



ORIGINAL ARTICLE

Phytochemical evaluation of root of *Punarnava* (*Boerhaavia diffusa* Linn.)

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Abstract

The medicinal plant which is mentioned as *Punarnava* in Ayurvedic classics is a trailing herb that grows untamed in Kerala. Utilization of *Punarnava*'s therapeutic properties started from the Vedic era. *Punarnava* is botanically identified as *Boerhaavia diffusa* Linn.- Nyctaginaceae. The root of *Boerhaavia diffusa* Linn. can be administered internally as various dosage forms along with particular *anupanas* (vehicle) mentioned in classical textbooks. It is also used as an ingredient in various Ayurvedic formulations. It is therapeutically indicated in *Pandu* (anaemia), *Hridroga* (cardiac disorders), *Gulma* (abdominal tumor), *Pleeha roga* (splenic disorders), *Vasthi soola* (pain in urinary bladder) etc. In order to determine the purity and quality of the drug as well as to provide scientific validation for these traditional claims, a preliminary phytochemical assessment was conducted. Phytochemical evaluation revealed the presence of high tannin content, phenol content, alkaloids, flavonoids, steroids etc. and these are responsible for various therapeutic indications in different systems of the body. Previous phytochemical evaluation was conducted by some scholars about the *Boerhaavia diffusa* Linn. root. In addition to that, present study evaluated the hot water-soluble extractive value, hot alcohol soluble extractive values, water insoluble ash value and qualitative analysis of ash. Successive solvent extraction of the root was conducted in four solvents petroleum ether, cyclohexane, acetone and alcohol. The results contribute to ensuring the authenticity, quality and purity of *Punarnava*.

Introduction

Punarnava is trailing herb which is botanically identified as *Boerhaavia diffusa* Linn. (Nyctaginaceae) and is found throughout India. Both internal and external administration of the drug *Punarnava* was started from the Vedic period itself.¹ The word *Punarnava* itself means which is a renewer of body.² Root of *Punarnava* is indicated in diseases affecting various systems of the body which includes *Kasa* (cough), *Gara* (poison), *Hridroga* (cardiac disorders), *Soola* (abdominal colic), *Pandu* (anaemia), *Gulma* (abdominal tumor), *Pleeha roga* (splenic disorders), *Arsas* (haemorrhoids), *Vasthi soola* (pain in urinary bladder), *Vrana* (wounds) etc.^{3,4,5} Numerous pharmacological and clinical investigations describing the unique bioactivity of plant extracts have added credence to these traditional uses. There are several researches which proves the hepatoprotective activity, antioxidant property, immunomodulatory effect, anthelmintic activity etc of the root of *Boerhaavia diffusa* Linn.⁶ The first step towards the scientific validation of

pharmacological actions is phytochemical evaluation. Details regarding the preliminary phytochemical evaluation of root were mentioned in Quality standards of Indian medicinal plants.⁷ Standards of some parameters are also added in the Ayurvedic pharmacopoeia of India.⁸ The diverse pharmacological actions are attributed to phytochemical components. Previous research on phytochemical evaluation of root of *Boerhaavia diffusa* Linn. were carried out by Gupta AK et al⁹, Mohammad Khalid et.al.¹⁰, Shanmugapriya et.al¹¹, Deepti Malhotra et al.¹² and Arvind Kumar Gupta et al.¹³ The purpose of the present study is to obtain more understanding into the phytochemical screening of *Boerhaavia diffusa* Linn. in order ensure the drug's authenticity, quality and purity as well as its potential for therapeutic use.

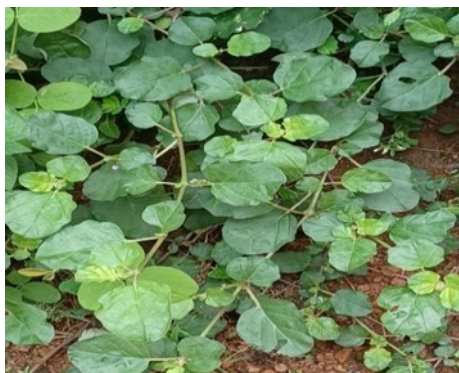
Materials and Methods

Collection of drug

The study drug *Punarnava* (*Boerhaavia diffusa* Linn.) was collected from its natural habitat of Moonnilavu village, Kottayam district. In the month of May and June, the entire plant along with its roots were dug out and the roots were then separated and cleaned.

