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BOERHAAVIA DIFFUSA: A WONDERING PLANT

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ABSTRACT

Perennial creeping herb widespread throughout India's wastelands, Boerhaavia diffusa L. (Nyctaginaceae) is a species of flowering plant of the four o'clock family commonly known as "Punarnava" in the Indian medical system. Punernava is widely used because of its medicinal properties as Diuretics. Laxative, Antioxidants, Antiobesity, also used in rheumatic arthritis, Expectorant, Stomachic, Prescribed in the treatment of jaundice, Enlargement of spleen etc. Punernava contains Phenolic glycoside as Punernavoside, C-Methyl flavones as Borhaavone, Flavonol as Quercetin, kaempferol and isoflavones. In this review article, we have focused our interest on phytochemistry, responsible for therapeutic values, traditional uses and its reported pharmacological properties.

KEYWORDS: Boerhaavia diffusa, Diuretics. Quercetin, pharmacological.

INTRODUCTION

Perennial creeping herb widespread throughout India's wastelands, Boerhaavia diffusa L. (Nyctaginaceae) is a species of flowering plant of the four o'clock family commonly known as "Punarnava" in the Indian medical system. The various parts of the plant are used in the treatment of cancer, jaundice, dyspepsia, inflammation, ophthalmic, enlargement of spleen, abdominal pain and as an anti-stress agent.[1]

1. TAXONOMICAL CLASSIFICATION

Botanical Name - Boerhaavia diffusa L.

Family - Nyctaginaceae

Division - Magnoliophyta

Class - Magnoliopsida

Order -Caryophyllales

Genus – Boerhaavia

Species - B. diffusa

Part used - Root, Leaves and Seeds[2]

Figure No.1: Boerhaavia diffusa leaves.

2. Names in Different Languages (Vernacular Name)

Sanskrit: Kahtilla, Sophaghni, Varshabhu, Punarnava, Raktakanda, Shothaghni,

Hindi: Gadahpurna, Lalpunarnava, Snathikari, Biskhafra, Beshakapori

Bengali: Raktapunarnava, Punurnava

English: Horse Purslene, spreeding Hog - Weed

Assamese: RangaPunarnabha

Gujrati: Dholisaturdi, Motosatodo

Kannada: Sanadika, Kommeberu, Komma, Kommegida

Kashmiri: VanjulaPunarnava

Malayalam: ChuvannaTazhutawa

Marathi: Ghetuli, Vasuchimuli, Satodimula, Punarnava, Khaparkhuti, Tambadivasu

Oriya: Lalapuiruni, Nalipuruni

Punjabi: Khattan

Tamil: Mukurattai (Shihappu)

Telugu: Atikamamidi, Erragalijeru, Punernava.[3,4,5]

3. Macroscopical Characteristic

1. Stem: Boerhaavia diffusa's stems are stiff, slender, cylindrical, greenish purple, swelling at nodes or thick at nodes, minutely pubescent, or almost hairless. They have prostrate, variable branches that grow off of a common stalk that is around one metre long. Above, stems are light reddish brown, and below, they are pale greenish.[6]

2. Leaves: Boerhaavia diffusa leaves are arranged in unequal pairs, ovate-oblong or suborbicular, with a slightly pointy or rounded apex and a subcordate or rounded base. Larger leaves measure 25–37 mm in length, while smaller leaves measure 12–18 mm. The hue of the leaves is green and white below, and glabrous above. Petioles are slender and almost as long as the blade, with a thick texture and an entire or sub-undulating margin. In certain situations, the dorsal side seems pink.[7]

3. Root: Boerhaavia diffusa has elongated, fusiform, tapering roots that are 0.2–1.5 cm in diameter, cylindrical, and smooth to the touch but rough due to minute longitudinal striations and root scars. The roots also shatter easily and are short. Boerhaavia diffusa roots penetrate deeply into the ground as they develop up vertically downward. Knotty scars from fallen rootlets are common markers of old roots. The taste of roots is slightly sweet, peppery, and bitter; they don't have a distinct smell.[8.9]

4. Flower: Boerhaavia diffusa flowers are very small, with an ovoid, greenish lower part and a pink upper part. They are funnel-shaped, nearly sessile or shortly stalked, and measure 10–25 cm. They are arranged in small umbells on slender, long stalks, with 4–10 corymbs, axillary, and in terminal panicles. The flowers also have small, acute bracteoles and a perianth tube.

