

## Comparative Studies of *Boerhaavia Diffusa* L. and *Boerhaavia Verticillata* Poir. (Nyctaginaceae)

ARADHANA BAJPAI AND J. K OJHA

Department of Dravyaguna  
Institute of Medical sciences, B.H.U.  
Varanasi – 221 005

Received: 12.2.2000

Accepted: 13.3.2000

**ABSTRACT** : Comparative taxonomical and phytochemical studies of *B. diffusa* and *B. verticillata* are described in this article.

### INTRODUCTION

*Boerhaavia* L. is a genus of some 40 tropical and subtropical species of herbs<sup>(1)</sup>. Two species of the genus, namely *B. Diffusa* and *B. Verticillata* is economically important because both the species have been used since time immemorial as an important about herbal diuretic by Ayurvedic physicians of India<sup>(2-6)</sup>. The problem of accurate identification and dearth of information about numerous medicinal plant species is not well documented and have hampered the optimal utilization of these crude drugs. This is especially the case when dealing with closed related species of same genus. This is also true for genus *boerhaavia* as both white and red flowered *boerhaavia* are taken as *B.diffusa*<sup>(2-7)</sup>. Thus absence of proper identification and adulteration of the plant species may change desirable therapeutic responses and sometimes may not be suitable in a given clinical situation.

*B. Diffusa* and *B. verticillata*, commonly known as 'Punarnava' are perennial weed of family Nyctaginaceae. Phytochemistry of Punarnava was first time reported by Ghosal<sup>(7)</sup>, after that Chopra<sup>(8)</sup>, Agrawal<sup>(9)</sup> and Surange et al<sup>(10)</sup> reported large quantities of potassium salt and an alkaloid called

punarnavine. The roots of this herb have been used in ancient Ayurvedic medicine as diuretic and in renal disorders since centuries<sup>(11)</sup>. Ayurvedic physicians still use this herb in a variety of renal disorders and the Indian pharmacopoeia describes it as a diuretic<sup>(12)</sup>. Singh and Upadhyay<sup>(13)</sup>, Singh<sup>(14)</sup> and Bajpai<sup>(15)</sup> have conducted clinical trials of the drug using modern parameters of assessment and found it to be useful in renal and urinary tract diseases. The root (crude) of this plant is highly effective in cases of chronic pyelonephritis and urinary tract infections (U.T.I) in animals and man<sup>(16)</sup>. Singh et al<sup>(17)</sup> showed significant teratogenic potential in *B. diffusa*.

These highly reputed therapeutic claims of the drug drew our attention to explore comparative taxonomical as well as phytochemical details of *B. diffusa* and *B. verticillata*.

### MATERIALS AND METHODS

Plants of *B. diffusa* and *B. verticillata* were collected from department of Dravyaguna, Banaras Hindu University campus, Varanasi. Department of Dravyaguna, Banaras Hindu University campus,

Varanasi. Department of Dravyaguna helped in identifying both the plants and uses. Conformation of vernacular names of medicinal plants was done by showing live plant specimens to various herbalists. Voucher specimens were prepared and identified with the help of floras<sup>(18-21)</sup> and also by comparing them with identified specimens deposited in the Herbarium, department of Dravyaguna (HDG). Voucher specimens were deposited there along with author's field notes and number under the name of HDG.

In the preliminary phytochemical screening as values, extractive values and solubility were determined as per Indian pharmacopoeia<sup>(22)</sup>. Further extracts of both the plants were analysed for the presence or absence of various chemical constituents.

## RESULTS AND DISCUSSION

### Taxonomical studies:

*Boerhaavia* L. is a genus of some 40 tropical and subtropical species of herbs<sup>(18)</sup> of which *B. Diffusa* (Rakta Punarnava) and *B. verticillata* (swet punarnava) are reputed for its medicinal uses.

*Boerhaavia diffusa* L. (Family: Nyctaginaceae)

**Syn:** *B. repens*

**Habit:** A diffuse herbaceous perennial<sup>(19)</sup>.

**Root:** Large, fusiform.

**Stem:** Prostrate or ascending, reaching 2-3 feet long, divaricately branched, slender cylindrical, thickened at nodes, minutely pubescent or nearly glabrous often purplish.

**Leaves:** Arranged in unequal pairs at each node, 1/2-11/1 in long, ovate, oblong or suborbicular, green and glabrous above, white beneath, base rounded or subcordate,

margins subundulate, often pink petioles about as long as blade.