Preparation of *choorna* (powder) of root

The roots were collected from a clean place and the mud particles removed properly. Then it was washed and dried under sunlight. The properly dried pieces of roots were chopped and then made into powder form. Mesh size 120 were used for sieving of the root powder. This fine powder was used for phytochemical evaluation.



Picture No. 1 *Boerhaavia diffusa* Linn.



Picture No.2 Fresh root of *Boerhaavia diffusa* Linn.



Picture No. 3 Dried root powder of *Boerhaavia diffusa* Linn.

Apparatus used

Bunsen burner, heating mantle, Clevenger's apparatus, petri dishes, Dean and stark's apparatus, water condensers, Soxhlet apparatus, measuring jars, round bottom flask, shaker, muffle furnace, pipettes, glass beakers, centrifuge, silica crucible, burettes, watch glass, hot air oven, glass rods, conical flask, standard flask, funnel.

Reagents used

Sodium hydroxide solution, xylene, lead acetate solution, concentrated nitric acid, dilute nitric acid, KMnO₄ solution, concentrated sulphuric acid, dilute sulphuric acid, anhydrous sodium carbonate, concentrated hydrochloric acid, dilute hydrochloric acid, petroleum ether, cyclohexane, acetone, alcohol, chloroform, fehling's solution a, fehling's solution b mayer's reagent, dragendroff's reagent, magnesium ribbon, methylene blue reagent, neutral ferric chloride, sodium bicarbonate, catechol, folin catechu phenol reagent.

Procedure

Physicochemical parameters

Determination of foreign matter, total ash, acid insoluble ash, water insoluble ash, moisture content, volatile oil content, estimation of tannin, sugar and pH were conducted in physico chemical evaluation.

Ash analysis

Results showed the presence of the basic radical potassium and the acid radicals carbonate, phosphate, chloride and sulphate were confirmed through qualitative analysis of the ash.

Extractive values

The cold alcohol soluble value, hot alcohol soluble value, cold water-soluble value and hot water-soluble values of the root *Boerhaavia diffusa* Linn. were analyzed. To analyze the successive solvent extraction of the root powder petroleum ether, cyclohexane, acetone and alcohol were used.

Phytochemical parameters

To determine whether phytochemical elements alkaloids, flavonoids, phenols, saponins, carbohydrates, proteins, steroids, and tannins were present or absent, a preliminary screening of phytochemicals was conducted. Petroleum ether, cyclohexane, acetone, and alcohol extracts were qualitatively analysed to determine whether steroids, alkaloids, flavonoids, and phenols were present.

Results

Physicochemical parameters

The values obtained by evaluation of twelve physicochemical parameters were tabulated below.

Table No. 1 Physicochemical parameters - *Boerhaavia diffusa* Linn. root powder

SL.NO.	Parameters	
1	Foreign matter	Nil
2	Total ash	8.45%
3	Acid Insoluble Ash	2.27%
4	Water Insoluble Ash	4.60%
5	Volatile oil	Nil
6	Moisture Content	5%
7	Fibre	23.42%
8	Tannin Content	25.25%
9	Total sugar	Nil
10	Reducing sugar	Nil
11	Phenol	0.44%
12	pH	6.49

Qualitative evaluation of ash

Chloride was found to be absent and the results were tabulated below.

Table No. 2 Qualitative analysis of ash - *Boerhaavia diffusa* Linn. root powder

SL.NO.	Experiment	<i>Boerhaavia diffusa</i> Linn. root powder
1	Carbonate	+
2	Phosphate	+
3	Chloride	-
4	Sulphate	+
5	Potassium	+

Water soluble and alcohol soluble extractive value

The values obtained are tabulated below.

Table No.3 Water soluble and alcohol soluble extractive value - *Boerhaavia diffusa* Linn. root powder

Sl.No	Type of Extractives	<i>Boerhaavia diffusa</i> Linn. root powder
1	Cold water soluble	4.10%
2	Hot water soluble	5.27%
3	Cold alcohol soluble	0.20%
4	Hot alcohol soluble	15.9%

Table No.4 Extractive values (in different solvents) - *Boerhaavia diffusa* Linn. root powder

SL.NO.	Solvents	<i>Boerhaavia diffusa</i> Linn. root powder
1	Petroleum ether	0.08%
2	Cyclohexane	0.18%
3	Acetone	1.75%
4	Alcohol	0.90%

