



## AN ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS USED FOR THE TREATMENT OF DIABETES IN BUNDELKHAND REGION OF INDIA

R.B. YADAV<sup>1</sup>, AJAY KUMAR<sup>2</sup>, S.K. VERMA<sup>3</sup> AND LAL JI SINGH<sup>4</sup>

<sup>1</sup>Associate Professor and Head, Department of Botany, Janta Mahavidyalaya, Ajitmal, Auraiya.

<sup>2</sup>Associate Professor, Department of Genetics and Plant Breeding, Janta Mahavidyalaya, Ajitmal, Auraiya.

<sup>3</sup>Associate Professor, Department of Botany, Janta Mahavidyalaya, Ajitmal, Auraiya.

<sup>4</sup>Scientist 'E' & Head of Office Botanical Survey of India, Andaman Nicobar Regional Centre, Port Blair.

**Abstract:** Present survey was undertaken with objective to find out the ethnomedicinal plants with antidiabetic potential in the Bundelkhand region of Uttar Pradesh. The result revealed that 48 species belong to 41 genera and 26 families, used for the treatment of diabetes mellitus. The excessive exploitation and anthropogenic pressure cause rapid decrease in these medicinal plants. Some species like *Gymnema sylvestre*, *Barleria prionitis*, *Pterocarpus marsupium*, and *Terminalia chebula* fall in critically endangered category in this region.

**Key words:** Ethnomedicinal plant, Diabetes, Bundelkhand, Uttar Pradesh, India.

### INTRODUCTION

Bundelkhand is a historic region of central India. This region is known for land of warrior, sacrifice and love. It is spread in the territory of Uttar Pradesh and Madhya Pradesh state. It includes seven districts of Uttar Pradesh and six district of Madhya Pradesh. Seven districts of Uttar Pradesh are Jhansi, Lalitpur, Jalaun, Hamirpur, Mahoba, Banda and Chitrakoot located in southern part of the state. The topography of Bundelkhand includes fertile plains around rivers, ravines as well as significant stretches of plateau and hilly land. Soil of this region falls in two categories *viz.* red sandy soil and black soil with high clay content. The climate change and monsoon failure have repeatedly caused drought. The region being rainfed area, dryland farming and low productivity are the characteristic of this region. The livelihood of the peoples significantly depends on the agriculture. Annual rainfall in some districts is 663 mm or even less. Heavy soil erosion leads to large scale formation of ravines along the river Yamuna and Chambal. Whole of the Bundelkhand region is situated in encatchment area of the river Yamuna and its tributaries *viz.* Chambal, Betwa, Dhasan, Ken, Mandakini, Sindh and Pahuj rivers. The area adjoining the Madhya Pradesh state is inhabitat by tribal community like Gond, Kol, Sahariya etc.

Diabetes mellitus is a major public health problem not only in India but at worldwide (WHO 2021). The World Health Organization (WHO) projects that diabetes will be the seventh leading cause of death in 2030 (Mathers and Loncar 2006). The value of ethno-botanical information is now

progressively more accredited. The accounts on the Indian plants having antidiabetic properties have been recorded by various workers (Jain 1973, 1989, 1991, Grover *et al.* 2002, Saxena and Vikram 2004, Chhetri *et al.* 2005, Mukherjee *et al.* 2006, Jeyachandran and Mahesh 2007, Modak *et al.* 2007, Wadker and Makdem 2008, Ayodhya *et al.* 2010, Chauhan *et al.* 2010, Khan and Yadava 2010, Malaviya *et al.* 2010, Meghani *et al.* 2010, Singh 2011, Umashanker and Srivastava 2011, Murthy *et al.* 2012, Saravanamuttu and Sudarsanam 2012, Gulsan and Rao 2013, Mukesh and Namita 2013, Rizvi and Mishra 2013, Maina *et al.* 2015, Mishra *et al.* 2016). A review of the available literature reveals that no detail studies have been carried out so far on the knowledge of the medicinal plants used for the Treatment of Diabetes in Bundelkhand Region of India. Although, vegetation of various part of Uttar Pradesh presented by various workers (Srivastava *et al.* 1987, Ranjan, 1996, Sinha and Dixit, 2000, Narain and Singh, 2008, Verma *et al.* 2008, Chaturvedi 2012, Ansari and Tiwari, 2014, Yadav and Singh 2011, Yadav *et al.* 2014, 2015, 2016, 2021a, b, Mishra *et al.* 2021, Singh and Ranjan 2021). The present study records ethno-medicinal plants used in Bundelkhand Region of India in great details which can be effectively used in the treatment of diabetes. Conservation of this traditional knowledge will open pathways for new drug discoveries.

