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Study of the floristic diversity of pasture lands in arid regions of Algeria

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Abstract
In the context of identifying spontaneous Forage species; our inventory focused on the study of the floristic diversity of pasture lands in the DOUCEN region. The floristic surveys carried out in four grazing stations, made it possible to identify 28 species which are divided into 16 families, our results showed the dominance of *Poaceae*, *Asteraceae* and *Chenopodiaceae* which seem well adapted to the aridity of the environment. The results we obtained; show *Astragalus armatus* during the study period,as the most dominant species which shows that the region is subject to the action from the pasture and the total density is low in the four stations from 0.2 to 0.3 plants/Surface, this shows their exposure to accentuated grazing. The PCA study divided the species into distinct homogeneous groups and allowed us to characterize each station. One of the major points is to think about sustainable management of grazing areas;

Key Words: Animal feed, spontanous flora, inventory, arid regions.

Introduction

Pastoral lands in the Arab world are characterized by significant levels of degradation, reduced production and even desertification. This degradation results from the irrational management of the routes, the introductionn of means and development techniques unsuitable for the environment (Nedjraoui and al., 2009) and by the interaction of several parameters: natural factors generally linked to climatic conditions, and their influence on the physical environment (drought, wind erosion, etc.), anthropogenic pressures exceedingmost often the capacities of the environment (overgrazing, uncontrolled plowing, clearing, etc.) and legal and organizational short comings (Salemkour and al., 2013).It is in this context that our study was carried out with the objective of identifying the spontaneous forage species of the study region in order to assess the biodiversity of the heritage

of this region.

1.Materials and methods

Study area

This study took place in the Doucen region , 80 km from the provine of Biskra. It is located at an altitude of 102 m and between 4°57' and 5°17' east longitude, and 34°30' and 34°45' north latitude. With an area of 642 km2 We chose four stations representative of the study region; Rhayat, Louzen, Msanaj and Almousran, The locations of study stations are represented in red dots on the map of Biskra illustrated below tousing the GPS points of each of them.

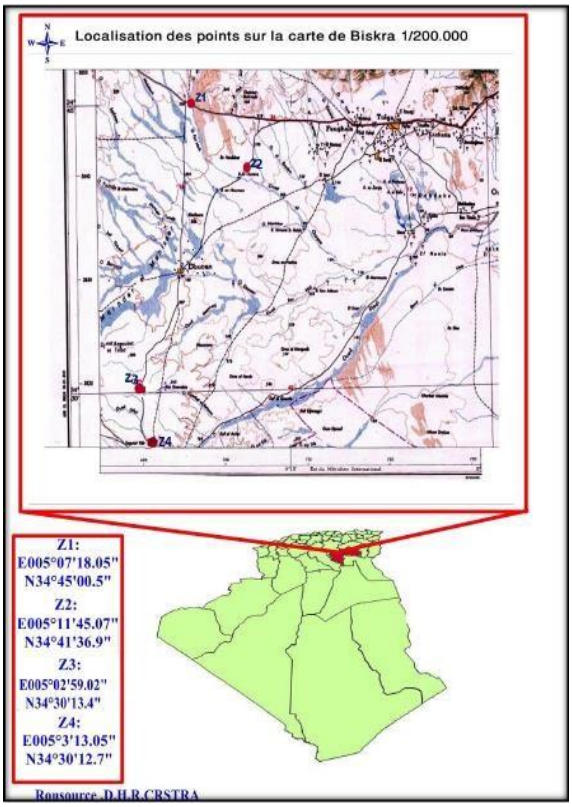

Fig.1. Locations of study stations on the map of Biskra (1/200,000)(CRSTRA, 2020)

Our study took place during the spring period, to do this ; we carried out a floristic study in the field and a physicochemical study of the soil in the laboratory.

Sampling methods

We have determined the location of our surveys based on homogeneity physiognomy of the courses. These surveys are carried out using the mixed line-surface survey method adopted by Gautier et al. (1994), which makes it possible to quantify and qualify the environment (Birkinshaw et al., 1998).