**Flowers:** Minute, subcapitate, 4-10 together in small bracteolate umbels forming slender, long –stalked, axillaries and terminal panicles; bracteoles lanceolate, acute. Perianth 1/8in long; tube glandular, hairy; limb funnel shaped, dark pink with 5 narrow vertical banks outside.

**Stamens:** 2-3, slightly exerted.

**Fruit:** 1/8 in long, clavate 5-ribbed, furnished with large glands along the ribs.

Distribution: Throughout India, Sri Lanka, Tropical and subtropical Asia Africa and America<sup>(20)</sup>.

*Boerhaavia verticillata* Poir (Family: Nyctaginaceae)

**Syns:** *B. stellata* Wight; *B. scandens* Grah.

**Habit:** A decumbent herbaceous perennial<sup>(19)</sup>.

**Root:** Elongate, stout, branched, tap root system.

**Stem:** Prostrate long, pale, terete glabrous<sup>(21)</sup>, divaricately branched, slender.

**Leaves:** At each node in unequal pairs opposite, thick, nearly as broad as long, ovate, obtuse, mucronate, glabrous white sinuate, margins base cordate, 1/2 in-13/4 in long, distinctly petioled, 1/2-3/4 in long slender.

**Flowers:** In long peduncled racemes, arranged in distant few flowered whorls on a slender rachis, pedicels long and slender, bracteoles small, ovate oblong acute deciduous Perianth 1/3 in long gamotepalous white, ovarial part of the tube 1/2 in long, constricted above the ovule,

petaloid portion funnel-shaped, lobes of the limb 2-fid.

**Stemens:** 3. slightly exserted.

**Fruit:** 1/8 in long 5-ribbed, clavate, furnished with large semi-globose glands round the crown.

**Distribution:** India (Punjab, Hissar, Rohtak), Sind and in drier parts of the

western peninsula, also in Afghanistan and Baluchistan, extending westwards to Syria and tropical Africa<sup>(19)</sup>.

Phytochemical studies: Preliminary phytochemical screening indicated that extractive value was maximum in methanol minimum in benzene for both the species. Also values were high for *B. verticillata* (Table -1)

**Table 1- Percentage Extractive Value**

Solvent	Extractive Value <i>B. diffusa</i>	<i>B. verticillata</i>
Benzene	0.85 ± 0.02	0.87 ± 0.04
Chloroform	0.90 ± 0.05	0.93 ± 0.07
Methanol	8.98 ± 0.69	9.60 ± 0.85

**Table 2- Percentage Ash Value**

Ash Value	<i>B. diffusa</i>	<i>B. verticillata</i>
Total Ash	11.04 ± 0.63	10.20 ± 0.42
Acid Insoluble Ash	3.12 ± 0.18	2.01 ± 0.08

**Table 3- Percentage of Solubility**

Solubility	<i>B. diffusa</i>	<i>B. verticillata</i>
Water	5.22 ± 0.69	5.61 ± 0.62
Alcohol	5.35 ± 0.60	5.20 ± 0.58

± = Standard error

Phytochemistry revealed that as content was more in *B. diffusa* when compared with *B. verticillata* (Table-2) Table -3 depicts that solubility in water is higher in *B. verticillata*, but solubility in alcohol is more in case of *B. diffusa*.

Analysis of Phytochemical constituents:

The powdered plant material was subjected to continuous hot extraction in a Soxhlet apparatus and the extracts so obtained were subjected to preliminary phytochemical screening<sup>(22, 24)</sup>. The presence of various phytoconstituents were detected.

The results obtained are compiled in Table-4

**Table 4- Phytochemical constituents of *B. diffusa* and *B. verticillata***

Phytochemical	Benzene E		Chloroform E		Methanol E	
	B.D	B.V.	B.D	B.V.	B.D	B.V.
Constituents						
Alkaloids	-	-	-	-	++	++
Sterols	+	++	+	++	-	-
Phenols	-	-	-	-	+	+
Glycosides	-	-	-	-	++	+
Reducing sugars	-	-	-	-	++	+
Amino acids	-	-	-	-	+	+
Flavonoids	-	-	-	-	+	+

Key: E=Extract; B.D =*B diffusa* ;

B.V + *B. verticillata*; += Present; -= Absent

#### Quantitative Estimation of Phytoconstituents

The preliminary phytochemical screening indicated the presence of alkaloids, sterols, glycosides, phenols, etc. These phytoconstituents were estimated using various methods (23,25). The results obtained were as follows.

