ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Study of some edaphic factors in coastal areas of Nador lagoon (Mediterranean – North-eastern Morocco)

CHERGUI Abdelhak, EL HAFID Latifa, and MELHAOUI Mohammed

Laboratory of Hydrobiology and General Ecology, Mohamed first University, Faculty of Sciences, Oujda- Morocco

ABSTRACT

Though the soil of coastal areas of the Nador lagoon is very rich in total limestone, it's very poor in nitrogen, in organic matter, in phosphorus (P2O5) and in active limestone. Furthermore the substrate of the beach and the fixed dunes are salty with a relatively high content of Potassium (K2O), while the embryonic dunes, mobile dunes and the semi fixed dunes are not salty and have a relatively low level of potassium. Besides, the distribution of coastal dune vegetation could be controlled by the Salinity level and the potassium concentration.

Keywords: coastal areas, soil, Nador lagoon.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Classically, coastal dunes profile can be described as a succession of well-defined areas. From the sea to the continent, we can underscore that: the beach is devoid of any vegetation for instance, embryonic dunes, mobile dunes or white dunes, semi-fixed dunes or transition dunes , fixed dunes and forested dunes [24]. Mobile dunes and embryonic dunes are foredunes [28, 11]. These dune fractions correspond to both morphodynamic and phytosociological division [14]. This dune profile, typical of the Atlantic dunes, is however modified according to sedimentary environments (lagoons, estuaries…), geological environments (sharp cliff or dead cliff) and human activity. In the SIBE (Site of Biological and Ecological Interest) of the Moulouya Mouth and the Nador lagoon (Mediterranean, north-eastern Morocco), temporary salt marshlands consist of plants that are rich in halophyte, succeeding to the semi-fixed dunes [16, 17].

Among the coastal environments that display a vegetal zonation from the vegetation of the embryonic dunes until the salt marshlands (fixed dunes) halophytes, there is the coast of SIBE the Nador lagoon. This SIBE, classified RAMSAR site in 2005 [2], is located in the eastern region of Morocco in latitude 35°10'N and between longitude 02°45'W and 02°57'W and it covers an area of 14,000 ha. The SIBE is an important lagoon area of the Mediterranean coast which is composed of the Nador lagoon, its southeast and northwest dune ridges, and salt marshlands of Kariat Arekmane. The rainfall varies between 300 and 400 mm [21, 22] and the relative humidity is close to 75% [5].Monthly average temperatures fluctuate between a maximum (M =33.5) during the hottest months (summer) and a minimum (m = 5.3) during the coldest months (winter). The level of vegetation is thermo Mediterranean [1, 27] with a semi-arid bioclimatic weather [13, 29].

The aim of this study of coastal areas is to identify some edaphical factors that can control the distribution of coastal dune vegetation.

MATERIALS AND METHODS

The present edaphical study concerns five coastal areas namely; the beach, the embryonic dunes, the top of mobile dunes, semi-fixed dunes and fixed dunes (dry banks of the lagoon). From each coastal area three samples of soil (depth: 30cm) were taken during the month of May (year 2010). Soil analyses focused on the total limestone, active limestone, salinity, total nitrogen, organic matter, phosphorus (P_2O_5) and potassium (K_2O).Determination of total limestone was made by the Bernard calcimeter at 20°C, while the determination of active limestone was done according to the Drouineau method [12] modified by Galet. The salinity was estimated by electrical conductivity of soil solution; 1/5extract (salinity E1/5) and saturated paste extracts (salinity E.S) [26]. Total carbon was determined according to the method of Walkley and Black [30], and then the organic content was deduced by multiplying the rate of total carbon by a coefficient of 1,724. The content of total nitrogen was appreciated by the determination of nitrogen using the Kjeldahl-Wilforth-Gunning method [3]. The K_2O

ISSN: 0975-8585

content was determined after extraction by neutral normal ammonium acetate (CH3COONH4). For P2O5, extraction was made by a sodium bicarbonate (NaHCO3) according to the Olsen & *al*. method [25] and the calorimetric determination was made according to the Duval protocol [10].