Identification of species

A herbarium was prepared for the identification of species which was carried out according to different botanical guides and identification keys: Quezel and Santa (1954); Ozenda (1954-1994); and also by consulting researchers specialized in the field.

Analysis of biological heritage

It seems more judicious to use ecological indices to better characterize the spontaneous flora of the Doucen region. This study concerns the total and specific richness, their abundance dominance, the diversity indices and the Shannon and equitability indices of the spontaneous flora across the different stations, and finally the types of formation or the biological spectra.

Soil analysis

Soil samples were analyzed to determine certain soil characteristics.After air drying, the samples are sieved to approximately 2 mm. The physicochemical analyses concern the granulometry, texture, humidity, electrical conductivity, pH, total limestone (CaCO3), and gypsum (CaSO4, 2H2O).

Statistical analysis

All our data underwent appropriate statistical analyses; PCA (Principal Component Analysis) soil-site-vegetation.

2.Results and discussion

Floristic approach: The inventory of spontaneous flora in the study region will be processed.

1. Calculation of the minimum air:

The examination of the representative figures of the minimum areas of the stations studied shows that station 4 of Almousran, presents the smallest surface area (128 m2) this could be explained by the impact of overgrazing, while for the three other stations a minimum area of 256 m2 was recorded (quadrat of 16 * 16 m).