Flowers are tiny, internally sessile umbels that range in length from 10 to 25 mm. Fruits are one spherical, glandular, 0.5 cm in size, with one seed, 6 mm long, clavate, widely spaced, and simply five ribbed. The entire Boerhaavia diffusa plant has an unpleasant taste and no scent.[10,11]

4. MICROSCOPICAL CHARACTERISTIC OF Boerhaavia diffusa

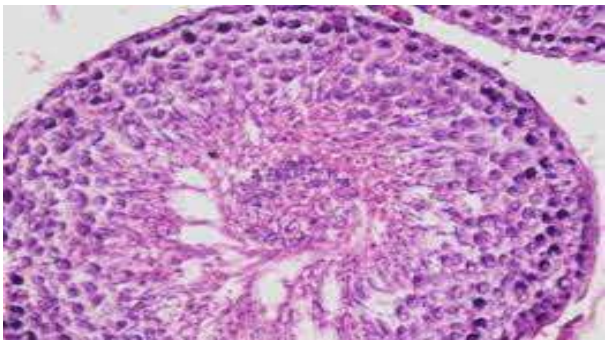

Figure no. 2: T.S of Boerhaavia diffusa.

MICROSCOPIC STUDY

A transverse section of the stem, a cork made up of thin-walled cells with brown walls in the outer layers, a secondary cortex made up of two to three layers of parenchymatous cells, a cortex made up of five to twelve layers of thin-walled, oval-to-polygonal cells, and several concentric bands of xylem tissue alternate with a wide zone of parenchymatous tissue located below cortical regions are among the microscopic structures. The root is made up of several concentric bands of xylem tissue alternating with a wide zone of parenchymatous tissue, a secondary cortex made up of two to three layers of parenchymatous cells, a cortex made up of five to twelve layers of thin-walled, oval-to-polygonal cells, and a cork made up of thin-walled, elongated cells with brown walls in the outer few layers. The mesophyll of Boerhaavia diffusa leaves is composed of idioblasts, hairs, palisade, parenchyma, and anomocytic stomata that cluster calcium oxalate and an orange-red resinous material. Vein islet number 9–15, stomatal index 11–16, and palisade ratio 3.5–6.5.[12,13]

GEOGRAPHICAL DISTRIBUTION AND HABITAT

Boerhaavia diffusa (Nyctaginaceae) plant 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. Boerhaavia diffusa plant is consisting of 40 species is distributed in tropical and subtropical regions and warm climate. It is found in Pakistan, Ceylon, Australia, Sudan and Malay Peninsula, extending to China, Africa, America and Islands of the Pacific that is found in warmer parts of these countries. 6 species of Boerhaavia diffusa plant are found in India, namely Boerhaavia diffusa, B.erecta, B. rependa, B. chinensis, B. hirsute and B. rubicunda in warmer parts and all over up to 2,000 m altitude in the Himalayan area. The plant is also cultivated to some extent in West Bengal.[14,15,16]

PHYTOCONSTITUENTS OF BOERHAAVIA DIFFUSA[17,18,19]

Table no. 1: Phytoconstituents of Boerhaavia Diffusa.

Chemical class	Plant part	Name of chemical constituent	Pharmacological activity
Phenolic glycoside	Roots	Punarnavoside	Antifibrinolytic
C-Methyl Flavone	Roots	Borhaavone	Antifibrinolytic
Isoflavone	Roots	2′-O-Methyl abronisoflavone	Antifibrinolytic
Flavonol	Leaves	Quarcetine	Antifibrinolytic
Phenolic acid	Roots	Trans-caftaric acid	Antifibrinolytic
Rotenoid	Roots	Boeravinones A,B,C,D, E, F	Antifibrinolytic
Rotenoid	Roots	Boeravinones G,H, I, J, K, L ,M ,P, Q ,R, S	Anticancer, Spasmolytic
Flavanol glycoside	Leaves Leaves Leaves Leaves Leaves	3,4-Dihydroxy-5-methoxycinnamoyl rhamnoside , Quercetin 3-Orhamnosyl (1→6) galactoside (quercetin 3-Orobinobioside), Eupalitin 3-Ogalactosyl (1→2) Glucoside, Kaempferol 3-Orobinobioside, Eupalitin-3-O-β-Dgalactopyranoside	Antifibrinolytic Antifibrinolytic Antifibrinolytic Antifibrinolytic Antifibrinolytic
Lignan	Roots	Liriodendrin, Syringaresinol mono-β-Dglucoside	Ca2+ channel Antagonist Ca2+ channel antagonist
Purine nucleoside	Roots	Hypoxanthine-9-Larabinofuranoside	Cardiotonic
Ecdysteroid	Roots	β-Ecdysone	Increases protein synthesis, antidepressant, antistress and immunomodulation, antihyperglycemic, hepatoprotective

