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ORIGINAL ARTICLE **OPEN ACCESS**

Impact of the pasture on dynamics and phytodiversity heterogeneity in Tessala Mountains (Western Algerian)

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ABSTRACT
The Mountains Tessala presents a real interest by its ecological and geographic components, His environmental and socioeconomic roles merit to be reported and investigated. This massive area of particular interest phytodiversity favoring the development of vegetation and make it a natural forest vocation. The work undertaken is to estimate the grazing impact on the dynamics and heterogeneity of plant diversity in Tessala Mountains (Algeria, NW). The richness florists, phytosociological surveys conducted on the 10 selected stations had raised 77 species distributed in 69 genera and 33 botanical families; we noticed an abundance of Lamiaceae and Asteraceae by contribution of other botanical families. The biological spectrum analysis in the inventory shows the dominance of the therophytes and the hemicryptophytes than the other types which are moderately or poorly represented. The processing of data obtained by multivariate analysis performed using the software (Statistica 10.0), the principal component analysis (PCA), the correspondence analysis factorial (CFA) in particular and hierarchical cluster analysis (HCA) has highlighted that each of the different groups show that grazing is the major factor of the distribution, heterogeneity and regressive dynamics of plant formations keys in the Tessala Mountains. An essential characteristic of extensive grazing lies in variability due to a possible heterogeneity of the disturbance (heterogeneity of grazing, trampling and excrement).
Keywords*: Tessala of Mountains, grazing, Dynamic of phytodiversity, Heterogeneity.*

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INTRODUCTION

Grazing is an important way of permanent management in plant biodiversity [20, 7, 57, 19, 39] and ecosystem processes [66, 27, 6, 62]. In fact, the creation of heterogeneity [2, 33, 63] and control of competitive species [7, 20, 4] are the frequent factors cited to explain the impact of grazing on floristic composition and diversity of plant communities. Tessala Mountains are rich of flora [17]. Just for the most representative and most natural species encountered, there are more than 193 species distributed in 49 families and 146 genera. This same flora lists 103 medicinal plants and aromatic character and very diverse uses in the area and local residents [8]. Most of these species are a food source for animals. In this regard, several studies are carried out in our study area as Baraka (2008), Bouzidi (2009), Cherifi (2011), Bachir bouidejra (2011), Saidi (2014) and Dif (2014) these authors have shown that phytoecological the phytogeographical point of view, the region has a gradient regressive facies with accelerated dynamics largely due to the pressure anthropozoogene and natural phenomenon. Approaching the study of such ecosystems in the southern Mediterranean region is linking the human impact, especially its harmful actions [36].
The degradation of the Tessala Mounts phytodiversity mainly anthropogenic [17]. Moreover, several authors point out that the deterioration of plant biodiversity [30, 43, 5, 44, 45, 28, 51]. While the climate is only worsening degradation [48]. At this last time, pastoral societies adapt often using the settlement and supplementation of their herds [42, 63, 67]. The objective of this work is a synthesis of some available research results on the impact of

herbivore grazing on plant diversity. We present successively the positive impact of grazing on the dynamics and heterogeneity of plant diversity in the Tessala Mounts by detailing and beforehand the mechanisms involved.

MATERIALS AND METHODS

Presentation of the study area

The study is performed in the western of Algeria, precisely Tessala Mountains, which are located in the Sidi bel abbes region as shown in Fig. 1. These mountains are about 15 km north-west of the capital town. They are limited to the north by the plain of Mleta which they meet to the east and to the west by the Sebkha of Oran, southeast by of Beni Chograne mountains and west by Sidi Bel Abbes plain.

Tessala mountains part of the atlas Tellian extend to 50-60 km, with an altitude ranging between 500 m and 1061 winning a relatively rugged area [57].

Tessala region has a Mediterranean climate. Ferka-zazou's research can rank Mountains Tessala in the semi arid bioclimatic floor to lower costs winter precipitation in the area which is distinguished.

The inventory of flora has allowed us to bring out a list of species in the region of Tessala Mounts. This list is presented in Appendix. Tessala Mountains are characterized by their heterogeneity and fluctuations year to year. Low and irregular rainfall (400 mm / year) after the dry season (summer), the autumn rains are sudden and violent respectively with altitude. Less rainfall is noticeable from west to east. The minimum recorded temperature is between 3-4 ° C during the cold season and marks a maximum average of 35.3 ° C during the months of July and August [29]. In the mountains of Tessala, the predominant geological formations are marl, clays and sandstones of Neogene tenders on marl and marl limestone of Paleogene and Cretaceous [15]. The soils are poor outcrop, which locate the two sharp slopes. The plant formations are characterized by the importance of training and low gradient where the matorral and scrub land. The thicket of green oak series described by Alcaraz (1982) with a small area that seems most appropriate since it is natural.

