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Floristic Indices and ion content of Some Medicinal Plants along Sand Dunes Altitude in Cholistan Desert of Pakistan

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Abstract

The present study was conducted to explore the nutrient ions status, their uptake ratio and floristic indices of some medicinal plants of Cholistan desert of Pakistan from Drawar fort area. Vegetations on sand dunes of approximately equal size were evaluated with three replications. In soil of zone 1 (top of dune), maximum frequency (100) of *Caligonum polygonoides and* minimum (33.34) of *Salsola imbricata* and *Capparis decidua* were recorded. In soil of zone 2, maximum frequency (100) of *Caligonum polygonoides* while minimum (33.33) of *Calotropis procera* while in zone 3, 100% frequency of lonely species *Symbopogon jawarancusa* was observed. In soil of zone 1, maximum concentrations were of sodium (Na), bicarbonate (HCO_3), nitrogen ((N) and organic matter (OM) while in soil of zone 2, EC, pH, phosphorus (P) and potassium (K) were maximum. Leaf K and Na were the highest (27.10mg/g) and (118.36mg/g) respectively in *Prosopis cineraria*. Leaf P was the highest (0.42mg/g) in *Prosopis cineraria* also. Maximum stem Na (333.00mg/g) was in *Salsola imbricata*. In flowers, highest P (0.42mg/g) was found in flower of *Salsola imbricata*.

Keywords: Vegetation, Nutrients, Medicinal Plants, Cholistan Desert, Drawar fort

Introduction

The concentration of nutrient ions in a plant plays pivotal role in its effectiveness as medicine. Ethno-pharmacological studies of desert plants can greatly contribute to modern medicinal purposes. Ethnomedicine is the medicinal use of plants by humans but it can be more precisely called as ethnobotanic medicine **[1,2]** and the practice goes back to some 60,000 years ago **[3]**. Recent reports show that a total 176 species of plants are only being used in medicine of asthma only **[4]**. In Cholistan, 20 indigenous plants belonging to 17 families are documented for medicinal practices **[5]**. However, Plant parts, method of medicine preparation and its application mode play a significant role in herbal medicine effectiveness **[6]**. Deserts of the world are arid and semi-arid regions comprising about one third of the world's land and are facing the water scarcity **[7]**. Water deficiency affects many aspects of the plant **[8, 9]**.

Cholistan is a desert which lies in the southern Punjab of Pakistan extended over an area of about 26,000km^2**[10]**. On topography, soil and vegetation, Cholistan is divided into two geomorphic types. The northern Lesser Cholistan comprising the canal-irrigated areas of approximately 7770 km^2 and southern Greater Cholistan which comprises about 18130km^2.

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The soil of Lesser Cholistan is saline, hard and compact with low sandy ridges. The valleys are of sandy soil. The Greater Cholistan comprises river terraces,large sand ridges with less interdunal plain areas **[11]**. The vegetation of Cholistan desert comprises of xerophytic plants and is a typical of arid regions. The soil topography and nutrients status plays important role in species distribution pattern.

In the Cholistan desert different soil types and plant species are found **[12]**. Soil type is among the major factors on the base of which distribution of vegetation of desert occurs **[13]**. The present studies were conducted to explore the nutrient status and nutrients uptake ratio of medicinal plants in relation to edaphic characters to get assistance for the management and restoration of vegetation in the desert.

Materials and Methods

Field survey

A preliminary survey of Drawar fort area of Cholistan desert was carried out for the study. Typical desert sand dunes with uniform height were selected for study. The information on medicinal uses and local names of plant were collected from nearby peoples. Plant identification was carried by coordinating with them and scientific names were confirmed from herbarium reference record lying in the departmental herbarium (Dr. Mumtaz Bukhari herbarium) Department of Botany, Bahauddin Zakaryia University, Multan, Pakistan and additionally by the literature **[14]**.

