A Study on the Extent of the Success or Failure of Adaptation to the Environmental Conditions for Introduced Animals in the North-East of Libya

Yousef. K. A. Abdalhafid, and Masoud.M.M.Zatout

***Abstract*—** In this study I intend to determine the feasibility to introduce IIama (Lama. glama) animals and to investigate of effect a variety of factors on an adaptive feature for environmental conditions in the Mediterranean mountain and desert environments. This study carried out between 2000 and 2005 the natality and mortalities (males and females) on IIama (L. glama) animals, whereby Libyan government was brought more than 600 individuals of IIama (L. glama) animals from Bolivia to east Libya in by the end of 1999, so this study revealed that, natality were constant in 2000 and increased in 2001 and increased gradually between 2001 to 2005, on the other hand, the mortalities were decreased gradually from 2000 to 2005 in both males and females.

***Keywords*—** IIamas (Lama. glama), Environmental, AL- Jabal Akhdar, Mortality, Natality.

I. Introduction

SINCE the middle of the last century, efforts at maintain and protect the environment and safeguard natural resources have been a major part of the strategy adopted by the plans and programs for sustainable development in north of Libya particularly establish the national parks to conservation of biodiversity [1]. El Kouf National Park, established in 1975, is one of the important national parks of Libya, whereby Libyan government was brought about 600 individuals of IIama (L. glama) animals from Bolivia to east Libya in by the end of 1999.

In the last century IIamas (L. glama) were introduced to different new environments, at sea level, in many countries of Africa [2] ,[3] There are nearly three million individuals worldwide with about 70 % of the population located in Bolivia [4] . Traits that enable introduced species to persist or spread successfully include high survival rates, adaptability, good defence mechanisms, high fecundity and a lack of natural enemies such as predators and diseases [5].

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IIamas (L. glama) have a native widespread all along the Andes mountains, but are not found in the wild. IIamas (L. glama) can be found commercially throughout countries of North America, Europe and Australia [6]. Adaptation to these environments did not change the blood constituents . The Altiplano of Bolivia and Peru countries, is the natural habitat of IIamas (L. glama). In the these regions, the south is drier, desert-like and inhospitable, whereas the northern reaches are reasonably temperate and mountainous. IIamas (L. glama) have evolved at over rugged mountain terrain at an elevation of 5000 meters or more and are therefore well adapted to high altitudes. IIamas (L. glama) hemoglobin has a an unusually high affinity for oxygen and the blood contains an usually high concentration of red blood cells, at least partially explaining the ability of llamas to function so well at high altitudes [7].

IIamas (L. glama) get most of the moisture from their food and consume about 2-3 gallons of water, and 1.8% of their body weight in dry food per day and Camelids tend to live in very dry climates. When kept as native animals IIamas (L. glama) adapt well to the same diet as goats and sheep [8]. After mating, gestation takes about 360 days, and the female IIamas (L. glama) gives birth to one infant llama almost every year. Crias are nursed for four months. Sexual maturity occurs at the age of two years [9].

In this study, I intend to collate, review and summarise available information and determine the feasibility to introduce IIamas (L. glama) animals and to investigate of effect a variety of factors on an adaptive feature for environmental conditions in the Mediterranean mountain and desert environments. (Case study on IIamas (L. glama) animals).

II. Materials and Methods

A. The study animal (the llama (L.glama) habitats)

The IIamas (L. glama) is thought to have evolved from the old world camel-like animals that inhabited the regions that is today the Middle East. Although the IIamas (L. glama) has many similarities to the camel, the most noticeable difference

between the IIamas (L. glama) and the camel is that the IIamas (L. glama) does not have a hump on its back. The IIamas (L. glama) is a herbivore and gets most of its nutrition from grass, leaves and young shoots. Llamas also do not have the same water retaining properties of their camel cousins, meaning that the IIamas (L. glama) must drink more often and IIamas (L. glama) , therefore prefer to be close to water. Female IIamas (L. glama) give birth to baby IIamas (L. glama) standing up. The gestation period for a IIamas (L. glama) is between 11 and 12 months. Baby llamas are generally standing up and attempting to walk within an hour of birth. IIamas (L. glama) mating takes place throughout the year and baby IIamas (L. glama) tend to be born in the morning when the weather is warm .

