Research Paper

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Studieson Floristic Diversity and Their Seasonal Appearance on the Ancient Walls of Kota District, Rajasthan.

Life Science

KEYWORDS : Archaeological, Wall flora, Seasonal appearance, perennials, annuals.

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ABSTRACT

An extensive study is conducted in and around Kota District to observe floristic composition and their seasonal appearance on the walls of Archaeological buildings. A total of 135 plant species are observed, out of which 120 plant species are dicotyledons and only 15 species are monocotyledons. Total 106 genera comprising 46 families are documented. The Asteraceae, Poaceae and Amaranthaceaeare the dominant families of the wall flora. Herb and Shrub habit is dominant on the walls whereas climbers and trees are least observed. Majority of the species were observed in winters and Monsoon of the year. Among the woody perennials Ficusreligiosa, Ficusbenghalensis, Ficus, racemosa, Ficushispida and Holopteleaintegrifolia are dominant species, whereas among annuals Achyranthusaspera, Amaranthusspinosus, Partheniumhysterophorus, Commelinabenghalensis, Tridaxprocumbens, Chenopodium album and Sidacordata are profusely present.

INTRODUCTION

Walls are artificial habitats which represent a specific environment. Generally cracks and crevices are found in walls which are partly similar to rocks and rock fissures [1]. These crevices favour the growth and development of plant species. The technology of wall building influences a range of plant species, which are able to colonize this habitat. Floristic composition of the wall habitats in India and abroad has been studied broadly [2,3,4,5,6,7]. The cracks and crevices in the walls provide anchorage to the plant roots which support the growth of the plants.

Walls usually consist of three different zones: (i) the basal zone with more moisture and nutrients (ii) the vertical wall surface with joints (fissures) and (iii) the wall top with disintegration of material. The walls provide:-

(1) Better conditions for growth (i.e. more water and substrate);
(2) More chance of seeds landing;
(3) A good perch for birds that excrete seeds;
(4) A good site for ant nests where seeds are stored.

Following sites are best habitats for colonization of plants.

A. Ground level cavities, hosts many species as this substrate naturally collects rain water that does not runoff.
B. Cavities in inclined surfaces have more moisture than vertical surfaces which is favourable for seeds to lodge.
C. Cavities between two types of building material have chemical difference which offers more nutrients.
D. In horizontal surface cavities, water availability is good but the plant must be capable of retaining it.
E. Cavities at the junction of vertical and horizontal surfaces have sufficient water availability but there is less substrate.
F. Wall invaded by the rhizome of a plant in adjacent soil.

This paper deals with vascular plant diversity on the walls of the selected sites located in Kota district and discuss their importance in conservation of regional plant diversity.

STUDY SITES

Kota is located along eastern bank of the Chambal River in the southern part of Rajasthan. It is the 3rd largest city of Rajasthan after Jaipur and Jodhpur. Kota once belonged to the princely state of Bundi under the rule of the Chauhans. In the 17th century, Emperor Jahangir declared Kota a separate state and it was ruled by Rao Madho Singh and their apparent to the throne of Kota. Many Historical buildings and monuments are found in and around the city. Chatra Vilas Garden, Lakkhi Burj, Garh Palace, Kota Barrage are some of the selected sites of the Kota city for the present study.

METHODOLOGY

An extensive field study was conducted during the session of 2014-2015 to record the vascular wall flora growing on the walls of the studied sites of Kota City. One visit was made after every two months. The walls surrounding the Forts, Palaces, Monuments, Temples and Canal's walls. The identification of plant species was done using taxonomic literatures.

