FLORAL DIVERSITY OF BALKASSAR, DISTRICT CHAKWAL PAKISTAN

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خلاصہ

موجودہ مطالعہ پاکستان کے چکوال کے تیزی سے بڑھتے ہوئے گاؤں بلکسّر میں کیا گیا تھا تاکہ پودوں کے نمونے اور معاشرتی ڈھانچے کے بارے میں بنیادی معلومات اکٹھی کی جا سکیں جو اس سے پہلے نامعلوم تھیں اور اس سے پہلے اس کی دستاویزات نہیں تھیں۔ سال 2015- 2016 کے دوران پودوں کی مختلف اقسام کو اڈریٹ طریقہ استعمال کرتے ہوئے جمع کی گئیں۔ جمع شدہ نمونے خشک، دبایا اور جڑی بوٹیوں کی چادروں پر سوار تھے۔ درجہ بندی مختلف اعداد و شمار کے پودوں کے گروپوں میں تفریق کے لئے استعمال کی گئی تھی۔ مجموعی طور پر 45 پودوں کی پرجاتیوں جن میں 15 خاندانوں سے تعلق رکھنے والی 26 جڑی بوٹیاں، 9 خاندانوں سے تعلق رکھنے والی 10 جھاڑیوں اور 6 خاندانوں سے تعلق رکھنے والے 9 درختوں کا مطالعہ کیا گیا تھا اور 15 منتخب مقامات سے ان کی نشاندہی کی گئی تھی۔ امارانتھاسی، اسٹیریسی، پوسیسی، یوفوربیسی، مالواسی، اپوکیسیسی، فاباسائینڈ مورسی، جڑی بوٹیاں، جھاڑیوں اور درختوں کی سب سے عام فیملی تھیں جن کو منتخب علاقے سے پہچانا گیا تھا۔ موجودہ مطالعے کے نتائج سے معلوم ہوتا ہے کہ یہ علاقہ بوٹیوں کے پودوں سے مالا مال تھا۔ اس علاقے کی بائیوڈائیورسٹی کے تحفظ کے حصول اور بہتری کی ضرورت ہے۔ پودوں کی حفاظت اور دیکھ بھال کے لئے انسانی کنٹرول، زمین کا صحرا اور زمین کے استعمال کی سفارش کی جاتی ہے۔

Abstract

Present study was conducted in Balkassar, one of the rapidly growing village of Chakwal, Pakistan for collecting basic information about flora pattern and community structure which was unknown and not well documented before. Different plant species were collected using Quadrat method. The collected specimens were dried, pressed and mounted on herbarium sheets. The taxonomic classification was done for differentiation of plant groups. A total of 45 plant species including 26 herbs belonging to 15 families, 10 shrubs belonging to 9 families and 9 trees belonging to 6 families were studied and identified from 15 selected sites. Amaranthaceae, Asteraceae, Poaceae, Euphorbiaceae, Malvaceae, Apocynaceae, Fabaceae and Moraceae were the most common families of herbs, shrubs and trees which were recognized from the selected area. Present study findings suggest that this area is rich in herb flora. There is a need of accomplishment and improvement of preservation of biodiversity of the area. Human control, land desertion and land use for the preservation and maintenance of vegetation is recommended.

Key Words: Balkassar, Chakwal, Floral Diversity, medicinal plants, conservation, taxonomy, herbarium, ecology, climate

Introduction

Balkassar is a village, an administrative subdivision of Chakwal District in the Punjab Province of Pakistan, located 95 km south of the federal capital, Islamabad. Its geographical coordinates are 32° 56' 0" North, 72° 39' 0" East. The elevation above sea level is 528 meters. The Latitude is 32°56'15.25" and Longitude is 72°38'38.55".

In district Chakwal, the air temperature changes all over the year. In winter, the temperature varies from 4° C and 25° C and in summer temperature varies from 15° C and 40° C. In winter the coldest month is December and in summer the hottest month is June. The average rainfall of District ranges from 558 to 635 mm. In summers more than 70% of annual precipitation of rainfall occurs. (GoP, 2007).