RESULTS AND DISCUSSION

The concentration of total limestone (figure 1) is between 400,20 and 440,67g/Kg. Thus the substrate is very rich in limestone. This richness in limestone, related to the Abundance of shelly debris, was also reported in the coastal dunes of Mehdia (Atlantic coast, Morocco) where the values are between 270,50 and 470g/Kg [4] and in the coastal dunes of the Moulouya mouth where the contents are estimated at 380,60g/Kg [7]. Active limestone (figure 1) is very low hardly reaching 30g/Kg. The same result was reported in the European Atlantic dunes where the rate of active limestone is ≤ 34g/Kg [15].

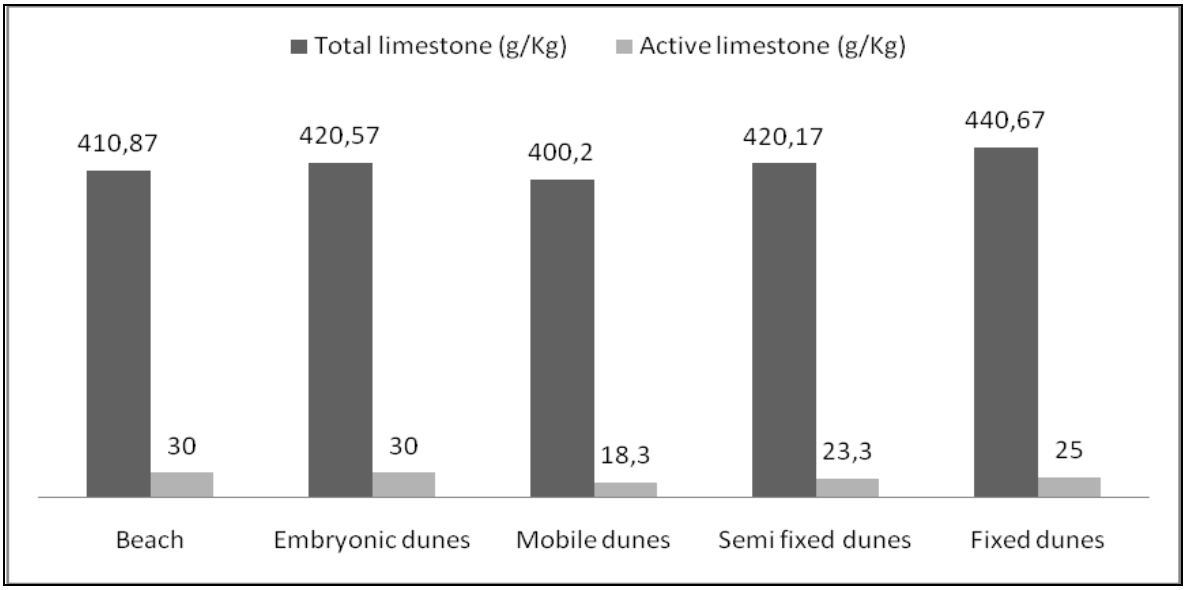

Figure 1: Rate of total limestone and active limestone (average value) in the coastal areas of Nador lagoon

The substrate of the beach and fixed dunes is saline to strongly saline (salinity E.S), while the embryonic dunes, mobile dunes and semi fixed are unsalted (salinity E1/5 and salinity E.S) (Figure2). The lowest salinities are recorded in these last areas. These results confirm those of Despeyroux [9], where the salinity level in dune ridge of Aquitaine (France) does not exceed 0.20% (3mmhos/cm). Low salinities (less than 2,50mmhos/cm) were also measured in the mobile dunes of the Moulouya mouth [7.8].However the salinity measured at the mobile dunes of Saidia (Mediterranean, north-eastern of Morocco) is much higher reaching 7.20% [19].