Collection of data for floristic indices

Quadrate method was opted to explore floristic indices. Sand dunes were divided into three zones along their altitudes. Three quadrates were applied in each zone and data of three replicates were taken, pooled and analyzed. Following parameters were evaluated.

Frequency

Frequency was calculated by following formula

$$F(\%) = \frac{\text{Number of quadrates in which species occoured}}{\text{Total number of quadrates}} \times 100$$

Relative frequency

Relative frequency was calculated by following formula

$$RF(\%) = \frac{\text{Frequency of one species}}{\text{Total frequency of all species}} \times 100$$

Density

Density has been used to describe the characteristics of communities. However comparison can only be based on similar life forms. Basically, density is the number of individuals in a unit area.

Relative density

Following formula was used to calculate the relative density of species in all of the quadrates.

$$RD(\%) = \frac{\text{Density of one species}}{\text{Density of all species}} \times 100$$

Laboratory work

Keeping in mind the consistency among age and size of plants and their parts, specimen were gathered by a proper system **[15, 16]**. Further preparing of collected material was studied in laboratory of Botany department, Bahauddin Zakariya University, Multan.

Chemical analysis of soil

Soil was collected from three different elevations of sand dunes in triplicate. Soil (200g) was taken in 600ml plastic beaker. Distilled water was added to prepare the soil saturation paste. Stone and other such materials were removed. Extract was obtained with the help of suction pump. Passed the extract through whattman filter paper and diluted the filtrate by distilled water.

Electrical Conductivity (EC)

Electrical conductivity of the extract was determined by using EC meter. Buffer of KCl (0.01M) was prepared to calibrate the EC meter. Readings for EC from extracts of soil samples were noted with EC meter.

Organic Matter (OM)

Soil organic matter was determined by method of Jackson **[17]**. Soil (0.5 g) was taken and transferred into 500ml flask. In it, 10ml of 1N potassium dichromate and 20ml of conc. H_2SO_4 were added and left for 30 minutes. After cooling, 200ml of distilled water + 10 ml of H_3PO_4 and 1ml of diphenylamine were added and it was titrated against $FeSO_4$. In the beginning colour changed to voilet, later it became intense blue. The ferrous sulphate was added drop by drop till the blue colour changed to green which indicated the end point.

Soil organic matter = $(V_1\text{-}V_2/W)\times 0.003\times 100\times 1.724$

Where,

V_1= volume used of $K_2Cr_2O_7$

V_2= volume used of Fe_2SO_4

W= weight of soil

Nitrogen (N)

Nitrogen was estimated by multiplying the factor (0.05) with organic matter.

pH

Soil pH was determined by pH meter. To calibrate the pH meter, dissolve one pH tablet in 100 ml of water, note down the readings of sample shown on the meter.

Bicarbonates (HCO_3)

To determine the bicarbonate in soil sample, took 1 ml of soil extract in 50 ml of beaker and add drop wise phenolphthalein as indicator. No pink color appeared, add 0.1 of bromophenol blue or methyl orange and titrate it to mid color of bromophenol blue. The readings on the burette gave the total amount of dissolved bicarbonate, calculated by the following formula.

HCO_3^{-1}(meq/L)= volume of H_2SO_4× Normality of H_2SO_4/vol. of aliquot used×1000

Chloride ions

For chloride ions analysis 1ml of soil extract was added in 10ml of water. Added few drops of $K_2Cr_2O_7$ and titrated it against $AgNO_3$. The end point was black ppt. The presence of Cl^{-1} was calculated by following formula.

Cl^{-1} meq/L= Normality of $AgNO_3$×vol of $AgNO_3$/ vol of aliquot used×1000

Nutrient extraction from soil and Plant

Soil/ or plants samples (0.5gm) was taken in pyrex glass vials and 6ml H_2SO_4 was added. This method involved temperature control, with slow ramp rates and a final temperature 3500C for 4 hours. H_2O_2 was added to clear the solution and allowed to cool at room temperature. Filtered with the whattman filter paper and marked the filtrate up to 50ml with distilled water and stored in plastic bottles at room temperature.