The flora of any area is the compiled checklist of different plant species growing in any of the geographical area. The valuable data is recorded through this practice and could be used as a reference for future studies. There is a vast range of flora which is available ranging from concise or field flora to research floras (Qureshi *et al*., 2011).

Most plants live in community structure, there are forces which increase and decrease the natural tendency of plant species. With the passage of time the patchiness of plant species increases in the respected regions. Furthermore the environmental variation shows correlation so that sites close to one plant have a tendency to be good for another plant of species. (Frelich *et al*., 1993). The vegetation analysis and description of plants can be studied by different life form and leaf size spectra of plants. The changes in microclimate and macroclimate are analyzed by life form spectra of vegetation (Shimwell, 1971).

The ecosystem of any area is a mixture of different ecological processes which include the biodiversity and biorichness of the area. The biodiversity of ecosystem contain four major components which include diversity of genes, diversity of species, diversity of ecosystem and diversity of ecological processes. There is a rich floral diversity in Pakistan which is the indication of climatic condition, soil and other biological characters. (Kilic and Arslan, 2010).

Amjad and Arshad (2014) reported the pattern of species diversity and regeneration capacity in the forest of Nikyal valley. The quadrate method is used for analysis of herbs, shrubs and trees of the whole area. Diversity values of majority species were similar to the other Himalayan forests.

Badshah *et al*., (2013) studied the ecological characteristics and floristic composition of district Tank Pakistan in different seasons. The flora of the Tank area contains 205 species relating with 56 families. Poaceae contain 34 species, Papilionaceae contain 19 species, Asteraceae contain 14 species, Chenopodiaceae contain 10 species, Brassicaceae contain 9 species, Euphorbiaceae contain 8 species, and Broginaceae and Polygonaceae contain 7 species which was observed in area of Tank. Some families had less than 7 species.

Osman *et al*., (2014) analyzed the vegetation types, life forms as well as floristic diversity and distribution of species in Wadi Arar in the Northern border region of Saudi Arabia. 31 families of vascular plants were recorded which contain 196 species. The most common familiar families were Compositae, Gramineae and Leguminosae. Chamaephytes and Thereophytes were the most frequent life forms which indicate typical desert spectrum vegetation. The distribution of these species were reported in different regions of Wadi.91 species were recorded which were typical bi-regional. There was a highest number of plants which were recorded for annual plants while perennial and annual plants had low number.

Sharma *et al*., (2014) studied floral diversity and patterns of vegetation in Sangla Valley of Northwest Himalaya. The qualitative and quantitative assessment of vegetation was analyzed in that area. The 320 species were recorded which relate to 199 genera and 75 families. The dominant families were Ranunculaceae, Apiaceaea and Rosaceae. Nearly 182 species were observed which were native to the Himalaya. The density of trees and shrubs ranged from 205 to 600 and 105 to 1030. Floristic diversity and vegetation struture of Himalaya was analyzed which was not studied previously.

Hussain *et al*., (2009) conducted a study in Nurpur rangelands which are present in district Chakwal. The main objectives of that study were to study species composition and plant communities.29 families were recorded which contain 69 plant species in 4 sites of rangelands. The number of herbs and under shrubs was 6, shrubs were 31, trees were 12 and 20 species of grasses were identified in respected regions of Chakwal. Each plant species had significant values from species point of view.

Khan *et al*., (2011) studied the species and community diversity in Naran Valley. The species were analyzed through multivariate approach. They analyzed the qualitative and quantitative characteristics of floral diversity of species. At northern and southern level, data was collected at 144 sampling sites.198 species related with 68 families were identified at different sampling sites. There were families of plant recognized at the study area. At middle altitudes, there was more diversity of species observed.

