

A Survey of Invasive and Exotic Plant Species of Lahore City, Pakistan

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ABSTRACT

Lahore city had a well-established plant cover. In order to meet the needs of increasing population, the infrastructure such as new residential colonies, roads etc. had to be developed which seriously affected indigenous plant communities. This has caused destruction of local vegetation growing there and exposed land for colonization of invasive and exotic plant species. Besides this many exotic species have been planted as ornamental plants at the green belts. With the passage of time the exotic plant species also called Invasive Alien Species (IAS) is going to be a serious threat to local ecosystems. This research work was planned to determine the harmful and significant effects of exotic plants on local flora. Fourteen species of exotic and invasive plants viz., *Eucalyptus camaldulensis* Dehnh., *Populus deltoids* W. Bartram ex Marshall, *Prosopis juliflora* (Sw.) DC., *Broussonetia papyrifera* (L.) Vent, *Lantana camara* L., *Cannabis sativa* L., *Parthenium hysterophorus* L., *Xanthium strumarium* L., *Alternanthera pungens* Kunth, *Trianthema portulacastrum* L., *Pistia stratiotes* (Sw.) DC., *Phragmites australis* Adans., *Eichhornia crassipes* (C.Martius) Solms Loub. and *Portulaca oleracea* L. were identified in the selected area. Information regarding the family, habit and nativity of the species was also compiled. These species not only reduce the land value and crop yield but are also hazardous for humans e.g., cause allergies, itching, drowsiness, insensibility etc. Effective planning is required for timely detection in order to check and control the spread of new acclimatized exotics.

Key Words: Invasive, Exotic, Nativity, Lahore.

INTRODUCTION

A form of biological pollution, known as biological invasion is considered more devastating than chemical pollution and thus, after habitat destruction it stands as the second major threat to the stability of biodiversity (Reddy, 2008). Living organisms categorized as invasive are widely dispersed all around the world in various ecosystems. Exotic plants do not grow naturally in an area but they use humans and animals as vectors to get established in an ecosystem from an entirely distinct area (Thompson *et al.*, 1995). Human intervention are in the form of disturbance including the removal of native vegetation for construction, forming, cultivation and mining etc., provides an open area for colonization of exotic plants due to lack of competition and a changed soil structure, moisture content and nutrient status (Randall and Marinelli, 1996). Alien species pose a threat to indigenous biodiversity by establishing in natural or semi natural that frequent disturbances help in the spread of certain invasive exotic plant species

ecosystems. Their growth rate is faster than indigenous plant species, thus out competing the native species in terms of light, space, nutrients etc. and bringing change in ecosystem. They have an edge in not having natural predators to check their growth rate (Hafeez, 1986). *Prosopis juliflora* was first introduced before partition of Indo Pak and later by the Punjab forest department on a large scale. This helped the species to naturalize in the environment. International Union for Conservation of Nature (IUCN) had listed mesquite plants of the *Prosopis* genus as most problematic exotic plant. The other alien invasive species harming local vegetation include *Parthniumhy sterophorus*, *Broussonetia papyrifera*, *Salvinia* and *Eucalyptus* species (found in Punjab). *Parthniumhy sterophorus* has invaded every town of Lahore and became dominant by eliminating natural vegetation.

The presence of *Parthniumhy sterophorus*, which is an exotic species but exhibiting significant cover values hold the fact (Larson, 2003). Pollen grains of Paper mulberry (*Broussonetia papyrifera*) cause

allergy while *Eucalyptus* lowers soil water table. After destroying the indigenous water communities, *Eichornia crassipes*, *Pistia stratiotes* and *Salvinia* species have become established in local water bodies (Baker *et al.*, 2002). The exotic species has been proved to be a real threat to local biodiversity as it releases harmful chemicals that have extremely undesirable effects on the growth and survival of vegetation. The world community is also showing great concern to this growing menace and extensive research is being conducted to investigate the negative impact of these species (Mooney and Hobbs, 2000). The current research work designed to study the effects of invasive and exotic plant species on indigenous flora of Lahore City.