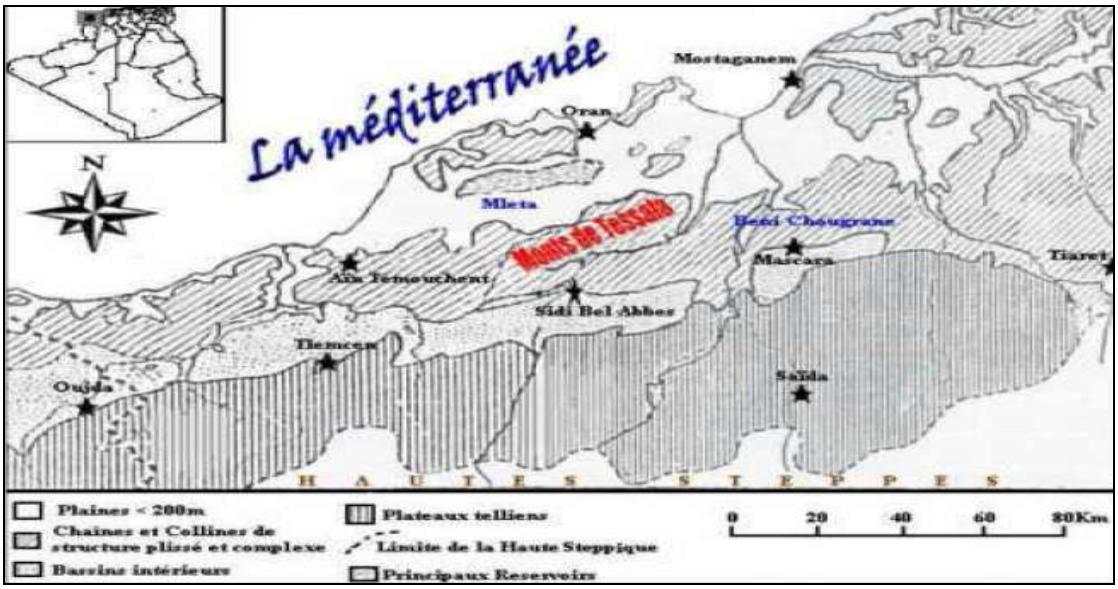

Figure 1: geographical position of Tessala mounts with modification [38].

Methodology

For a good overview of the dynamics and heterogeneity of plant diversity present in the Mounts of Tessala, thirty phytoecological surveys were performed in 10 different stations as shown in Fig. 2. Since 2015 using the quadrant point method [31]. Thus, the choice of stations reflects the vegetation physiognomy (including vegetation density, species composition, heterogeneity and homogeneity) and ecological conditions (soil texture, topographic position ...). While we were ensuring to consider the plant community as a

whole, and thus translate the variability due to heterogeneity of a possible disturbance (heterogeneity of grazing, trampling and manure for example).

Table 1: variables ecological considered and evaluation

Biotic disturbances	**Modalities**	
pasture	**Absence of livestock: 1**	**Presence of livestock : 2**
trampling	**absence: 1**	**presence : 2**
excrement	**absence: 1**	**presence: 2**

For the determination of plant species, we have used the new flora of Algeria of Quézel and Santa completed and Mayor of North Africa as required by the guide of Mediterranean flora [11] and various floras Algerian [10, 12]. To analyze the spatial heterogeneity of vegetation cover, the correspondence analysis (AFC) was chosen to determine statistically similar entities and to compare between stations in pairs [14]. Using Statistical 10.0 software. The hierarchical cluster analysis (HCA) also used to better individualize the boundaries between different groups [13] and we have used also the principal component analysis (PCA) which is a technique to synthesize the information in many variables [25].