Materials and Methods

After going through the topographic map of Balkassar area followed by frequent survey and visits, which were conducted during initial steps of research. The whole area of Balkassar was divided into 15 sites based on topographic map, physiognomy, altitude, and floristic composition of the region followed by frequent surveys. This resulted in the identification of different sites. Each site was positioned at a distance of 100 meter. 5 replicates were used in each community stand. The data was collected during spring and monsoon seasons. A complete specimen of each of the species was collected in triplicate, dried, preserved and mounted on standard herbarium sheets. Observation on life form and phenological behavior were recorded on the spot.

Quadrat methods were used for the quantitative study of vegetation at each locality. Three stands, each measuring 100 x 100 m were established at each locality and 15 sub-quadrates of 10 x 10 m size were laid randomly in each stand. In each sub-quadrat, plant density, frequency and cover were recorded (Mueller-Dombois & Ellenberg, 1974).

A mixture of random and systematic quadrats was used as it gives most excellent consequences of species distribution. Quadrats were laid systematically in lower altitudes and quadrats were laid randomly in hilly sites of the area. There were 100 meter distances between two adjacent stands. The following phytosociological attributes were measured in each case. Fifteen different study sites were selected in the Balkassar region on the base of location. These sites were selected for vegetation analysis and floral diversity of the area. The distribution and population of trees, shrubs and herbs were determined with the help of different parameters.

Results and Discussion

1-Climate of Balkassar of district Chakwal: In figure 1 and 2 climate condition of Balkassar, Chakwal is shown. There was maximum rainfall observed in March 2016 and minimum rainfall was observed in December 2015. There was maximum vegetation of herb species observed in March. The herb, shrub and tree vegetation of the area was totally effected by climatic condition and varied from site to site in Balkassar. The maximum temperature was observed in the month of April and minimum temperature was observed in the month of December.

There was diversity of herb species observed in different regions of Balkassar which was due to seasonal change of that particular area. There was high rainfall occurred in March 2016 so maximum variety of herbs were observed during these months.

2-Family Description of Plant Species: Table 1, 2 and 3 shows the floral diversity of Balkassar which were classified into herbs, shrubs and trees. In the present study, vegetation analysis, ecological attributes and floral diversity are investigated. Phytosociological study of Balkassar area shows that there are dominant herb species than shrubs and trees which show that area is rich in herbs diversity. A total of 45 plants species that were distributed among 30 families were recorded from the 15 sites of Balkassar of district Chakwal. At 15 study sites of respective area there were 15 plant communities recognized which included 26 species of herbs, 10 species of shrubs and 9 species of trees. Amaranthaceae, Asteraceae, Poaceae, Euphorbiaceae, Malvacea, Apocynaceae, Fabaceae and Moraceae were the most dominant families of the area.

Stewart (1972) also reported these families in Pakistan. The most common shrub which were observed at majority study sites were *Calotropis procera* and *Lantana camara*. *Ziziphus mauritiana* and *Dalbergia sissoo* were also observed at different study sites. The most common family which was observed at different regions was Fabaceae which contain *Dalbergia sissoo, Acacia nilotica* and *Acacia modesta. Eucalyptus alba* was also the common tree species of Balkassar because it was present in a large number at majority of sites. In herb species *Solanum nigrum, Chenopodium album, Alternanthera pungen, Cynadon dactylon, Oxalis corniculata* and *Amaranthus viridus* were most common and dominant species.*Lantana camara, Ziziphus mauritiana and Calotropis procera* were most common and dominant species of shrub. *Ziziphus mauritiana, Acacia nilotica, Acacia modesta, Dalbergia siss*o and *Eucalyptus alba* were the most common and dominant tree species of the area. Amjad *et al*., 2014 also reported phytosociological survey for investigation of vegetation structure and its correlation with altitude and edaphic factor of the Nikyal valley, Azad Jammu and Kashmir. They used 15 sampling sites for analysis of flora and reported 110 numbers of plants from the study area.

The plant species and community diversity was also studied in Narran Valley by Khan *et al*., (2011).They used 144 sampling sites for analysis of floral diversity and they observed 198 plant species related with 68 families.

Community structure, composition and vegetative function are the most important ecological attributes of vegetative area showing variations in response to various environmental variables. These variations in vegetative structure, richness, diversity and distribution are directly correlated with the intensity of variables like geographical location, productivity and evolutionary competition (Criddle *et al*., 2003).

