INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 15, No. 6, p. 376-382, 2019

RESEARCH PAPER OPEN ACCESS

Detrimental effects of drought and salinity stress on floral diversity of Kalabagh Mianwali, Punjab Pakistan

Allah Nawaz Khan[1*], Hira Zameer[2], Syeda Nusrat Manzoor[4], Muhammad Asif Akram[1], Muhammad Sufyan[3], Tahir irfan[1], Muhammad Amjad farooq[4], Abdul Basit[1]

[1*]*Department of Botany, Agriculture University Faisalabad, Pakistan*

[2]*Quaid-i-Azam University Islamabad, Pakistan*

[3]*College of Life Sciences China Agriculture University Beijing, China*

[4]*Bahauddin Zakariya University, Multan, Pakistan*

Key words: Floral diversity, drought stress, salinity stress, Kalabagh Mianwali.

http://dx.doi.org/10.12692/ijb/15.6.376-382 Article published on December 29, 2019

Abstract

Present study was conducted to investigate the Detrimental effects of Drought and salinity stress on floral diversity and how physical symptoms appear after these stresses. Plants in their natural habitats adapt to stresses in the environment through variety of mechanisms. But stresses are harmful with their exceeding concentrations that damage the floral diversity. Study was completed by different surveys during May 2017 to August 2019. 40 plant species were collected and sample were tested and observed to check physical symptoms in plants parts like fruit, flower, leaves, stem and roots. Plant species recorded under salt stress were 57.5%, drought stress 22.5% while combine affect of both salinity and drought in plants were 20%. Growth of many plants were badly affected by drought and salinity stress. Fruit and flower of the plants were much reduced, Stem was stunted, leaves mostly were wilted and roots were hollow and poor. Halophytes and drought tolerating plants were best in their growth. Overall floral diversity was under stress that was limiting the natural habitats.

* **Corresponding Author:** Allah Nawaz Khan ✉ nawazniazi409@yahoo.com

Introduction

Floristic study is the main key to get botanical information and it leads to detail study (Keith, 1988). Identification of plant species with respect to their origin and particular area is more important because it provides basic map to understand complete life history of plant. Plants are playing important role for environment they are the main factors to stabilize the earth environment, they have tremendous contributions for mankind (Ali, 2008). Floral diversity is economically and medicinally very important, they are playing important role for livestock, industries and many other applications. Trees, shrubs, herbs and grasses are habitat for many wildlife species (Ahmad *et al*., 2010). Salts are major constituent of soil but exceeding amount in soil result in many dangerous situations (Munns, 2005). Many areas of Pakistan have been recorded as affected areas due to salinity. (Chatrath *et al.,* 2007). The long salt range of Pakistan is 175km long having longitude of 71.30° and 73.30° eastern and latitude northern 32.23 and 33.0. Sakesar is the highest point in this range (Khan, 1960).

Soil salinity is major problem in salty areas and its affects physiological and metabolic process of plants and in results plants growth stops. (Ashraf & Harris, 2004). Soil salinity affects the nutrient level and water in the soil and in result convert the soil into arable land which leads to the destruction floral diversity from the area. Salinity stress produces osmotic stress and physiological drought which leads to decline of photosynthesis (Pasternak, 1987).

Salt stress and drought causes the accumulation of reactive oxygen species in many plants like hydrogen peroxide and singlet oxygen (Lee *et al*., 2001).

Ros attacks many important molecules of plants and its removal occurs by antioxidative action of plant. (Menezes Benavente *et al*., 2004). Elimination reactive oxygen species is possible by antioxidants which accumulate plant and this characteristic features is found only in some plants (Noctor & Foyer, 1998).

Reduction in growth of plants like leaves wilting, stunted growth fast and short life cycle of plant are due to imbalance of ion which occurs due to drought and salinity stress. (Guetadahan *et al*., 1998). Some plant species have great tolerance against drought and salinity and they show much adaptation. They also resist to oxidative stress (Hernandez *et al*., 2001). Soil salinity and drought have adverse impacts on the floral diversity and they are main limiting factors for plant growth and habitat degradation (Laüchli & Epstein, 1990). Limited water supply and low annual rain fall in the area result in physiological drought and induces many strains like stomatal closure and photosynthesis level (Flexas & Medrano, 2002). Aims and objective of the current study were to explore the floral diversity of Kalabagh in Mianwali district of Punjab Pakistan which is facing drought and salinity stress. Secondly to findout the plant species those have adaptation to resist in such kind of stresses.