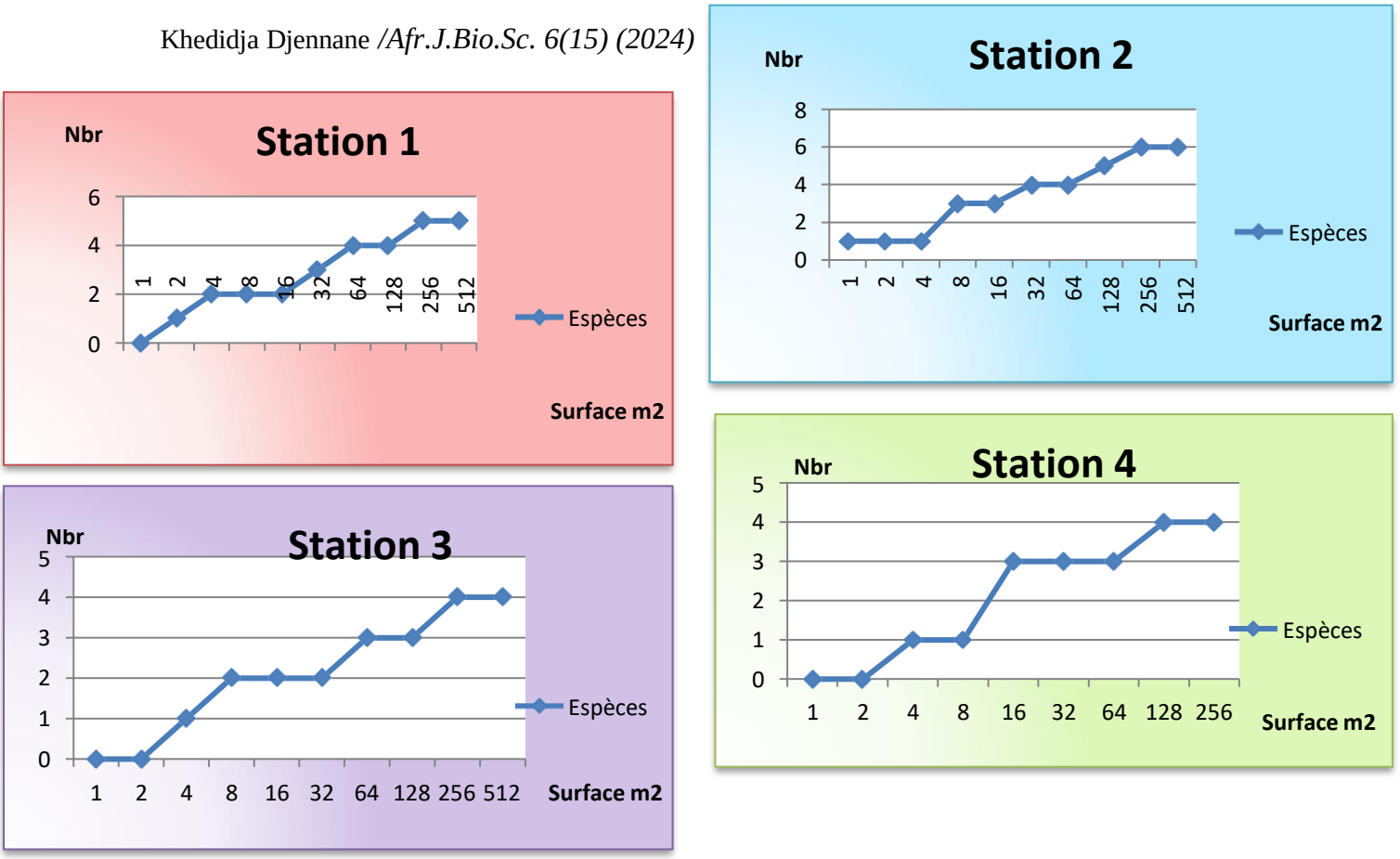

Fig.2.area-species curve of the study stations

2. Inventory of the spontaneous flora of the study region

Purposive sampling was carried out during the spring period as proposed by Chehma and al., (2005) where the highest density of the latter is observed.

Table 1. List of inventoried spontaneous species in the study region

Family	Scientific name	St 1	St 2	St 3	St 4
Apiaceae	Ridolfia segetum				*
Apocynaceae	Pergularia tomentosa			*	
Asteraceae	Echinops spinosus	*			
	Envlea radiatum			*	
	Launanen residifolia			*	*
Borraginaceae	Echum irigorhizon		*		
Brassicaceae	Maresia nana	*			
	Moricandia arvensis			*	
Carduoideae	Atractylis Flava	*			
Chenopodiaceae	Anabasis articulata	*	*		
	Haloxylon articulatum		*		
	Salsola vermiculata		*		
Compositeae	Centaurea dimerphatgia	*			
Curcurbutaceae	Colocynthis vulgaris				*
Fabaceae	Astragalus armatus	*	*	*	*
	Retama retam				*
Neurdaceae	Neurada procumbens	*			
Plantaginaceae	Plantago notata	*			
Poaceae	Artistida pugens		*		
	Avena sterillis			*	
	Cyndon dactylon			*	
	Polygon monspeliensis			*	*
	Stipa retorta				*
Rutaceae	Ruta tuberculata	*			

Thymeleaceae	Thymelea histuta	*	
	Thymelea microphylla		*

Zygophylaceae	Peganum harmala		*	*
	Zygophyllum cornutum	*		

From table (1), it appears that of the 28 species collected in the field and which are divided into 16 families, it appears that 9 families are represented by only one species; or 56.25% of the total number. The *Poaceaes* represented by 5 species with a rate of 17.85%, the latter constitute a natural barrier against the advance of sand and the desertification (Djabeur and Kaid-Harche, 2006), followed by *Asteraceae* and *Chenopodiaceae* by 3 species or 10.71%. The dominance of *Poaceaes*, *Chenopodiaceae* and *Asteraceaes* is similar to the results obtained by (Ouled el haj and al., 2003) in the Ouargla region, who reported the following rates: *Asteraceae* (13.51%), *Poaceae* (10.81%) and *Chenopodiaceae* (8.10%). These families seem slow well adapted to the aridity of the environment (OZENDA, 1988) since soil analyses show that the study stations have a very low humidity rate.

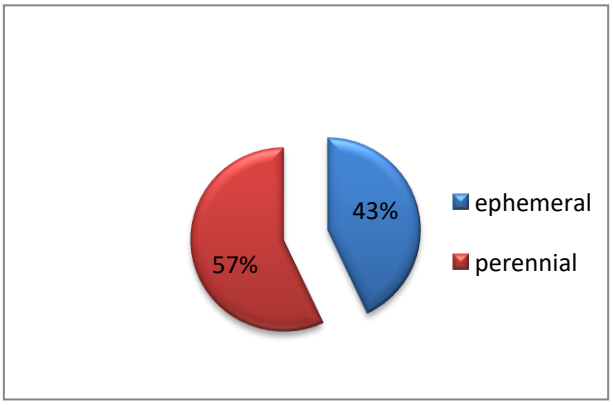

Fig.3. Distribution by species categories in the study region

It is noted that 57.14% are ephemeral and 42.86% are perennial. (Fig3). It seems that the dominance of ephemerals is influenced by the water factor; and it is noted that perennial species can only survive in reserve areas where they undergo a significant slowdown in development which may be a simple quiescence (Baameur,2006).