Estimation of Potassium (K) in soil and plant

Respective digested material (10ml) was taken and marked up to 50 ml with distilled water and took 10ml from this in the test tube and set the nob of flame photometer for k^+ and calibrated with buffers of different standards (0.1, 0.2, 0.3, 0.4, 0.5, 0.6) and after that readings of aliquot were noted.

Estimation of Sodium (Na) in soil and plant

Respective extract (10ml) was taken and marked up to 50 ml with distilled water and took 10ml from this in the test tube and set the nob of flame photometer for Na^+ and calibrated with buffer of different standards and after that readings of aliquot were noted.

Estimation of Phosphorus (P) in soil and plant

The aliquot (2ml) was taken in measuring cylinder. Barton reagent (2ml) was added and volume was made to 50ml by distilled water. These samples were kept for half an hour before analyzing phosphorus. The phosphorus was analyzed by spectrophotometer. The values of phosphorus were calculated by using standard curve.

After finding the values of nutrients concentration in soil and plant sample, %age uptake of respective nutrient was calculated as

%age uptake = Conc. in soil- conc. in plant sample/ Conc. in soil x 100

Statistical analysis

The data collected were analyzed for analysis of variance for all the parameters using COSTAT computer package (CoHort Software, Berkeley, CA). To compare means, Duncan's New Multiple Range test at 5% level of probability was used **[18]**. Significant F values were tested by LSD tests at 0.05% significance level, by using MSTAT-C Computer Statistical Programme.

Results

Floristic indices

The data regarding the floristic indices of vegetation is given in Table 1. *Tamarix aphylla* has maximum frequency (66.6) in elevation 1 of Drawar fort. *Salsola imbricata* and *Capparis decidua* have same frequency in the first elevation. In the second elevation *Caligonum polygonoides* (100) has maximum frequency, *Prosopis cineraria* (66.67) has moderate and *Calotropis procera* (33.33) has low frequency. In the lower elevation *Symbopogon* has (100) frequency. Relative frequency of *Caligonum polygonoides* (37.50) is higher in the first elevation while *Tamarix aphylla* has less relative frequency (25) and *Salsola imbricata* and *Capparis decidua* have almost same relative frequency. *Caligonum polygonoides* has higher relative frequency (42.85) while *Prosopis* has relatively low and *Calotropis procera* has lowest relative frequency among these plants in second elevation. *Symbopogon* has (100) relative frequency. *Tamarix aphylla* (14) has high density, *Caligonum polygonoides* (10.33), *Salsola imbricata* and *Capparis decidua* have almost same density while *Capparis decidua* has slightly high density. In the second elevation *Caligonum polygonoides* (3) has high density while *Calotropis procera* and *Prosopis* has same density; *Symbopogon* has highest density in the third elevation. Almost same pattern had been observed in relative frequency of Drawar fort species. *Tamarix aphylla* (38.86) has relative density in the first elevation while *Caligonum polygonoides* has slightly high (43.05). *Salsola imbricata* (5.56) and *Capparis decidua* (8.33)

(4.16) have low relative frequency. In second elevation *Caligonum polygonoides* (66.67) has high relative frequency, *Prosopis* (22.22) has moderate and *Calotropis procera* had lower relative density.

Table 1: Vegetation Indices along altitudinal gradients of sand dune in Drawar fort area of Cholistan desert of Pakistan

Dune elevation	Name of species	F	R.F	D	R.D
1	*Tamarix aphylla* (Linn.) Karst	66.67	25	14	38.88
	Caligonum polygonoides Linn	100	37.50	10.33	43.05
	Salsola imbricata Forssk.var. *imbricata*	33.34	12.50	4	5.56
	Capparis decidua (Forsskal.) Edgew	33.34	12.49	6	8.33
2	*Caligonum polygonoides* Linn	100	42.856	3	66.67
	Prosopis cineraria (Linn.) Druce	66.67	28.51	1	22.22
	Calotropis procera subsp. hamiltonii (Wight) Ali	33.33	14.283	1	11.11
3	*Symbopogon jawarancusa* (Jones) Schult.	100	100	49	100

F= frequency; R.F=relative frequency; D= density; R.D=relative Density

Symbopogon has (100) relative density in the third elevation.

