IMPACT OF BROWSING UPON HEIGHT, DENSITY, CANOPY COVER AND NUTRIENT (Fe+) ACQUISITION BY *SERIPHIDIUM QUETTENSE* IN HIGH RANGELANDS OF DISTRICT QUETTA, BALOCHISTAN.

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ABSTRACT

Seriphidium is the dominated species of arid and semi-arid rangelands of Balochistan. Six (06) species of *Seriphidium* are found in this region. The dwellers of the area are dependent on livestock to earn their keeps and livestock is dependent on these rangelands. Being a high palatable species, *Seriphidium* is the main target of large mammals. The experimental work has been carried out in the Maslakh protected area by comparing the cover, height, density and Fe+ concentration in the samples taken from both un-protected (browsed) and protected (un-browsed) areas. The sampling followed the line transect method. Leaves of intercepted plants were removed at a distance of 5 meters. The cover and height of the same plants was also measured. Quadrat method was used to measure the number of individuals per unit area of *Seriphidium* at both sites. For measuring the concentration of Fe+, the plant samples were dried, digested and analyzed on AAS (Atomic Absorption Spectrometer). It has been concluded that there was non-significant impact of browsing upon the nutrient concentration but there was a significant difference in plant cover, height and density at un-protected and protected sites.

INTRODUCTION

Balochistan is the largest province of Pakistan having total geographical area of 34.73 million ha. About 93% area of Balochistan is classified as rangelands (Mohammad, 1989). In Balochistan, 90 % of the livestock feed is obtained from pastures (FAO, 1987). About 87% of local people of Balochistan get their livelihood directly or indirectly from livestock rearing (Heymell, 1989). Rangelands of Balochistan are, however, degrading by overgrazing and other human activities. Re-establishment of native plant species is one of the options to restore the productivity of degraded rangelands. The over exploitation of range area has caused a severe damage to the range health, and badly degraded these areas. As the *Seriphidium quettense* is a highly palatable species, so it is the main target of browsing animals.

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Browsing is a naturally occurring phenomenon in a rangeland ecosystem. An ecosystem can be reshaped after being browsed, in terms of species competition, or nutrients cycling by the altering, rates and pathways (Hoobs, 1996; Augustin & McNaghton, 1998; Danell *et al.*, 2003). This competition among plants species, induced by herbivory, may bring out a domination of un-palatability (Pastor *et al.,* 1988). Browsing influences plant productivity and hence reproduction. Primary production increases when intensity or frequency of browsing is low or moderate. Productivity declines with increasing level of herbivory (Hilbert *et al*., 1981).

The responses of plants to herbivory are not same. Once browsing receives similar responses by a plant in all season, but next time there is a great difference. A low to medium level of browsing may increase the shoot length and an opposite effect is seen when a high level of browsing takes place. Change in season like winter browsing affects the shoot size, by increase in length, and on long shoots the degree of branching is also affected**.** Browsing of high or medium level during winter season causes increase in shoot size, stimulation of branching and leaf size also increased after winter browsing. The impact of summer browsing on the shoot size, degree of branching, is negative, while upon leaf size is neutral (Danell *et al*., 2007).

Plants require raw material for their growth and development, and produce a given quality of biomass, these raw materials are acquired from the environment. These are present as resource (Bloom *et al*., 1985). Herbivory may alter the utilization of resources; these resources are used to defend the plant against the herbivory rather than being used in plants growth and reproduction (Walls *et al*., 2005).

Browsing has a negative or neutral effect upon nutrient concentration in plant shoot, no change in concentration of Na and K after browsing, while the concentration of Ca, Mg and N not affected or decreased, but a slight increase in concentration of N occurred after browsing in late summer, but decreased after repeated action (Danell *et al.,* 2007).

Balochistan has a great influence of livestock grazing and browsing on its range lands. *Artemisia* and *Seriphidium* species are the dominant dwarf shrubs in rangelands of highland Balochistan. There are 135 species of *Seriphidium* distributed in North America, temperate Asia, and in Europe (Ghafoor, 2002). 13 species have been reported in Pakistan, out of which 6 species (*Seriphidium freitagii, Seriphidium turanicum, Seriphidium sieberi, Seriphidium quettense, Seriphidium stenocephalum,* and *Seriphidium oliverianum)* are found in Balochistan (Ghaphoor, 2002). *Seriphidium quettense* (Podlech) Synonyms *Artemisia quettensis* is the dominant species of Balochistan. It provides nutrient

to small herbivores in winter and summer seasons when other palatable plant species produce little dry matter.