## MATERIALS AND METHODS

Survey was carried out in various villages of all the seven districts of Bundelkhand region during 2019 to 2021. Every year field visit was done in different seasons of the year. In the duration of field trips information was gathered by having personal interaction with elderly peoples of the villages, Bhagat, Ojhas, Vaidyas and herbal practicers. Many of them did not co-operate and bluntly refused to give information, but some of them told the local names of the plant being used for the treatment of diabetes. These local names of the plant varied by collecting samples from the locality. These collected plant specimens was identified with the help of available taxonomic literature (Duthie 1994, eFloras 2008, The Plant List 2013, JSTOR 2020, GIBF 2020 and Herbarium catalogue 2021). The questionnaire was also prepared to collect data such as local name of the plant used, which part of the plant used, used for which disease, mode of administration, side effects if any etc. Recorded ethnomedicinal data of this region also compared with data available from other part of the state as well as country.

### Questionnaire

The questionnaire was composed of 15 questions, which were divided into three distinct parts *viz.*

(i) Patient: Age; Gender; Educational level.

(ii) Disease: Type of Diabetes; Date of diagnosis.

(iii) Plant(s) used: vernacular name; parts used; amount or dose used; mode of preparation; mode of administration; duration of treatment; who recommended or prescribed the plant; selling location; medicinal plant effectiveness; possible adverse effects (AEs) observed.

In the questionnaire, treatment by medicinal plants for diabetic symptoms like frequent urination, leg sores, neuropathy etc. in patients was not included. The study related to the disease itself, not to its complications. So, it sought to obtain information on medicinal plants that are used for treating diabetes.

### Study integrity

Participation in the survey was voluntary. Each patient who was willing to participate in the study received oral information about the research and its publication for scientific purposes. Patients could at any time withdraw from the interview. Patients received no incentives or payment, and all cooperated voluntarily. For illiterate patients, the questionnaire was completed by the interviewer who reported what the patient told him orally.

### Data analysis

The data reported on the questionnaire were entered and listed on a Microsoft Excel database and analyzed to determine the proportions of different variables such as gender and age, plant parts used, and preparation methods. These results were analyzed descriptively and comparatively.

### Literature data

The use of plants from this survey was compared with other surveys of plants used traditionally in treating diabetes in Morocco and in other parts of the world. This was not done exhaustively. A single reference was enough to determine that a plant was already used for diabetes.

**OBSERVATIONS**

Ethnomedicinal plants are arranged alphabetically with their botanical name and family followed by vernacular name and plant part being used for the treatment of diabetes and mode of administration are given in Table1.

**Table 1: List of Ethnomedicinal plants being used for the treatment of diabetes**

S.No.	Botanical Name	Name's of family	Vernacular Names	Plants part used	Mode of administration
1	<i>Abelmoschus esculentus</i> (L.) Moench.	Malvaceae	Bhindi	Fruits	Chopped fruits soaked in water over night and aqueous extract taken in morning
2	<i>Abrus precatorius</i> L.	Fabaceae	Ratti, Gunja, Gumchi	Leaves, seeds	Leaves chewed with betel. Uncoated water-soaked seeds, boiled in milk, rinsed with water, dried and powdered.
3	<i>Achyranthes aspera</i> L.	Amaranthaceae	Chirchita	Whole plant	Powder and decoction
4	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	Bel	Leaves, fruits	Aqueous extract and powder
5	<i>Allium sativum</i> L.	Amaryllidaceae	Lashun	Cloves	Cloves taken with water
6	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Bark, leaves	Aqueous extract
7	<i>Albizia lebbek</i> (L.) Benth.	Fabaceae	Siris	Bark	Powder
8	<i>Aloe vera</i> (L.) Burm. F.	Asphodelaceae	Gwarpatha, Gheekwar	Leaves	Pulp
9	<i>Annona squamosa</i> L.	Annonaceae	Sitaphal	Leaves	Decoction of fresh leaves
10	<i>Asparagus racemosus</i> Willd.	Asperagaceae	Satavari	Root	One teaspoon of powdered root administered orally
11	<i>Barleria prionitis</i> L.	Acanthaceae	Bajradanti, Katsareya	Whole plant	Decoctions and Powder
12	<i>Bauhinia variegata</i> (L.) Benth.	Fabaceae	Kachnar	Bark, Flower	Powder and decoction
13	<i>Boerhaavia diffusa</i> L.	Nyctaginaceae	Punarnava	Whole plant	Aqueous extract
14	<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	Sadabahar	Leaves, flower	Aqueous extract and fresh leaves are chewed daily in morning in empty stomach
15	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Kundru	Fruits	Tender and ripe fruits eaten raw and as vegetable
16	<i>Citrullus colocynthis</i> (L.) Schrad	Cucurbitaceae	Indrayan	Fruits	Powder and decoction
17	<i>Datura metel</i> L.	Solanaceae	Datura	Roots	One teaspoon of powdered dried roots are taken with milk at night
18	<i>Dioscorea alata</i> L.	Dioscoreaceae	Ratalu	Tuber	Boiled slices consumed as vegetable

