Plant Archives Vol. 19 No. 1, 2019 pp. 403-406 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EXPLORATION OF FLORAL DIVERSITY OF POLLUTED HABITATS AROUND BHILWARA CITY FOR PHYTOREMEDIATION

Bhagawatilal Jagetiya* and Sunil Rai Porwal

Phytotechnology Research Laboratory, Depart. of Botany, M.L.V. Govt. College, Bhilwara-311 001(Rajasthan)

Abstract

The textile industry is a major revenue generator, in many Asian Countries. Negative impacts on the environment of textile industry are due to the discharge of pollutants and the consumption of water and energy. Conventional remediation technologies are used to clean the vast majority of metal polluted sites but they also tend be clumsy, costly and disruptive to the surrounding environment. In contrast, plants are known to sequester certain metal in their tissues and may prove useful in the removal of contaminants from the polluted soils. Over the past few decades there has been increasing attention and interest for the development of plant based green remediation strategies and methods which have the potential to be low–cost, visually benign and environmentally sound and this concept is known as "phytoremediation". Phytoremediation is energy efficient, aesthetically pleasing process of remediating locations with low to moderate levels of pollution, in which specially selected or engineered plants are used for in situ risk reduction and/or removal of contaminants from contaminated water, soil, sediments and air. This is a promising application based on the 'green liver concept' and operates on the principles of bio-geochemical cycling. Phytoremediation has many different types such as- phyto-accumulation, phytostabilization, rhizofiltration, phytovolatilization, phytodegradation, rhizodegradation and hydraulic control. Only few of the plant species are capable of maximum absorption and accumulation of pollutants.

All the species in the nature do not have equal absorption and accumulation of pollutants/heavy metals/textile effluents. There are no reports on the flora near by the textile effluent affected area particular in Bhilwara district. Two different sites affected from textile effluents were selected to explore floral diversity namely S_1 and S_2. At both the textile polluted habitats, fifty three plant species belonging to dicot and monocot families were recorded during two seasons (late rains and spring). The plant species richness in late- rainy season was almost double of spring season. Asteraceae was the richest family. These species may be used further for effective phytoremediation programme. This contribution on plant diversity in Bhilwara will focus on the species and habitat level with special regard to selected habitats in south and west sides of Bhilwara.

Keywords: phytoremediation, discharge, pollutants, conventional remediation.

Introduction

The textile industry is a major revenue generator, in many Asian Countries including India. Discharge of pollutants and the consumption of water and energy are the foremost negative impacts of textile industries on environment. Conventional remediation technologies are clumsy, costly and disruptive to the surrounding environment in contrast to the phytoremediation where plants sequester certain metal elements in their tissues and may prove valuable in the removal of metals from polluted soils. Plant based remediation technologies which have the potential to be low–cost, low–impact, visually benign and environmentally sound (Jagetiya and Purohit 2006; Jagetiya and Sharma, 2009; 2013; Jagetiya *et al.*, 2011a; 2014). Phytoremediation is a promising biogeotechnological application based on the 'green liver concept'. It operates on the principles of bio-geochemical cycling and energy efficient, aesthetically pleasing process to remove contaminants from the sites with low to moderate levels of toxicity. In this technology specially selected or engineered plants are used for in situ risk reduction and/or removal of contaminants from contaminated soil, water, sediments and air. The first step for phytoremediation technique is to explore the plant species growing in vicinity of polluted area. All the species in the nature do not have equal absorption and

****Author for correspondence :*** E-mail : bljagetiya@yahoo.com

accumulation of pollutants/heavy metals/textile effluents. Only few species are capable of maximum absorption and accumulation of certain pollutants.