Ecological analysis of spontaneous species

1.Analysis of abundance frequencies

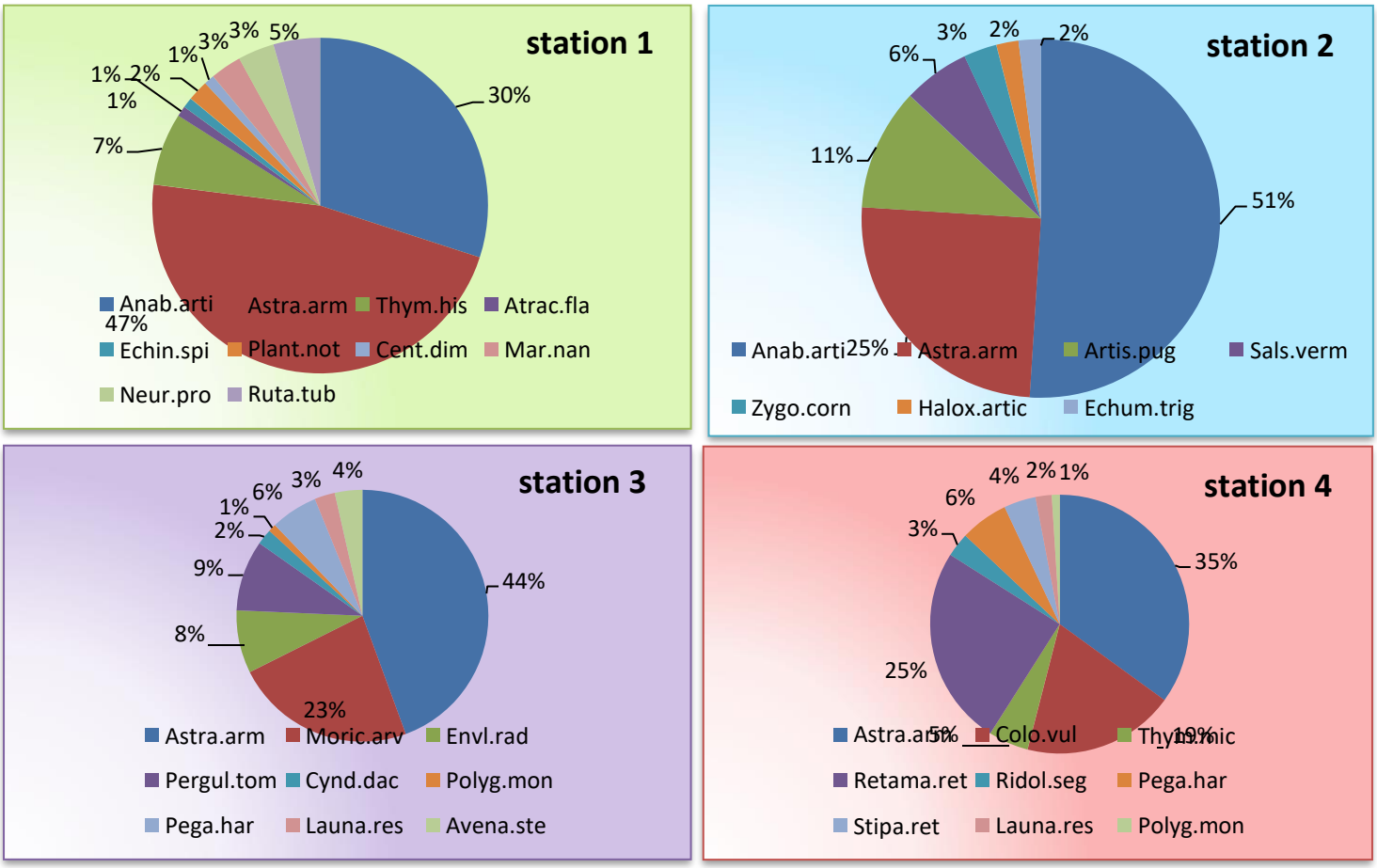

Fig.4. Abundance frequencies of species at each station

The results illustrated in the figures above; show that *astragalus armatus* during the study period, remains the mosts dominant which shows that the region is subject to the action of grazing. The dominance of *Astragalus* with its thorny morphology proves that livestock feed on other plants and let this species appear, which is confirmed in the work of Hirsch and al., (2010), who showed that this species is distributed in the pre-Saharan zone and is associated with desertification in arid areas due to overgrazing. *Astragalus* has a frequency of between 25% and 47% of the prospected surface. Species such as *Anabasis articulata*, *Moricandia arvensis*, *Colocynthis vulgaris*, *Retama retam* are encountered with *Astragalus* but with lesser frequencies, which are less than 25%.It is noted that the species *Anabasis articulata* ,alone presents a frequency of more than 50% in the Louzen station, *Anabasis* is a genus that grows in the stony and sandy soils of wadis, heavily navigated by camels and goats (Chopra, 1956). Note also that the rest of the species recorded represent individuals with a low frequency.

2. Specific and total densities

We noticed that the total density is low in the four stations from 0.2 to 0.3 plant/Surface, this shows their exposure to increased grazing, however; the specific density is very different depending on the species and for the same species depending on the study stations, This supports the results of Le Houerou (1990), who reported that the vegetation is arranged, in a diffuse mode, on sandy substrates and a contracted mode, on skeletal or clayey substrates

3. Abundance and dominance according to Braun Blanquet:

The dominance abundance scale applied to the different species constituting the study stations, shows that *Anabasis articulata* affected by note 5 is the most dominant and abundant species in the Louzen station, representing alone more than 75% of the cover. It is a Xerophyte species which adapts in the environments arid and semi arid; then comes the *Astragalus armatus,* assigned a rating of 4 despitethat it is the most abundant and dominant species in all stations and throughout theperiod of surveys exceeding 75%, but its recovery rate is 25% to 47%.