3-Shannon Diversity Index: Shannon diversity Index was applied on all 15 sites. The species diversity, species richness and species evenness was analyzed and shown in table 4.

In table 4 all 45 species were analyzed on the basis of Shannon diversity Index. At all sites, there was maximum diversity of herbs, shrub and tree species and their number of species were varied from site to site and it was the presentation of overall flora of Balkassar area. The diversity and richness of herb species at most sites were equal but evenness of herb species was greater at site1, site 7, site 8 and site 10.The diversity of shrub was less than herbs. Site 2, site 3, site 4 and site 6 had high diversity of shrub species than other sites. Site 5 and site 15 had show maximum species richness because these sites were rich in number of shrub species. Site 2, site 3, site 4 and site 6 showed maximum species evenness. The number of trees was 9 and all sites had different number of tree species. The most common trees were *Dalbergia sisso* and *Eycalyptus alba* which were observed at majority of sites. At site 2 and site 4, there was maximum evenness of tree species was observed. At site 10 there was maximum richness of species according to Shannon diversity index.

Partosa and Reyes (2013) studied the vegetation analysis of the Pasonanca Natural Park Zamboanga City, Philippines. Three sites were established at the distance of 300m. Total 283 individuals were observed belonging to 45 species, 27 genera and 25 families. Shannon-Wiener's measure of evenness was applied in determination of species structure and distribution. Araceae, Arecaceae, Euphorbiaceae, Maranthaceae and Athyriaceae were most common families which were observed in that Island.

Ahmed *et al*., (2008) used 30 sampling sites for analysis of floral diversity of Royle forests of lower Dir district of Pakistan. They also calculated the diversity, density, frequency and basal cover of all, plant species present in 30 strands..

4-Maturity Index

In table 5 the maturity index of herb species at the site 2, 3, 4, 5, 7, 9, 10, and 12 of the study area shows maximum maturity. These sites show 60% maturity index of herb species in Balkassar region. Other sites show less maturity of species. Overall all herb species show less maturity than shrubs and trees. Herbs were grown in the area according to climate condition and other biological factors and the life span of herbs is short so there was less maturity of herbs observed at different study sites.

All 15 sites show maximum maturity index of shrubs in selected sites of Balkassar. At site 2, site 3, site 4, site 5 and site 6 there was maximum maturity of shrubs was observed. At site 10 the maturity of shrubs seemed to be less than other sites. Other study site had almost average level of maturity. Trees of all 15 sites show maximum maturity index. At site 4 there was maximum maturity observed which show maximum number of tree species at the respected site. At site 13 there was less maturity of tree species observed.

Trees of all 15 sites show maximum maturity index. At site 4 there was maximum maturity observed which show maximum number of tree species at the respected site. At site 13 there was less maturity of tree species observed.

Hussain *et al*., (2009) also conducted a study in Nurpur of District Chakwal. They used 4 sampling sites in the study area and recorded 69 plant species related with 29 families. In 4 sampling sites of study area, different plant species were identified and studied their maturity index and richness of species. There were 15 different sites recognized at the Balkassar area. Sharma *et al*., (2014) also studied floral diversity and patterns of vegetation in Sangla Valley of Northwest Himalaya and recorded 15 sampling sites which relate with 320 species 199 genera and 75 families.

Table 1. Herb species and their families at 15 selected sites of Balkassar.