In 1992, biological diversity (biodiversity) was introduced as a major objective in world-wide conservation strategies at the conference in Rio de Janeiro. It is quite recent knowledge that not only natural and semi-natural landscapes can be highly diverse in flora, fauna and habitats, but that also urban and industrial areas show a wide variety of habitats and organisms (Zerbe *et al.*, 2004). Soil forms and water quality change due to natural metal mineralization also affects the plant diversity (Jagetiya *et al.*, 2006; 2008; 2011b; Jagetiya and Soni, 2012). Water pollution may affect the diversity of plant species at particular area and industries are the major sources of pollution in all environments. Based on the type of industries, various levels of pollutants can be discharged into the environment directly or indirectly through public sewer lines and these affects the floral diversity of particular site or area (Glyn and Gary, 1996). Industrial areas are different from other areas because these places have most of the factors which affect ecosystems in the cities like climate, soil, water conditions and human impact (Ijeoma and Achi, 2011). Many areas have been described the lack of vegetation caused by the industrial waste effluents, in which water plants have been affected particularly (Kurimo, 1970; Kullberg, 1974). However, some of the species like monocotyledons have been shown to sustain little long-term damage than the dicotyledons (Baker, 1971; Besch and Roberts-Pichette, 1970; Sopper, 1973).

There are various reasons for different plant species diversity in industrial areas are- 1. Urban agglomerations are very much heterogeneous, consisting of a variety of settlement and land use patterns (Sukopp and Werner, 1983; Sukopp, 1998); 2.Various examples are documented for the genetic changes and the evolution of new taxa, which occur especially on man-made sites within and outside of settlements (Scholz, 1993; Sukopp and Scholz, 1997); 3. Floristic richness of a given surrounding geographical area may also influence the number of species in cities (Pysek, 1998) and 4. Species which have been introduced into an area through human activity directly or indirectly, frequently begin their dispersal in urban areas and therefore occur

Table 1: List of plant species recorded from textile effluent area of Bhilwara city

S.No.	Family	Botanical name
1.	Capparaceae	*Capparis sepiaria* L. *Capparis decidua* (Forsk.) Edgew.
2.	Tiliaceae	*Triumfetta rhomboidea* Jacq.
3.	Zygophyllaceae	*Tribulus terrestris* L.
4.	Meliaceae	*Azadirachta indica* A Juss.
5.	Rhamnaceae	*Ziziphus nummularia* (Burm.f.) W. & A. *Ziziphus rotundifolia* Lamk.
6.	Vitaceae	*Cayratia carnosa* (Lamk.) Gagnep.
7.	Fabaceae	*Butea monosperma* (Lamk.) Taub. *Indigofera hochstetteri* Baker *Pongamia pinnata* (L.) Pierre
8.	Caesalpiniaceae	*Parkinsonia aculeata* L.
9.	Mimosaceae	*Acacia leucophloea* (Roxb.) Willd. *Prosopis cineraria* (L.) Druce *Prosopis juliflora* (Sw.) DC.
10.	Myrtaceae	*Callistemon lanceolatus* DC. *Eucalyptus* sp.
11.	Passifloraceae	*Passiflora foetida* L.
12.	Cucurbitaceae	*Blastania fimbristipula* Fenzl. *Coccinia grandis* (L.)
13.	Asteraceae	*Blainvillea acmella* (L.) Philipson *Blumea mollis* sp. *Parthenium hysterophorus* L. *Xanthium strumarium* L. *Vernonia cinerea* (L.) Less.
14.	Asclepiadaceae	*Calotropis procera* (Ait.) R. Br. *Pergularia daemia* (Forsk) Chiov.
15.	Convolvulaceae	*Ipomoea fistulosa* Mart ex Choisy *Ipomoea pes-tigridis* L.
16.	Solanaceae	*Solanum nigrum* L.
17.	Verbenaceae	*Lantana camara* L. Var. *aculeate* (L.) Moldenke
18.	Lamiaceae	*Leucas cephalotes* (Koen. Ex Roth.) Spreng. *Ocimum americanum* L. Cent., *Ocimum* sp.
19.	Nyctaginaceae	*Boerhavia verticillata* Poir.
20.	Amaranthaceae	*Achyranthes aspera* L.
21.	Euphorbiaceae	*Croton bonplandianum* Baill. *Euphorbia hirta* L. *Pedilanthus tithymaloides* (L.) Poir. *Phyllanthus maderaspatensis* L.
22.	Liliaceae	*Asparagus racemosus* Willd.
23.	Commelinaceae	*Cyanotis axillaris* (L.) Roem & Schult
24.	Arecaceae	*Phoenix sylvestris* (L.) Roxb.
25.	Cyperaceae	*Cyperus* sp.
26.	Poaceae	*Cynodon dactylon* L. Pers. *Cenchrus pennisetiformis* Hoscht. & Steud. ex Steud. *Desmostachya bipinnata* (L.) Stapf