The soil of coastal areas is very poor in organic matter that does not exceed 3500mg/Kg (figure 3). This low organic matter level is consistent with other authors findings; 400 to 4500mg/Kg for Géhu [15] and ≤1200mg/Kg for Bouziani [7]. This low level in organic matter was

ISSN: 0975-8585

also observed on the dunes of the North Sea [18, 20, 23]. Nevertheless higher values in organic matter (55000mg/Kg) were recorded in the costal dunes of Moulouya Embouchure [19]. The rate of organic matter seems to increase from the beach to fixed dunes.

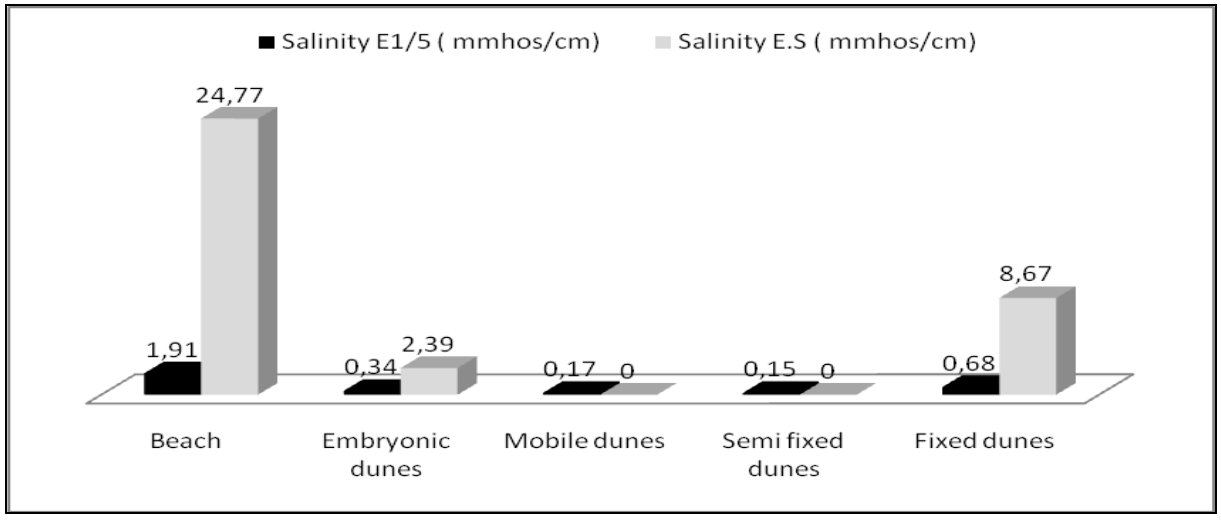

Figure 2: Salinity (average value) in the coastal areas of the Nador lagoon

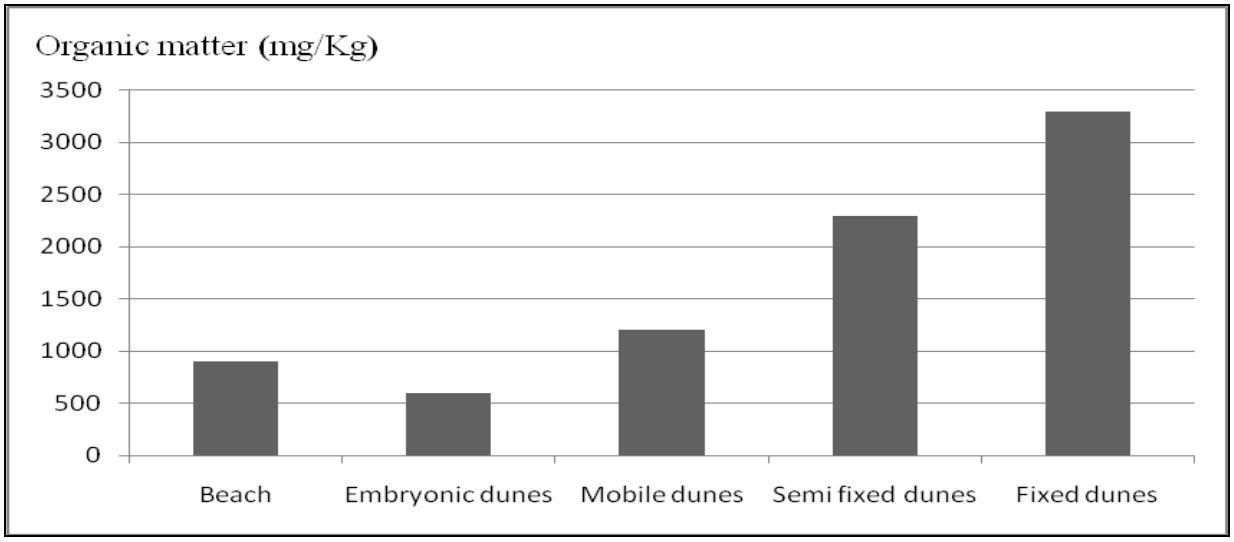

Figure 3: Rate of organic matter (average value) in the coastal areas of the Nador lagoon