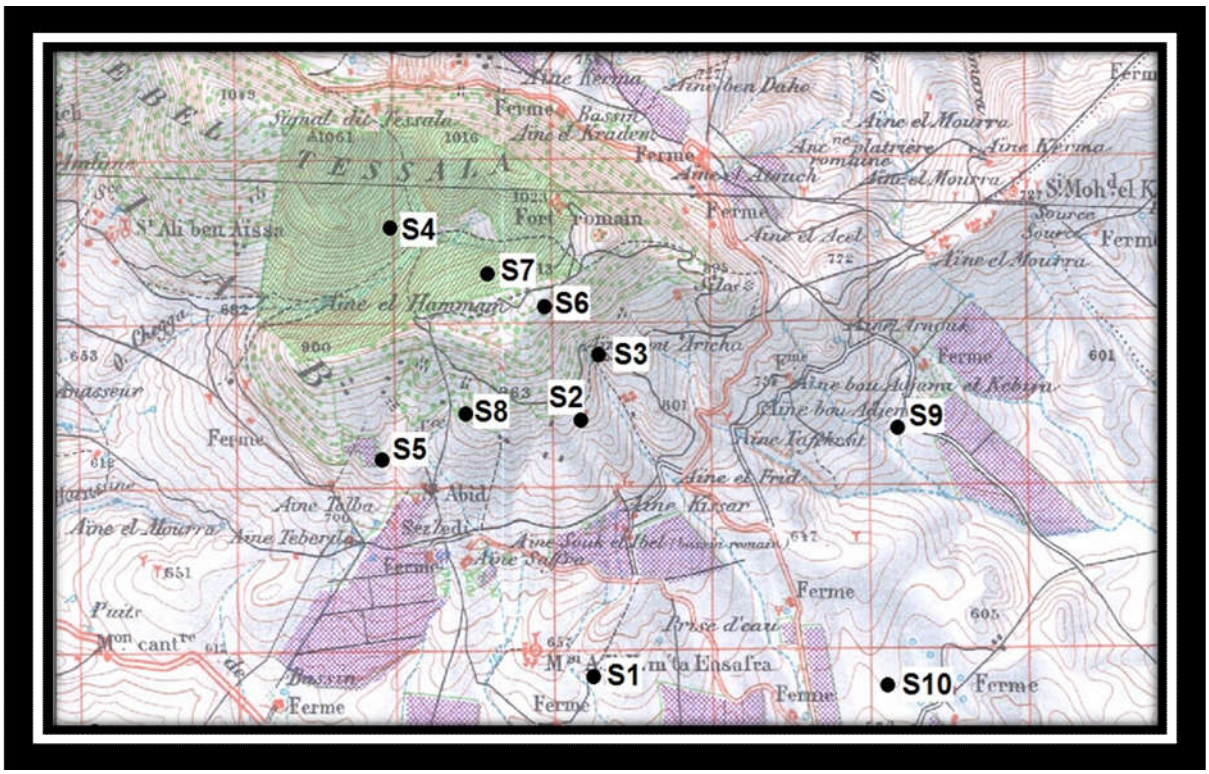

Figure 2: Localization of different stations in Tessala Mount (chart established by MapInfo Professional software version 8.0)

RESULTS AND DISCUSSION

In the mountains of the Tessala, grazing plays a central role in the economy of the region and in the setting of pastoral society. They cover more than 49,508 ha and support more than 50,000 heads of sheep, cattle, goats and horses.

We found that the number of sheep that remains dominant in comparison with cattle and goats .By an increased number of individual sheep and cattle in 2015 compared with 2014 and a decrease in the number of goats as shown in Fig. 3. The terms of the environmental variables are considered biotic disturbances (grazing, trampling and excrement).

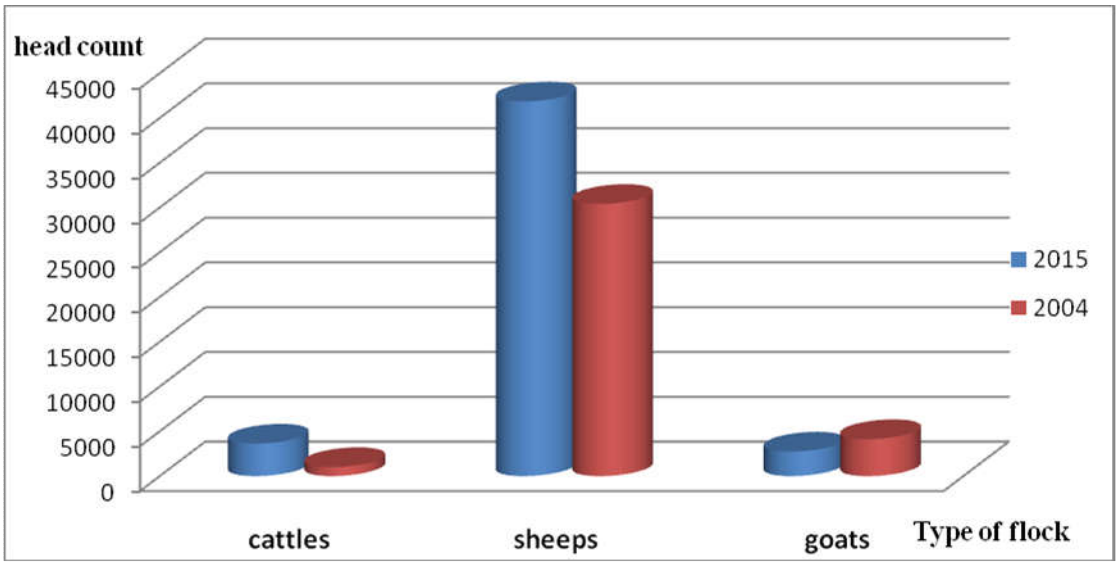

Figure 3: the census herbivores by the conservation of the forest in Tessala Mounts (2004/2015)

The biological spectra

The clear domination of therophytes with 23 species, followed by hemicryptophyts with 18 species, representing approximately 29.87% and 23.38% respectively of organic types in the floristic inventory as shown in Fig. 4. In addition, we record the low representation of nanophanerophyts (6 species) compared to phanerophyts about 10 species and chamaephyts about 13 species, against the Geophyts (7 species), due to the strong use of these plants, including their bulbs and rhizomes in local medicine, which is also a threat against these plants. The dominance of therophyts and chamaephyts at our study area and confirms therophytisation chamephytisation. This implies the presence of drought-tolerant plants resistant to climatic stress (prolonged drought) and the grazing action.