Species; *Retama retam, Moricandia arvensis, Peganum harmala, Pergularia tomentosa* have scores of 3 to 2; their recovery rates vary from 25 to 50%, However, other species barely reaching 5% coverage are classified at scale 1and (+); such as: *Launanen residifolia*, *Polygonmon speliensi* and *Echum trigorhizon.*

4. Occurrence index

According to the classification of Dajoz (1985), the species inventoried in the stations study are dominated by three categories according to their frequencies of appearance. They are categorized as omnipresent species (*Astragalus armatus, Anabasis articulata, Moricandia arvensis*,…..) because these species adapt to the dry and harsh soil conditions of this region. Other species are**regular**(*Thymelea histuta, Ruta tuberculata* .....), the third class corresponds to the eaccessory species (*Thymelea histuta, Echinops spinosu, Peganum harmala….).*The rest of the species are accidental or constant with low percentages compared to the dominant classes.

5. Specific richness

Table 2.specific richness of the study stations

	Station 1	**Station 2**	**Station 3**	**Station 4**
S	**10**	**7**	**9**	**9**

Species richness consists of studying the floristic composition of a given habitat. It is traditionally assessed by two ecological indices, namely total richness and average richness. It should be noted that; it is the ephemeral plants that highlight the difference between the various stations with a total richness of 28 plant species sampled. For the Rhayat station, this richness is 10 species including 7 ephemeral and 3 perennial. In second place, the Msanage and Elmousran stations are marked with 9 species, the Louzen station is ranked third in terms of its total richness with 7 species divided into 5 perennial and 2 ephemeral (sandy soil). These results highlight the absence of significant differences between the different study stations since the latter belong to the same ecological conditions except for the Louzen station which presents the lowest richness of 7 species. This could be explained by the nature of the soil which is silty-sandy with a relatively high rate of gypsum compared to the other stations.

