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A complete review on traditional Healers- Punarnava

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Abstract
There are 40 species in the genus *Boerhavia* (Nyctaginaceae), and they are all found in humid, subtropical, and warm climate zones. Since the dawn of time, traditional healers have used several species of this genus to treat a wide range of ailments. Some of them, including antimicrobial, antioxidant, anti-diabetic, anti-asthmatic, anticonvulsant, cytotoxic, antiulcer, anti-inflammatory, antioxidant, anti-diabetic, anti-asthmatic, anticonvulsant, cytotoxic, antiulcer, anti-inflammatory, analgesic, and hepatoprotective, have already received scientific validation. While there are still many issues to be resolved. Different categories of chemicals, including alkaloids, flavonoids, rotenoids, and phytosterols, have been isolated from distinct species of this genus. In this study, data on chemicals and drugs from current phytochemical research on a range of plants in the genus *Boerhavia* are present.

Keywords: *Boerhavia, traditional healers, phytochemicals, parmacology*

1. Introduction
For many years, plants have been a significant source of medicine. According to the World Health Organization, up to 80% of people still use traditional medicines [1]. In traditional and ethnomedical traditions, more than 35,000 plant species are used worldwide as therapeutic herbs [2].

Fig 1: Boerhavia (Punarnava)

From natural sources, an astounding number of contemporary medications have been isolated [3]. In addition to their widespread use, herbs can potentially combine with other drugs or create harmful reactions, so it's crucial to have a thorough understanding of them [4]. As a result, the needs of medicinal plants cannot be ignored [5]. *Boerhavia* is a genus of 40 species that are found in warm, humid, and subtropical climates [6]. *Boerhavia* genera have been used medicinally for centuries in a variety of societies dating back to the B.C. [7]. Google scholar, PubMed, Research Gate, and other databases were used to conduct the literature search.

1.1 Common name
Erect spiderling
Erect tar vine

Erect *boerhavia*
Hindi: shweta
Marathi: Punarnava

1.2 Plant profile
Kingdom: Plantae
Clade: Tracheophytes, Angiosperms, Eudicots
Order: Caryophyllales
Family: Nyctaginaceae (Bougainvillea family)
Genus: *Boerhavia*
Species: B. Erecta
Botanical name: *Boerhavia erecta* L.

1.3 Synonyms
Boerhavia atomaria Raf.
Boerhavia discolour Kunth
Boerhavia elongate Salisb.
Boerhavia erecta f. Subepunctata Heimerl
Boerhavia erecta var. thornberi (M.E.Jones) Standl.
Boerhavia paniculata var. Subacuta Choisy
Boerhavia thornberi M.E.Jone

1.4 Stem
Boerhavia erecta plants can survive considerable damage from grazing and fire because their stems produce perennating buds near the ground surface.

Fig 2: Dry stem of Boerhavia

Stems of *Boerhavia* typically grow to about 60 centimetres (24 in) tall and 3–5 millimetres (0.12–0.20 in) across. They generally are cylindrical without furrows or ridges. In colour they are green, commonly tinted with purple, and towards their upper regions they are slightly pubescent, being covered in short, soft hairs. The base of the stem however, is glabrous and woody [8].

Fig 3: Wet stem of Boerhavia

1.5 Leaf
The leaves are somewhat fleshy. Their arrangement is opposite and unequal. Typically the leaf size ranges from 1.5–2.5 cm (0.59–0.98 in) long and 2–3.5 cm (0.79–1.38 in) wide to 3–4.5 cm (1.2–1.8 in) long and 2–3.5 cm (0.79–1.38 in) wide, with a petiole of roughly 2 cm (0.79 in) to 3 cm (1.2 in). The petioles of the leaf are pale green with a hint of purple. The blade of the leaf isovate, ovate- lanceolate or lanceolate. The upper surface of the leaf is green and pubescent, sometimes with scattered glands. The underside is grayish-white, often with tints of purplish red that also appear on the leaf margins [9].

Fig 4: Leaf of Boerhavia

The flowering season of *Boerhavia erecta* is from early summer to mid-autumn. The inflorescences are determinatively cymose, meaning that the central, terminate flowers open before the basal flowers. Two leafy bracts subtend each branch of the inflorescence, but detach at an early stage. Each peduncle bears 2–6 sessile flowers at its apex. The flowers are tiny, pink and cream. The corolla is bell-shaped, 5-petalled, 1.5 mm long and 2 mm wide. There are 2-3 stamens. Anthocarps (false fruits) are circular and flat. They are 5-ribbed (0.3-0.5 mm wide) and glabrous. The ripe fruits of this plant are sticky and adapted to dispersal by humans and animals.

2. Ethnomedicinal Importance of Genus *Boerhavia*
Boerhavia diffusa is used to treat a variety of conditions, including hypertension, inflammations, and wounds. Decoction of [10,11]roots to remove kidney stones. For the treatment of dyspepsia, jaundice, spleen enlargement, and abdominal pain, [12]roots are frequently utilised. *Boerhavia diffusa* leaves are used as an appetiser, while the roots are utilised as stomachic, diuretic, and laxative remedies. [13] It is a good liver stimulant and treats viral jaundice to use *Boerhavia diffusa* Linn. It has diuretic, antibacterial, anti-arthritic, anti-inflammatory, and spasmodic effects. In conjunctivitis, roots are used as an anticonvulsant, analgesic, laxative, diuretic, and abortifacient [14, 15] It is thought to protect and enhance vision. Diabetics use the plant's diuretic qualities to reduce blood sugar levels.
The root is used as a diuretic to treat internal inflammations such gonorrhoea, enlarged spleen, and

jaundice. It is also used as a laxative, anthelmintic (expels parasitic worms), febrifuge (reduces fever), stomachic, cardiac tonic, hepatic protective, expectorant, and anthelmintic. To ripen abscesses and ulcers, the skin is massaged with a root paste. [16] *Boerhavia procumbens* leaves are prescribed for edoema, dropsy, and dysmenorrhea. The dried root powder is inhaled through the chimney. For coughs and asthma, this plant's powdered roots are administered with honey [17, 18[.