Material method

Study area

Kalabagh is mountainous are in district Mianwali of province Punjab of Pakistan. It is located on the western bank of famous Indus River. Kalabgh is famous due to its rich salt reservoirs. Many salt mines are located in this area.

Survey timing

Floral diversity of Kalabagh area in district Mianwali was fully explored that was facing drought and salinity stress during May 2017 to August 2019.

Methodology

40 Plant species were collected hard pressed and later mounted on herbarium sheets for record in university of agriculture Faisalabad. Collected plant species were identified with the help of flora of Pakistan (Nasir and Ali, 1970-2003). Photographs of habitat and plant species were taken with high quality camera.

Observation for drought and salinity stress

Area was fully surveyed, floral diversity was measured by Quadrat method along the straight transect line.

Phonotypical plant condition like Fruit, flowers, leaves, stem and roots were checked to find out the clear symptoms of these stresses and findings were enlisted like drought, stress and combine effect of both present in many plant species. Every mentioned above parts of plant was separately observed and every symptoms was noted accurately.

Fig. 1. Map of Pakistan.

Fig. 2. Map of study area Kalabagh.

Results

Pakistan has rich soil and beautiful geographical location as shown in fig1. In present research work it was concluded that area was rich with floral diversity as shown in table1 and it is diverse area as shown in fig 2. but due to stresses like salt stress and drought stress floral diversity was declining in the area as shown in fig 4, plants species that were tolerating were best in their growth. Salt tolerating plant species were larger in numbers while glycophtes were less in number.

Table 1. Floral diversity of Plant species affected by Drought and Salt stress.

Sr.no	Scientific name	Family	Affected by Salinity	Affected by Drought
1	*Grewia villosa*	Tiliaceae	Salinity	Drought
2	*Olea ferruginea*	Oleaceae	Salinity	
3	*Acacia nilotica*	Fabaceae		Drought
4	*Prosopis juliflora*	Fabaceae	Salinity	
5	*Capparis deciduas*	Capparidaceae	Salinity	Drought
6	*Salvadora oleoides*	Salvadoraceae	Salinity	
7	*Cgrysopogon serrulatus*	Poaceae	Salinity	Drought
8	*Rhazya stricta*	Apocynaceae	Salinity	
9	*Cymbopogon jwarancusa*	Poaceae	Salinity	Drought
10	*Suaeda vera*	Amaranthaceae	Salinity	
11	*Aristida adscensionis*	Poaceae	Salinity	Drought
12	*Ziziphus nummularia*	Rhamnaceae	Salinity	
13	*Cenchrus setigerus*	Poaceae		Drought
14	*Dactyloctenium scindicum*	Poaceae	Salinity	
15	*Asphodelus tenuifolius*	Asphodelaceae	Salinity	
16	*Acacia modesta*	Fabaceae	Salinity	
17	*Cressa cretica*	Convolvulaceae		Drought
18	*Eragrostis ciliaris*	Poaceae	Salinity	
19	*Fagonia ovalifolia*	Zygophyllaceae	Salinity	Drought
20	*Grewia villosa*	Tiliaceae	Salinity	
21	*Justicia adhatoda*	Acanthaceae	Salinity	
22	*Achyranthes aspera*	Amaranthaceae	Salinity	Drought
23	*Bombax cieba*	Malvaceae	Salinity	
24	*Boerhavia diffusa*	Nyctaginaceae	Salinity	Drought
25	*Malvastrum coromandelianum*	Malvaceae		Drought
26	*Verbascum Thapsus*	Scrophulariaceae	Salinity	
27	*Calotropis procera*	Asclepidaceae	Salinity	
28	*Cenchrus pennisetiformis*	Poaceae	Salinity	
29	*Cyperus compressus*	Cyperaceae		Drought
30	*Alopecurus aequalis*	Poaceae		Drought
31	*Achyranthes aspera*	Amaranthaceae	Salinity	
32	*Morus alba*	Moraceae	Salinity	
33	*Cynodon dactylon*	Poaceae		Drought
34	*Xanthium strumarium*	Asteraceae	Salinity	
35	*Dalbergia sissoo*	Papilionaceae	Salinity	
36	*Saccharum bengalense*	Poaceae	Salinity	
37	*Boerhavia diffusa*	Nyctaginaceae		Drought
38	*Digitaria adscendens*	Poaceae	Salinity	
39	*Malvastrum coromandelianum*	Malvaceae		Drought
40	*Eucalyptus camaldulensis*	Myrtaceae	Salinity	