there most frequently (Kowarik, 1992).

This contribution on plant diversity in Bhilwara will focus on the species and habitat level with special regard to selected habitats in west and south sides of Bhilwara. Very little work has been carried out on biodiversity around textile effluent areas in India, in general and Bhilwara of Rajasthan, in particular. Floristic list of a particular area also gives reliable background information about the species diversity in a community as each plant species has its own specific ecological amplitude and the same indicates the ecological nature of the habitat. In present study, an attempt has been made to investigate the biodiversity of textile effluent area of Bhilwara. Moreover, the present study is the first attempt to document the phytodiversity of textile effluent area Bhilwara.

Materials and Methods

The present work was based on critical observation of plant species of both the study sites (south site S_1 and west site S_2) of Bhilwara city. Plants were collected during the study period from January, 2016 to December, 2016. During trips observation on morphological characters were recorded. Plants were brought to the Phytotechnology Research Laboratory, Department of Botany, M.L.V. Government College Bhilwara, where they were identified with the help of relevant floras (Bhandari, 1995; Shetty and Singh 1987; Singh and Singh, 2001; Tiagi and Aery, 2007).

Results and discussion

The present study shows that 53 species belonging to 42 genera and 26 families were represented by plant species in S_1 and S_2 sites of Bhilwara city (Table. 1). The dominant family is Asteraceae (5 species) followed by Euphorbiaceae (4 species), Fabaceae (3 species), Mimosaceae (3 species), Lamiaceae (3 species) Poaceae (3 species), Capparaceae (2 species), Myrtaceae (2 species), Cucurbitaceae (2 species), Asclepiadaceae (2 species) and Convolvulaceae (2 species).

Acknowledgement

Authors are thankful to Professor B. L. Malviya, Principal, M. L. V. Government College, Bhilwara for his valuable guidance and providing facilities. We also acknowledge heartfelt thanks to Dr. M. L. Verma, Adjunct Professor, M.D.S. University, Ajmer for identifying the plant species.

References

Baker, J.M. (1971). Seasonal effects of oil pollution on salt marsh vegetation. *Oikos,* **22**: 106-110.

Besch, K.W. and P. Roberts-Pichette (1970). Effects of mining pollution on vascular plants in the Northwest Miramichi river system. *Can. J. Bot.,* **48**: 1647-1656.

Bhandari, M.M. (1995). Flora of the Indian Desert. MPS REPROS, 39 BGKT Extn., New Pali Road, Jhodpur, India.

Glyn, H. J. and W. H. Gary (1996). Environmental Sciences and Engineering Prentice Hall International Inc. pp778.

Ijeoma, K. and O.K. Achi (2011). Industrial effluents and their impact on water quality of receiving rivers in Nigeria, **1**: 75-86.

Jagetiya B.L., A. Jagetiya, M.J. Kaur and A. Sharma (2006). Phytoplanktonic population in relation to physico-chemical factors of Raithalias dam, Bhilwara, NSL 2007. 255-257.

Jagetiya, B.L. and A. Sharma (2009). Phytoremediation of radioactive pollution: Present status and future. *Ind. J. Bot. Res.,* **5(1&2)**: 45-78.