MARKETED FORMULATIONS AND USES OF BOERHAAVIA DIFFUSA[20,21,22]

Table no. 2: Marketed Formulations and uses of Boerhaavia Diffusa.

Sr.no	Marketed Formulations	Uses
1.	Varuni	Rhinitis&pain.
2.	Punarnavadyarishta	Heart Disease, Anaemia, Inflammation, Vertigo, Asthma, Diseases Of Skin & Itching
3.	Punarnavaguggulu	Gout, Rheumatism, Pain In Bladder Region
4.	Punaravastaka Kvatha Curna	Cough, Asthma & Colicky Pain
5.	Prnarnavadi Kvatha Curna	Cough, Asthma, & Anaemia
6.	Punarnavasava	Dyspepsia, Inflammation, Disorder Of Spleen&Liver
7.	Punarnavadi Mandura	Anaemia, Inflammation, Splenic Disease, Helminthiasis
8.	Sukumara Ghrita	Constipation, Diseases of Abdomen, Pain In Female Genital Tract, Disease Due to Vata Dosha and Gout[7]

PHARMACOLOGICAL ACTIVITIES OF BOERHAAVIA DIFFUSA

1. Analgesic activity

In traditional medicine, the decoction or juice of *Boerhaavia diffusa* leaves is used for its analgesic and anti-inflammatory properties. Two crude extracts were examined for their potential antinociceptive properties: one derived from fresh leaf juice (JE) and the other from a lyophilized decoction (DE). B. diffusa DE and JE were assessed in standard mice models of inflammation and analgesia.[23]

2. Anti fibrinolytic activity

In menstrual monkeys fitted with IUDs, the study investigates the impact of anti-inflammatory drugs, anti-fibrinolytic pharmaceuticals, and BD root extracts on endometrial histology. The data show that whereas fibrin and platelet deposition are growing in the arterial lumen, stromal edoema, inflammation, and tortuosity are decreasing.[24]

3. Cytology

The Boerhaavia diffusa extract dramatically inhibited the mitosis of Crinum jagus roots. The mitotic index of the control experiment was 5.27, and the extract was employed for cytological activity. There was a negative correlation seen between the mitotic indices and the concentrations of the test extracts. The mitotic index inhibition rose significantly as the concentration of the treatment solution increased.[25]

4. Anti hypertensive action

Rats with adrenaline-induced hypertension were used to test Boerhaavia diffusa roots' antihypertensive properties. Every week, testing for vascular reactivity using phenylephrine, noradrenaline, and adrenaline were conducted along with blood pressure readings. The results showed that the methanolic extract of Boerhaavia diffusa had potent antihypertensive effects.[26]

5. Hepato protective activity

In vivo trials, BD roots extract decreased blood markers, SGPT, SAP, triglycerides, and total lipid levels by 50%, thereby mitigating liver damage. It also exhibited low liver fatty cysts and raised cholesterol levels. This implies the presence of an extra antilipidemic effect.[27]

6. Aggravated activities

B. diffusa is a popular herbal remedy with antigenetic activity that is used to assess genetic diversity in Indian accessions originating from various geographic locations.[28]

7. Antioxidant activity

Compared to the roots, B. diffusa leaves have more antioxidant activity. Both the ethanol and methanol extracts showed strong antioxidant activity, with the ethanolic extract surpassing the methanolic extract in this regard.[29]

8. Activities for Bronchial Asthma

In dhoomapana, dried leaves are used to treat bronchial asthma; a leaf decoction, when mixed with punarnava, ginger juice, and black pepper, works well as an expectorant.[30]