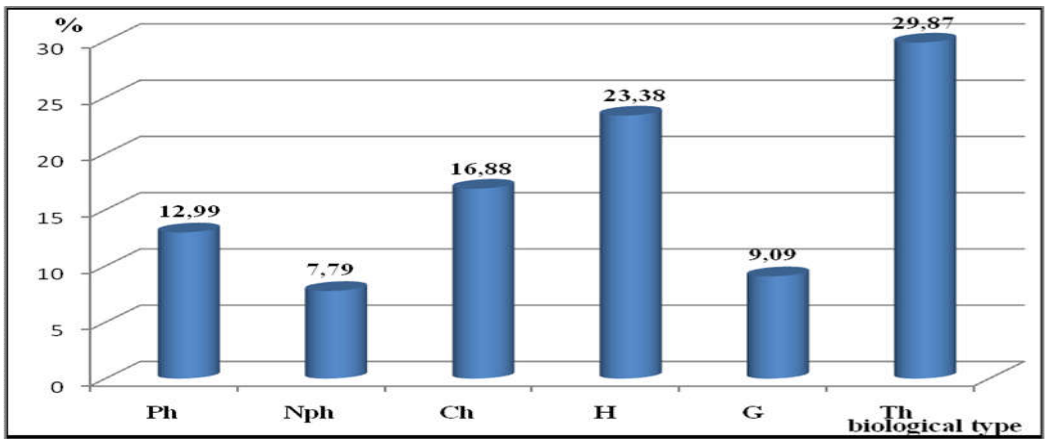

Figure 4: Distribution of per biological type

Ecosystem heterogeneity of Tessala forest

The floristic analysis of 77 plant species inventory in our stations as shown in Table 2, reveals 33 families and 69 genera. We denote abundance Lamiaceae with 11 species or 14% of existing families and Asteraceae with 09 species, approximately 12%, while the Apiaceae, brassicaceae and Poaceae are moderately represented with 05 species. Other families like the Fagaceae, the papilionaceae the rutaceae the Thymelaeaceae the Plantaginaceae and anacardiaceae are also less present as shown in Fig. 5. We also find the majority usually families in similar surveys in other parts of the country are very poorly represented. It is indeed severe ecological, human actions and natural disasters that affect our study area (forest, scrub, scrub …) that some families dominate over others in this type of study.

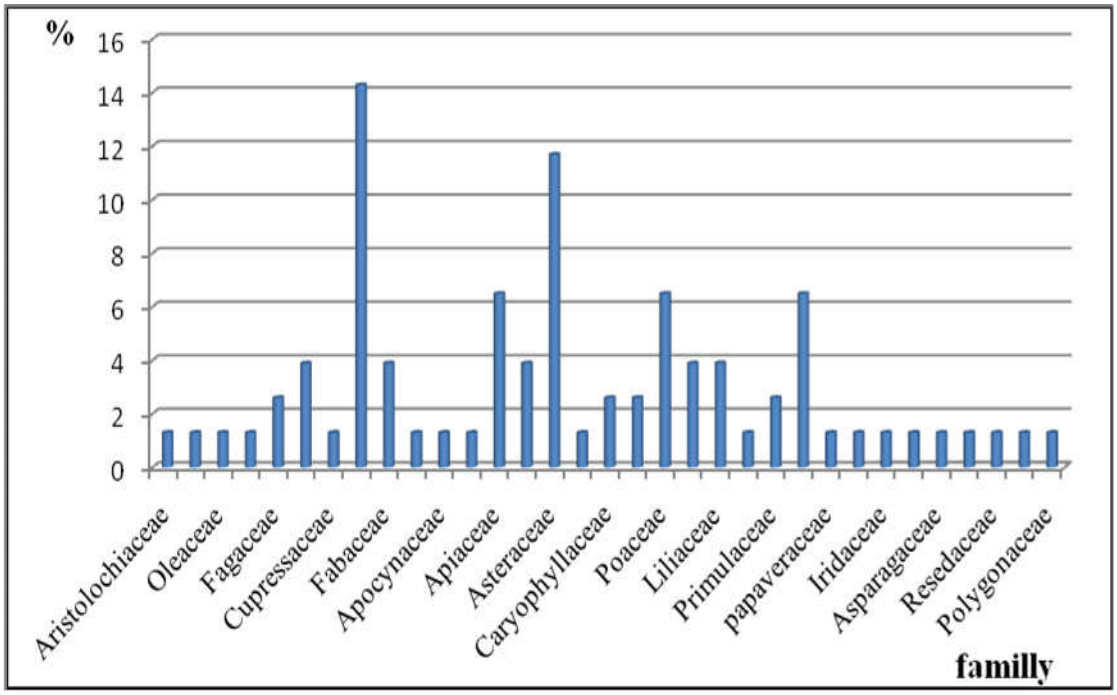

Figure 5: Distribution of species number per family

Statistical analysis

The hierarchical cluster analysis (HCA)