Blood cleansers such as *Boerhavia procumbens* are employed [19, 20]. To treat jaundice [21, 22]. *Boerhavia procumbens* pastes are used as antidotes, a decoction as a refrigerant, and to stop nosebleeds and reduce discomfort [23]. For one month, *Boerhavia erecta* powder is inhaled like a cigarette once per day to treat asthma [24]. Cardiotonic *Boerhavia repensis* is utilised [25, 26]. The Teli practitioner employed *Boerhavia repens* to cure edoema, gonorrhoea, and persistent coughs [27]. *Boerhavia repens* L. whole plant extract is beneficial for treating leucorrhoea in women [28]. The entire *Boerhavia repens* plant is used as a diuretic, laxative, emetic, and stomachic [29]. An essential medicinal plant, *Boerhavia repens*, is used to treat jaundice, fever, constipation, and as a blood purifier [30].

The leaves of *Boerhavia repens* are used to treat skin conditions [31]. *Boerhavia chinensis* roots are traditionally consumed orally for their antihelmintic, leucorrhea, galactoseamine, and paracetamol intoxicating properties [32]. *Boerhavia chinensis* is a plant that has been used in a number of ayurveda and siddha formulations for its hepato-protective, gastro-protective, useful for Down's syndrome, analgesic, antipyretic, and anti-inflammatory properties [33]. In conventional medicine, *Boerhavia elegans* has been used to treat dysmenorrhea, problems with the urinary system, infections of the intestines, inflammation, jaundice, and body weakness [34].

3. Pharmacology of genus *boerhavia*

3.1 Anti-microbial activity

Boerhavia repens crude methanolic extract was evaluated for its antibacterial and antifungal properties. Only gramme negative bacteria displayed mild susceptibility at low concentrations of the methanolic extract of *Boerhavia repens*, while all gramme positive bacteria, gramme negative bacteria, and fungi showed moderate susceptibility. We can infer from the findings that Boerhavia repens entire plant extract exhibited notable antibacterial activity [35].

The agar well diffusion method was used to test the antimicrobial activity of the methanolic extract of *Boerhavia* diffusa L. roots against a variety of human pathogens, including Escherichia coli, Pseudomonas aeruginosa, Salmonella typhimurium, Staphylococcus aureus, Shigellaflexneri, Streptococcus pneumoniae, Klebsiellapneumoniae, and The size of the inhibition zones varied from 4.26 mm to 16.61 mm. All of the examined bacteria were suppressed by root extract with sizable zones of inhibition. At a concentration of 30 g/ml, it was discovered that the common antibiotics chloramphenicol and miconazole nitrate had zones of inhibition of 10.40 0.26 - 24.80 0.37 mm [36].

According to the antimicrobial study, *B. Diffusa* crude extracts displayed superior antibacterial activities against the tested microorganism at higher concentrations. Significant antifungal activity was demonstrated by *B. Diffusa* extracts, which may be attributed to the anthraquinones present [37].

The root extract of *B. Diffusa* has antimicrobial properties. Both gramme positive and gramme negative bacterial species, including Bacillus subtilis, Escherichia coli, Klebsiella pneumonia, Staphylococcus aureus, and Streptococcus, showed the zone of inhibition [38]. When compared to other solvent extracts, the ethanol extract of *B. Diffusa* L. leaves demonstrated greater activity against Gram-positive (S. aureus, zone of diameter 11 mm) and Gram-negative (E. coli, zone of diameter 9 mm) bacteria with the exception of V. cholerae. The result confirmed the present of antibacterial activity of *B. Diffusa* L. leavea extract against various human pahogenic bacteria [39]. By using the pour plate and cup diffusion procedures with agar diffusion, the antibacterial and antifungal properties of *Boerhavia erecta* extract were investigated against four different strains of bacteria and fungus. According to the findings, *Boerhavia erecta* whole plant extract exhibited noteworthy antibacterial activity [40].

Boerhavia coccinea was found to be antibacterial. By using the agar dilution method *in vitro*, the antibacterial capabilities were assessed against enteric bacteria that were multi-resistant and derived from clinical isolates of Escherichia coli [41].

3.2 Diuretic activity

In albino rats, the diuretic activity of an aqueous extract of the roots of the plant *Boerhavia* diffusa was tested, and its effectiveness was compared to that of the widely used diuretic furosemide. The extract of *Boerhavia* diffusa was discovered to have a maximal "diuretic dose-response relationship" at 300 mg/kg (oral). The test medication also demonstrated a maximum increase in urine volume and electrolyte excretion [42]. *Boerhavia* diffusa Linn. increased urination, hastened the process of eradicating the built-up crystal deposits, enhanced renal function by enhancing the removal of nitrogenous waste products, and reduced oxalate excretion most likely by interfering with metabolism. All of these actions together contribute to *Boerhavia* diffusa Linn's anti urolithiatic properties [43].