The Andes is the longest continental mountain range in the world. It is a continual range of highlands along the western coast of South America. This range is about 7,000 km (4,300 mi) long, about 200 km (120 mi) to 700 km (430 mi) wide (widest between 18° south and 20° south latitude), and of an average height of about 4,000 m (13,000 ft). The Andes extend from north to south through seven South American countries: Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile, and Argentina. Along its length, the Andes is split into several ranges, which are separated by intermediate depressions. The Andes is the location of several high plateaux – some of which host major cities such as Quito, Bogotá, Arequipa, Medellín, Sucre, Mérida, and La Paz. The Altiplano plateau is the world's second-highest following the Tibetan plateau. These ranges are in turn grouped into three major divisions based on climate: the Tropical Andes, the Dry Andes, and the Wet Andes.

B. The Study Area (The new habitats of llama (L.glama)

The El Kouf National Park is located between latitude 32°44′36″N and 21°12′18″E, along Libya's northeastern Mediterranean coastline and has both marine and terrestrial biodiversity, protected under the Ramsar Convention since 2000 [9]. It covers a land area of 35,000 hectares with a coastline of 20 km. The total conservation area, however, is 100,000 hectares including the large basin area of Wade El Kouf and also beaches, rocky cliffs, sand dunes and ephemeral lagoons. The area is bounded by the limestone mass of Jabel Al-Akhdar, a mountain of 860 metres forming a rectangular area bordered by the coast line of the Mediterranean Sea. The Jabal Akhdar upland represents a plateau formed from tectonic lifting up of a primary plain of marine deposits, with the maximum altitude of the upland being 878 m in the Hemre region [11].The El Kouf National Park has a Mediterranean climate with moderate air temperatures of 10 to 30 °C [1].. The mean air temperature in winter is lower than the summer [12] . This part of Libya receives an annual rainfall of nearly 650 mm [1], [13]. The relative humidity, which averages about 60 % from April to September, may reach up to 90 % during December and January [1], [13].In the El Kouf National Park the prevailing winds are north westerly, prevailing winds in the spring and autumn coming from the south, known locally as “Ghibli”, blow over the plain, transporting sand and raising the air temperature to an average of 50 °C; they fill the air with sand and dust [14].

Libyan government was introduced IIamas (L. glama) animals to east Libya in an attempt to biodiversity . Libyan government was brought more than 600 individuals of IIamas (L. glama) animals from Bolivia to east Libya (El Kouf National Park about 20 km west Al-Bayda city) by the end of 1999, This is study concentrated on natality and mortality of L. glama introduced in east Libya (AL- Jabal Akhdar), and carried out between 2000 and 2005 whereby counted monthly natality and mortality to each year . Through follow-up monthly herd movement and counting monthly number of births and deaths and follow-up temperatures in Libya, compared to the state of Bolivia,(original habitats), There are clear differences and variation.

Monthly calculated to each year the natality and mortality were collected from January 2000 to December 2005 and analysis statistical. Data were presented as means ± standard error (SE). The statistical analysis was performed with multi-variant analysis of variance (MANOVA) using SPSS (version 13) software package for Windows comparing the multivariations between the groups. F-test was calculated and considered statistically significant at $p < 0.05$.

III. Results

Family cameldae have two genes Llama and camelus , Llama genes has four species , L. glama , L. Pacos (Alpaca) , L. guanaco and L. Vicuna , also camels have two species , C.dromedary and C.hactrianus .

TABLE I
ILLUSTRATES THE MORTALITY AND NATALITY OF IIAMAS (L. GLAMA), BETWEEN 2000 TO 2005.

- years	Mortality		natality
	M	F	Births
2000	4.04±0.06	6.15±0.096	1.16±0.01
2001	3.52±0.03	5.95±0.20	1.25±0.02
2002	3.13±0.04	3.36±0.03	1.81±0.02
2003	2.19±0.19	2.79±0.197	2.55±0.03
2004	2.01±0.155	2.12±0.187	2.95±0.05
2005	1.5±0.02	1.83±0.012	3.23±0.12
F-test	51.034		13.378
P ≤ 0.05	S.		S.

Data were presented as means ± standard error (SE) ,(M. Male , F, Female).

L. glama , L. Pacos (Alpaca) are related. They are members of the camelid family. There are four in the species, including two wild members: the Guanaco and the Vicuña. . The camel family first originated and evolved on the central plains of North America. There are fossilized footprints in Kansas, Colorado, Nevada, and other places. Evidence goes back 40-50 million years.

The ancient ancestors migrated to Asia and northern Africa three million years ago to eventually evolve into camels. Also, they went to South America to become the lama related species. At the end of the last ice age, 10,000-12,000 years ago, camelids became extinct in North America except Lamas genes remained in South America including L. glama is the target species in this study [15].