Total nitrogen (figure 4) does not exceed 160mg/Kg, which means that the soil is very poor in nitrogen. Géhu studies [15] on the European Atlantic dunes show similar results, with low total nitrogen rates ranging from 30 to 250mg/Kg. However recent studies on the Aquitaine dunes showed higher values, ranging from 600 to 1000mg/Kg [14]. As for organic matter, total nitrogen level is relatively high at the banks of the lagoon.

ISSN: 0975-8585

The content of P2O5 in coastal areas is very low and constant (approximately 2,3mg/Kg), while the K2O is variable (figure 5). This low phosphorus level reminds that one found in coastal dunes of Aquitaine [18,23]. However the P2O5 content measured by Géhu [15] on the European Atlantic dunes varies in wide range from 0 to 80mg/Kg which corresponds to very low to very high level of P2O5.

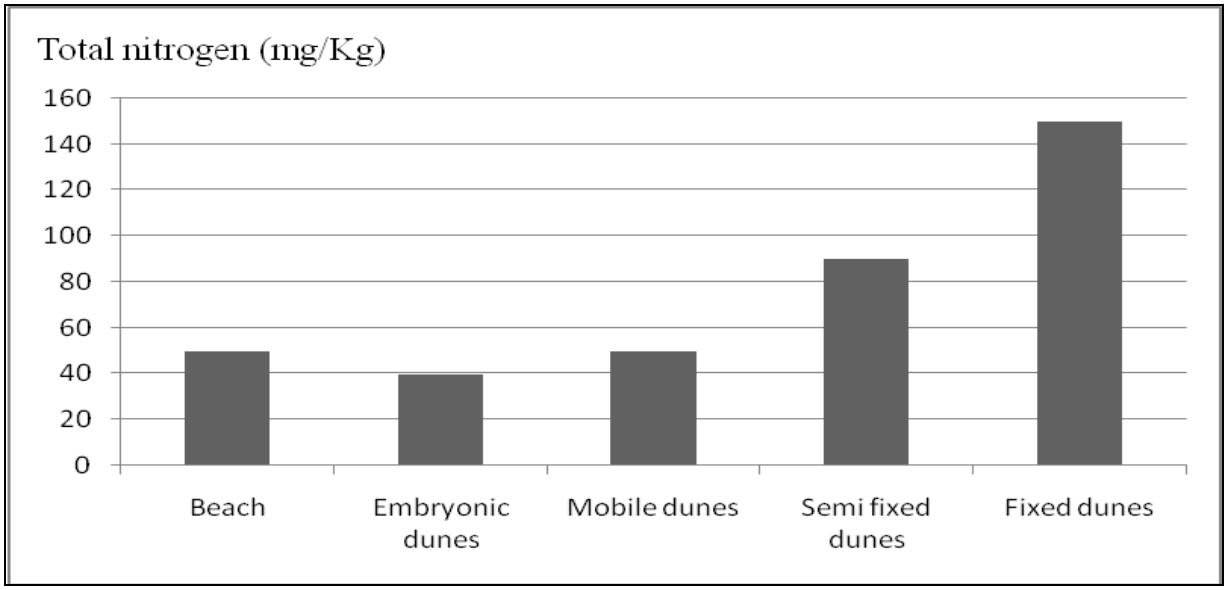

Figure 4: Rate of total nitrogen (average value) in the coastal areas of the Nador lagoon