MATERIALS AND METHODS

In the present study several field trips were carried during the years 2015 to 2017 to get the indigenous information regarding exotic plant species of Lahore. Residential and cultivated areas were surveyed followed by the documentation of the collected data/ records. A questionnaire was prepared to record ethnobotanical information from local community including the indigenous people, agriculturist, herbalists etc. Collected plant specimens were identified by extensive literature review on world invasive species (Cracraft and Francesca, 1999; Huxel, 1999; Elton, 2000; Mooney and Hobbs, 2000; Almeilla and Freitas, 2001; Cowie, 2001; McNeely *et al.*, 2001; Cox, 1999). The sampled plants were properly pressed, dried out and fixed on herbarium sheets, conferring to standard techniques (Judd *et al.*, 2002) and submitted to the herbarium of Botany Department, University of Education Bank Road Campus Lahore.

RESULTS

Climate of Lahore

Lahore District of the Province Punjab, Pakistan is comprised of Lahore City. It covers an area of 1.772 sq.m. In revised administrative structure of Pakistan, disseminated in 2001, Lahore was given the status of City District, comprised of nine towns (CDG, 2009). According to PMD, 2015 (Pakistan Meteorological Department), Lahore has semi-arid climate (Köppen climate cataloguing *BSh*). Its summers are very hot and long while winters are cold and of short duration. Monsoon rain phenomenon occurs in summer as well as in winter (PMD, 2015).

Dust storms hit the area in summers (Table. I and Fig.1). Soil of the area, that is well drained brownish yellow, silty loam, is formed of river alluvium. Crops of the area include rice, wheat, sugarcane and forages (Ahmad, 1986). By the survey of study area 14 plant species under 13 families were identified. Out of these, 08 species (57%) were native to America and 03 species (21%) native to Europe while China, Australia and Mexico contributed 01 species each (07%). Habit wise study indicated that herbs with 10 species (71%) predominated while shrubs and trees contributed two species (14%) each. Five species (36%) were associated with agricultural fields, seven (50%) with waste lands and nine (64%) with road sides. However eight species (57%) were found growing in multiple areas (Fig. 2). According to local community these species were causing serious problems in different areas.

Town wise survey of Invasive Exotic Species in Lahore

Knowledge provided by inhabitants of study area and observations made during field visits revealed that 14 plant species were cause of serious concern in Lahore. It was noticed that *Parthenium hysterophorus* and *Trianthema portulacastrum* were most aggressive invasive plants growing in the study area. The town wise distribution of the recorded invasive and exotic plant species is documented in table II.

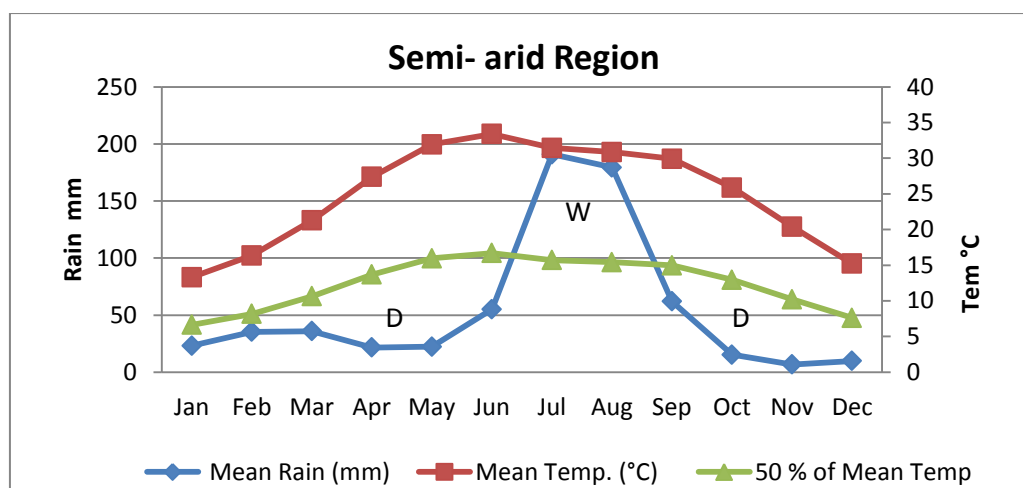


Fig. 1: Climate of Lahore City.(**D**- Dry Period, **W**- Wet Period)