3.3 Anti oxidant activity

Boerhavia diffusa's leaves, stem, and root were extracted in methanol, and their total antioxidant capacity, as well as their conte nts of phenolic, flavonoid, and ascorbic acid, were estimated using spectrophotometric techniques and the 1, 1-diphenyl picrylhydrazyl (DPPH) free radical scavenging assay.

Significant antioxidant activity is exhibited by the plant extracts [44]. The radical scavengers DPPH, ABTS, and NO were active in *B. Diffusa* . With increasing concentration, the extracts' capacity to scavenge these three radicals grows [45]. *Boerhavia* diffusa's ethanolic extract was tested for its *in vitro* antioxidant activity using the methods of 1-diphenyl-2-picrylhydrazyl (DPPH) scavenging activity, reduction potential, and nitric oxide scavenging activity. The root of *B. Diffusa* had a percentage (I%) DPPH, NO, and thiocyanate inhibition activity of 91.25% 2.26%, 90.39% 1.23%, and 88.59% 1.72%, respectively. Gallic acid and conventional he most promising free radical [46] scavenging properties as determined by DPPH and ABTS assays [47]. *Boerhavia* chinensis leaf aqueous extract demonstrates excellent antioxidant and free radical scavenging properties. Additionally, it has reducing power and scavenges NO and DPPH free radicals. The anti-oxidant properties of *Boerhavia procumbens* extend to the entire plant [48].

3.4 Cytotoxic activity

Human peripheral blood mononuclear cell proliferation that was enhanced by concanavalin A and the T cell mitogen phytohemagglutinin was suppressed by the ethanolic extract of *Boerhavia* diffusa (PBMC). Additionally, it prevented the proliferation of human mixed lymphocytes and PBMCs induced by pure protein derivative antigen. Additionally, *B. Diffusa* extract slowed the growth of a number of cell lines with mouse and human origins, including mouse lymphoma cells (EL-4), human erythroleukemic cells (K562), human T cells, human monocytic cells (THP-1), human embryonic kidney cells (HEK293), mouse liver cells (BNLCL.2), and human kidney cells from African green monkeys. *In vitro*, the plant therefore has the ability to inhibit proliferation [49].

The crude ethanolic extract of *B. Diffusa* roots has been shown through pharmacological analysis to have anti-proliferative and immunomodulatory properties. DNA fragmentation and the activation of caspase-9 are signs that the *Boerhavia* diffusa fraction induced cell death by apoptosis. As a result, the *B. Diffusa* fraction may prevent the spread of the human cervical cancer cell line [50].

3.5 Anti-malarial activity

Boerhavia elegans (Choisy) shown positive anti-plasmodial action both *in vivo* and *in vitro* (IC50 = 50 microgram/ml) [51]. In mice implanted with red blood cells parasitized with *Plasmodium berghei* for a 4-day suppressive anti-malarial experiment, the plant extract of *Boerhavia erecta* demonstrated substantial anti-malarial activity [52].

Using the three malaria models—suppressive, curative, and prophylactic tests—the plant's crude methanolic root extract was evaluated for its *in vivo* anti-plasmodial efficacy against *Plasmodium berghei* NK 65 (a strain resistant to chloroquine). *B. Diffusa 's* methanolic root extract had anti-malarial potential [53].

3.6 Anti-ulcer activity

In comparison to the common medication rabeprazole, the aqueous leaf extract of *Boerhavia chinensis* shown substantial antiulcer action. The ulcer index was dramatically decreased by the aqueous extract, and the percentage protection was improved in a dose-dependent way. The *B. Diffusa* plant extract had antacid properties [54].

3.7 Analgesic activity and anti inflammatory activity

We investigated the central (narcotic) and peripheral (non-narcotic) analgesic effects of the entire B. repens plant. Diclofenac was a commonly prescribed medication. The plant as a whole has analgesic properties [55]. Only the ethanol extract of *B. Diffusa* displayed good analgesic potential and an anti-inflammatory activity when compared to the standard medication analgin at a dose of 200mg/kg, according to the analgesic and anti-inflammatory activity it exhibited [56]. The anti-inflammatory and analgesic properties of *B. Diffusa* were investigated using carrageenan-induced paw edoema, cotton pellet granuloma, and tail immersion methods. When compared to the control and standard drug, *B. Diffusa* aqueous root extract (1000mg/kg) demonstrated a highly significant anti-inflammatory effect. The test substance had a strong analgesic effect in both models used for analges [57]. Due to its ability to stabilise cell membranes and thereby prevent the lysis and release of proinflammatory mediators, the aqueous extract of the root of *B. Diffusa* has anti-inflammatory properties [58].

3.8 Hepatoprotective activity

Orally administered *Boerhavia diffusa* alcohol extract shown hepatoprotective efficacy against experimentally generated carbon tetrachloride liver damage in rats and mice [60]. When Ibuprofen causes hepatotoxicity in albino rats, the aerial portions of *Boerhavia diffusa* L.'s hydro alcoholic extract have both a therapeutic and preventative effect [61]. When albino rats were given CCl4 [62] to cause hepatotoxicity, the plant extract of *Boerhavia diffusa* demonstrated hepatoprotective action. Rats with rat liver poisoning caused by Carbon Tetrachloride (CCl4) were examined for hepatoprotective action using an alcoholic extract of the stem and leaves of *Boerhavia diffusa*. By administering CCl4 intraperitoneally to Albino rats of either sex, hepatotoxicity was induced (in olive oil). Serum Glutamate Oxaloacetate Transaminase (SGOT), Serum Glutamate Pyruvate Tranaminase (SGPT), Serum Alkaline Phosphatase (SALP), and Total and Direct Serum Bilirubin were used to measure the hepatoprotective effects of the extracts. The alcoholic extract of *B. Diffusa* was found to have hepatoprotective properties against CCl4-induced rat liver toxicity [63].