Mineral salty rocks in larger number were the main factors and salt was accumulating in nearby areas by weathering. Over all salinity stress was main limiting factors for floral diversity that was responsible for many injuries to plant species as shown in fig 3.

Discussion

In recent study of detrimental effects of drought and salinity in Kalabagh district Mianwali-Pakistan it was noticed that under drought condition plants usually decrease their growth and moves towards stunted

condition, some plants leaves were dull from shiny, grass species were wilting and some species were found to be wilted. Those plant species that were permanently under drought stress were in bad condition their leaves color was changed, body water was very low. Drought symptoms were different in different plant species like yellowing, early falling leaves, wilting of leaves, leaves scorching on their edges and stunted growth. At some sites plant species were found to be completely dead due to drought stress. Most common symptom of drought injury is drying around the margin of leaves and that slowly moves towards the midrib.

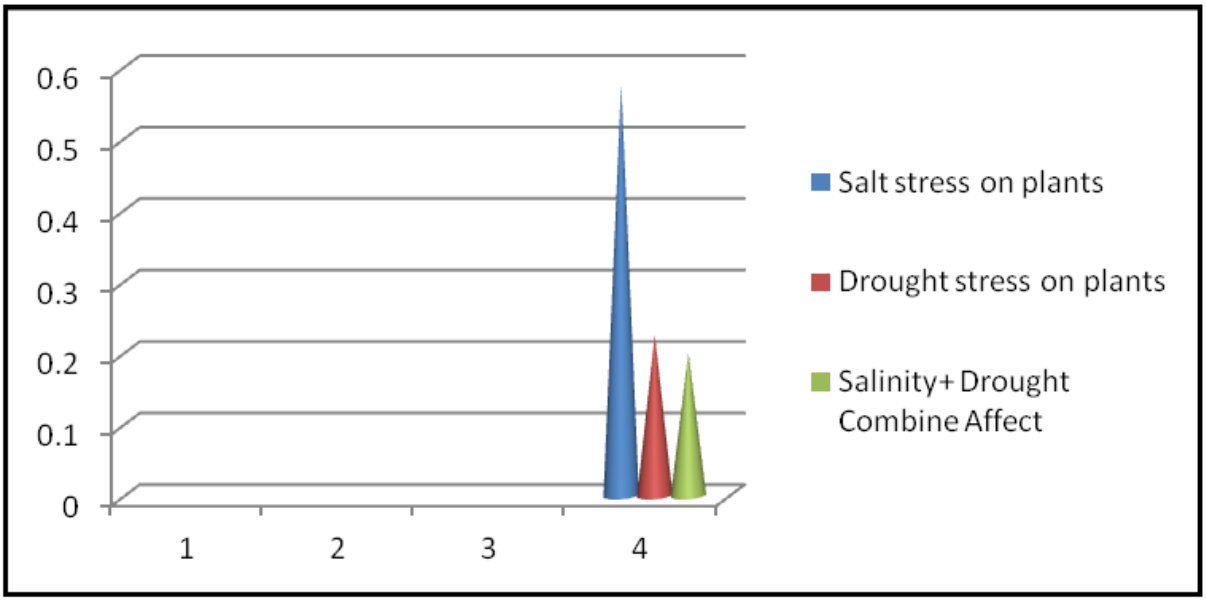

Fig. 3. Floral diversity affected by Salinity, drought and combine effect of both in percentage%.

Drought affected many plant species were affected at marginal leaf tissue more than other parts of the plant body and this condition was prolonged therefore many plant species were found to be at their end stages it was also noticed that after rainfall some plant species were passing through recovery but this process was very slow.