9. Reverse of Proliferative and Estrogenic

The antiproliferative and antiestrogenic properties of Boerhavia diffusa methanol extract on MCF-7 breast cancer cell lines. Boerhavia diffusa extracts have been shown to have a potent inhibitory effect on the proliferation of human breast cancer cells in vitro, which is likely due to their antiestrogenic properties mediated via ER. In phytochemical studies of BME, alkaloids, flavonoids, phenols, and saponins have all been identified. The antiestrogenic properties of the extract could be attributed to these several components.[31]

10. Anti-tumor

The effectiveness of Boerhaavia diffusa as a cancer chemopreventive agent was assessed in male Swiss albino mice that had developed skin papillomas caused by 7, 12, dimethyl benz

anthracene. Bifunctional modulators reduced the availability of carcinogen metabolites in the epithelial stage, and it altered the activity of enzymes linked to drug metabolism. Anticancer Activity was induced by immunomodulation.[31]

11. Refusal

In pentyle netetrazol Ghosh and Rai-induced seizures, the methanolic extract of Boerhaavia diffusa roots showed anticonvulsant effect; the liriodendron-rich fraction showed dose-dependent protection and considerable protection against BAY k-8644-induced seizures.[32]

12. Anti-diabetic activities

This study looked into how normal and alloxan-induced diabetic albino wistar rats' hepatic enzymes and blood glucose concentration responded to an oral aqueous extract of Boerhaavia diffusa Linn leaves administered 200 mg/kg wt/day. A chloroform extract of Boerhaavia diffusa leaf caused a dose-dependent decline in blood sugar after 48 hours of exposure to streptozotocin, which dramatically enhanced the number of MCF-7 cells in the G0-G1 fraction.[32]

13. Anti-bacterial activities

Strong antibacterial qualities found in Boerhaavia diffusa leaves can combat Gram-positive bacteria such as Streptococcus faecalis, Bacillus subtilis, S. aureus, and Micrococcus luteus. All of these bacteria are inhibited by the ethanol extract, with the exception of V. cholerae.[32]

14. Anti-viral and Anti-fungal activities

Boerhaavia diffusa possesses antiviral and antifungal properties; an extract from the roots inhibits plant virus infection, and it exhibits antifungal properties against Microsporon nanumi in vitro.[36]

15. Resort activities

The study examined the effects of a hydro ethanolic extract and Boerhaavia diffusa in a polyherbal formulation (Punarnava mandur) PHF-09 on animal cold stress. The biochemical indicators displayed considerable anti-stress activity and were almost normal.[33]

ADVERSE EFFECT

- Dysuria, pedal oedema
- Abdominal distension
- Eye swelling

- Recurrent UTI
- Conjunctivitis
- Pedal oedema
- Urinary calculi, dysuria[33]

MARKETED FORMULATION

1. Punarnava tea

Ingredients: Boerhaavia diffusa leaves (fresh or dried), hot water.

Method: Steep the leaves in hot water for 10-15 minutes, then strain. Drink the tea for its diuretic properties, which may help in conditions like edema and kidney-related issues.[34]

2. Punarnava Powder

Ingredients: Dried Boerhaavia diffusa roots.

Method: Grind the dried roots to a fine powder. This powder is often used in traditional medicine to alleviate swelling, inflammation, and water retention.[34]

3. Punarnava Juice

Ingredients: Fresh Boerhaavia diffusa leaves or roots, water.

Method: Crush the leaves or roots, extract the juice, and dilute it with water. Consuming this juice may have detoxifying effects on the liver and kidneys.[35]

4. Punarnava Oil

Ingredients: Boerhaavia diffusa leaves, coconut oil.

Method: Infuse the crushed leaves in coconut oil over low heat. Once cooled, strain the oil. This homemade oil is believed to have anti-inflammatory properties and can be used topically for joint pain or skin conditions.[35]

5. Punarnava Paste

Ingredients: Fresh leaves, water.

Method: Blend the leaves with water to form a paste. This paste can be applied externally on skin issues like boils, wounds, or insect bites due to its potential anti-microbial properties.[35]

CONCLUSIONS

In many traditional and ethnobotanical medical systems across the world, BD is a well-known plant. It has a variety of chemical components with demonstrated medicinal

properties, including diuresis, immune modulations, Hepatoprotective, Anticancer and anti-inflammtory properties.

