to Scientific Assessment - A Review. *International Journal of Pharmaceutical & Biological Archives*, 2012; 3(6): 1346-1354.
  7. Somenath Ghosh, Rai S.K., *Boerhaavia diffusa*: One plant with many functions. *International Journal of Green Pharmacy*, 2018; 12(3): 442-448.
  8. Kanagavalli U., Mohamed Sadiq A., historical review of Indian divine herb *boerhaavia diffusa* linn and its medicinal importance. *World journal of pharmacy and pharmaceutical sciences*, 2018; 7(9): 577-594.
  9. Rajesh Kumar, Gautam S., Singh K.D., Kumar P., Pharmacological properties of *Boerhaavia diffusa*: A review. *International Conference on Food Security and Sustainable Agriculture*, 2018; 1: 72-80.
  10. Nishi Saxena and Ameeta Argal, Physical and Phytochemical Screening of *Boerhaavia diffusa* L. Roots. *Research and reviews: journal of pharmacognosy and phytochemistry*, 2014; 2(1): 01-04.
  11. Mayur Chandranshu Mishra, Shastri Prasad Shukla, Scientific evaluation of punarnawa (*boerhaavia diffusa* linn.) –root. *European journal of biomedical and pharmaceutical sciences*, 2017; 4(9): 636-641.
  12. Sahu A. N., Damiki L., Nilanjan G., Dubey S., Plant Review Phytopharmacological Review of *Boerhaavia diffusa* Linn.(Punarnava). *Pharmacognosy Reviews [Phcog Rev.] – Supplement*, 2008; 2(4): 14-22.
  13. Shikha Mishra, Vidhu Aeri and Praveen K. Gaur, Phytochemical, Therapeutic, and Ethno pharmacological Overview for a Traditionally Important Herb: *Boerhaavia. diffusa* Linn. Hindawi Publishing Corporation BioMed Research International Volume, 2014; 01-19.
  14. Praveen Kumar Posa Krishnamoorthy and Sivanandham Muthukumaran, Isolation, purification and characterization of boeravinone b from *Boerhaavia diffusa* linn. *International research journal of pharmacy*, 2017; 8(11): 140-145.
  15. Santhosha D., Ramesh A., Sravan Prasad M., review article on *Punarnava* plant. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 2011; 2 (4): 427-436.
  16. Juna Beegum G.R., Suhara Beevy S., Sugunan V.S., Qualitative Phytochemical Screening and GC-MS Analysis of *Boerhaavia diffusa* L. *International Journal of Emerging Technology and Advanced Engineering*, 2014; 4(7): 317- 324.
  17. Gulshan Chaudhary and Prem Kumar Dantu, Morphological, phytochemical and pharmacological, studies on *Boerhaavia diffusa* L. *Journal of Medicinal Plants Research*, 2011; 5(11): 2125-2130.
  18. Shikha Mishra, Vidhu Aeri, Praveen Kumar Gaur, Sanjay M. Jachak, "Phytochemical, Therapeutic, and Ethnopharmacological Overview for a Traditionally Important Herb: *Boerhaavia diffusa* Linn.", *BioMed Research International*, 2014; Article ID 808302, 19,.
  19. Krishna Murti, vijay lambole, antidiabetic and antihyperlipidemic activity of roots of *boerhaavia diffusa* on streptozotocin induced diabetic rats. *Pharmacology online*, 2011; 1: 15-21.
  20. Mohan Nisha, Balakrishnan Nair Vinod, Evaluation of *Boerhaavia erecta* L. for potential antidiabetic and antihyperlipidemic activities in streptozotocin-induced diabetic Wistar rats. *Future Journal of Pharmaceutical Sciences*, 2018; 4: 150-155.
  21. Rao K. Nalamolu, Krishna M. Boini, Effect of chronic administration of *Boerhaavia diffusa* Linn. Leaf extract on experimental diabetes in rats. *Tropical Journal of Pharmaceutical Research*, June, 2004; 3 1): 305-309.