Data processing from (HCA) which is a method that brings together similar objects in the respective categories. We used the HCA based on Pearson's distance index using statistical software (Statistica 10.0) for determining the change in the floristic composition and the degree of the extent of Group 1 is represented by the station S1, Group 2 is represented by S2 stations, S3, S8, S9 and S10 characterize scrub land highly degraded based calycotomne (*Calycotmne spinosa* Link.) Joins the dwarf palm (*Chamearops humilis* L .) and Daphne (*Daphne gniduim* L.), the installation of these species raised in stations is explained by their better adaptation to environmental conditions [17], according to the Houerou (1992), the sheep and cattle grazing leads to the development of chamaephytes mainly represented by *calycotmne spinosa* Link. And *Chamearops humilis* L. and S4, S7, which is the clear forest-based Aleppo pine (*Pinus halepensis* L). In these two groups the livestock exerts a modification of the plant group accompanied by a regression of palatable species as shown in Fig. 6. Group 3 is represented by the S5 station, which is the oak-based scrub tree (*Quercus ilex* L. and *Quercus coccifera* L).

Group 4 is represented by the station S6, characterized by the following species *Asparagus acutifolius* L., *Asphodelus microcarpus* Salzm and Viv., *Asteriscus maritimus* L., *calycotmne spinosa* Link., *Chamearops humilis* L., *Lobularia maritima* L., *Ornithogalum umbellatum* L., *Urginea maritima* L., this group of species proliferates and gradually invaded large areas and causing a change in the physiognomy of vegetation.

We observe a strong apparent resemblance to the same floristic composition, with the strong presence of *Calycotme spinosa* Link. With *chamaerops humilis* L. and *Daphne gnidium* L. This explains the sharp deterioration of the vegetation cover of the Mounts of Tessala because of the heterogeneity of grazing can lead to heterogeneity of favourable vegetation floristic diversity [1, 23]. The grain of this heterogeneity can be highly variable. The scale on which it appears is generally wider for large herbivores such as horses or cattle than in smaller herbivores such as goats or sheep [60, 62].

The practice of intensive grazing on limited areas has also led to a significant reduction in plant diversity and the loss of heritage species [66]. The abandonment of grazing in some areas has led to flooding through the timber, thereby increasing the risk of fire places related to biomass accumulation [54].