Potassium concentration and uptake ratio in trees

Table 2: Analysis of variance (ANOVA) for soil properties of sand dune in Drawar fort area of Cholistan desert of Pakistan.

Source	Df	MS						
		P	**Na**	**K**	**Cl**	**pH**	**HCO_3**	**EC**
Soil	2	0.001**	37793.3***	2062.81***	8331.25***	0.247 ns	75***	6.175*
Error	6	5.298	73.048	4.71	14.49	2.218	4.497	0.9480
Total	8							

df=degree of freedom; ** highly significance, ns= non significance

Analysis of variance has shown significant difference among different plants and their parts (Table 2). The mean values (Table 4) showed that the significant differences were recorded among *Prosopis* stem (17.92mg/g), *Prosopis* leaves (27.10mg/g),*Tamarix apyhlla* bark (8.73mg/g), *Tamarix apyhlla* root (26.90mg/g), *Tamarix apyhlla* stem (15.30mg/g), *Capparis decidua* bark (23.66mg/g). Significant differences were observed in two trees which were *Prosopis* stem (17.92mg/g), *Capparis decidua* stem (26.80mg/g). Trees of Drawar fort (Cholistan) have shown maximum absorption of K^+ ions from soil. *Prosopis cineraria* stem (91.81), *Prosopis cineraria* leaves (87.62), *Tamarix apyhlla* bark (96.01), *Tamarix apyhlla* root (87.71), *Tamarix apyhlla* stem (93.01),

Capparis decidua bark (89.19), *Capparis decidua* stem (87.76) showed maximum absorption of K^+ ion from soil and non-significant differences were present.

Sodium concentration and uptake ratio in trees

Analysis of variance has revealed statistically different values between plants (Table 2). The mean values (Table 4) showed that the significant differences were present among *Prosopis* stem (64.3mg/g), *Prosopis* leaves (118.36mg/g), *Tamarix apyhlla* stem (19.16mg/g), *Tamarix apyhlla* bark (30.63mg/g), *Capparis decidua* stem (21.36mg/g) and *Capparis decidua* bark

Table 3: Mean values for soil properties of sand dune in Drawar fort area of Cholistan desert of Pakistan.

	P	**Na**	**K**	**N**	**HCO_3**	**OM**	**pH**	**EC**
Elevation 1	0.13±0 b	236.5±13.1a	21.6±1.2b	117.5±6a	25±2.5 a	0.813±0.052 b	6.99± 1.45	7.433±0.68 ab
Elevation 2	0.175±0.009 a	201.3±6.56b	60.01±3.55a	27.5±2.35b	15±2 c	0.812±0.035 a	7.56±1.89	9.317±0.72 a
Elevation 3	0.148±0.008 b	26.9±2.12c	10±0.3 c	25±1.4b	20±1.8 b	0.729±0.026 c	7.28±0.99	6.5±1.36 b

(23.55mg/g). Non- significant values were present among *Tamarix apyhlla* bark (30.63mg/g) and *Tamarix apyhlla*root (27.33mg/g). High absorption was shown by *Tamarix apyhlla* bark (80.22), *Tamarix apyhlla* root (82.35), *Tamarix apyhlla* stem (87.63), *Capparis decidua* bark (84.79) and *Capparis decidua* stem (86.21) and considerable difference was not present. Relatively low absorption was shown by *Prosopis cineraria* stem (58.48), while lowest value of absorption was shown by *Prosopis cineraria* leaves (23.58).