3.9 Anti diabetic and anti hypeelipidemic activity

In streptozotocin-induced NIDDM rats, *B. Diffusa* leaf extract reduced blood glucose in a dose-dependent manner comparable to gliben clamide. The findings suggest that the extract's ability to lower blood glucose levels is likely due to the regeneration of pancreatic beta cells or to increased pancreatic activity. Therefore, the *B. Diffusa* chloroform extract exhibits significant antidiabetic activity [64]. In comparison to a diabetic control group, an ethanolic extract of the roots of *Boerhavia diffusa* considerably decreased total cholesterol, triglycerides, VLDL, and LDL while increasing HDL, which serves as a protective factor for the heart. As a result, streptozotocin-induced diabetic rats showed decreased blood sugar levels when exposed to an ethanol extract of *B. Diffusa* roots [65]. Blood glucose concentration and hepatic enzymes in normal and alloxan-induced diabetic rats treated with an aqueous solution of *Boerhavia diffusa* L. leaf extract (200 mg/kg) for 4 weeks showed a significant decrease in blood glucose and a significant increase in plasma insulin levels [66]. In streptozotocin-induced rats, *Boerhavia diffusa* root ethanolic extract significantly reduced blood sugar levels [67].

3.10 Anti- histaminic activity

Boerhaviadiffsa Linn. roots extracted with ethanol and tested on animals. Using an isolated goat tracheal chain preparation and guinea pig histamine-induced bronchoconstriction, *B. Diffusa* 's anti-histaminic activity was assessed. *B. Diffusa* demonstrated significant protection by extending the Preconvulsion Dyspnoea Time (PCD) in guinea pigs and significantly inhibited the histamine-induced, dose-dependent contraction of the goat tracheal chain. As a result, plant demonstrated anti-histaminic and bronchodilating activity against histamine and may therefore play a role in the management of asthma [68].

3.11 Nephroprotective activity

In an animal model of lead acetate-induced nephrotoxicity, *Boerhavia diffusa* was examined. Due to the nephrotoxicity of lead acetate, treatment with *Boerhavia diffusa* extract speeds up the recovery from nephritic damage caused by lead acetate [69].

3.12 Anti-convulsant activity

B. Diffusa root methanolic extract had anti-convulsant properties against PTZ-induced convulsions. The anti-convulsant activity of the crude methanolic extract is confirmed to be caused by the presence of liriodendrin because this activity was only retained in the liriodendrin-rich fraction. The fact that BAY k-8644-induced seizures were prevented by liriodendrin-rich fraction further supports the theory that liriodendron's activity is a result of its calcium channel antagonistic characteristics [70].

4. Nutritional value of Punarnava

Due to the punarnava leaf's high nutritional value and widespread use since antiquity, it has been recognised for its health advantages. Punarnava contains 1.61% of the daily recommended amount of total fat in 100 g.

It contains 2.26% of the daily required protein intake and 162 mg of salt. It contains 142 mg of calcium and 44.8 mg of vitamin C. Additionally, it contains 0.012 mg of iron. Punarnava plant nutrients are essential for the health of the liver, kidneys, eyes, and overall body function. They can also be used to treat a variety of illnesses as well as prevent many diseases and infections.

Fig 5: Health Benefits of Punarnava

5. Health Benefits of Punarnava

Use the ayurvedic herb Punarnava, which has anti-inflammatory, wound-healing, and antioxidant properties. It can also be used to treat liver detoxification, urinary tract infections, and other conditions. Add punarnava powder and tea to your diet

if you're seeking to shed some extra pounds. The elimination of kidney stones is one of the punarnava leaf's additional health advantages. Punarnava tablets, powder, and root extracts are readily available in your neighbourhood stores. Include this herb in your daily routine for maximum health benefits. You can even prepare and consume Punarnava juice, which is healthy for your eyes and vision. The best health advantages of the Punarnava plant are listed here [71].

5.1 Benefits of Punarnava Leaf Powder for the Liver

One of the body's most vital organs is the liver. When the body is being attacked, the liver works hard, and a dysfunctional liver can increase weariness and stress. Punarnava powder has fantastic benefits for the liver. It assists in regularly stimulating bile secretion, which maintains the livers health and functionality [71].

5.2 Punarnava Extract Treats Urinary Tract Infections Naturally

Although they can affect males too, urinary tract infections are very common in women. They are really uncomfortable and make it feel scorching to urinate. Anti-spasmodic, anti-microbial, and anti-inflammatory activities can be found in punarnavapowder. When used together, these are an excellent UTI treatment that quickly and efficiently eliminates the illness. Punarnava plant has no harmful effects on either the mother or the foetus, so it can also be used to treat UTIs during pregnancy [72, 73].

5.3 Punarnava (*Boerrhavia diffusa*): A Powerful Weight-Loss Herb

The fact that Punarnava aids in the battle against obesity is one of its well-known advantages. Punarnava is a common ingredient in herbal slimming products due to its potency. With no loss of essential potassium or electrolytes, this herb aids in the removal of surplus fluids from the body by promoting excretion. Punarnava Mandur therefore encourages the body to lose weight. It also has a minor laxative effect [71, 72, 73].