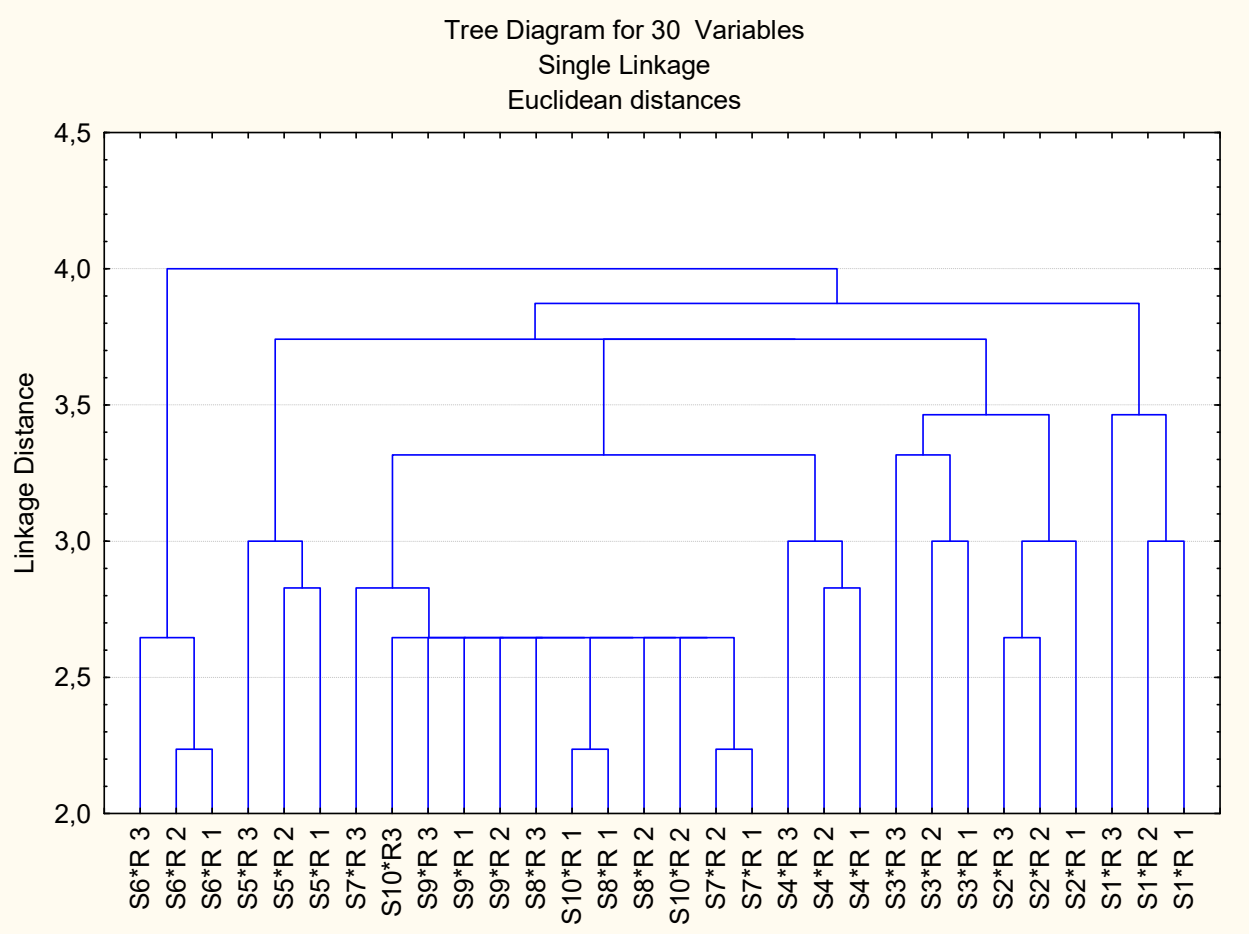

Figure 6: Dendrogramme of the ascending hierarchical classification (CHA) of the 10 stations sampled (thirty statements)

Correspondence analysis (AFC)

The correspondence analysis developed by Benzecri (1964) and Cordier (1965), applies to qualitative data and is widely used in all areas of ecology [14]. In particular, numerous authors have used in plant ecology, where his interest is well established.

This analysis (FAC) executed 10 stations sampled, allowed to identify four groups of plant formation as shown in Fig. 7, the factorial design, the F1 axis that provides more information in the AFC (12.79%) compared to the axis F2 (10.45%).

Group 1 is represented by the resorts: S4, S7, S8, S9 and S10.

The group is represented by two stations: S6.

Group 2 is represented by the stations S1, S2, S3.

The group is represented by two stations: S5.

Based on this factor segregation about the axis F1, oppose facies related to the heterogeneity of plant covered: the vegetation very important stations heterogeneity represented by G1 and similar and very homogeneous stations represented by G2, G3 and G4. Furthermore, this analysis has identified that the F1 axis expresses the degree of openness of the environment related to trampling gradient (expressed regressive dynamic since the positive part of the axis towards the negative part).