Sr. No.	Family	Species Name	No. of Species
1.	Amaranthaceae	*Acyhranthus aspera*	*4*
		Alternanthera pungens	
		Amaranthus viridis	
		Digeria muricata	
2.	Asteraceae	*Corthamus oxycantha*	*4*
		Parthenium hysterophorus	
		Sonchus asper	
		Sonchus oleraceus	
3.	Poaceae	*Avena sativa*	*3*
		Cynodon dactylon	
		Saccharum bengalense	
4.	Euphorbiaceae	*Euphorbia helioscopia*	*3*
		Euphorbia hirta	
		Euphorbia thymifolia.	
5.	Malvacea	*Malva parviflora.*	*2*
		Malvastrum coromendelianum	
6.	Primulacea	*Anagalis arvensis*	*1*
7.	Papavaracea	*Fumaria indica*	*1*
8.	Xanthorrhoacaea	*Asphodelus tenuifolius*	*1*
9.	Cannabaceae	*Cannabis sativa*	*1*
10.	Chenopodiacea	*Chenopodium album*	*1*
11.	Convolvulaceae	*Convolvulus arvensis*	*1*
12.	Fabacaea	*Medicago sativa*	*1*
13.	Oxalidaceae	*Oxalis corniculata*	*1*
14.	Solanaceae	*Solanum nigrum*	*1*
15.	Zygophyllaceae	*Tribulus terrestris*	*1*

Table 2. Shrub species and their families at 15 selected sites of Balkassar.

Sr. No.	Family	Species Name	No. of species
1.	Apocynaceae	*Calotropis procera*	2
		Carissa africana	
2.	Fabaceae	*Dalbergia sissoo*	1
3.	Sapindaceae	*Dedonea viscose*	1
4.	Acanthaceae	*Justicia adhatoda*	1
5.	Verbenaceae	*Lantana camara*	1
6.	Euphorbiaceae	*Mallotus philippensis*	1
7.	Rosaceae	*Pyrus pashia*	1
8.	Celastraceae	*Indigofera gerardiana*	1
9.	Rhamnaceae	*Ziziphus mauritiana*	1

Table 3. Tree species and their families at 15 selected sites of Balkassar

Sr. No.	Family	Species Name	No. of Species
1.	Fabaceae	*Dalbergia sissoo*	3
		Acacia nilotica	
		Acacia modesta	
2.	Moraceae	*Broussonetia papyrifera*	2
		Ficus carica	
3.	Rhamnaceae	*Ziziphus mauritiana*	1
4.	Meliaceae	*Melia azedarach*	1
5.	Mrytaceae	*Eucalyptus alba*	1
6.	Fabaceae	*Pongamia glabra*	1

Table 4. Shannon diversity index of all plant species at 15 selected sites in Balkassar

Shannon Diversity Index	
No. of sites	**Diversity Index**
Site 1	3.32
Site 2	3.34
Site 3	3.32
Site 4	3.35
Site 5	3.22
Site 6	3.19
Site 7	2.97
Site 8	3.03
Site 9	3.13
Site 10	3.08
Site 11	3.01
Site 12	3.14
Site 13	3.08
Site 14	3.13
Site 15	3.12

Table 5. Maturity Index of herb, shrub and tree species at 15 selected sites at Balkassar, during current study period.

No. of sites	HERBS	SHRUBS	TREES
SITE 1	2.815	7.333	14.545
SITE 2	3.270	9.117	13.684
SITE 3	3.184	10	15.882
SITE 4	3.035	9.047	17.333
SITE 5	3.150	9.375	14.814
SITE 6	2.840	9.0322	12.592
SITE 7	3.310	7.058	14
SITE 8	2.962	8.214	15
SITE 9	3.113	7.727	14.666
SITE 10	3.030	6.923	14.545
SITE 11	2.997	8.5	15.625
SITE 12	3.314	8.333	13.714
SITE 13	2.942	7	12.777
SITE 14	2.896	7.419	16.428
SITE 15	2.931	8.823	11.794

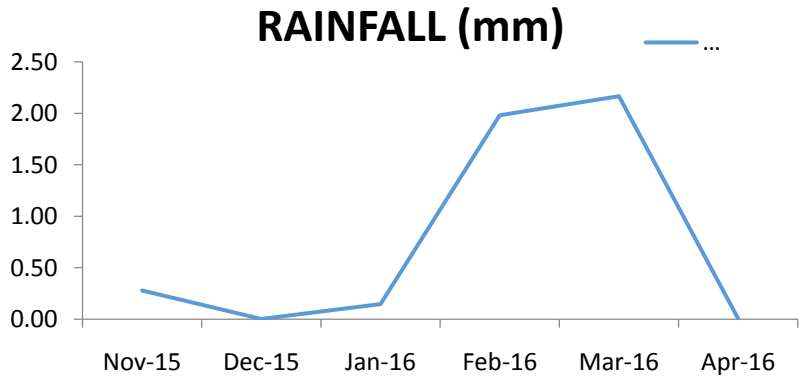

Fig.1 Rainfall of Balkassar from November 2015 to April 2016.