OBSERVATION AND RESULTS

Table- Angiospermic flora of Ancient walls of Kota District

S.No.	Families & Plant Species	Habit	Seasonal Appearance
Acanthaceae			
1.	*Barleria prionitis* subsp. *prionitis* var. *prionitis*	Shrub	Winters
2.	*Blepharis repens* (Vahl.) Roth	Herb	Winters
3.	*Indoneesiella echioides* (L.) Sree.	Herb	Monsoon
4.	*Justicia diffusa* var. *diffusa*	Herb	Monsoon
5.	*Peristrophe paniculata* (Forsk.) Brummitt	Herb	Winters
Aizoaceae			
1.	*Trianthema portulacastrum* L.	Herb	Winters
Amaranthaceae			
1.	*Achyranthes aspera* L. var. *aspera*	Herb	Throughout the year
2.	*Aerva lanata* (L.) Juss. ex Schult	Herb	Summer
3.	*Alternanthera sessilis* R.Br.	Herb	Rainy & Winter
4.	*Amaranthus polygamous* L.	Herb	Summer
5.	*Amaranthus spinosus* L.	Herb	Rainy & Winter
6.	*Amaranthus tenuifolius* Willd.	Herb	Summer
7.	*Amaranthus viridis* L.	Herb	Summer
8.	*Celosia argentea* L.	Herb	Rainy & Winter
9.	*Digera muricata* (L.) Mart.	Herb	Monsoon
Apocynaceae			
1.	*Catharanthus pusillus* (Murr.) G. Don	Herb	Monsoon
2.	*Nerium oleander* L.	Shrub	Throughout the year
Araceae			
1.	*Colocasia esculenta* (L.) Schott	Herb	Winters
Arecaceae			
1.	*Phoenix sylvestris* (L.) Roxb.	Tree	Throughout the year
Asclepiadaceae			
1.	*Calotropis gigantea* (L.) R. Br.	Shrub	Throughout the year