19	<i>Eugenia jambolona</i> (L.) Skeels	Myrtaceae	Jamuni	Leaves, fruits, seeds	Aqueous extract and seed powder
20	<i>Ficus benghalensis</i> L.	Moraceae	Bargad	Aerial roots	Tips of fresh prop roots chewed in morning empty stomach with water
21	<i>Ficus hispida</i> L.f.	Moraceae	Fig	Fruit	Boiled figs are consumed.
22	<i>Ficus religiosa</i> (L.)	Moraceae	Pipal	Bark, leaves	Decoction
23	<i>Ficus racemosa</i> L.	Moraceae	Gular, Umar	Fruit	Cooked young figs taken as vegetable and ripe ones consumed directly
24	<i>Gymnema sylvestre</i> R. Br.	Apocynaceae	Gurmar	Whole plant	Aqueous extract
25	<i>Mangifera indica</i> L.	Anacardiaceae	Aam	Bark, leaves, seeds	Power and decoction
26	<i>Memordica charantia</i> L.	Cucurbitaceae	Karela	Fruits	Aqueous extract
27	<i>Mimosa pudica</i> L.	Mimosoideae	Chhui-mui	Seeds	One teaspoon of powdered seeds taken with milk/ water twice a day
28	<i>Macuna pruriens</i> (L.) DC	Fabaceae	Kewanch	Seeds	Powder
29	<i>Moringa oleifera</i> Lam.	Moringaceae	Shahjan	Leaves, Pods	Aqueous extract and pickles
30	<i>Morus alba</i> L.	Moraceae	Shahtoot	Leaves, fruits	Aqueous extract of leaf and serbet of fruits
31	<i>Muraya Koeingii</i> (L.) Spreng.	Rutaceae	Curry Patta	Leaves	Aqueous extract
32	<i>Nyctanthus arbortritis</i> L.	Oleaceae	Harsingar, Parijat	Leaves	Aqueous extract
33	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Tulsi	Leaves	Aqueous extract and decoction
34	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Amla	Fruits, leaves	Teaspoon of fruit powder taken twice a day
35	<i>Phyllanthus niruri</i> L.	Phyllanthaceae	Bhoomi Aonla	Whole plant	Aqueous extract
36	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	Karanj, Aichum;	Tender stem, bark	Half cup decoction taken orally in morning
37	<i>Pterocarpus marsupium</i> Roxburgh	Fabaceae	Bijasal	Bark, leaf, flower	Decoction
38	<i>Senegalia pennata</i> (L.) Maslin ssp. <i>insuavis</i> (Lace) Maslin	Mimosoideae	Babul	Pods	A teaspoon of powder of dried tender pods taken in the morning.
39	<i>Tamrindus indica</i> L.	Fabaceae	Imli	Bark	Decoction
40	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Kahua, Arjun	Bark	Decoction