Table No. 5 Qualitative phytochemical analysis - *Boerhaavia diffusa* Linn. root powder

SL.NO	Experiment	<i>Boerhaavia diffusa</i> Linn. root powder
1	Alkaloids Dragendroff's test	+
	Meyer's test	+
2	Flavonoids	+
	Saponins	+
4	Carbohydrates Fehling's test	+
	Benedict's test	+
	Proteins	+
6	Phenols Ferric chloride test	+
	Lead acetate test	+
	Steroids	+
8	Tannins Ferric chloride test	+
	Lead acetate test	+

Table No. 6 Qualitative phytochemical evaluation of cold water extract - *Boerhaavia diffusa* Linn. root powder

Experiment	Cold water extract
Alkaloids Dragendroff's test	+
Meyers test	+
Flavonoids	+
Phenols Ferric chloride test	+
Lead acetate test	+
Steroids	+

Table No. 7 Qualitative phytochemical evaluation of solvent extracts - *Boerhaavia diffusa* Linn. root powder

Experiment	Extracts			
	Petroleum ether	Cyclohexane	Acetone	Alcohol
Alkaloids				
Dragendorff's test	-	-	+	+
Meyer's test	-	-	+	+
Flavonoids	-	+	+	+
Phenols				
Ferric chloride test	-	+	+	+
Lead acetate test	-	+	+	+
Steroids	-	-	+	+

DISCUSSION

The quality and purity of the *Boerhaavia diffusa* Linn. root powder was evaluated by the findings from the present study. Foreign matter was found to be absent in the dried root powder of *Boerhaavia diffusa* Linn. The ash value of drug was analysed through three different methods. The total ash value and acid insoluble ash value of *Boerhaavia diffusa* Linn. was found to be 8.45% and 2.27% respectively which is comparable with or much lesser to value found in Ayurvedic pharmacopoeia of India. This, ascertains the purity of the drug. In addition to this, the water insoluble ash value of the root powder was conducted in the present study and was found to be 4.60%. The value thus obtained can be used for future reference. In the present study the moisture content was found to be 5% which was comparable with or much lesser to the previous research work. Volatile oil, total sugar and reducing sugar were found to be absent in the root powder of *Boerhaavia diffusa* Linn. The fibre content found to be 23.42% which was higher when compared with previous research work. The difference in the value may be due to the difference in the maturity and collecting season of root of *Boerhaavia diffusa* Linn. Tannin and phenol were also analysed in the present study and found to be 25.26% and 0.44% respectively. The difference in the value when compared with previous research work may be because of the difference in the maturity and collection time of the root. Estimation of pH of powder of dried root of *Boerhaavia diffusa* Linn. was done in the current study. Powder of dried root turned blue litmus paper red thereby confirming its acidic nature. Root powder showed a pH of 6.49 and is comparable with the value obtained in the previous research work.

The evaluation of quality, purity, and detection of drug adulteration by exhausted substances are aided by extractive values in various solvents. In the present study, the cold-water soluble extractive and cold alcohol soluble extractive of the root powder were analysed. The results obtained were 4.10% for cold water soluble extractive and 1.20% for cold alcohol soluble extractive and which are

comparable with the previous study. In addition to these, the hot water-soluble extractive value and hot alcohol soluble extractive value were analysed and the values were obtained as 5.27% and 15.9% respectively. The value thus obtained can be used as references for future studies. The powdered root of *Boerhaavia diffusa* Linn. had higher alcohol-soluble extractive values than water-soluble extractive values. In the present study, petroleum ether extract, cyclohexane extract, acetone extract and alcohol extract were used for the successive solvent extraction of root powder.

Extractive values of *Boerhaavia diffusa* Linn. root powder were 0.08 % in petroleum ether, 0.18% in cyclohexane, 1.75% in acetone and 0.90% in alcohol. Petroleum ether and alcohol extraction are comparable with the previous research work. In addition to this cyclohexane and alcohol extractions were also done. In present study alcoholic extract of powdered drug was used to determine the presence of alkaloids, flavonoids, phenols. Aqueous extract was used to evaluate whether saponins, carbohydrates, proteins and tannins were present or not. Chloroform extract was used to analyse steroid. Qualitative analysis of powdered drug showed the presence of alkaloids, flavonoids, saponins, carbohydrates, proteins, phenols, steroids and tannins which is found comparable with the research work of Deepti Malhotra et al. In addition to previous research work qualitative analysis of cold water extractive were also done. It revealed the presence of alkaloids, flavonoids, phenols and steroids. Results thus obtained can be used as reference for future studies. The qualitative evaluation of successive solvent extractives was analysed in the present study and was done using solvents such as petroleum ether, cyclohexane, acetone and alcohol. Result revealed that phenols were present all the four extracts of *Boerhaavia diffusa* Linn. Flavonoids were found in the three extracts like acetone, cyclohexane and alcoholic extract while steroids and alkaloids were identified in the petroleum ether, acetone and alcoholic extract and which are found comparable with the previous research work.