Phosphorus concentration and uptake ratio in trees

Analysis of variance has expressed different values between plants (Table 2). The mean values (Table 4) showed that the significant differences were present among *Prosopis* stem (0.12mg/g), *Prosopis* leaves (0.42mg/g), *Tamarix apyhlla* stem (0.24mg/g), *Tamarix apyhlla* bark (0.39mg/g), *Tamarix apyhlla* root (0.36mg/g) and *Capparis decidua* bark (0.21mg/g). Non-significant values were present among *Prosopis* stem (0.12mg/g) and *Capparis decidua* stem (0.23mg/g). High absorption has been revealed by *Prosopis cineraria* leaves (175.33), *Tamarix apyhlla* bark (155.73), *Tamarix apyhlla* root (136.06). Moderate absorption has been revealed by *Tamarix apyhlla* stem (57.37) and *Capparis decidua* stem (50.81). Relatively low absorption has been revealed by *Capparis decidua* bark (37.70) while surprisingly lowest value of absorption was shown by *Prosopis cineraria* stem (21.31).

Table 4: Mean values for nutrients accumulation and uptake ratio of trees in Drawar fort area of Cholistan desert of Pakistan.

Name of species	Plant part	Potassium	Uptake (%)	Sodium LSD=3.34	Uptake (%)	Phosphorous LSD=0.017	Uptake (%)
***Prosopis cineraria* (Linn.) Druce**	S	17.92±2.45 b	91.8185	64.3±2.2 b	58.4893	0.12±0.008 f	21.31
	L	27.1±4.6 a	87.6273	118.36±2.95 a	23.5894	0.42±0.012 a	175.41
***Tamarix aphylla* (Linn.) Karst**	B	8.73±1.04 c	96.0142	30.63±1.15 c	80.226	0.39±0.007 b	155.74
	R	26.9±1.65 a	87.7186	27.33±2.02 c	82.3564	0.36±0.009 c	136.06
	S	15.3±1.40 b	93.0147	19.16±1.35 e	87.6307	0.24±0.015 d	57.38
***Capparis decidua* (Forssk) Edgew**	B	23.66±1.75 a	89.1978	23.55±1.60 d	84.7966	0.21±0.010 e	37.70
	S	26.80±2.24 a	87.7642	21.36±1.45 de	86.2105	0.23±0.009 f	50.82

Potassium concentration and uptake ratio in shrubs

Analysis of variance has revealed statistical difference among plants (Table 2). The mean values (Table 5) showed that the higher value of K^+ has been shown by *Caligonum polygonoides* stem (132.44mg/g) while the lower value was shown by *Calotropis procera* stem (12mg/g). There were some significant differences present in *Salsola imbricata* flower (17.20mg/g), *Salsola imbricata* root (27.50mg/g), *Caligonum polygonoides* root (35.25mg/g), *Caligonum polygonoides* stem (132.44mg/g). There were some non-significant differences present among *Salsola imbricata* flower (17.20mg/g), *Calotropis procera* leaves (12.96mg/g), *Calotropis procera* root (12.89mg/g), *Calotropis procera* stem (12.00mg/g). Surprisingly, high value was shown by *Caligonum polygonoides* stem (132.44mg/g). Shrubs of Drawar fort have shown high absorption of K^+ ions from soil. Maximum absorption has been shown by *Calotropis procera* (94.00) and no considerable difference has been shown by their parts, while relatively low absorption was shown by *Salsola imbricata* flower (92.14), root (87.44) and *Caligonum polygonoides* root (83.90) and lowest absorption was shown by *Caligonum polygonoides* stem (39.53).

Values represent mean ±standard deviation; Values sharing the different letters represent significance difference in respective column

Sodium concentration and uptake ratio in shrubs

Analysis of variance has shown different significant and non-significant values among plants (Table 2). The mean values (Table 5) showed that the significant differences were for *Salsola imbricata* flower (333.00mg/g), *Salsola imbricata* root (102.2mg/g), *Caligonum polygonoides* root (66.45mg/g), *Caligonum polygonoides* stem (10.56mg/g), *Calotropis procera* leaves (17.16mg/g). Some non-significant differences were recorded as for *Caligonum polygonoides* stem (10.56mg/g), *Calotropis procera* root (11.19mg/g) and *Calotropis procera* stem (30.62mg/g).