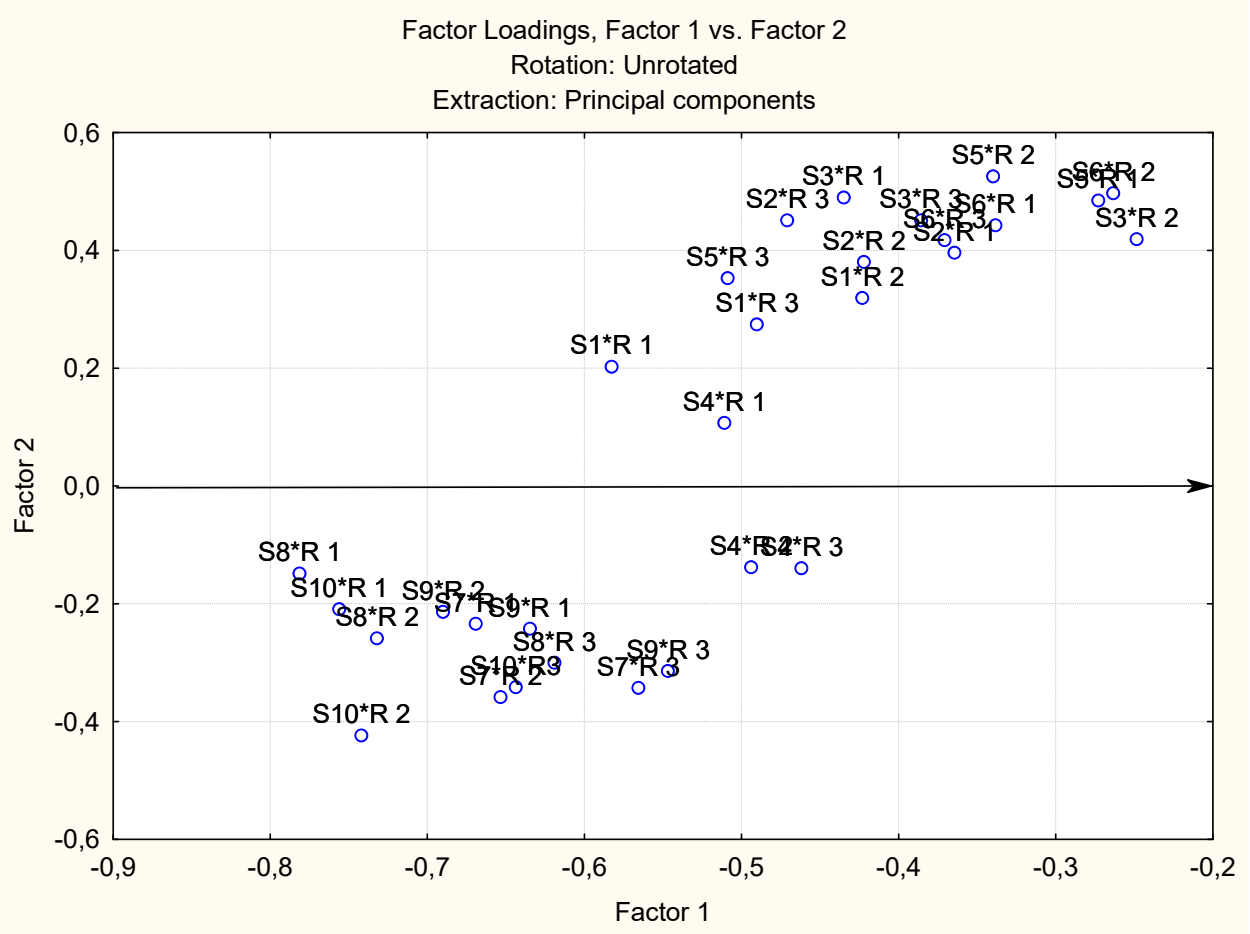

Figure 7: Chart of factorial analysis of correspondences (FAC)

Principal component analysis (PCA)

The principal component analysis (PCA) is a technique to synthesize the information in many variables, PCA does not require any condition of validity and is applicable to quantitative variables [25]. In our research performed the ACP, whose matrix is the intersection of all the variables (grazing, trampling, alluvial) of the 10 sampled stations we have identified one group G1 as shown in Fig. 8. On the factorial design, the F1 axis that provides the most information in the ACP (49.53% inert) compared to the axis F2 (10.58%). The presence of a single group G1 returns to the choice of herbivores When operate heterogeneous surfaces, herbivores found greater freedom of choice with respect to the systems in which they are conducted on an evener cover of grass. Thus, taking into account all factors that stimulate or direct ingestion of the animal. Besides their relative abundance, spatial distribution of preferred plant species directs food choices of animals. Preferred species in the Tessala Mounts should be approximately sensitive to grazing pressure as they are aggregated or dispersed over the entire surface of the plot, and under the influence of the spatial distribution of cutlery sought by herbivores.