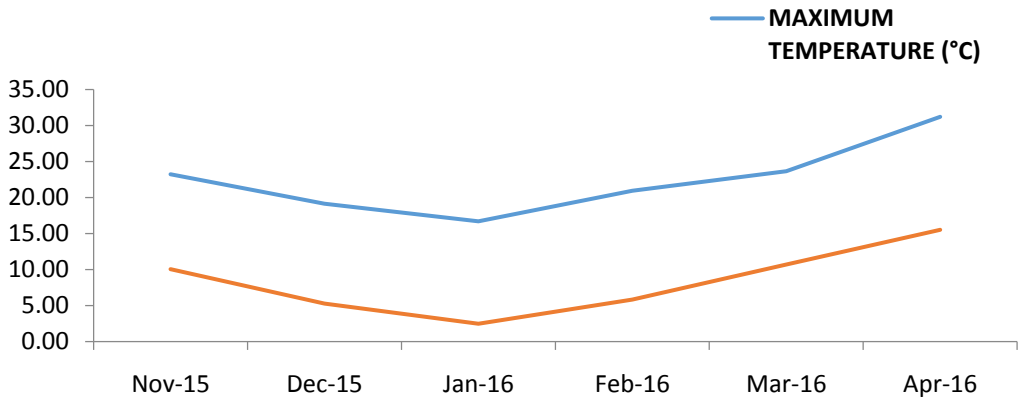

Fig .2. Minimum and Maximum temperature of Balkassar from November 2015 to April 2016.

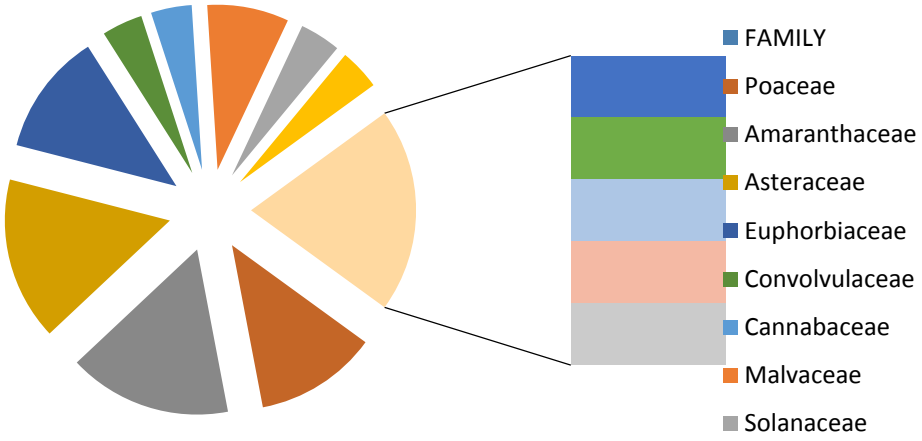

Fig.3. Herb species and their families at 15 selected sites of Balkassar.