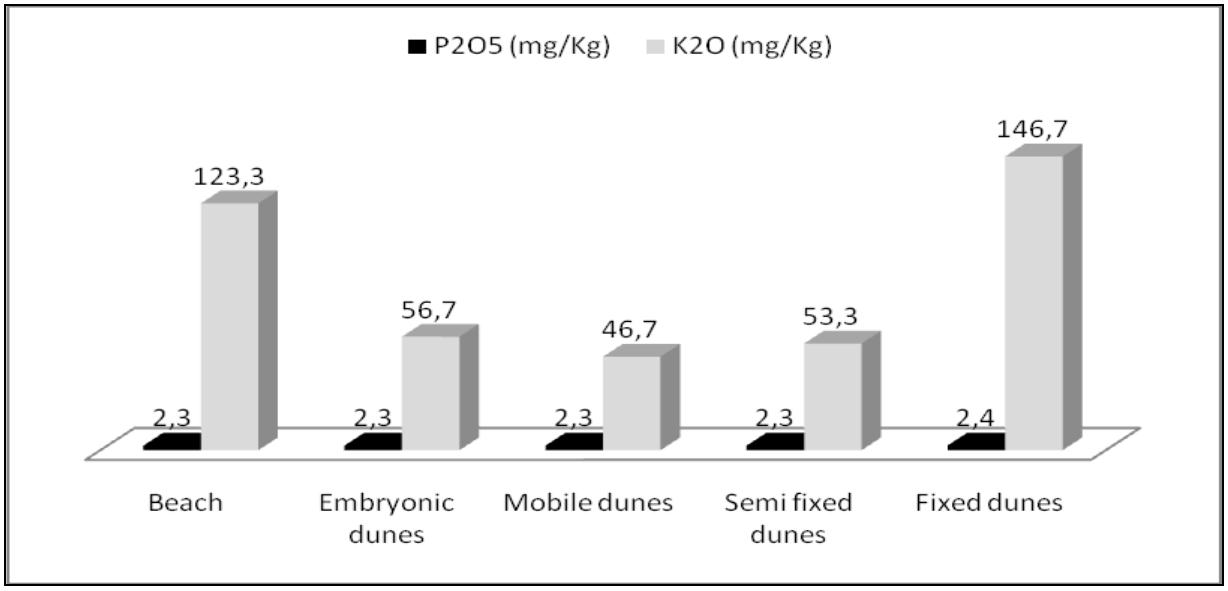

Figure 5: Rate of P2O5 and K2O (average value) in the coastal areas of the Nador lagoon

K2O concentrations are higher in the beach and the banks of the Lagoon (123,30 and 146,70mg/kg respectively). Embryonic dunes, mobile dunes, and semi-fixed dunes show lower

rates (between 46.70 and 56,70mg/Kg). The lowest values of K2O are registered in mobile dunes and semi fixed dunes.

CONCLUSION

Among the physicochemical parameters studied, it seems that the salinity and the K2O rate are the only ones that have notable édaphical variation between different coastal areas. Even if the rate of organic matter and total nitrogen varies, the soil remains poor in these two elements. Salinity and K2O level (in addition to sand deposition) may contribute to understand the zonation of coastal dune vegetation in the site understudy.

REFERENCES

[1] Achhal A, Akabli O, Barbero M, Benabid A, M'Hirit, O, Peyer C, Quezel P, Rivas –Martinez, SA. Ecologia mediterranea 1980 ; 5 : 211- 249.