2.	*Calotropis procera* subsp. *hamiltonii* Ali.	Shrub	Throughout the year
Asteraceae			
1.	*Ageratum conyzoides* L.	Herb	Throughout the year
2.	*Blumea eriantha* DC.	Herb	Winters
3.	*Blumea laciniata* (Roxb.) DC.	Herb	Winters
4.	*Cyathocline purpurea* (Ham. ex D.Don) O. Ktze.	Herb	Monsoon
5.	*Eclipta alba* (L.) Hassk.	Herb	Throughout the year
6.	*Gnaphalium pulvinatum* Delile	Herb	Winters
7.	*Launaea procumbens* (Roxb.) Ramayya Rajagopal	Herb	Rainy & Winters
8.	*Parthenium hysterophorus* L.	Shrub	Winters
9.	*Sonchus asper* (L.) Hill.	Herb	Winters
10.	*Sonchus oleraceus* L.	Herb	Winters
11.	*Tridax procumbens* L.	Herb	Winters
12.	*Vernonia cinerea* L.) Less.	Herb	Winters
13.	*Xanthium strumarium* L.	Shrub	Throughout the year
Boraginaceae			
1.	*Heliotropium ovalifolium* Forssk.	Herb	Summer
Cactaceae			
1.	*Opuntia elatior* Mill.	Shrub	Throughout the year
Caesalpiniaceae			
1.	*Cassia tora* L.	Shrub	Winters
Capparidaceae			
1.	*Capparis sepiaria* L. var. *sepiaria*	Shrub	Throughout the tear
Chenopodiaceae			
1.	*Chenopodium album* L.	Herb	Winters
2.	*Chenopodium murale* L.	Herb	Winters
Cleomaceae			
1.	*Cleome viscosa* L.	Herb	Monsoon
Commelinaceae			
1.	*Commelina benghalensis* L.	Herb	Monsoon
2.	*Cyanotis fasciculata* (Heyne ex Roth) J.A. Schult.f. & J.H. Schult	Herb	Monsoon
Convolvulaceae			
1.	*Evolvulus alsinoides* L.	Herb	Monsoon
2.	*Convolvulus prostratus* Forsk.	Herb	Monsoon
Cucurbitaceae			
1.	*Coccinia grandis* (L.) J.O.	Herb	Winters
2.	*Cucumis melo* L.	Herb	Monsoon
3.	*Momordica balsamina* L.	Herb	Winters
4.	*Momordica charantia* L.	Herb	Winters
Cyperaceae			
1.	*Cyperus compressus* L.	Grass	Monsoon
2.	Kyllinga brevifolia	Grass	Monsoon
Euphorbiaceae			
1.	*Acalypha indica* L.	Herb	Rainy & Winter
2.	*Euphorbia caducifolia* Haines	Herb	Throughout the year
3.	*Euphorbia hirta* L.	Herb	Throughout the year
4.	*Euphorbia prostrata* Ait.	Herb	Throughout the year
5.	*Phyllanthus amarus* L.	Herb	Winters
6.	*Ricinus communis* L.	Shrub	Throughout the year
7.	*Securinega leucopyrus* Muell.-Arg	Shrub	Throughout the year
Fabaceae			
1.	*Indigofera hirsuta* L.	Herb	Winters
2.	*Indigofera oblongifolia* Forssk	Herb	Winters
3.	*Indigofera trita* L.	Herb	Winters
4.	*Lathyrus aphaca* L.	Herb	Winters
5.	*Melilotus alba* Medik. Ex Desr	Herb	Winters
6.	*Melilotus indica* (L.) All. Fl. Pedem.	Herb	Winters
7.	*Pueraria tuberosa* (Roxb. ex Willd.) DC.	Herb	Winters
8.	*Vigna umbellata* (Thunb.) Ohwi & Ohashi	Herb	Winters
Gentianaceae			
1.	*Canscora diffusa* (Vahl.) R. Br.	Herb	Monsoon
Lamiaceae			
1.	*Hyptis suaveolens* (L.) Poit.	Herb	Winters
2.	*Nepeta hindostana* (Roth) Haines	Herb	Winters
3.	*Ocimum basilicum* L.	Shrub	Throughout the year
4.	*Ocimum canum* Sims	Shrub	Throughout the year
Liliaceae			
1.	*Aloe vera* (L.) Burm	Herb	Throughout the year
Lythraceae			
1.	*Ammannia auriculata* Willd.	Herb	Throughout the year
2.	*Ammannia baccifera* L.	Herb	Throughout the year
Malvaceae			
1.	*Abutilon bidentatum* Hochst. var. bidentatum	Shrub	Rainy & Winter
2.	*Abutilon indicum* subsp. *indicum*	Shrub	Rainy & Winter
3.	*Abutilon ramosum* (Cav.) Guill. & Perr.	Shrub	Rainy & Winter
4.	*Malvastrum coromandelianum* (L.) Garcke	Herb	Winters
5.	*Sida cordata* (Burm. f.)Borssum	Herb	Winters
6.	*Sida cordifolia* L.	Herb	Winters
7.	*Urena lobata* L. subsp. lobata	Herb	Winters
Menispermaceae			
1.	*Tinospora cordifolia* (Willd.) Miers ex Hook.f. & Thoms.	Climber	Throughout the year
Mimosaceae			
1.	*Acacia nilotica* (L.) Willd.subsp. *indica*	Under tree	Throughout the year
2.	*Mimosa pudica* L.	Herb	Monsoon
3.	*Prosopis juliflora* (Swartz.) DC.	Tree	Throughout the year
Moraceae			
1.	*Ficus benghalensis* L.	Tree	Throughout the year
2.	*Ficus glomerata* L.	Tree	Throughout the year
3.	*Ficus hispida* L. f.	Tree	Throughout the year
4.	*Ficus racemosa* L.	Tree	Throughout the year
5.	*Ficus religiosa* L.	Tree	Throughout the year
Moringaceae			
1.	*Moringa concanensis* Nimmo ex Dalz. & Gibs	Tree	Throughout the year
Musaceae			
1.	*Musa paradisiaca* L.	Under tree	Throughout the year
Nyctaginaceae			
1.	*Boerhavia diffusa* L.	Herb	Monsoon
2.	*Boerhavia erecta* L.	Herb	Monsoon
Oxalidaceae			
1.	*Oxalis corniculata* L.	Herb	Winters
Papaveraceae			
1.	*Argemone mexicana* L. forma mexicana	Herb	Throughout the year
Pedaliaceae			
1.	*Sesamum indicum* L.	Herb	Winters
Poaceae			
1.	*Brachiaria deflexa* C.E. Hubb	Grass	Monsoon
2.	*Chloris virgata* Sw.	Grass	Monsoon
3.	*Cynodon dactylon* (L.) Pers.	Grass	Monsoon
4.	*Dactyloctenium aegyptium* (L.) Willd.	Grass	Monsoon
5.	*Dichanthium annulatum* (Forssk) Stapf.	Grass	Monsoon
6.	*Digitaria ciliaris* Koel.	Grass	Monsoon
7.	*Echinochloa colona* (L.) Link.	Grass	Monsoon
8.	*Eragrostis tenella* P. Beauv.	Grass	Monsoon
9.	*Oplismenus burmannii* P. Beauv.	Grass	Monsoon
10.	*Panicum psilopodium* Trin	Grass	Monsoon
11.	*Saccharum spontaneum* L.	Grass	Monsoon