This study was carried out to assess the impacts of browsing upon the different parameters of *Seriphidium quettense* i.e.

1. Height
2. Cover
3. Density and
4. Nutrient(Fe+) acquisition

MATERIALS AND METHODS

The study was carried out in an extended area of Maslakh protected area lying in district Pishin of Balochistan province of Pakistan. Maslakh is protected from grazing, browsing and also from other activities since 1991. The main objectives of its establishment were to conserve the fauna and flora of the area. The Maslakh protected area is managed by Balochistan Forest Department. The range health is good, vegetation is vigor and all sort of local species are present inside the protected area. *Seriphidium quettense* is the dominant species of the area. Other co-dominant species are *Cymbopogon jwarancusa, Chrysopogon aucheri, Berberis lyceum* and other annual grasses. Area receives rainfall mostly in winter. Mean annual rainfall of past 19 years is 200mm. soil of the area is sandy to sandy loam.

To achieve the objectives of study, the line intercept and quadrat methods were followed to collect the vegetation parameters such as height, cover, density and nutrient (Fe+). Reconnaissance of the study area was carried out to layout the intercept line for data collection. Three (03) transect lines were laid down. The length of each transect was 100 meters and the distance between the transects was 30 meters. The transects were laid down on both sites i.e. Un-protected (browsed) and protected (un-browsed) area.

On each transect line, the individuals of *Seriphidium quettense*, present at the interval of 5 meters were taken into account. These were those individuals which were intercepted by line or were just nearby of the point after an interval of 5 meters. The heights of plants intercepted were recorded on the spot. For cover, the D1 and D2 of each plant intercepted at the 5m interval, were taken (D=diameter). For density, nine (09) quadrats were laid on each transect on each browsed and protected areas.

For nutrient acquisition, the leaves of branches of those plants were removed which were intercepted by line transect at a distance of 5 meters. These leaves of one or more plants were removed depending upon plant size. Leaves of

many branches were detached when the length of branch was short. Even the entire plant was pulled out when its size too small. The leaves of one branch were removed when the plant size was large. The removed leaves were collected in paper bags and were tagged. The further process was carried out in the laboratory.

The collected samples were taken to laboratory for further execution. The samples were dried in the oven for 24 hours at the temperature of 35°C. The samples were weighed. The weighed samples were kept in the muffle furnace, for turning into ashes, at a temperature of 550°C.

The samples (ashes) were digested in 2N Hcl solution. The 2N Hcl was prepared by adding 165ml of 37% concentrated Hcl into 500ml of distilled water. The solution was let to be cooled and then the volume of solution was raised up to 1000ml (1L).

Now each sample was digested in 5ml of 2N Hcl, in a beaker and well shaked. As during this digestion process the temperature of solution had raised. For 20 minutes the samples were let to be cooled. After 20 minutes, the volume of the digested ashes was raised upto 50ml by distilled water. Now the samples were filtered by 41 whatman filter paper. We had the extracts in conical flasks. The extracts were then analyzed under AAS (Atomic absorption spectrometer).

The plant height was valued in the field. The cover was then calculated from the diameter measured at the field as D1 and D2. And the value of each sample of ashes came out after running the them under AAS.

After having the data about each parameter, t-test was applied for calculating the difference level in means of cover, height, density and absorbance of both sites (browsed and un-browsed). The adjustment of tow sample t-test yielded in a comparative P-value of 0.001 levels. And the relationship between the plant cover and concentration of Fe in *Seriphidium* calculated with the help of correlation coefficient.

RESULTS AND DISCUSSION

There has been found a significant difference in the development of *Seriphidium quettense* in protected and un-protected areas (Fig. 1). The average plant cover on protected site was greater than the average plant cover on browsed site. Average plant cover was 4260.52cm inside and 346.25 cm out side the enclosures.