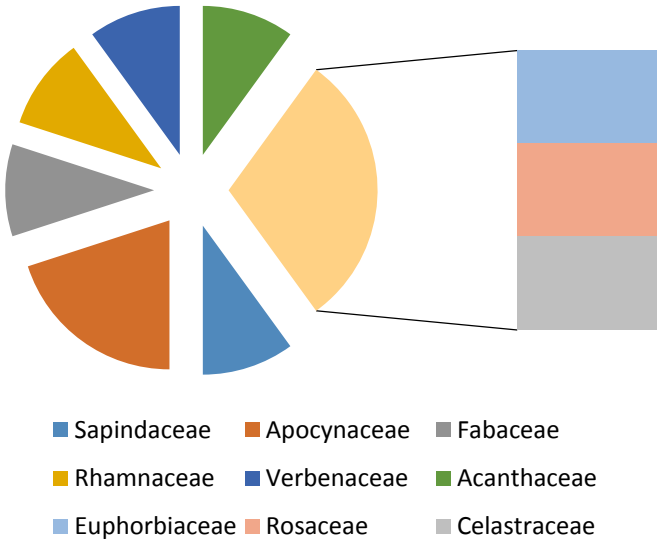

Fig.4.Shrub species and their families at 15 selected sites of Balkassar.

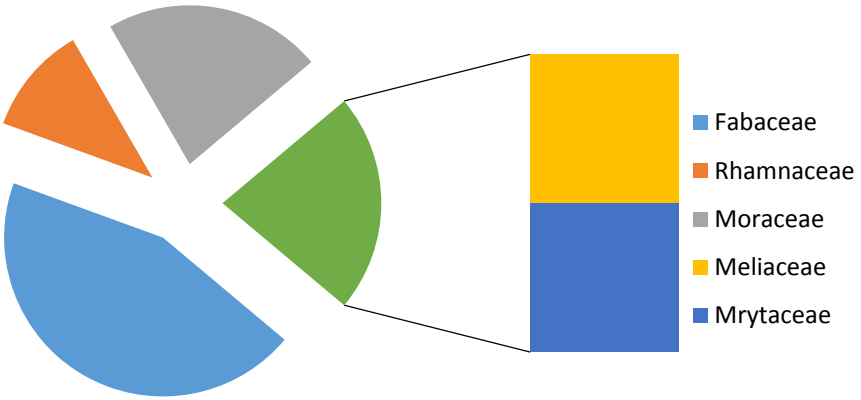

Fig.5. Tree species and their families at 15 selected sites of Balkassar.

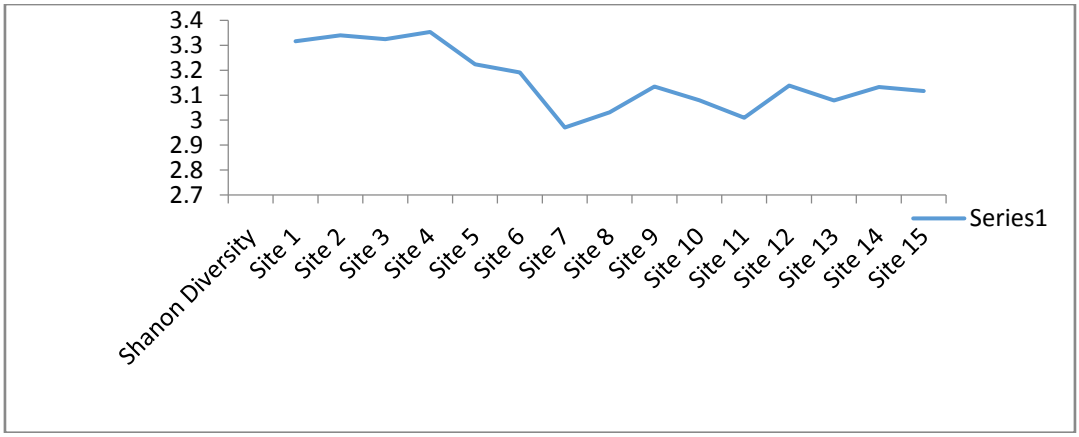

Fig.6. Shannon diversity index of all plant species at 15 selected sites in Balkassar.

