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TRADITIONAL MEDICINAL PLANT *BOERHAAVIA DIFFUSA*'PUNARVA' AND ITS PHARMACOLOGICAL VALUE: A REVIEW

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ABSTRACT

Boerhaavia diffusa is a species of flowering plants which belongs to family Nyctaginaceae (Four o'clock family). It is used as traditional medicine by indigenous people of many countries in the world for its protective role against inflammation, prostatic hyperplasia, diabetes, cancer, gastrointestinal problems, arthritis etc. The whole plant contains numerous bioactive compounds which are responsible for its pharmacological activities.

KEYWORDS: Punerva, medicinal plant, Nyctaginaceae, Inflamation, cancer.

1. INTRODUCTION

Boerhaavia diffusa is a species of flowering plants which belongs to family Nyctaginaceae (Four o'clock family). The genus '*Boerhaavia'* is so named to honour Hermann Boerhaave who was a famous 18th century Dutch physician and the species is named '*diffusa'* due to the typical diffuse branching of the plant (Mishra *et al*. 2014).

2. Habit and Habitat

Boerhaavia diffusa has a wide distribution, occurring on major part of the globe. Olaleye et al. (2010) reported that it is common in the Indo-Nepal Himalayan terrain. Boerhaavia diffusa L. occurs abundantly as a weed throughout India (Personal observation). Boerhaavia diffusa is an herbaceous weed, commonly known as, is the member of Nynctaginaceae family. It is known as Punarnava in Ayurveda and is a main ingredient in many formulations of Ayurveda. The tribal peoples harvest this plant for medicinal purposes. It is also cultivated to

some extent in West Bengal. It is a creeping and spreading perennial herb, with a stout root-stock and many erect or spreading branches. Boerhaavia diffusa is a prostrate herb, diffusely branched and pubescent The stem is cylindrical, creeping sometimes purplish or greenish in colour, swollen at the nodes (Chaudhary and Dantu 2011). The cluster of monochasial cymes borne on peduncles is terminal in position and limits the growth of axial shoots.

3. Distribution

It is distributed in countries located in tropical and subtropical regions like India, Sri Lanka, Egypt, Sudan, Ghana, South Africa, Nigeria, China, Australia, Philippines, Iran etc. (Chaudhary and Dantu 2018, Nayak and Thirunavoukkarasu 2016).

4. Taxomomy

Out of the 40 species of this genus, five are found in India – B. *diffusa, B. chinensis, B. erecta, B. rependa, and B. rubicunda* (Chopra, 1969; Anonymous, 1988; Dev, 2006).

5. Phytoconstituents

Trang et al. (2019) reported that phytochemical investigations indicated that *B. diffusa* L. extract contains a wide range of compounds including rotenoids, flavonoids, steroids, alkaloids, xanthones, lignans, and phenolic compounds. Khan et al. (2013) reported several bioactive compounds -flavonoids, alkaloids, steroids, triterpenoids, lipids, lignins, hypoxanthine 9-Larabinofuranoside, ursolic acid, lirodendrin, and glycoprotein that have been accredited to diverse pharmacological properties. Many rotenoids known as boeravinones (A-F) have also been isolated from the roots of the *B. diffusa*. Trang et al. (2019) reported the isolation and structural elucidation of a new coumaronochromone derivative, boeravinone R (5,7-dihydroxy-3′-methoxycoumaronochromone), together with 4 known compounds: β-sitosterol (Mehrotra et al. 2002), oleic acid (Chou et al. 2004), physcion (Rajpoot and Mishra 2011), and glutinol (Loi et al. 2015).

6. Medicinal uses

It is widely used by tribal people in Uttar Pradesh and Madhya Pradesh for the treatment of rheumatism, leucorrhea, stomach ache and elephantiasis. Chaudhary and Dantu (2011) reported that Edible parts of *B. diffusa* are leaves, seeds and roots. The whole plant and its various parts were used in treatment of enlargement of spleen, cancer, jaundice, dyspepsia, inflammation, abdominal pain and also worked as an anti-stress, tonic and carminative (Singh et al.. 2017).

Trang et al. (2019) reported that *Boerhaavia diffusa* L has been used in folklore medicine of India, Nepal and Vietnam, for the treatment of various diseases such as jaundice, asthma, anemia,, convulsions, dyspepsia, nephrotic syndrome, enlargement of spleen, abdominal pain, abdominal tumor, or urinary and kidney disorder (Mehrotra et al. 2002). Previous studies have reported that parts of *B. diffusa* such as root, leaf extracts exhibit a wide range of medicinal properties such as anti-inflammatory, diuretic, laxative, antiurethritis, anticonvulsant, antinematodal, antifibrinolytic, antibacterial, anthelmintic, antileprotic, antiscabby antistress, and antiasthmatic, hepatoprotective, antioxidant, antinociceptive, antibacterial and antidiabetic (Chou et al. 2004; Rajpoot and Mishra 2011; Loi et al. 2015). Further, it is also used as a kidney rejuvenating drug and as an excellent natural remedy for urinary track diseases (Chaudhary and Dantu 2011) The leaves and immature fruits are found to be a potential feed source for birds and poultry. Due to the presence of high nutrition, palatability and non- toxic factors, such weed plants are being grazed by sheep, goats and cows from agro-ecosystem.