The Fig.2 shows that there is a significant difference between the heights of *Seriphidium quettense* on both sides. As shown in the Fig.2, the average heights were 27.37cm on un-browsed site and 16.7cm on browsed site. The calculation shows that the average height on protected site is 164% of the average height at browsed site. Low and medium level of browsing or clipping by other means increases the shoot length, and, therefore, it increases the cover and height (Danell *et al.,* 2007). As here a pattern of over browsing occurs year long, so this result is in vice versa. And winter browsing also increases the degree of branching and shoot size hence increases the size, and on long shoots the degree of branching (Danell *et al.,* 2007). In winter season, even high level of browsing brings positive changes in the shoot size and the branching stimulated and the leaf size is also increased. But, increase in browsing level brings opposite impacts. It decreases the shoot size, branching rate but leaf size remains unaffected. And summer browsing also decreases the shoot length, degree of branching but does not affects the leaf size. Here in the study area the vegetation outside the enclosures is exposed to many factors, high intensity of browsing and other human activities. Which disrupt the normal growth of plants. The study carried out in the mid of May, when the people migrate along with their livestock back to Balochistan from Sindh. A degree of browsing is observed in this area. Summer browsing along with the high intensity, put adverse effects upon the growth height and upon the cover of the plants.

It is found that there was a considerable difference between the densities of two sites. According to the Fig.3, the difference is clearly shown that the density out side the enclosure is greater than the density inside the fences. As the *Seriphidium quettense* shows a great tendency of allelopathy. This inhibits the growth of its own seedlings. As old and mature plants of *Seriphidium quettense* are present inside the site, thus the average number of individuals of this species are lesser in number.

There was no significant relation between plant cover and acquisition of Fe+ ($P>0.05$). However, there was a trend slight increase of Fe+ acquisition and plant cover incase of protected area (Fig.4.a).

The concentration of Fe+ in *Seriphidium quettense* on browsed and protected sites were 2.67 ppm and 2.07 ppm respectively. This difference is not significant ($P>0.05$). But a slight trend is towards the low height and cover. This is logical as browsing has a neutral impact on nutrient acquisition but a slight increase occurs if the browsing is in summer (Danell *et al.,* 2007).

CONCLUSION

It is concluded that browsing has an adverse effect upon the cover, height, and a positive effect upon the density as the density was much better

outside the enclosures. And the difference in concentration of Fe+ was negligible. The relationship between the cover and iron acquisition was studied too. The results showed that there was a trend of slight increase of iron acquisition and plant cover in case of protected area. Browsing itself is not always negative but its season and the level has positive, negative and neutral impacts on the browsed species (*Seriphidium*).