Maximum absorption was shown by *Salsola imbricata* flower (114.97), *Caligonum polygonoides* stem (93.18), *Calotropis procera* leaves (92.77), *Calotropis procera*

root (88.92) while relatively low absorption has been shown by *Calotropis procera* stem (80.23) and lowest absorption was shown by *Caligonum* root (57.10) and *Salsola imbricata* root (34.02).

Phosphorus concentration and uptake ratio in shrubs

Analysis of Variance has expressed statistically different values among plants (Table 2).

Table 5. Mean values for nutrients accumulation and uptake ratio of shrubs in Drawar fort area of Cholistan desert of Pakistan.

Name of species	Plant part	Potassium LSD=5.18	Uptake (%)	Sodium LSD=3.59	Uptake (%)	Phosphorus LSD=0.016	Uptake (%)
Salsola imbricata* Forssk.var. *imbricata	F	17.2±3.59 d	92.1472	333±4.58 a	114.9774	0.42±0.008 a	170.92
	R	27.5±5.14 c	87.4446	102.2±0.81 b	34.0219	0.21±0.01 e	36.74
***Caligonum polygonoides* Linn**	R	35.25±1.35 b	83.9063	66.45±1.60 c	57.1014	0.42±0.009 a	170.92
	S	132.44±3.82a	39.5334	10.56±1.10 f	93.1827	0.42±0.009 a	170.92
***Calotropis procera subsp. hamiltonii* (Wight) Ali**	L	12.96±1.20 d	94.083	17.16±1.04 e	88.9219	0.33±0.01 c	113.41
	R	12.89±1.75 d	94.115	11.19±1.01 f	92.776	0.23±0.009 d	49.52
	S	12±1 d	94.5213	30.62±1.40 f	80.2324	0.39±0.006 b	151.75

The mean values (Table 5) show that the significant differences were of *Salsola imbricata* flower (0.42mg/g), *Salsola imbricata* root (0.21mg/g), *Calotropis procera* stem (0.39mg/g), *Calotropis procera* root (0.23mg/g) and *Calotropis procera* leaves (0.33mg/g). Non-significant differences were present among *Salsola imbricata* flower (0.42mg/g), *Caligonum polygonoides* root (0.42mg/g), *Caligonum polygonoides* stem (0.42mg/g), *Salsola imbricata* flower (170.92), *Calotropis procera* leaves (113.41) and *Calotropis procera* stem (151.75). High absorption has been shown by *Caligonum polygonoides* stem and root (170). Lowest value of absorption has been shown by *Calotropis procera* root (88.92) and *Salsola imbricata* flower (36. 74).

Discussion

The concentration and uptake percentage of nutrients differed among plant species and their organs (Table 1-3). The reason for difference might be various factors. The water availability depends upon the soil texture which is a basic soil property that influences water retention and infiltration in soil **[19]**. Variations in soil texture and composition occur along the altitudinal gradients of sand dunes of deserts. These differences are reflected in the form of uptake and retention of nutrients in plants and their parts. Salts in soil limit water absorption of plant **[20]**. Potassium accumulation in soil is promoted by soil moisture while sodium accumulations occur in saline soil **[21]**. Nutrients ion competitions for uptake influence the concentration of each other **[22]**. Under drought conditions ions accumulation play role in osmotic adjustment of plant **[23]**. The uptake and accumulation of ions in plants depends also on ionic concentration in soil. Potassium ion acts as osmoticum and an essential macronutrient **[24]**. More clear discrimination of ionic uptake occurs under low soil salinity **[25]**. Deficiency of other nutrients ions occur due to high uptake of sodium **[24]**, high sodium can displace membrane-bound Ca^{+2} **[26]**. Differences among nutrients status might also be due to reason that before the onset of senescence, perennial plant shift their nutrients from abscising tissues to healthy one **[27]**.