Karwasra et al. (2016) reported Cisplatin (Cis-diaminedichloroplatinum II), a chemotherapeutic agent, induced nephrotoxicity. They evaluated the nephroprotective role of Boerhaavia diffusa in cisplatin-induced acute kidney injury. Findings indicate that *Boerhaavia diffusa* is effective in mitigating cisplatin-induced nephrotoxicity and thus, for this the acute and sub-acute toxicity studies conducted to evaluate the safety profile of Boerhaavia diffusa.

Due to a high rate of oxidative metabolic activity in the brain, intense production of reactive oxygen metabolite occurs, and the subsequent generation of free radicals is implicated in the pathogenesis of traumatic brain injury, epilepsy, and ischemia as well as chronic neurodegenerative diseases (Ayyappan et al. 2016) According to Ayyappan et al. (2016) *B. diffusa* had high antioxidant potential that could inhibit the oxidative stress induced by different neurotoxic agents in brain. Since many of the neurological disorders are associated with free radical injury, these data may imply that B. diffusa, functioning as an antioxidant agent, may be beneficial for reducing various neurodegenerative complications.

7. Pharmacological studies

Boerhaavia diffusa Linn. (Nyctaginaceae) is widely used in traditional Indian medicines against renal afflictions including calcium oxalate (CaOx) urolithiasis and is known for antioxidant activity (Pareta et al. 2011). They studied role of aqueous extract of *B. diffusa*

roots (BDE) in hyperoxaluric oxidative stress and renal cell injury. BDE extract was found to posses a high total phenolic content and exhibited significant free radicals scavenging activity. Oxalate excretion significantly increased in hyperoxaluric animals as compared to control which was protected in BDE-treated animals (Pareta et al. 2011).

Olaleye et al. (2010) evaluated extracts of Boerhaavia diffusa leaves for antioxidant and hepatoprotective properties in the acetaminophen-induced lipid peroxidation causing liver damage. These results indicated that leaf extracts from B. diffusa possess hepatoprotective property against acetaminophen-induced liver damage which may be mediated through augmentation of antioxidant defences (Olaleye et al. 2010). The hepatoprotective effects of Boerhaavia diffusa was studied against the hepatotoxicity induced by oxaliplatin (Ain et al. 2019). They further repoted that *Boerhaavia diffusa* was effective in reducing risk of hypercholestremia associated with oxaliplatin. Histopathological examination of rat liver revealed that prophylactically treated group with Boerhaavia diffusa was effective in reducing oxidative stress induced steatohepatitis by oxaliplatin.

Anti-diabetic activity of *B. diffusa* has also been investigated by Chude et al. (2001) and Pari and Satheesh (2004). Kaur, H. (2019) conducted detailed experiments on *B. diffusa* and reported that it lowered down the blood glucose levels in the diabetic rats in a dose dependent manner. The extract anti-diabetic activity was comparable to that of the anti-diabetic drug glibenclamide. Kaur, H. (2019) reported that Streptozotain induces a massive damage to â-cells of islets of Langerhans and lower down the synthesis and release of insulin. Anti-diabetic action of the extract was attributed to its role in rejuvenation of pancreatic â-cells.

8. Phytochemical composition

B. diffusa contains some vital alkaloids, ratenoids, lignans which are named as punarnavine, boeravinones A-F, liriodendrons as punarnavine, boeravinones A-F, liriodendrons. Flavonoids, amino acids, ß-sitosterols and tetracosanoic, esacosanoic, stearic and ursolic acids were also reported, which has wide applicablity against chronic ailments (Wahi et al. 1997; Mishra et al. 2014).

9. Antibacterial activity

Velmurugan et al. (2010) and Umamaheshware et al. (2010) reported that the B. diffusa leaves have potent antibacterial activity against various Gram-negative and Gram-positive bacteria which might be due to the phytochemicals present in the leaves.

10. CONCLUSION

The bioactive compounds like alkaloids, flavonoids, saponins, phenolic compounds, tannins, terpenoids, glycosides, steroids etc. are present in the extracts prepared from whole plant of *B. diffusa* or its individual parts like leaves, stem and roots. These bioactive compounds are responsible for the curing effects of *B. diffusa* against a number of human ailments like cancer, inflammation, diabetes, harmful radiations induced damage, gastrointestinal problems, microbial infections, liver disorders, prostatic hyperplasia, cardiac problems, anxiety problem etc.

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