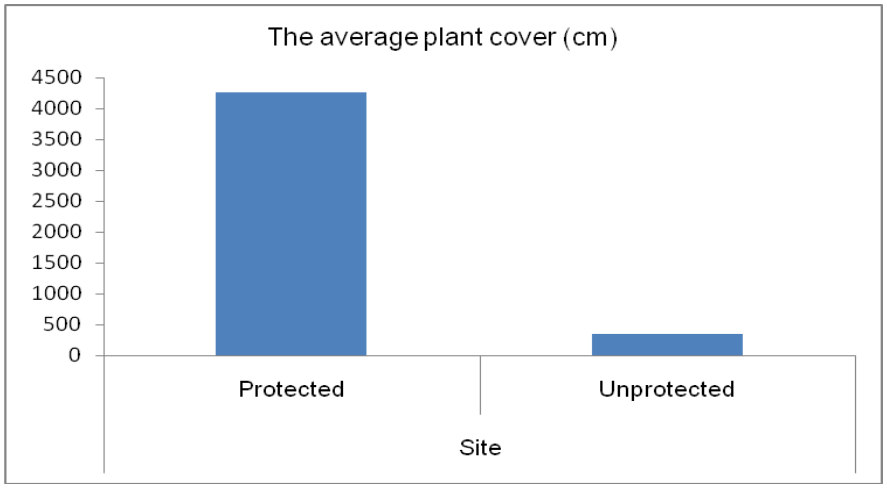


Fig.1. The averages cover of *Seriphidium quettense* on both sites

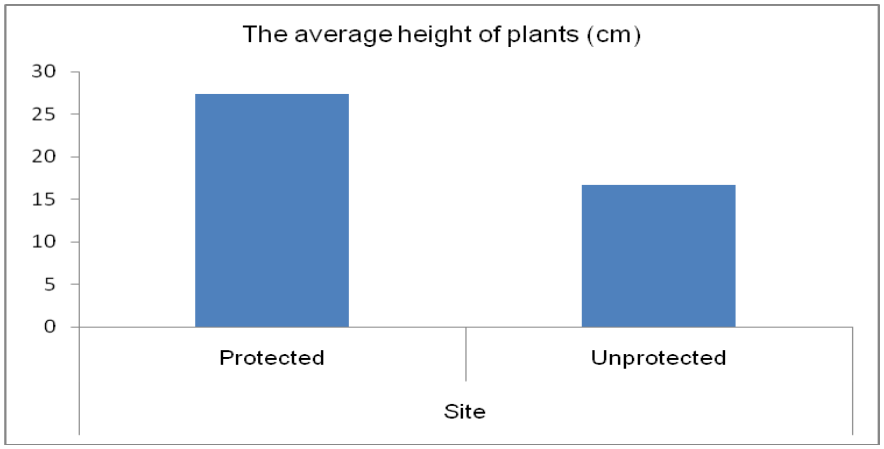


Fig.2. Effect of browsing upon height of *Seriphidium quettense* on both sites

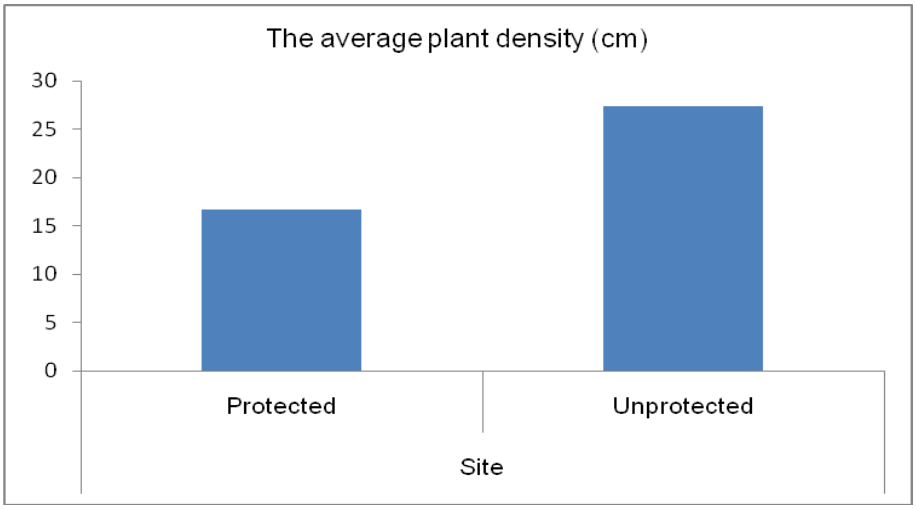
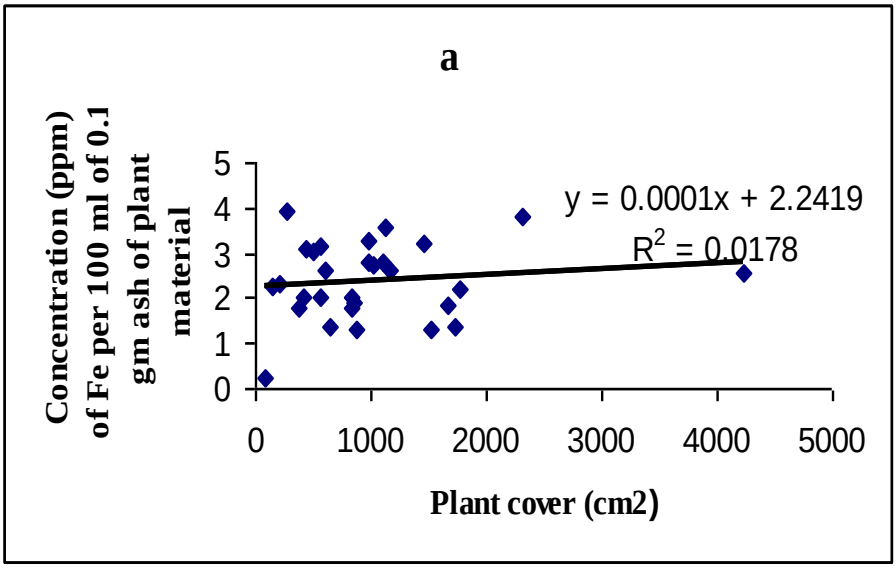