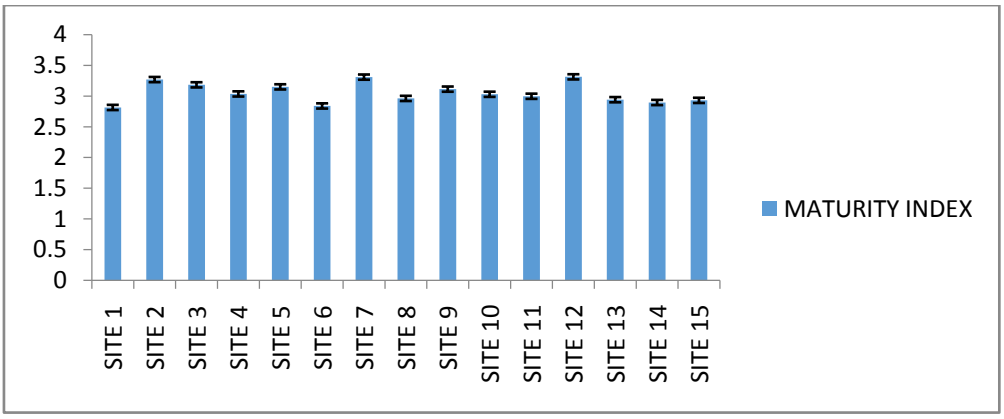

Fig.7. Maturity Index of herb species at 15 selected sites in Balkassar.

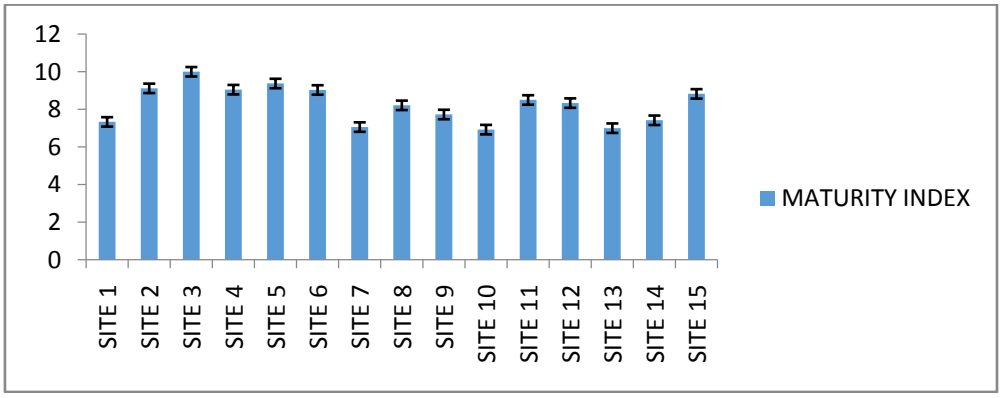

Fig.8. Maturity Index of Shrub species at 15 selected sites in Balkassar.

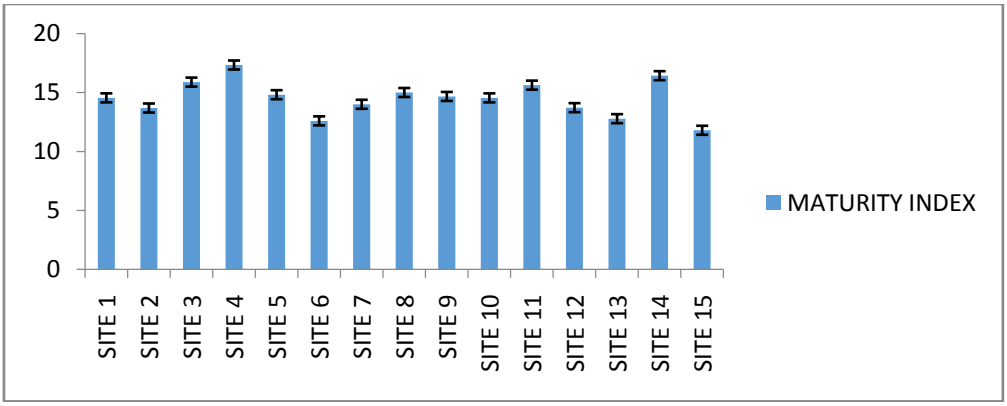

Fig.9. Maturity Index of Tree species at 15 selected sites in Balkassar.

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