5.4 Diuretic Nature of Punarnava Plant

Urinating is one of the most important body functions. This is because it helps get rid of excess toxins, water, and fat from the body, ultimately keeping it healthy and ensuring that all organs function as smoothly as possible. Punarnava drug is a diuretic, which means that it stimulates regular and plenty of urination. This helps keep the body clean. Furthermore, regular urination also clears out the calcium accumulated in the kidneys, thus preventing kidney stones from occurring. The diuretic properties of Punarnava root powder also help prevent dropsy, a condition in which water or watery fluids settle down in the tissue and cavities of the body and cause problems with the health. Frequently urinating can help get rid of these excess fluids and prevent the condition from occurring in the first place. It also helps cures ascites, which is also the accumulation of watery fluids in the body tissues. This is normally caused by a problem in the liver [73].

5.5 Effect of Punarnava Powder on Diabetes

If diabetes is not adequately managed, it can be quite hazardous. You can use the herb punarnava to manage your diabetes. This is due to the fact that its leaf (and the extracts from the leaves) regulates the body's glucose levels, which is very advantageous for diabetics. They benefit from the Ayurvedic Punarnava drug's ability to raise plasma insulin levels [73, 74].

5.6 Punarnava Root Juice is Beneficial for Eyes

Because the eyes are such a delicate organ, they are prone to a wide range of ailments and infections at any given time of the day. Because of this, it is crucial to keep children safe and provide the appropriate treatment when something goes wrong.

Conjunctivitis, night blindness, and other eye infections and disorders can all be treated with punarnava root juice. Your eyesight will improve dramatically if you place a few drops of the juice in your eyes [74].

5.7 Potential Benefits of Punarnava for Heart Health

Punarnava plant can help you prevent congestive heart failure. This is because it reduces the workload that's put on the heart by inducing edemas. For it to be as beneficial as possible, Punarnava root powder should ideally be mixed with *Terminala Arjuna* Bark powder, *Tapyadi Loha* or any other herbal remedy for heart failure for maximum results [74].

5.8 Ayurvedic Herbs Punarnava Reduce Arthritis Pain

Punarnava herb is known to be a good remedy for arthritis. This is because the herb provides a lot of relief from pain in the joints and the pain of inflamed muscles. In order to use this herb to relieve these pains, it must be ground into a paste and then applied topically. You can let the punarnava extract paste on your skin for as long as you want as there will not be any side effects on your skin [75].

5.9 Positive Effects of Punarnava on Impotence Problems

Impotence can be a huge problem. Punarnava's seeds are extremely beneficial to those who are suffering from impotence. It can help revive the entire male reproductive organ, and can also induce a lot of vitality and vigor, and it also increases your libido. Moreover, punarnava seeds can improve the overall quality of the semen that is produced. It is also a good home remedy for erectile dysfunction [75].

5.10 Punarnava Juice to Manage Stomach Disorders

Punarnava plant is a great herb if you are suffering from stomach disorders. This is because it strengthens the stomach muscles. It can also kill and get rid of intestinal worms, which is an important function as worms can be

quite harmful in your body and lead to starvation and death. Punarnava extract also helps prevent intestinal colic [76].

5.11 Punarnava Rich in Antioxidants, Anti-Cancer & Antihepatic

Apart from the benefits listed above, Punarnava plant can be used for a variety of other ailments as well. It can help cure bronchial asthma, is a good remedy for gout and can prevent there from being high amounts of ureic acid in the blood. Moreover, Punarnava leaf powder is also considered a good remedy for cancer as it is an anticancer agent. Punarnava is also a good antioxidant, cardiokine, antihepatic, and chloretic agent. It is, therefore, beneficial for various bodily systems and functions and a very good addition to your diet or lifestyle [77].

6. Conclusion

Herbal meditional plants have the great the rapeutic economic values in all over the world. *Boerhavia erecta* shows many pharmacological effect which are a knowledge in this review. Studies conducted on this plant have showed it's broad pharmacological properties with high medicinal values. It has been seen almost all parts of the plants, mainly the leaf contains many different active and non-active chemical compounds that possess a wide range of therapeutic values which have been used widely for centuries as traditional or folk medicine.