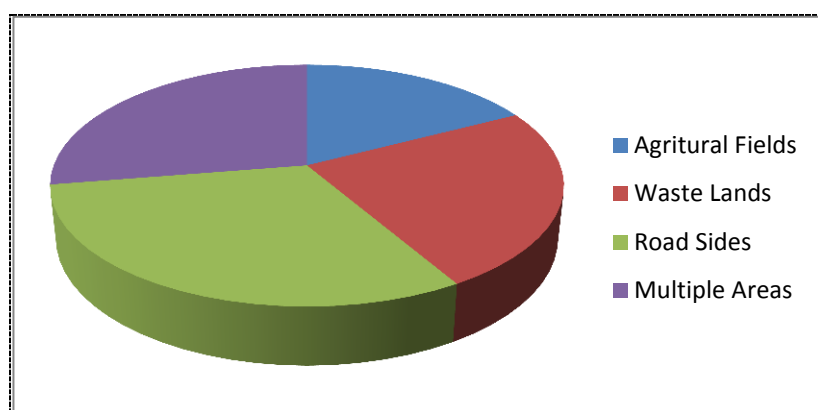


Fig. 2: Percentage of exotic species growing in different areas.

Table I: Climatic data of Lahore City (Semi- arid)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
M.T. (°C)	13.31	16.37	21.28	27.38	31.93	33.39	31.44	30.86	29.925	25.88	20.41	15.22	24.78
Rain (mm)	23.24	35.31	35.97	21.57	22.39	55.09	90.91	79.39	62.01	15.30	06.83	09.82	54.82

DISCUSSIONS

Exotic or non-native plant species invade beyond their natural geographical range and colonize such places where they can easily inhabit ecosystems by marginalizing indigenous species. This results in a large scale economic, environmental and ecological damage.

According to a study, IAS has resulted in about 40% of all animal extinctions since 17th century. It has been estimated that about ten percent vascular plants have the ability to colonize different ecosystems thus affecting indigenous vegetation. Plant cannot cross natural geographical boundaries like mountains, deserts or oceans on their own but through human assistance travel of biota has broken all barriers. This has resulted in severe Bio Pollution. Thus human-assisted travel of exotic species is several times larger than natural rate, especially for islands.

Exotic species in certain cases either equal or out-number the native species e.g., in New Zealand there are 1570 alien species in comparison to 1790 native species. Similarly in Hawaii there are 861 alien and 956 native species while in Trinstan da Cunhu there are 97 exotic and 70 local plant species (Randal and Marinelli, 1996). In the present study it was observed that *Parthiniumhy sterophorus* and *Trianthema portulacastrum* were most aggressive invasive plants of the study area covering most of space were they grow by marginalizing the local plant species. The exotic species from all taxonomic groups like viruses, microorganisms, fungi, algae, animals and plants are found almost throughout the world. Once established in a new area they proliferate exponentially and deprive native species of moisture, nutrients, space etc. ultimately modifying entire structure and function of the local ecosystem (Simson, 1993). Similar observations were made with reference to *Eucalyptus camaldulensis*, *Populus deltoides* and *Lantana camara* L., their litter and rhizosphere not only have allopathic effect on growth of other plants but also deprive soil of nutrients.

All these changes also have a negative impact on indigenous fauna. Modified flora not only results in depriving native animals of food and shelter but also introduce new pests and pathogens in the environment. Exotic plants should be replaced with indigenous species as the former contaminated the soil with its toxic effects. But this is not an easy task because the invasive plant could regenerate even from a little piece of root left in the soil. Most effective, traditional and ancient method for the removal of unwanted small annuals and biennials plant is pulling by hand, before their seed dispersal. Seeds require different conditions for germination. Many seeds require moisture and light for their germination. Therefore straw, hay and dry grass can serve as mulch to cut off light to prevent germination (Khan *et al.*, 2010).