**Table -5- Quantitative estimation of Phytoconstituents (%w/w)**

Phytoconstituents	<i>B. diffusa</i>	<i>B. verticillata</i>
Alkaloids	2.74	3.11
Fibre	3.51	3.23
Total reducing sugars	6.04	5.26
Glycosides	7.42	5.80

## CONCLUSION

*B.diffusa* and *B. verticillata* are perennial weed with thick roots that grow in deserted land and can be cultivated in gardens. The root of these herbs have been used in ancient Ayurvedic medicine as diuretic since centuries. Taxonomical characters revealed the two different species of *Boerhaavia*. A survey of literature reveals tat the active

principle of punarnava' is an alkaloid *B. verticillata* is also rich in alkaloid content. All the parameters that have been considered in this study could be used of rte authentication of the crude drugs.

## ACKNOWLEDGEMENTS

The authors are thankful to the head,  
Department of Dravyaguna, for providing

laboratory facilities for carrying out the  
present work

#### **REFERENCES:**

1. Heywood, A (1978). Flowering plants of the world, Oxford.
2. Chopra, R.N., Chopra, I.C., Handa, L.K.L. and Kapur, L.D. (1948). Chopras Indigenous Drugs of India, II<sup>nd</sup> Edition, U.N. Dhar and D sons Pvt Ltd., Calcutta.
3. Aiyer, K.N. and Kolammal, M. (1964). Pharmacognosy of Ayurvedic Drugs. Series 1-8, Published by Department of Pharmacognosy, Univ of Kerala Trivandrum.
4. Srivastava, A.K. (1966) Ph.D. Thesis. Banaras Hindu University, Varanasi, India
5. Singh, R.H. and Udupa, K.N. (1972). J. Res Ind Med 7(3), 17-27.
6. Singh, A.N. (1986) Ph.D. Thesis. Banaras Hindu University, Varanasi, India
7. Ghosal, I.M. (1910). Quoted by Chopra R.N., et al (1923) 58, 203-208.
8. Chopra, R.N., Ghosh, and Ghosh B.N. (1923). Ind Med Gaz 58, 203-208.
9. Agarwal R., R. and Dutt, S (1934). Proc Acad. Sci 4,73-76.
10. Surange, S.R. and Pends, G.S. (1972).J. Res Ind Med 7(1); 1-7.
11. Charak (1949). Charak samhita chikitsa sthanam. The section of therapeutics compiled and published by Ayurvedic society of India, Jamnagar 3, 1600-1607.
12. Nadkarni, A.K. (1954). Indian Materia medica, Vol .I. Popular Book Depot, Bombay.
13. Singh, R.H. and Udupa, K.N. (1972). J. Res Ind Med 7(3), 28-33.
14. Singh, A.N. (1989) Ph.D. Thesis. Banaras Hindu University, Varanasi, India
15. Bajpai, A. (1993). Ph.D. Thesis. Banaras Hindu University, Varanasi, India
16. Singh, A., Singh R.H. Singh R.G., Vrat, S., Singh N. (1987), Indian Drugs 26 (1); 1-4.
17. Singh, A., Singh R.H. Singh R.G., Mishra, N., Singh N. (1991), Planta Medica 57, 315-316.
18. Cooke, T. (1958). The flora of the presidency of Bombay, Vol. II, Botanical survey of India, Calcutta

19. Duthie, J.F. (1960)). Flora of the presidency of Bombay, Vol II, Botanical survey of India, Calcutta.
20. Hooker, J.D. (1973). Flora of British Indian. Vol IV Botanical survey of India, Calcutta.
21. Nair, N.C. (1978). Flora of the Punjab plains, records of botanical survey of India, Vol XXI No.1 Indian Botanic garden Howrah.
22. The Pharmacopoeia of India (1985), Govt. Of India, Delhi 3<sup>rd</sup> edi., II A – 74.
23. Brain, K.R. and Turner, T.D. (1975). Practical Evaluation of Phytopharmaceuticals. Wright-Scientifica.
24. Kokate, C.K. (1986), Practical Pharmacognosy, Vallabh Prakashan, Delhi, Ist Ed.
25. Trease, G.E. and Evans, W.C. (1983), Pharmacognosy, ELBS and Bailiere Tindall, 12<sup>th</sup> Ed.