Jagetiya, B.L. and P. Purohit (2006). Response of barley to uranium mining waste: An approach to phytoremediation and revegetation. EPIC-06. Engineering College, Kota. Mar. 25-26, In: Proceedings pp. 58-66. Section B.

Jagetiya, B.L. and A. Sharma (2013). Optimisation of chelators to enhance uranium uptake from tailings for phytoremediation. *Chemosphere,* **91**: 692-696.

Jagetiya, B.L., A. Sharma, A. Soni and U.K. Khatik (2014). Phytoremediation of Radionuclides: A Report on the State of the Art. In: Radionuclide Contamination and Remediation through Plants (eds. D.K. Gupta and C. Walther). pp. 1-31, Springer International Publishing Switzerland.

Jagetiya, B.L., A. Sharma, P. Purohit and S. Kothari (2008). Biodiversity assessment and conservation by remote sensing: A review. Proceedings of Natiional Conference on Microwaves, antennas, Propagation and Remote Sensing. Dec. 19-21. pp.88-101.

Jagetiya, B.L. and A. Soni (2012). Biodiversity of India and Rajasthan: Challenges and conservation strategies. Annals. Rajasthan Geographical Association, *Annals.,* **29**: 152-162.

Jagetiya, B.L., A. Soni, S. Kothari and U. Khatik (2011a). Bioremediation: An ecological solution to textile effluents. *Asian J. Bio. Sci.,* **6(2)**: 248-257.

Jagetiya, B.L., S. Kothari, A. Soni and U. Khatik (2011b). Phytodiversity around Dhor uranium mineralization site of Jahazpur Basin (Rajasthan). *J. Phytol. Res.,* **24(2)**: 135-139.

Kowarik, I. (1992). Einführung und Ausbreitung nichteinheimischer Gehölzarten in Berlin and Brandenburg. Verhandlungen Botanischer Verein Berlin and Brandenburg, *Beih.,* **(3)**: 1-188.

Kullberg, R.G. (1974). Distribution of aquatic macrophytes related to paper mills effluents in a Southern Michigan Stream. *The American Midland Naturalist,* **91**: 271-281.

Kurimo, U. (1970). Effect of pollution on the aquatic macroflora of the Varkaus area, Finnish Lake District. *Ann. Bot. Fennici.,* **7**: 213-254.

Pysek, P. (1998). Alien and native species in Central European urban floras: a quantitative comparison. *Journal of Biogeography,* **25**: 155-163.

Scholz, H. (1993). Plant evolution under the impact of man. *Scripta Botanica Belg.,* **15**: 144.

Shetty, B.V. and V. Singh (1987). Flora of Rajasthan. *Botanical Survey of India.* 1(3), India.

Singh, N.P. and D.K. Singh (2001). Floristic Diversity and Conservation Strategies in India. *Botanical Survey of India.* **(1-5)**, India.

Sopper, W.E. (1973). Crop selection and management alternatives- perennials: Proc Conf Recyc. *Muncipal sludges and effluents with Lard.* 143-53.

Sukopp, H. and H. Scholz (1997). Herkunft der Unkräuter. Osnabrücker Naturwissenschaftliche Mitteilungen, **23**: 327-333.

Sukopp, H. and P. Werner (1983). Urban environment and vegetation. 247-260.

Sukopp, H. (1998). Urban ecology – scientific and practical aspects. 3-16.

Tiagi, Y. D. and N. C. Aery (2007). Flora of Rajasthan (South & South- East Region), Himanshu Publication, Udaipur, India.

Zerbe, S., U. Maurer, T. Peschel, S. Schmitz and H. Sukopp (2004). Diversity of flora and vegetation in European cities as a potential for nature conservation in urban industrial areas – with examples from Berlin and Potsdam (Germany), 4th International Urban Wildlife Symposium, 35-49.