In present research work symptoms of damage by salt stress recorded in plant species were growth inhibition, senescence and death of many plants under prolonged exposure. Growth inhibition is the primary injury that leads to other symptoms. Physicall symptoms that were recorded due to salt stress were bud demage or complete death, twig and stem dieback, prolonged bud dormancy. Early leaf drop, reduced leaf and stem growth along with flower and fruit development delayed.

Salt stress was responsible for closing of stomata. Glycophytes plants were very less in number especially near the salt mine site because they cannot resist salinity stress. Halophytes plants are naturally salt tolerating plant species and their growth was best under such conditions. As shown in table 1 and fig 3.

From above discussion about detrimental effects of Drought and Salinity stress on Floral diversity of Kalabagh Mianwali, Punjab Pakistan it can be easily concluded that Annual rain fall in the area was very low and accumulation of salts in the area due to weathering of salt rocks and other factors were involve that were changing the soil, salt in the soil can absorb water and in the result drought appeared in the area which was also limiting factor for floral diversity in the Kalabagh area. Combine effect of both drought and salinity stress is harmful for floral diversity. Plants that were able to tolerate stresses like salt stress and drought stress were best in their growth only at some sites. Glycophytes were not good in their growth at salty sites. Deforestation was also recorded factor in the area.

Fig. 4. Habitat of study area along with plant species facing Drought and salinity stress.

References

Ahmad F, Khan MA, Ahmad M, Zafar M, Mahmood T, Jabeen A, Marwat SK. 2010 Ethnomedicinal uses of grasses in the Salt Range Region of Northern Pakistan. Journal of Medicinal Plants Research **4(5),** 362-369.

Ali SI. 2008. Significance of flora with special reference to Pakistan. Pakistan Journal of Botany **40(3),** 967-971.

Ashraf MPJC, Harris PJC. 2004. Potential biochemical indicators of salinity tolerance in plants. Plant science **166(1),** 3-16.

Chatrath R, Mishra B, Ferrara GO, Singh SK, Joshi AK. 2007. Challenges to wheat production in South Asia. Euphytica ***157*(3),** 447-456.

Flexas J, Medrano H. 2002. Drought-inhibition of photosynthesis in C3 plants: stomatal and non-stomatal limitations revisited. Annals of botany **89(2),** 183-189.

Hernández JA, Ferrer MA, Jiménez A, Barceló AR, Sevilla F. 2001. Antioxidant systems and O2.−/H2O2 production in the apoplast of pea leaves. Its relation with salt-induced necrotic lesions in minor veins. Plant physiology **127(3),** 817-831.

Keith DA. 1988. Floristic lists of New South Wales (III). Cunninghamia **2(1),** 39-73.

Khan MIR. 1960. Salt range forests of the Shahpur and Mianwali districts. Pakistan Journal of Forestry **10(4),** 326-33.

Läuchli A, Epstein E. 1990. Plant responses to saline and sodic conditions. Agricultural salinity assessment and management **71,** 113-137.

Lee DH, Kim YS, Lee CB. 2001. The inductive responses of the antioxidant enzymes by salt stress in the rice (Oryza sativa L.). Journal of plant physiology **158(6),** 737-745.

Menezes-Benavente L, Kernodle SP, Margis-Pinheiro M, Scandalios JG. 2004. Salt-induced antioxidant metabolism defenses in maize (Zea mays L.) seedlings. Redox report **9(1),** 29-36.

Munns R. 2005. Genes and salt tolerance: bringing them together. *New phytologist* **167(3),** 645-663.

Nasir E, Ali SI. 1970-2003. Flora of Pakistan (fasicles series 1-202) Department of Botany, University of Karachi, Pakistan.

Noctor G, Foyer CH. 1998. Ascorbate and glutathione: keeping active oxygen under control. Annual review of plant biology **49(1),** 249-279.

Pasternak D. 1987. Salt tolerance and crop production-a comprehensive approach. Annual review of phytopathology **25(1),** 271-291.

Shalata A, Tal M. 1998. The effect of salt stress on lipid peroxidation and antioxidants in the leaf of the cultivated tomato and its wild salt-tolerant relative Lycopersicon pennellii. Physiologia Plantarum **104(2),** 169-174.