[2] Amini T, Khttabi A, Ezzahiri M, Zine El Abidine A. Cartographie des groupements végétaux des sites : Lagune de Nador, commune de Beni Chiker et commune de Boudinar. Projet ACCMA, Ecole Nationale Forestière d'Ingénieurs, Salé 2008; 46.

[3] Association of Official Agricultural Chemists. Offiicial methods of analysis. 8th ed, AOAC Washington, DC, 1955.

[4] Atbib M. Bulletin de l'institut scientifique de Rabat 1983 ; 7 : 112.

[5] Atbib M. La végétation du littoral du Maroc septentrional. Université Med V, Rabat, 1988 ; 273.

[6] Baize D. Guide des analyses courantes en pédologie. INRA, Paris 1988; 172.

[7] Bouziani O. Etude des dunes bordières du SIBE de la Moulouya (Méditerrannée marocaine). Univesité Med I, Oujda, 2005; 78.

[8] Chergui A, El Hafid L, Melhaoui M. J Mater Environ 2011; 2 (S1): 552-555.

[9] Despeyroux JL. La végétation des dunes littorales du Golf de Gascogne. Université de Bordeaux III, 1984.

[10] Duval L. Chim Anal 1963 ; 45 : 237-250.

[11] Duvat V, Queney BT, Auby CC. Prat C.M.Roland Paskoff et les littoraux : regards de chercheurs. L'Harmanttan, Paris 2010; 361.

[12] Drouineau J. Dosage rapide du calcaire actif des sols. Ann, Agron, 1942 ; 441- 450.

[13] Emberger L. Classification géographique des climats. Rec, Trav, Labo, Bot, Géol, Zool, Fac, Sci, Montpellier 1955 Série Bota 3-43.

[14] Forey E. Importance de la perturbation, du stress et des interactions biotiques sur la diversité végétales des dunes littorales d'Aquitaine. Université Bordeaux I, 2007; 267.

[15] Gehu FJ. Anal Inst Bot, Cavanilles 1975; 32(2):1007- 1020.

[16] Haloui B, Ibn Tattou M, Hammada S. Flore de l'embouchure de la Moulouya. MedWetCoast- Maroc, PNUE/ Secr. Etat Envir. / Départ. Eaux et Forêts, Maroc 2003; 88.

[17] Hammada S. Rabat 2007; 187.

[18] Houle G. American J Botany 1997; 84: 1729-1737.

[19] Khalil A, Belabed A. Bull Inst Sci Rabat 1999; 22 :81-86.

[20] Koijman A M, Dopheide J C R, Sevink J, Takken I, Verstraten J M. J Ecology 1998; 86: 511-526.
[21] Laouina A. Le Maroc nord- oriental: Reliefs modelés et dynamique du calcaire.
[22] MATEE. Schéma de dévelopment et d'aménagement régional (SDAR). Ministère de l'Aménagement du Territoire, de l'Eau et de l'Environnement, Maroc, 2000.
[23] Olff H, Huisman J, Vantooren B F. J Ecology 1993; 81: 693-706.
[24] Olivier L, Emmanuelle M, Nolwen M, Toutous L. Comment peut-on concilier l'activité économique de camping et la préservation de la biodiversité sur un habitat prioritaire la dune fixée ? Université de Rennes I 2006; 31.
[25] Olsen S, Cole C, Watanabe F, Dean L. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA circular n° 939, US GOV, Print, Office, Washington, D.C 1954.
[26] ORMVAM. Méthodes d'analyses des sols et des eaux. Office Régionale de Mise en Valeur Agricole de la Moulouya, Berkane 1983; 104.
[27] Ozenda P. Ecol 1975; 16:1-30.
[28] Paskoff R. Caractéristiques et gestion d'un type de dune littorale : les avants dunes. Sécheresse 2005; 16:247-253.
[29] Sauvage C. Etages bioclimatiques. Atlas du Maroc, Notices, applications, Physiol, Météo 1963; 6 : 31.
[30] Walkley A, Black I A. Soil Sci 1934; 37: 29-38.