7. References

1. Kadam PV, Yadav KN, Deoda RS, *et al*. Mimusopselengi: A Riview on Ethnobotany, Phytochemical and Pharmacological Profile. J Pharmacogn Phytochem. 2012;1(3):64-74.
2. Shendye NV, Gurav SS. Cynodondactylon: A Systemic Review of Pharmacognosy, Photochemistry and Pharmacology. Int J Pharm Pharm Sci. 2014;6(8):7–12.
3. Sharma RA, Kumari A. Phytochemistry, Pharmacology and therapeutic application of Oxalis corniculata Linn. A Review. Int J Pharm Pharm Sci. 2014;6(3):6-12.
4. Agrawal B, Das S, Pandey A. *Boerhavia diffusa* Linn. Phytochemical and pharmacological profile. Asian J Applied Sci. 2011;1–22.
5. Awan AJ, Ahmed CB, Uzair M, *et al*. Family Acanthaceae and genus Aphelandra: Ethnopharmacological and Phytochemical Review. Int J Pharm Pharm Sci. 2014;10(6):44–55.
6. Riaz H, Raza SA, Hussain S, *et al.* An overview of Ethnopharmacological Properties of *Boerhavia diffusa*. Afr J Pharm Pharmacol. 2014;8(2):49–58.
7. Mahesh AR, Kumar H, Ranganath MK, *et al*. Detail Study on *Boerhavia diffusa* Plant for its Medicinal Importance- A Review. Res J of Pharmaceutical Sci. 2012;1(1):28-36.
8. Milic N. Biological and Phytochemical studies on "*Boerhavia diffusa*." 2008;74:113–123.
9. Das S. Antimicrobial activity study of ethanolic extract of *Boerhavia diffusa* whole plant. 2009;3(10):2006-2009.
10. Chauhan PN, Kumar D, Kasana MS. Medicinal plants of Muzaffaranagar district used in treatment of urinary tract and kidney stones. Indian J Tradit Know. 2009;8(2):191-195.
11. Kirtikar KR, Basu BD, Basu LM. Indian Medicinal Plants. (2nd edn), Allahabad, Uttar Pradesh, India; c2009.
12. Ragi TP, Shibu BS. *In vitro* propagation of *Boerhavia diffusa* L. (Nyctaginaceae) via nodal and leaf explants. AsPac J Mol Biol Biotechnol. 2014;22(3):219–223.
13. Pathak D, Alam K, Rohilla H, *et al*. Phytochemical Investigation of *Boerhavia diffusa* And Andrographispaniculata: A Comparative Study. Int J Pharm Pharm Sci. 2012;4(4):250–251.
14. Sharma A, Sharma MS, Mishra A, *et al*. A Review on Thar plants used in liver diseases. Int J Res Pharm & Chem. 2011;1(2):224–236.
15. Sandhu PS, Singh B, Gupta V, *et al*. Potential Herbs Used in Ocular Diseases. 2011;3(4):1127-1140.
16. Rameshkumar S, Ramakritinan CM. Floristic survey of traditional herbal medicinal plants for treatments of various diseases from coastal diversity in Pudhukkottai District, Tamilnadu, India. J coast life med. 2013;1:225–232.
17. Qureshi R, Bhatti GR, Memon RA. Ethnomedicinal Uses of Herbs from Northern Part of Nara Desert, Pakistan. Pak J Bot. 2010;42(2):839–851.
18. Khan RU, Mehmood S, khan SU, *et al*. Ethnobotanical Study of Common Weed Flora of Sugarcane in District Bannu, Khyber Pakhtunkhawa, Pakistan. J Med Plants stud. 2013;1(4):49–78.
19. Immanuel RR, Elizabeth LL. Weeds in Agro ecosystems: A source of medicines for human healthcare. Int J Pharm Tech Res. 2009;1(2):375–385.
20. Hameed M, Ashraf M, Al-Quriany F, *et al*. Medicinal Flora of The Cholistan Desert: A Review. Pak J Bot. 2011;43(2):39–50.
21. Hayat MQ, Khan MA, Ahmad M, *et al*. Ethno-taxonomical Approach in the Identification of useful Medicinal Flora of Tehsil Pindigheb (District Attock) Pakistan. Ethnobotany Research & Applications. 2008;6:35–62.
22. Hussain K, Nisar MF, Majeed A, *et al*. Ethnomedicinal Survey for Important Plants of JalalpurJattan, District Gujrat, Punjab, Pakistan. Ethnobot Leaflets. 2010;14:807–825.
23. Mushtaq A, Muhammad Z, Ajab KM, *et al*. Ethnomedicinal investigation of Phytomedicines among local communities of Arid areas of Pakistan. Indian J Tradit Know. 2012;11(3):436–446.
24. Shanmugam S, Rajendran K, Suresh K. Traditional