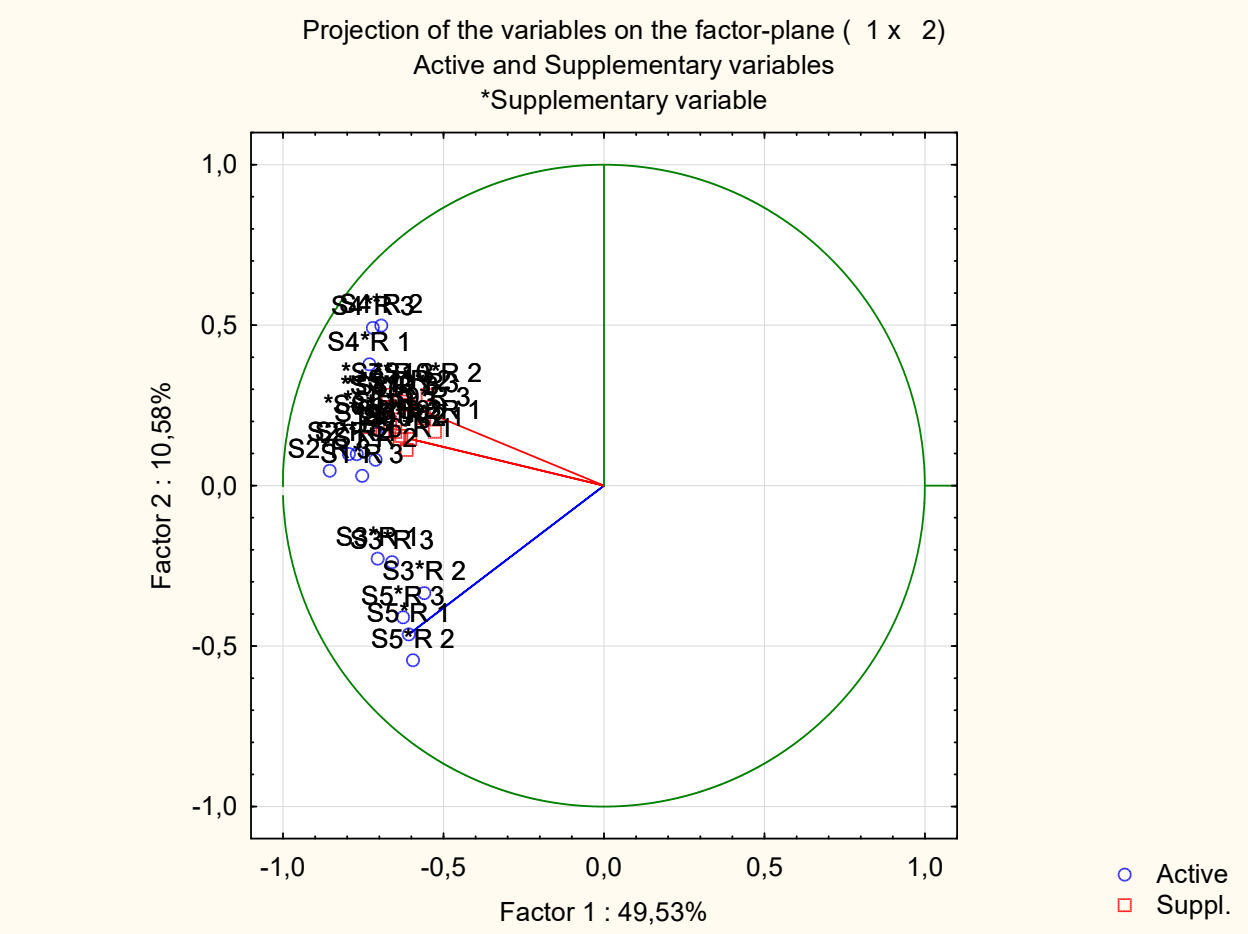

Figure 8: Chart of principal components analysis (PAC)

The positive effect of grazing

Theoretical and empirical studies have stressed the importance of grazing to promote and maintain plant diversity in communities [46, 21, 9, 69, 59]. Mixed grazing practices (sheep, cattle, goats and horses) are based on the complementary of the selection of animal species to use more fully diversified resources. Sampling and selection of palatable species by herbivores, rarely the direct cause plant death, against a decrease in biomass [41]. Consumption by herbivores reproductive organs can also affect flowering and the number, size and seed production. Had to make a decrease in the availability of plant resources [23]. Grazing destroyed part of the biomass and prevents litter accumulation, which may hinder future regrowth and germination of grasses. By cutting the young plants before flowering, grazing delays the reproductive cycle of certain herbs and maintains the quality of the pasture vegetative plants, which are much more nutritious than mature plants.

The effect of manure and trampling

The heterogeneous distribution of droppings and trampling alter the spatial structure of the plant cover [35].

Trampling animals also significantly affect plant tissue, often resulting in death of the plant consumed or part lying above the damaged item [23]. For the creation of holes which are nucleation sites for young seedlings, who are sheltered from competition with adult plants [16]. Finally, the deposition of feces and urine can cause physical damage to plants or have the local toxic effects even if its main impact is indirect through the nutrient cycle and also promotes the dispersal of grains [47], via the transport of seeds on their fur [26] or deposit their faeces [50].

Figure 9: dispersion of seeds by the cattles dejections (Saidi, 2014)

The grazing influence on the dynamics of plant diversity

Within grazed systems, local plant species richness is the result of a dynamic interaction between species extinction process, especially by inter specific competition and the colonization process by pools of species present in the medium [52], they lead to changes in floristic composition close to the alluvial [32]. At the field scale, the specific behaviour of herbivores vis-à-vis the waste, the opening of a medium by grazing Contrasting, create ecological conditions favour species dynamics, and the effect of eliminating competitive species for light sensitive to trampling herbivores and replacement, by smaller species lower foster competition on the light, leading to increased species richness, allowing the coexistence of a greater number of species .By different actions of grazing we can have effects on the abiotic environment (light, fertility) and biotic (competition intensity). The grazing plants response can depend on many traits associated with resource acquisition strategy, the regeneration mode or the ability to compete.

Grazing is a source of heterogeneity which occurs with intensity and frequency that varies depending time and space. Thus, there is a direct effect of grazing on vegetation destruction and biomass reduction [33], and changes in resource availability [56] and may can lead to a change in the composition of the phytodiversity community and structure. Since their effect on the abiotic environment (light, nutrients) and biotic (competition intensity) can vary in space and at very different scales. The heterogeneity of the effects of grazing disturbance is often evoked to explain their impact on the diversity [46, 69, 53]. Spatial heterogeneity in the occurrence of the disorders can explain their positive impact on species diversity [46, 69, 53].

It usually leads to a mosaic plate, which differ by their species compositions which promote species diversity at different Community level [46, 69]. An essential characteristic of extensive grazing that has a heterogeneous dimension [1, 24].

This heterogeneity can explain the impact on diversity [2, 32, 63]. Many factors can influence the spatial pattern of biomass sampling. Among the major include the availability and quality of vegetation and social behaviour in the case of sheep [36, 68, 55]. In some herbivores, deposition of faeces may be heterogeneous. This is the case of horses that are responsible for the creation of "crottinoires; areas reserved for deposit droppings which are usually very few grazed.

CONCLUSION

The pasture can be a sustainable management of suitable natural areas for the conservation objectives and restoration diversity and can reconcile ecological and agronomic issues [38]. Our study has clarified the grazing influence on the dynamics and heterogeneity of plant diversity in Tessala Mounts (West Algeria). The rich flora is estimated 77 wild species, revealing 69 genera and 33 botanical families. On the floristic plant, we found plenty of Lamiaceae and Asteraceae through transfer of other botanical families. The biological type of analysis in the inventory shows the dominance of therophytes and hemicryptophytes than other types that are moderately or weakly represented. Data processing from (HCA) 4 groups which show strong similarities characterize resemble the same floristic composition, with the strong presence of *Calycotme*

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