It still hasn't been able to establish itself in the herbal market, though. For hepatoprotection, diuresis, and immunomodulation, BD may show to be a useful and reasonably priced medication in the current landscape of plant-based pharmaceuticals. Additionally, it provides structurally unique rotenoid compounds that may be used to create fresh semisynthetic chemicals with newer indications.

REFERENCES

1. Banjare L, Kumar P., Boerhaavia diffusa from Traditional Use to Scientific Assessment-A Review, International Journal of Pharmaceutical & Biological Archives, 2012; 3(6): 1346-1354
2. 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.
3. 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
4. Shikha Mishra, Vidhu Aeri, Praveen Kumar Gaur, Sanjay M. Jachak, "Phytochemical, Therapeutic, and Ethnopharmacological Overview for a Traditionally Important Herb: Boerhavia diffusa Linn.", BioMed Research International, 2014; Article ID 808302: 19,
5. 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.
6. 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.
7. Rekha Gour, Boerhaavia Diffusa Linn Plant: A Review-One Plant with Many Therapeutic uses.Int. Journal of Pharmaceutical Sciences and Medicine (IJPSM), April, 2021; 6(4): 25-41.
8. 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

9. 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.
10. 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.
11. Juna Beegum G.R., Suhara Beevy S., Sugunan V.S., Qualitative Phytochemical Screening and GC-MSAnalysis of Boerhaavia diffusa L. International Journal of Emerging Technology and Advanced Engineering, 2014; 4(7): 317- 324.
12. 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**.**
13. 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.
14. 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.
15. Somenath Ghosh, Rai S.K., Boerhaavia diffusa: One plant with many functions. International Journal of Green Pharmacy, 2018; 12(3): 442-448.
16. 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.
17. 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.
18. Nishi Saxena and Ameeta Argal, Physical and Phytochemical Screening of Boerhaavia diffusa L. Roots. Research and reviews: journal of pharmacognsoy and phytochemistry, 2014; 2(1): 01-04.
19. 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.
20. 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.

21. 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, 2014; 01-19.
22. 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.
23. 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.
24. 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.
25. 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.
26. Rachh PR, Rachh MR, Modi DC, Shah BN, Bhargava AS, Patel NM, Rupareliya MT. In-vitro Evaluation of Antioxidant Activity of Punarnava (BoerhaaviadiffusaLinn.) International Journal of Pharmaceutical Research., 2009; 1(1): 36-40.
27. Sasikala M, Vijay SK, Gauthaman K. Relevance of the use of Alternative Medicine for BronchialAsthma: A review. J young pharm., 2009; 1(2): 184-189.
28. Sreeja S. ,An in vitro study on antiproliferative and antiestrogenic effects of Boerhaavia diffusa L. extracts, Journal of Ethnopharmacology, 1923; 126: 221-225.
29. 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.
30. 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.
31. Rekha Gour, Boerhaavia Diffusa Linn Plant: A Review-One Plant with Many Therapeutic uses. Int. Journal of Pharmaceutical Sciences and Medicine (IJPSM), April- 2021; 6(4): 25-41.
32. Krishna Murti, vijay lambole, antidiabetic and antihyperlipidemic activity of roots of boerhaavia diffusa onmstreptozotocin induced diabetic rats. Pharmacology online, 2011; 1: 15-21.

33. Mohan Nisha, Balakrishnan Nair Vinod, Evaluation of Boerhaavia erecta L. for potential antidiabetic and antihyperlipidemic activities in streptozotocininduced diabetic Wistar rats. Future Journal of Pharmaceutical Sciences, 2018; 4: 150-155.
34. 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.
35. Mehrotra S., Mishra K.P., Mourya R., immunomodulation by ethanolic extract of boerhaavia diffusa roots,international immune pharmacology, 2002; 2(7): 987-996.
36. Khandelwal DA, Donga SB, Dei L. Clinical efficacy of Punarnava Mandura and Dhatri Lauha in the management of Garbhini Pandu (anemia in pregnancy). Ayu., Oct. 2015; 36(4): 397.