Conclusion

The therapeutic potential of the drug *Punarnava* (*Boerhaavia diffusa* Linn.) is based on various phytoconstituents such as tannin, phenols, alkaloids, flavonoids, proteins, steroids etc. Physico chemical characteristics such as foreign matter, total ash, acid- and water-insoluble ash, moisture content, volatile oil content, estimation of fibre, tannin, sugar, and phenol content, as well as pH, were assessed and compared with the available references. Foreign matter, ash values, value of moisture content and volatile oil content were comparable with

Ayurvedic Pharmacopoeia of India and previous research works. Aside from the results of previous research, water insoluble ash value, hot water-soluble extractive value, hot alcohol soluble extractive values and qualitative analysis of ash were conducted. Successive solvent extraction was done in four solvents petroleum ether, cyclohexane, acetone and alcohol. Each of these findings helps to ensure genuinity of the study drug *Boerhaavia diffusa* Linn.

Conflict of Interest: Nil

References

1. Kapiladeva Dwivedi. *Vedom mem Ayurveda*. Bhadohi: Viswabharati anusandhan parishad; 2009. *Chikitsa sthana*. chapter 12. vividha oushadhiyam; p.257.
2. Priya Vrat Sharma. *Namarupajnanam, Characterization of medicinal plants based on etymological derivation of names and synonyms*. Varanasi: Satyapriya prakashan; 2000. p.131.
3. Mahendra Bhogika. *Dhanwantari Nighantu*. Dr. Amritpal Singh (1st ed.). Delhi: Chaukambha Orientalia; 2008. p.73-74.
4. Kaiyyadeva. Translated by Sharma P V Sharma and G P Sharma. *Kaiyyadeva Nighantu*. Varanasi: Chaukambha Orientalia; 2013. sloka 752-754. p.139.
5. Bhavamisra. *Bhavaprakasha Nighantu*. Dr K C Chunekar, G S Pandey (ed.). Varanasi: Chaukambha Bharati Academy; Reprint 2010. sloka 232-233. p. 406-408.
6. Nayak P, Thirunavoukkrasu M. A review of the plant *Boerhaavia diffusa*: its chemistry, pharmacology and therapeutical potential. *J. Phytopharmacol*. 2016;5(2):83-92.
7. Neeraj Tandon. Quality Standards Of Indian Medicinal Plants. Vol 9. New Delhi: *Medicinal plants unit Indian council of medical research*; 2011. p. 59-71.
8. Ministry of Health and Family welfare. Ayurveda Pharmacopoeia of India. 1st edition. Government of India, Part 1. Vol 1. p.126-128.
9. Gupta A K, K Kaur, Nawazish Alam, Sayeed Ahmad. Comparative Standardization of Roots of *Boerhaavia diffusa* Linn. From Two Different Geographical Regions. *Research journal of pharmacy and technology*. 2012; 5(1):114-118.
10. Mohammad Khalid, H H Sidhiqui, Sheeba Freed. Pharmacognostical evaluation and qualitative analysis of *Boerhaavia diffusa* L. roots. *International journal of pharma and Bio sciences*. vol 3. Issue 1. 2012. ISSN0475-6299.
11. Shanmugapriya A, S maneemegalai. Quantitative phytochemical estimation and GC-MS studies in ethanolic root extracts of *Boerhaavia diffusa* Linn. *International journal of Green and Herbal chemistry*. 2018:010-016
12. Deepti Malhotra et al. Phytochemical screening and antibacterial effect of root extract of *Boerhaavia diffusa* L. (Family Nyctaginaceae), *Journal of Applied and Natural Science*. 75(3): June 2013; Page 221-225.
13. Arvind Kumar Gupta et al. Comparative Standardization of Roots of *Boerhaavia diffusa* Linn. From Two Different Geographical Regions. *Research J. Pharm. and Tech*. 5(1): Jan. 2012; Page 114-118.

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