6. Shannon diversity and fairness index

The Shannon index assesses both richness and evenness when species have a very even distribution

Table 3. Shannon diversity, maximum diversity and equitability indices

Diverstiy index	Station 1	Station 2	Station 3	Station 4
H_{max}	3.32	2.81	3.17	3.17
H'	2.18	1.99	2.37	2.47
E	0.65	0.71	0.75	0.79

The regularity of species distribution is an important element of diversity. A species represented abundantly or by an individual does not make the same contribution to the ecosystem. For an equal number of species, the presence of very dominant species mathematically leads to the rarity of certain others: we therefore understand quite intuitively that the maximum diversity will be reached when the species have a very regular distribution. (Rekis, 2012).

Biological Types

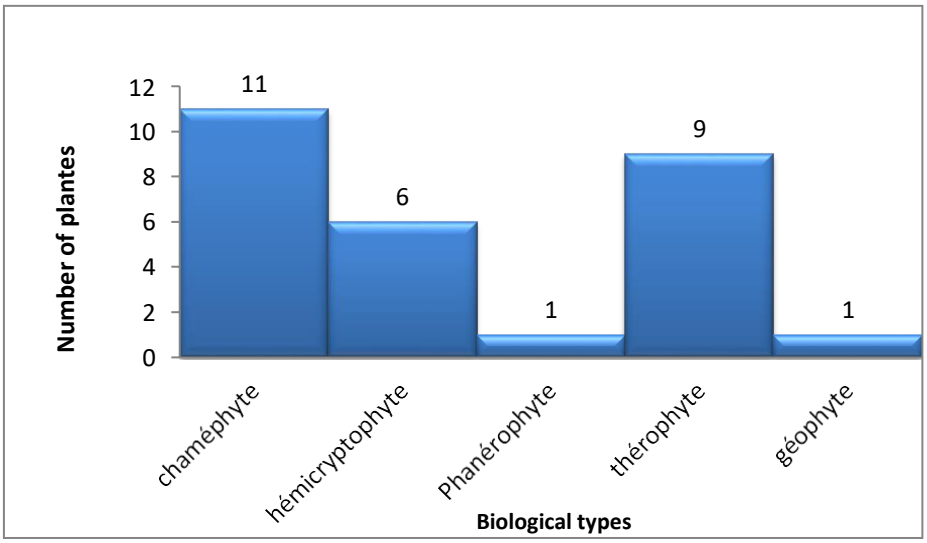

Fig.5. Representation of biological types

It is noted that chamaephytes occupy 39% of the total space and therophytes come in second place with 32%. This result is similar to that found Medjber Teguig (2014), who reported that the most frequent biological types remain therophytes (45.16%), followed by chamephytes (30.64%) in the Souf region.

Chamaephytes have a good adaptation to drought and strong light, their dominance indicates overgrazing as found by Kadi-Hanifi (1998), overgrazing also generally favors chamaephytes pushed back by herds.

In third place come the hemicryptophytes this could be explained by the richness of the soil in organic matter. This phenomenon was confirmed by Barbero and al., (1989): "in fact the abundance of hemicryptophytes is explained by a richness in organic matter in the forest environment and by the altitude". Concerning the rarity of phanerophytes, result also indicated by Aidoud (2005); OZENDA (1964) reported that the tree layer of the arid zone is very disseminated and dispersed in space. Monod (1973), notes that the common characteristic of all deserts is the rarity of trees.

Soil analysis:

The results of the physico-chemical analyses of the soils of the four study stations are indicated on table 4.