uses of medicinal plants among the rural people in Sivagangai district of Tamil Nadu, Southern India. Asian Pac J Trop Biomed. 2012 Jan 1;2(1):S429-34
25. Santhosha D, Ramesh A, Prasad SM, *et al*. Punarnava: A Review. Res J Pharm BiolChem Sci. 2011;2:427–436.
26. Larbie C, Mensah DA. Botanicals for managing cardiovascular disorders: A Review of medicinal weeds of Knust Campus. Global J Res Med plants &Indigen Med. 2014;3(9):349–358.
27. Rahmatullah M, Khatun Z, Hasan A, *et al*. Survey and scientific evaluation of medicinal plants used by the Pahan and Teli tribal communities of natore district, Bangladesh. Afr J Tradit Complement Altern Med. 2012;9(3):366–373.
28. Rahman AHMM. Ethno-Gynecological Study of Traditional Medicinal Plants Used by Santals of Joypurhat District, Bangladesh. J Biomed Biotechnol. 2014;2(1):10–13.
29. Rahman AHMM, Kabir EZMF, Islam AKMR, *et al*.; Medico-botanical investigation by the tribal people of Naogaon district, Bangladesh. J Med Plants Stud. 2013;1(4):136–147.
30. Dey A, Rehamn SMA, Chowdhury RN, *et al*. Invitro Pharmacological investigations of the plant Boerhaviarepens (Family: Nystaginaceae). Int Res J Pharm. 2013;4(7):36–38.
31. Shahnaj S, Asha U, Mim T, Rumi RSH, Akter S, *et al*. A survey on the ethnomedicinal practices of a folk medicinal practitioner in Manikganj district, Bangladesh. J Chem Pharm Res. 2015;7(8):90–696.
32. Mahurkar N, hasan SSM. Antiulcer Activity of Commicarpus chinensis in Ethanol and Aspirin Induced Ulcers. Asian J Pharm Res. 2014;4(3):119–122.
33. Boxi M, Rajesh Y, Kumar VR, *et al*. Phytochemical Screening and In-Vitro Evaluation of Anti-Oxidant Properties of Commicarpus Chinesis (Aqueous Leaf Extract). Int J Pharm Bio Sci. 2010;1(4):537–547.
34. Sadeghi Z, Valizadeh J, Shermeh OA, *et al*. Antioxidant activity and total phenolic content of Boerhaviaelegans (choisy) grown in Baluchestan, Iran. Avicenna J Phytomed. 2015;5(1):1–9.
35. Rahman SM, Alam MM, Amin MR, *et al*. Antimicrobial activity and brine shrimp toxicity of methanolic whole plant extract of Boerhaviarepens L. (Family: Nyctaginaceae). Int J of Phyto Pharm. 2014;4(6):135–139.
36. Kamlekar S, Kota K, Tahashildar J, *et al*. *In vitro* antimicrobial potential of *Boerhavia diffusa* L. Root extract on pathogenic organisms. World J Pharm Res. 2014;3:442–450.
37. Apu AS, Liza MS, Jamaluddin ATM, *et al*. Phytochemical screening and *in vitro* bioactivities of the extracts of aerial part of *Boerhavia diffusa* Linn. Asian Pac J Trop Biomed. 2012;2(9):673–678.
38. Malhotra D, Khan A, Ishaq F. Phytochemical screening and antibacterial effect of root extract of *Boerhavia diffusa* L. (Family Nyctaginaceae). J Appl Nat Sci. 2013;5(1):221–225.
39. Umamaheswari A, Nuni A, Shreevidya R. Evaluation of antibacterial activity of *Boerhavia diffusa* L. leaves. Int J Green Pharm. 2010;4(2):75–78.
40. Suriyavathana M, Parameswari G, Shiyan SP. Biochemical and antimicrobial study of *Boerhavia erecta* and *Chromolaena odorata* (L.) King & Probinson. Int J Pharm Res. 2011;3(2):465–468.
41. Osuna L, Tapia-Perez ME, Jimenez-Ferrer JE, *et al*. Screening of Alternanthera repens, Boerhavia coccinea, Flaveria trinervia, Tournefortia densiflora, and Vitexmollis. Extracts to Evaluate their Antibacterial Activity and Effect on Smooth Muscle. Pharm Biol. 2005;43(9):749–753.
42. Madhuri S, Kalasker V, Rambhimaiah, *et al*. Evaluation of diuretic activity of aqueous extract of Boerhavia diffusa roots in Rats. Int J Pharm Bio Sci. 2013;4(4):843–848.
43. Pareta SK, Patra KC, Mazumder PM, *et al*. Boerhavia diffusa Linn. Aqueous extract as curative agent in ethyl- glycol i-nduced urolithiasis. Pharmacology online. 2010;3:112–120.
44. Bhardwaj R, Yadav A, Sharma RA. Phytochemicals and Antioxidant Activity in *Boerhavia diffusa*. Int J Pharm Pharm Sci. 2014;6(1):344–348.
45. Dhakar P, Saini MR, Sharma J . Comparative evaluation of free radical scavenging activity of *Boerhavia diffusa* root extracts (BDRE) and determination of dose effectively against radiation induced damages in Swiss albino mice. Int J Appl Res Nat Prod. 2013;5(4):9–18.
46. Khalid M, Siddiqui HH, Fareed S. *In vitro* estimation of the antioxidant activity and phytochemical screening of *Boerhavia diffusa* root extract. Asian J Tradit Med. 2011;6(6):259–266.
47. Ammar AF, Zhang H, Siddeeg A. *In Vitro* Antioxidant Activity and Total Phenolic and Flavonoid Contents of Alhydwan (Boerhaviaelegana Choisy) Seeds. J Food Nutr Res. 2014;2:215–220.
48. Bokhari J, Khan MR, haq I. Assessment of Phytochemicals, antioxidant and anti-inflammatory potential of Boerhaviaprocumbens Banks ex Roxb. ToxicolInd Health. 2014;32(8):1456–1466.
49. Mehrotra S, Singh VK, Agarwal SS, *et al*. Anti-lymphoproliferative activity of ethanolic extract of *Boerhavia diffusa* roots. ExpMolPathol. 2002;72(3):236–242.
50. Srivastava R, Saluja D, Dwarakanath BS, *et al*.Inhibition of Human Cervical Cancer Cell Growth by Ethanolic Extract of *Boerhavia diffusa* Linn. (Punarnava) Root. Evid Based Complement Alternat Med. 2011;2011:1–13.
51. Ramazani A, Zakeri S, Sardari S, *et al*. *In vitro* and *in vivo* anti-malarial activity of *Boerhavia elegans* and Solanumsurattense. Malar J. 2010;19:119–124.