  22. Rekha Gour, Int. *Journal of Pharmaceutical Sciences and Medicine (IJPSM)*, April- 2021; 6(4): 25-41. *Boerhaavia Diffusa* Linn Plant: A Review-One Plant with Many Therapeutic uses.
  23. Mehrotra S., Mishra K.P., Mourya R., immunomodulation by ethanolic extract of *boerhaavia diffusa* roots, *international immunopharmacology*, 2002; 2(7): 987-996.
  24. M. Sumanth and S. S. Mustafa, "Antistress, adoptogenic and immunopotentiating activity roots of *Boerhaavia diffusa* in mice," *International Journal of Pharmacology*, 2007; 3(5): 416–420
  25. A. A. Mungantiwar, A. M. Nair, K. K. Kamal, and M. N. Saraf, "Adaptogenic activity of aqueous extract of the roots of *Boerhaavia diffusa* linn," *Indian Drugs*, 1997; 34(4): 184–189.
  26. S. Mehrotra, K. P. Mishra, R. Maurya, R. C. Srimal, and V. K. Singh, "Immunomodulation by ethanolic extract of *Boerhaavia diffusa* roots," *International Immunopharmacology*, 2002; 2(7): 987–996.
  27. Gulshan Chaudhary and Prem Kumar Dantu, Morphological, phytochemical and pharmacological, studies on *Boerhaavia diffusa* L. *Journal of Medicinal Plants Research*, 2011; 5(11): 2125-2130.
  28. Sreeja S. and Sreeja S., An in vitro study on antiproliferative and antiestrogenic effects of *Boerhaaviadiffusa* L. extracts, *Journal of Ethnopharmacology*, 1923; 126: 221-225.
  29. Rachh PR, Rachh MR, Modi DC, Shah BN, Bhargava AS, Patel NM, Rupareliya MT. In-vitro Evaluation of Antioxidant Activity of Punarnava

- (*Boerhaaviadiffusa*Linn.) International Journal of Pharmaceutical Research., 2009; 1(1): 36-40.
30. Sasikala M, Vijay SK, Gauthaman K. Relevance of the use of Alternative Medicine for Bronchial Asthma: A review. *J young pharm.*, 2009; 1(2): 184-189.
  31. Singh R.H., Udupa K.N., Studies on the Indian indigenous drug *punarnava* (*Boerhaavia diffusa* Linn.). Part IV: Preliminary controlled clinical trial in nephrotic syndrome. *J. Res. Ind. Med.*, 1972; 7: 28-33.
  32. F. Borrelli, V. Ascione, R. Capasso, A. A. Izzo, E. Fattorusso, and O. Tagliatela-Scafati, "Spasmolytic effects of nonprenylated rotenoid constituents of *Boerhaavia diffusa* roots," *Journal of Natural Products*, 2014; 9(6): 903–906, 2006.
  33. Bhallat n, Gupta mb.,. Anti inflammatory activity of *boerhaavia diffusa* .*Indian j of physiology and Pharmacology*, 1968; 12: 37.
  34. Poojavermaa., Lalv. K., Punarnava-A natural Remedy By Ayurveda, *International Journal Of Pharmacy And Pharmaceutical Sciences*, 2014; 6(8).
  35. R. Gulati, S. Agarwal, and S. S. Agarwal, "Hepatoprotective activity of *Boerhaavia diffusa* linn. against country made liquor induced hepatotoxicity in albino rats fed on controlled calorie diet," *Indian Journal of Pharmacology*, 1991; 23: 264–267.
  36. S. Mehrotra, V. K. Singh, S. S. Agarwal, R. Maurya, and R. C. Srimal, "Antilymphoproliferative activity of ethanolic extract of *Boerhaavia diffusa* roots," *Experimental and Molecular Pathology*, 2002; 72(3): 236–242.
  37. C.A. Hiruma-Lima , J.S. Gracioso , E.J.B. Bighetti , L. Germonse'n Robineou and A.R.M. Souza Brito. The juice of fresh leaves of *Boerhaavia diffusa* L.(Nyctaginaceae) markedly reduces pain in mice. *Journal of Ethnopharmacology*, 2000; 71: 267- 274.