Table II: List of invasive and exotic plant species with their effect on Lahore flora.

Sr. No.	Species	Family	Habit	Nativity	Exotic/ Invasive	Collection Site	Impact on Lahore Flora
1.	<i>Alternanthera pungens</i> Kunth	Amaranthaceae	Herb	America	Invasive	Allama Iqbal Town, Samanabad Town	It Reduces crop yield and sharp spines of head are annoying.
2.	<i>Broussonetia papyrifera</i> (L.) Vent	Moraceae	Shrub	China	Exotic	Aziz Bhatti Town, Gullberg Town, Allama Iqbal Town, Nishtar Town, Ravi Town, Samanabad Town, Shalimar Town	Marginalize local vegetation and cause pollen allergy.
3.	<i>Cannabis sativa</i> L.	Cannabaceae	Herb	Europe	Exotic	Aziz Bhatti Town, Gullberg Town, Samanabad Town, Wagha Town	It colonizes the waste lands and cause psychoactive effects on human health.
4.	<i>Eichhornia crassipes</i> (C. Martius) Solms Loub.	Pontederiaceae	Herb	America	Invasive	Ravi Town, Aziz Bhatti Town	It effects water flow and destroy local water bodies communities.
5.	<i>Eucalyptus camaldulensis</i> Dehnh.	Myrtaceae	Tree	Australia	Exotic	Aziz Bhatti Town, Allama Iqbal Town, Nishtar Town, Ravi Town, Samanabad Town	Lowers the soil water table and deprive soil of nutrients.
6.	<i>Lantana camara</i> L.	Verbenaceae	Herb	America	Exotic	Aziz Bhatti Town, Gullberg Town, Samanabad Town, Wagha Town	Its litter and rhizospheric soil has allelopathic effects on growth of other plants.
7.	<i>Parthenium hysterophorus</i> L.	Asteraceae	Herb	America	Exotic	Aziz Bhatti Town, Gullberg Town, Allama Iqbal Town, Nishtar Town, Ravi Town, Samanabad Town, Shalimar Town, Wagha Town	It grows in dense strands over large areas replacing native vegetation and exerts allelopathic effects on other plants. Its pollens cause various allergies.

8.	<i>Phragmites australis</i> Adans.	Poaceae	Grass	Europe	Invasive	AllamaIqbal Town, Ravi Town	It has negative impact on local vegetation and wild life.
9.	<i>Pistiastratiotes</i> L.	Araceae	Herb	America	Invasive	Ravi Town	Effects water flow, destroy local water bodies communities.
10.	<i>Populusdeltoides</i> W.Bartram ex Marshall	Salicaceae	Tree	Europe	Exotic	AllamaIqbal Town, Samanabad Town	Its litter and rhizosphere has allopathic effect on growth of other plants including important crop species.
11.	<i>Portulaca oleracea</i> L.	Portulacaceae	Herb	America	Invasive	Nishtar Town, Ravi Town, Samanabad Town	It is a weed of the crop fields and cause reduction in crop yield.
12.	<i>Prosopis juliflora</i> (Sw.)DC.	Fabaceae	Shrub	America	Exotic	AllamaIqbal Town, Ravi Town	Its rapid growth out competes the growth of native species. Its thorns make areas impenetrable.
13.	<i>Trianthema portulacastrum</i> L.	Aizoaceae	Herb	Mexico	Invasive	Samanabad Town, Wagha Town	Cause yield reduction due to competition with crop plants. Its management is very difficult.
14.	<i>Xanthium strumarium</i> L.	Asteraceae	Herb	America	Invasive	Wagha Town, Shalimar Town	It reduces the growth of other plant species in the area it establishes. Its seedlings and seeds are toxic.

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