Table 4. Soil analyses of study stations

	H.cm	Arg+ L.F %	L.G. %	S.F. %	S.G. %	H. %	pH 1/5	CE 1/5	CaSo 4 2H2O %	CaCo3 %
St 1	0-50	9,7	49,4	12,8	27,4	0.94	7,52	0,2	11	24,44
St 2	0-50	1	61.8	36.1	1.1	0.95	7.76	0.1	43	1.48
St 3	0-50	10.5	71.3	8.6	8.4	0.99	7.63	0.2	1.2	36.29
St 4	0-50	9.6	55.3	16.1	18	0.99	7.39	2.2	15	22.22

The analysis of table (4) shows that the soils of the studied stations have the same edaphic characteristics, namely, texture, pH, salinity and humidity. However, station 2 has significant gypsum levels compared to the presence of this element in the other three stations.

The soils are sandy in texture, therefore inducing low soil moisture, negligible <1%; expressing the aridity of the climate and high evapotranspirations. Salinity expressed by CE, shows medium to low rates between 0.2 and 2.2 ds/m. This grade explains the importance and effect of calcium to combat salinity expressed by high rates of CaCo3 whose values are greater than 20%. The presence of gypsum with a rate of 43% indicates the presence of a sulfate-rich layer close to the surface or the mobilization of Ca ions++by the So--4induces the formation of gypsum in the form of CaSo4.2H2O. Finally, it is noted that the region presents the same typology of carbonate soil.

Principal component analysis (PCA)

The aim of using this method of analysis is to see if groups can be distinguished among the set of individuals. So it is a relationship between spontaneous species on the one hand and on the other hand the presence of a species or groupings of species induces the existence of certain physicochemical characteristics of the soil.

One advantage of PCA is that it provides both optimal visualization of variables and stations, and biplots mixing the two (Figure 6).

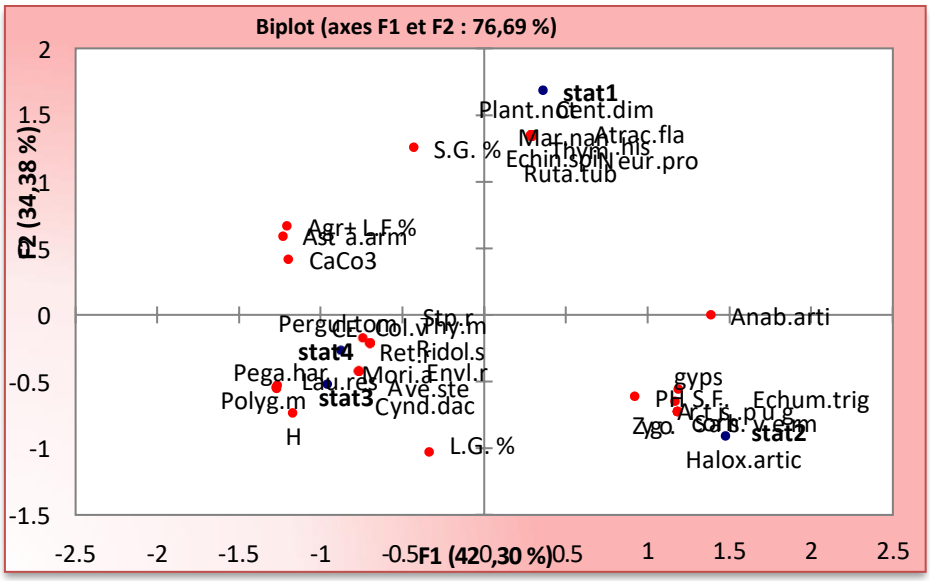

Fig.6. Projection of variables and species onto the plane (biplots)

The point cloud (fig 6) clearly shows us on a plan the groupings of spontaneous species reflecting the types of substrates, although certain pedological factors have discriminating values such as gypsum, limestone, fine sand and clay+silt. Thereforewe can conclude that this spatial distribution depends on the nature of the substrate which confirms the presence of*anabasis articulata*in sandy soils as indicated in the work of Chopra (1956) that this species grows in sandy soils and wadis, also for Zygophyllum cornitumwhich confirms that it is a gypsiferous species which corroborates theresult of Haddad (2011).

4.Conclusion

For this reason, we conclude that the plant composition is essentially influenced by the nature of the substrate; vegetation can be considered as an index in the pedological reading which easily explains the skeletal and discontinuous character of the soils of arid regions (Halitim, 1988 in Haddad, 2011).

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