Fig.3. Average density of plants in protected and un-protected sites



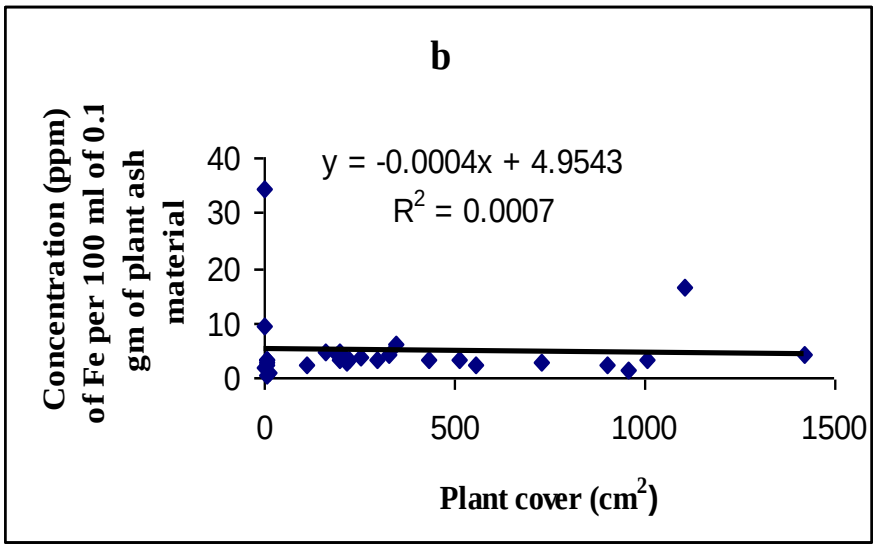


Fig.4. Relation between plant cover and Fe+ concentration in *Seriphidium quettense* of protected (a) and unprotected (b) areas. Lines are based on regression equation, where Y=concentration in ppm per 100ml 0.1 gm of plant ash material. And X=plant cover.

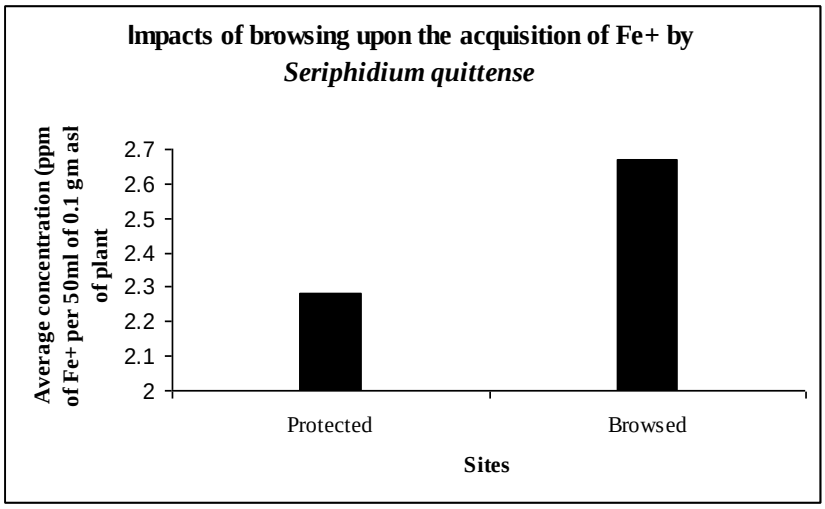


Fig.5. The average Fe+ concentration in *Seriphidium quettense* in protected and browsed sites.

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