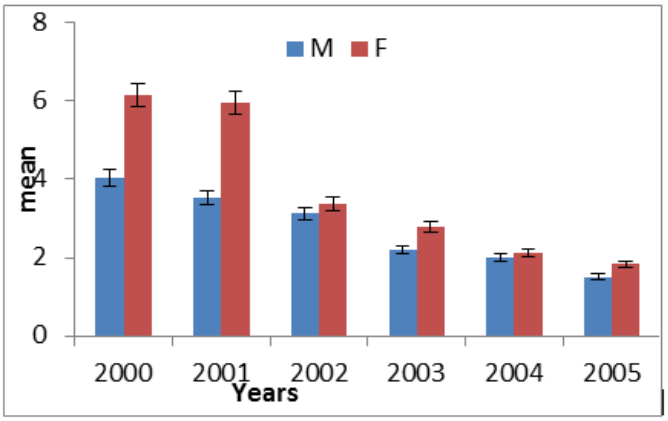

Fig.1 Representing the mortality males and females of IIamas(*L. glama*) from 2000 to 2005

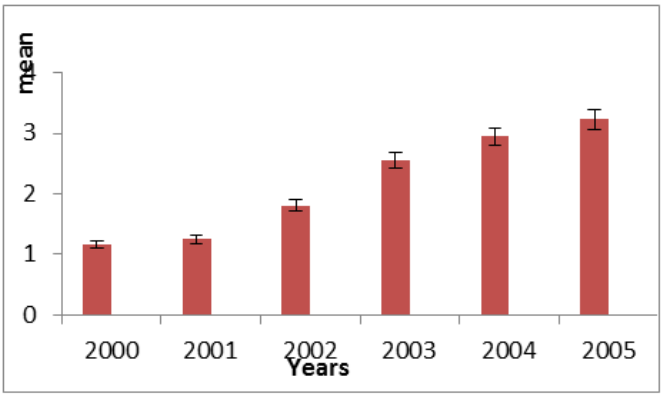

Fig.2 Representing the natality (Births) of IIamas *(L. glama*) from 2000 to 2005.

IV. Discussion

IIamas (L. glama), one of the south American camels have evolved at high altitudes , under mild environmental temperature seldom exceed 37°C, They have been introduced in the decades into many countries in different continents including Libya [16] .where they experienced ambient temperatures greater than 37°C [17]. The study of environmental factors affecting vertebrate reproduction has long interested both developmental and evolutionary biologists. Although temperature and humidity have been considered to be an important environmental parameter for vertebrates such as birds and livestocks. The ecology in Libya is still little studied, although the amount of information on the subject has increased considerably within the last ten years.This lack of knowledge hampers understanding of how ecological and physiological differences may arise as a result of the environmental changes in terms of seasonal variation.

Environmental conditions such as Temperature reflects the average kinetic energy of a biochemical system, so changes in temperature dramatically alter the rate of all physiological functions .Temperature plays an important role in various aspects of the life history, ecology, and physiology of all animals and geographic distribution [17].are all influenced by environmental temperatures. Physiological processes such as metabolic rate generally increase with temperature [18], [19].

Different seasons in most part of the world have different climate , the major climatic variables , like humidity , rainfall and solar radiation may affect livestocks [19]. in general , animals are drastically affected at all levels of their organisation by any change in their thermal surroundings (Willmer el al, 2005) and the process of adaptation of organisms to seasonal changes in the environment involve changes in every aspect of bodily function [20].

The IIamas (L. glama) introduced into Libya were well adapted to the new environment and living at sea level did not change their blood constituents. To gain reproductive success, organisms have adopted a bewildering array of adaptive mechanisms. Among them, seasonal reproduction is an important strategy that, by restricting breeding to periods characterised by favourable climatic conditions, ensures a high rate of offspring survival [21].A fundamental role in this strategy is played by environmental parameters, such as humidity and temperature, that may act as ultimate factors capable of modulating reproductive functions [22].

V. Conclusion

IIamas (L. glama) South American camelids are well adapted to live and survive in harsh , dry environmental conditions at high altitudes and Lack of oxygen., The El Kouf National Park has a Mediterranean climate with moderate air temperatures of 10 to 30 °C. .The mean air temperature in winter is lower than the summer . it seems that their adaptation in the Mediterranean basin was not difficult which is evident by minor changes observed through different natality and mortality this results were came identical with our results. Finally We can say that ,in the beginning the number of deaths are increased , but decreased with time. After the animal adapted to the new environment. As well as a marked increase in the number of births.

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