52. Hilou A, Nacoulma OG, Guiguemde TR. *In vivo* antimalarial activities of extracts from *Amaranthus spinosus* L. and *Boerhavia erecta* L. in mice. J Ethnopharmacol. 2006;103(2):236–240.
53. Adefokun DI, Iwalewa EO, Omisore NO, *et al*.The Antimalarial Effect and Mechanism of Action of Methanolic Root Extract of *Boerhavia diffusa* in Mice. Br J Pharm Res. 2015;8(2):1–14.
54. Gharate M, Kasture V. Evaluation of anti-inflammatory, analgesic, antipyretic and antiulcer activity of Punarnavasava: an Ayurvedic formulation of *Boerhavia diffusa*. Orient Pharm Exp Med. 2013;13(2):121–126.
55. Avijit D, Rehman ASM, Mohammad AA, *et al*.Evaluation of analgesic and antidiarrheal activity of whole plant Boerhaviarepens (Family: Nyctaginaceae). Int Res J Pharm. 2012;3:102–105.
56. Shubha G, Govindaraju B. Anti-inflammatory and Analgesic Activity of *Boerhavia diffusa* L. Int Res J Pharm Appl. 2013;3:131–135.
57. Nagarajaiah BH, Arshad M, Kamdod MA, *et al*.Comparative Study of Anti-Inflammatory & Analgesic Activity of *Boerhavia diffusa* Linn. with Selective Cox 2 Inhibitors. Asian J Biochem Pharm Res. 2013;3:200–210.
58. Oladele GM, Ode OD, Ogunbodede MA. Evaluation of Anti-Inflammatory and Membrane Stabilizing Effects of aqueous root extract of *Boerhavia diffusa* Linn in Rats. Int. J Appl. Biol Pharm Tech. 2011;2(3):84–85.
59. Hiruma-Lima CA, Gracioso JS, Bighetti EJB, *et al*. The juice of fresh leaves of *Boerhavia diffusa* L. (Nyctaginaceae) markedly reduces pain in mice. J Ethnopharmacol. 2000;71(1-2):267–274.
60. Chandan BK, Sharma AK, Anand KK. *Boerhavia diffusa*: A study of its hepatoprotective activity. J Ethnopharmacol. 1991;31(3):299–307.
61. Jayavelu A, Natarajan A, Sundaresan S, *et al*. Hepatoprotective Activity of Boerhavia Diffusa Linn. (Nyctaginaceae) against Ibuprofen Induced Hepatotoxicity in Wistar Albino Rats. Int J Pharm Res Rev. 2013;2(4):1–8.
62. Ramachandra YL, Shilali K, Ahmed M, *et al*. Hepatoprotective Properties of Boerhavia Diffusa and AervaLanata Against Carbo-n tetra Chloride induced Hepatic damage Rats. Pharmacology online. 2011;3:435–441.
63. Venkatesh P, Dinakar A, Senthilkumar N. Hepatoprotective Activity of alcoholic extracts of *Boerhavia diffusa* and *Anisochlilus carnosus* Against Carbon tetrachloride induced hepatotoxicity in rats. Asian J Pharm Clin Res. 2000;5:232–234.
64. Nalamolu RK, Boini KM, Nammi S. Effect of chronic administration of *Boerhavia diffusa* Linn. Leaf extract on experimental diabetes in rats. Trop J Pharm Res. 2004;3(1):305–309.
65. Murti K, Lambole V, Panchal M, *et al*. Antidiabetic and Antihyperlipidemic activity of roots of Boerhavia Diffusa on Streptozotocin induced Diabetic rats. Pharmacology online. 2011;1(1):15–21.
66. Pari L, Satheesh MA. Antidiabetic activity of *Boerhavia diffusa* L. effect on hepatic key enzymes in experimental diabetes. J Ethnopharmacol. 2004;91(1):109–113.
67. Kumar AG, Srikanth S, Chidrawar V, *et al*. Evaluation of Insulin Potentiating Activity of Ethanolic Root Extract of *Boerhavia diffusa* in Streptozotocin -Induced Diabetic Rats. Res J Pharm Biol Chem Sci. 2013;4:849–857.
68. Suralkar AA, Verma AK, Kamble RD, *et al*.Pharmacological Evaluation of Anti-Histaminic activity of *Boerhavia diffusa*. Int J Adv Pharm Biol Chem. 2012;1(4):503–507.
69. Vaidegi N, Anuradha. Antinephrotoxic effect of *Boerhavia diffusa* L. root on lead acetate induced nephrotoxicity in male albino rats. Research journal of pharmacology and pharmacodynamics. 2012;4(6):353–356.
70. Kaur M, Goel RK. Anti-Convulsant Activity of *Boerhavia diffusa*: Plausible Role of Calcium Channel Antagonism. Evid Based Complementary Altern Med. 2011;1–7.
71. Bhowmik D, Sampath KK, Srivastava S, Paswan S, Sankar A. Traditional Indian herbs Punarnava and its medicinal importance. J Pharmacognosy Phytochem. 2012 May 1;1(1):52-8.
72. http://www.phytojournal.com/archives/?year=2012&vol=1&issue=1&ArticleId=7&si=false
73. Mishra S, Aeri V, Gaur PK, Jachak SM. Phytochemical, therapeutic, and ethno pharmacological overview for a traditionally important herb: *Boerhavia diffusa* Linn. BioMed research international. 2014;2014.
74. https://www.hindawi.com/journals/bmri/2014/808302/abs/
75. Banjare L, Prasad AK, Naik ML. *Boerhaavia diffusa* from traditional use to scientific assessment-a review. Int J Pharm Biol Arch. 2012;3(6):1346-54.
76. https://www.academia.edu/3833589/Boerhaavia_diffusa_from_Traditional_Use_to_Scientific_Assessment-_A_Review
77. https://www.lybrate.com/amp/topic/punarnava-benefits-and-side-effec