41	<i>Terminalia chebula</i> Retz.	Combre-taceae	Bahera	Bark, fruit	Decoction and powder
42	<i>Tinospora cordifolia</i> (Thunb.) Miers	Menispermaceae	Gurich	Stem	Half cup decoction taken in the morning
43	<i>Trichosanthes tricuspidata</i> Lour.	Cucurbitaceae	Urubethe	Whole plant	Taken as vegetable
44	<i>Trigonella foenum-graceum</i> L.	Fabaceae	Methi	Leaves, seeds	Vegetable and power
45	<i>Vachellia nilotica</i> (L.) P.J.H, Hurter ssp. <i>indica</i> (Benth.) Kyal. & Boatwr.	Mimosoideae	Kikar, Babul	Bark, tender Pods	Decoction taken in morning; a teaspoon of powdered tender pods taken twice a day
46	<i>Psidium guajava</i> L.	Myrtaceae	Amrood	Leaves, fruits	Aqueous extract
47	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn.	Rhamnaceae	Barari, Jharbera	Root	Half cup decoction taken in morning empty stomach
48	<i>Ziziphus oenoplia</i> (L.) Mill. var. <i>oenoplia</i>	Rhamnaceae	Makoi	Fruits	Ripe fruits are consumed

## RESULTS AND DISCUSSION

In the present observation 48 plant species being used by inhabitants of seven districts, Jhansi, Lalitpur, Jalaun, Hamirpur, Mahoba, Banda and Chitrakoot of Bundelkhand region of Uttar Pradesh, for the treatment of diabetes mellitus (Table1). The plant parts are being used for lowering the blood sugar level are stem, leaves, bark, flower, fruits, seeds, gums, pulp and even whole plant in some cases. The decoction, powder and aqueous extract, along with adjuvant like lukewarm water and milk are the main mode of oral drug administration.

Hypoglycemic property of plants due to presence of various phytochemical like, alkaloids, carotenoids, terpenoids, flavonoids and tannins. These phytochemicals enhance the physiological activity of pancreas, which is responsible for production, and secretion of insulin hormone.

## CONCLUSION

A total of 48 plant species have been recorded that are being used for the treatment of diabetes. These 48 species belong to 41 genera and 26 families. The family Fabaceae includes 8 genus, Cucurbitaceae 4 genus, Mimosoideae 3 genus while families Myrtaceae, Moraceae, Rutaceae and Apocynaceae include two genus each. Remaining 19 families with single genera. Due to reckless exploitation of herbal drugs, to obtain stem bark, leaves, flowers and fruits, roots, seeds, pulp and gums, lead to cutting of trees and destruction of life cycle of the plants. This anthropogenic pressure culminates into devastation of herbal flora. The diversity of medicinal plants is being threatened and some plants *viz.* *Gymnema sylvestri*, *Barleria prionitis*, *Pterocarpus marsupium* and *Terminalia chebula* comes under critically endangered category. To sustain the growth of these valuable plant resources, co-operative endeavours should be adopted by the inhabitants of this area for rehabilitation of vanishing plants. This survey would be helpful in the management of diabetes and conservation of medicinal plant wealth in the Bundelkhand region.

## ACKNOWLEDGEMENTS

The authors are grateful to the Director, Botanical Survey of India, Kolkata for constant support. The authors are thankful to the Principal, Janta Mahavidyalaya Ajitmal, Auraiya U.P., India.