Due to low water availability in desert, nutrient cycling is insufficient **[28]**. Topography and texture of desert soil plays important role in distribution of plants. The association of certain plant species to specific soil type is commonly observed in deserts **[29]**. The different vegetation types correspond to different soil types. Natural products from plants having ethnomedicnal potentials have long played important role in the innovation of drugs **[30]**.

Complex plant-soil interactions exist in plant communities **[31]**. The patterns of soil resources distribution have significant effects on plant establishment, growth and survival **[32]** and conversely, spatial patterns of plant distribution can have influence on physical and biogeochemical cycling of nutrients **[33]**.

The spatial distribution of nutrients on surface of soils in desert region is a result of complex interactions among the plants. Nutrient uptake, its litter falling, soil erosion, soil deposition, soil microbes, atmosphere, mineralization and decomposition etc affect nutritional status of soil **[34]**. Distribution of nutrients like N, P and K is positively

correlated with shrub size and their clustering strands. Soil under the canopy of larger and mixed plant have greater N, P and K levels than that of smaller mixed plant canopies **[35]**. Soil texture determines the infiltration and root uptake **[36]**, water logging **[37]**; root growth inhibition and by limiting soil depth **[38]**. Mineral materials, organic matter and other nutrients are moved through wind erosion processes from down slope to inter-dune areas **[39]**. Topographic characteristics determine the soil resource redistribution and transformations **[40]**. Nitrogen mineralization occurs more in the inter dune as compared to on top of dune **[24]**.

In an arid region soil heterogeneity varies spatially to a considerable extent. Under the plants soil heterogeneity seems more clear **[41]**. Under the canopy of plants nutrients are tied up and mineralized as a primary source and are point of high concentration of nitrogen, organic matter and other nutrients, in addition to mycorrhizal inoculums **[42]**. Under the canopy of plants falling of reduced solar radiation and low temperatures are observed **[43]**. Soil erosion by wind brings soil and its nutrients from the top to the bottom of dunes **[39]**. The soil particles also vary between shrubs (inter space soils) and under canopy soil. Small particles occur under the canopies as wind carried particles are captured by plant canopy **[35]**. Difference of rain falling water, under and away from the plant canopy, results in one sided transport of soil particles toward plants **[44]**. However, occasionally coarse soils are observed under the plant canopy **[45]**. Under the canopies, water contents of soil are modified by biological communities also **[46]**. High moisture contents are found in soil of under canopy **[45]**. Due to high moisture contents greater mineralization is expected **[47]**. Soil nutrients concentrations vary with plant species mineral absorption capacity **[41]** (Wezel et al., 2000) and nutrients quantity in plant litter falling under the canopy **[48]**. Nitrogen fixing ability of plant may alter soil fertility characteristics **[49]**. The soil nutrients status depends upon the presence of animals that feed directly from soil nutrients or as herbivores **[42]**.

Vegetation patterns are affected on local scale by energy, water, or nutrient availability **[50]**. Vegetation patterns in desert ecosystems within small areas establish relationships between vegetation patterns and edaphic factors **[38]**. Soil texture limits plant dynamics by changing soil moisture contents **[51]**. In desert environments, Nitrogen and water are the factors which can limit plant growth **[52]**. Hence, the variations in distribution of water and nitrogen spatially play role in determining the pattern of vegetation in desert environments **[53]**. Community dynamics are related to the mechanisms which control the availability of nutrient resources **[42]**. Under the canopies, plants protect other biological species from overheating and insolation directly **[43]**. By capturing animal resourced matter, wind and sheet water flow, soils under canopies are important sites for plant habilitation. These features have effects on plants life in arid zone **[54]**. However, these relations of plants to soil under the canopies depend upon many other environmental factors **[55]**. Also, away from the ecotone range of a species various biotic and abiotic constraints exert pressure on species to occur in fragments with a decrease in patch sizes as they get farther from their center of biome **[56]**.

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