12.	*Sporobolus diander* (Retz.) P. Beauv.	Grass	Monsoon
Polygonaceae			
1.	*Rumex nepalensis* Spreng	Herb	Summer
Portulacaceae			
1.	*Portulaca oleracea* L.	Herb	Winters
2.	*Portulaca quadrifida* L.	Herb	Winters
Primulaceae			
1.	*Anagallis arvensis* L.	Herb	Winters
Rhamnaceae			
1.	*Ziziphus mauritiana* Lam.	Shrub	Throughout the year
2.	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Shrub	Throughout the year
Rubiaceae			
1.	*Borreria articularis* (L.f.) F.N. Will.	Herb	Monsoon
2.	*Mitragyna parviflora* (Roxb.) Korth.	Tree	Throughout the year
3.	*Morinda tomentosa* Heyne ex Roth	Tree	Throughout the year
4.	*Oldenlandia corymbosa* L.	Herb	Monsoon
5.	Oldenlandia digyna	Herb	Monsoon
Scrophulariaceae			
1.	*Lindenbergia indica* Vatke	Herb	Summer
2.	*Lindernia crustacea* (L.) F. Muell.	Herb	Rainy & Winter
3.	*Lindernia parviflora* (Roxb.) Haines	Herb	Rainy & Winter
Solanaceae			
1.	*Nicotiana plumbaginifolia* Viv.	Herb	Summer
2.	Physalis maxima	Herb	Winters
3.	*Physalis minima* L.	Herb	Winters
4.	*Solanum nigrum* L.	Herb	Winters
5.	Solanum xanthocarpum	Shrub	Throughout the year
6.	*Withania somnifera* (L.) Dunal	Shrub	Throughout the year
7.	*Xanthium strumarium* L.	Shrub	Throughout the year
Tiliaceae			
1.	*Corchorus olitorius* L.	Herb	Monsoon
Ulmaceae			
1.	*Holoptelea integrifolia* Planch.	Tree	Throughout the year
Verbenaceae			
1.	*Lantana camara* L.	Shrub	Throughout the year
Vitaceae			
1.	*Ampelocissus latifolia* (Roxb.) Planch.	Climber	Throughout the year
2.	*Cayratia trifolia* (L.) Domin	Climber	Rainy & Winter

The vascular wall flora of the Kota City along with their habit and seasonal appearance is depicted in the Table 1. A total of 135 Angiospermic plant species were observed. Some pteridophytes and bryophytes were also observed but they are not listed. No any species of Gymnosperm was reported from the walls of any selected site. The Angiosperms were represented by 106 Genera belonging to 46 families, of which 43 were represented by dicotyledonous families while only 3 were represented by monocotyledonous families. Of the total Angiospermic flora recorded, the maximum number of the species, that is 13(28.26%) belongs to Asteraceae family, 12 (26.08%) to Poaceae family whereas 9 (19.56%) species were represented by Amaranthaceae family. Thus the study reveals that the Asteraceae and Poaceae are the dominant families of the wall flora of Kota city. Many other studies suggest that Asteraceae and Poaceae families are dominant on walls [8,9,10,11]. Thus the present study also supports that Asteraceae, Poaceae and Amaranthaceae are the dominant families of the wall flora of study area. It is also observed that mostly members of Asteraceae colonize the walls in winter season while the members of Poaceae colonize the walls in Monsoon. Contrary to these, members of Amaranthaceae generally colonize the walls in summer season. Of the total plant species observed, based on the habit, 83 (61.48%) were represented by herbs, 22 (16.29%) by shrubs, 11 (8.14%) by trees, 14 (10.37%) by grasses and only 3(2.22%) by climbers and 2 (1.48%) by under trees. It represents that herbs dominate the old walls of the studied sites. [8], [9] and [10] also suggest that plants of herbaceous habits are chief representative of wall flora. Of the total studied plants 42 (31.11%) species were recorded in winters, 33 (24.44%) species in Monsoon and 8 (5.92%) species in summer season. However, 41 (30.37%) plant species were recorded throughout the year and 11 (8.14%) plant species were observed both rainy and winter seasons. It is evident from the present study that most of the plant species colonize the walls during rainy and winter seasons.

The most commonly visible angiospermic flora on the walls of the study area include, *Achyranthus aspera, Amaranthus spinosus, Parthenium hysterophorus, Commelina benghalensis, Tridax procumbens, Chenopodium album, Sida cordata, Ficus benghalensis, Ficus hispida, Ficus racemosa, Ficus religiosa* etc.

CONCLUSION

The favourable climatic conditions and the composition of old historical walls, have contributed to high taxonomic diversity at species, genera and family levels. The walls are situated within urban and rural landscape, so the composition of the wall flora is strongly influenced by the surrounding vegetation type. The wall flora plants in almost all the studied sites create an additional decorative effect on the walls and the buildings as archaeological and historical sites. The growth of trees causes a strong and negative effect on their consistence.

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