## REFERENCE

- [1] Ayodhya, S.; Kusum S. and Anjali S. 2010. Hypoglycaemic activity of different extracts of various herbal plants. *Int. J. Ayurveda Res. Pharm.* 1(1): 212-224.
- [2] Chaturvedi P. 2012. "Antidiabetic Potentials of *Memordica charantia* multiple mechanism behind the effects". *Journal of Medicinal Food*, Vol. 15, No. 2, pp 101-107.
- [3] Chhetri, D.R.; Parajuli P. and Subba G.C. 2005. Antidiabetic plants used by Sikkim and Darjeeling Himalayan tribes. *Indian J. Ethnopharmac.* 99: 199-202.
- [4] Chauhan, A.; Sharma P.K.; Srivastava S.; Kumar N. and Duehe R. 2010. Plants having potential antidiabetic activity: a review. *Der. Pharm. Lett.* 2(3): 369-387.
- [5] Duthie, J.F. 1994. *Flora of Upper Gangetic Plain, adjacent Shivalik and Sub-Himalayan tract. I and II Rep.* 1994. Bishen Singh Mahendra Pal Singh, Dehradun.
- [6] eFloras 2008. Missouri Botanical Garden, st Louis, MO & Harvard University Herbaria, Cambridge, MA. <http://www.efloras.org/>
- [7] GIBF 2020. Backbone Taxonomy. <http://www.gibf.org/species>.
- [8] Grover, J. K.; Yadav S. and Vats V. 2002. Medicinal plants of India with anti-diabetic potential. *J. Ethnopharmac.* 81(1): 81-100.
- [9] Gulsan, M. D. and Rama Rao N. 2013. An Overview on Medicinal Plants with Antidiabetic Potential. *Int. J. Pharm. Sci. Rev. Res.* 23(2): 335-342.
- [10] Jain, S.K. 1973. Medicinal Plants among Adivasis in India. *Bull.Bot.Sur. India* 15 (1&2): 85-91.
- [11] Jain, S.K. 1989. *Methods and Approaches in Ethno-botany* (Society of Ethno-botanist, Lucknow).
- [12] Jain, S.K. 1991. *Dictionary of Indian Medicine and Ethnobotany: Deep Publication, New Delhi.*
- [13] Jeyachandran, R. and Mahesh A. 2007. Enumeration of Antidiabetic Herbal Flora of Tamil Nadu. *Res. J. of Med. Pl.* 1(4): 144-148.
- [14] JSTOR 2020. JSTOR Global Plants. Ithaka. <<http://www.plants.jstor.org/>.
- [15] Khan, H. Md. and Yadava P.S. 2010. Antidiabetic plants used in Thoubal district of Manipur, Northeast India. *Indian J. Tradit. Knowl.* 9(3): 510-514.
- [16] Maina, V.; Ravi Prasad and Chakrabarty T. 2015. Antidiabetic plants used by the tribes and settlers of Andaman & Nicobar Islands, India **Nelumbo** Vol 57, (75-81)
- [17] Malaviya, N.; Jain S. and Malaviya S. 2010. Antidiabetic potential of medicinal plants. *Acta Poloniae Pharmaceutic. Drug Res.* 67(2): 117-118.
- [18] Menghani, Ekta; Pareek A.; Negi R.S. and Ojha C.K. 2010. Antidiabetic Potentials of Various Ethno-Medicinal Plants of Rajasthan. *Ethnobot. Leafl.* 14: 578-583.
- [19] Mathers, C.D., Loncar D. 2006. Projections of global mortality and burden of disease from 2002 to 2030, *PLoS Med.* 3: 442.
- [20] Mishra, S.; Shruti Mishra; Sidharth Tiwari and Misra D.R. 2021. On Some Medicinal Plants Curing Orthopaedics Ailments In: Singh L.J. and V. Ranjan, (eds.), *New Vistas in Indian Flora*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India, 2: 000- 000.
- [21] Mishra Sanjay; Gautam Anuj Ekka; Ranjan Vinay and Singh Lal Ji 2016. Role of DEGCA, BSI Garden in Conservation of Medicinal Plant Diversity of Andaman and Nicobar Islands, India In: Chourasia, H.K. (ed.), *Conservation of Medicinal Plants Conventional and Modern Approaches*. Omega Publications, New Delhi. 95-108
- [22] Modak, M.; Dixit P.; Londhe J.; Ghaskadbi S.; Paul A. and Devasagayam T. 2007. Indian herbs and herbal drugs used for the treatment of diabetes. *J. Clin. Biochem. Nutr.* 40(3): 163-173.
- [23] Mukesh, R. and Namita P. 2013. Medicinal plants with antidiabetic potential – A review. *American-Eurasian J. Agric. & Environ. Sci.* 13(1): 81-94.
- [24] Mukherjee, P. K.; Maiti K.; Mukherjee K. and Houghton P.J. 2006. Leads from Indian medicinal plants with hypoglycemic potentials. *J. Ethnopharmacol.* 106: 1-28.
- [25] Murthy Shankar K. and Kiran B.R. 2012. Medicinal plants used as an antidiabetic drug in pharmaceutical industry and their conservation: an overview. *Int. Res. J. Pharmac.* 3(10): 65-71.
- [26] Narain, S. and Singh, S.M. 2008. Aquatic and Marshy Angiosperms of Sarsainawar wetland of Etawah district Uttar Pradesh India. *Journal of Indian Botanical Society.* 87(3 & 4): 157-161.
- [27] Ranjan, V. 1996. Aquatic, marshy and wetland plants of Lalitpur district. *Geobios New Reports.* 15: 44-48.

- [28] Rizvi, S.I. and Mishra, N. 2013. Traditional Indian Medicines used for the Management of Diabetes Mellitus. *Journal of Diabetes Research*, Vol. 2013, Article I.D. 712092, 11 Pages.
- [29] Saravanamuttu, S. and Sudarsanam, D. 2012. Antidiabetic plants and their active ingredients: A review. *Int. J. Pharm. Sci. Res.* 3(10): 3639-3650.
- [30] Saxena, A. and Vikram, N.K. 2004. Role of selected Indian plants in management of type 2 diabetes: a review. *J. Altern. Complement. Med.* 10(2): 369-378.
- [31] Singh, L. W. 2011. Traditional medicinal plants of Manipur as anti-diabetics. *J. Med. Pl. Res.* 5(5): 677-687.
- [32] Singh, L.J. and Ranjan, V. (Eds.) 2021. *New Vistas in Indian Flora* Vol. 1 & 2, Bishen Singh Mahendra Pal Singh, Dehra Dun, Uttarakhand, India, pp. 417 & 819.
- [33] Sinha, B.K. and Dixit, R.D. 2000. Floristic and Ecological studies of Salon Wetland, Uttar Pradesh. Prof. D. D. Nautiyal Communication Volume Recent Trends in Botanical Research. 255-267.
- [34] Srivastava, A.K.; Dixit, S.N. and Singh, S.K. 1987. Aquatic angiosperm of Gorakhpur. *Indian Journal of Forestry.* 10(1): 46-51.
- [35] The Herbarium Catalogue 2021. Royal Botanic Garden Kew. <http://www.org/herbcat>. The Plant List (2013). Version 1.1, <http://www.theplantlist.org/>
- [36] Umashanker, M. and Srivastava S. 2011. Traditional Indian herbal medicine used as antipyretic, antiulcer, antidiabetic and anticancer. *Int. J. Res. Pharm. Chem.* 1(4): 1152-1159.
- [37] Verma, R.K.; Kumar, V. and Gupta, S.R. 2008. Some ethnomedicinal plants used for various skin ailments in villages of Jhansi, India. *Internet. J. Plant. Sci.*, 3(1) 273-276.
- [38] WHO 2021. World Health Organisation, "Global Report on Diabetes", 13 April, 2021.
- [39] **Yadav, R. B.; Kumar Ajay; Singh Lal Ji and Verma, S. K.** 2015. Ethno-medicinal weed species of Auraiya District, Uttar Pradesh, India *Geophytology* 45(2): 227-232.
- [40] **Yadav, R.B.; Kumar Ajay; Singh, L.J. and Verma, S.K.** 2021a. Weed Flora of Uttar Pradesh, India. In: Singh L.J. and V. Ranjan, (eds.), *New Vistas in Indian Flora*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India, 2: 519- 528.
- [41] **Yadav R.B.; Kumar Ajay; Verma, S.K. and Singh Lal Ji** 2021b. Floristic diversity of angiosperms in aquatic and marshy habitats within floodplain and residual relieves of ranipur wildlife sanctuary, U.P., India. *Plant Archives* Vol. 21, No. 2, 2021 pp. 816-823.
- [42] **Yadav R. B. and Singh L.J.** 2011. Medicinal Plants of Ranipur Wildlife Sanctuary U.P., India *Int. Sym. On Plant Biotech. Towards Tolerance to Stresses & Enhancing Crop Yield Ranchi Abs.* 02:59.
- [43] **Yadav R. B.; Singh Lal Ji; Verma S.K. and Kumar Ajay** 2014. Medicinal plants of Auraiya District, Uttar Pradesh, India: their uses and conservation status. *Geophytology* 44(1): 55-62.
- [44] **Yadav R.B.; Verma S.K., Lal Ji Singh and Ajay Kumar.** 2016, Medicinal Plants of Vindhyan Hills of Chitrakoot District of U. P. In: National Seminar on Biodiversity Conservation and Sustainable development at Kanpur on 20<sup>th</sup> January 2016. Abs. 129.