DEVELOPING HEAT AND COLD TOLERANCE INDICES IN CHICKENS WITH THE USE OF RADIOISOTOPES

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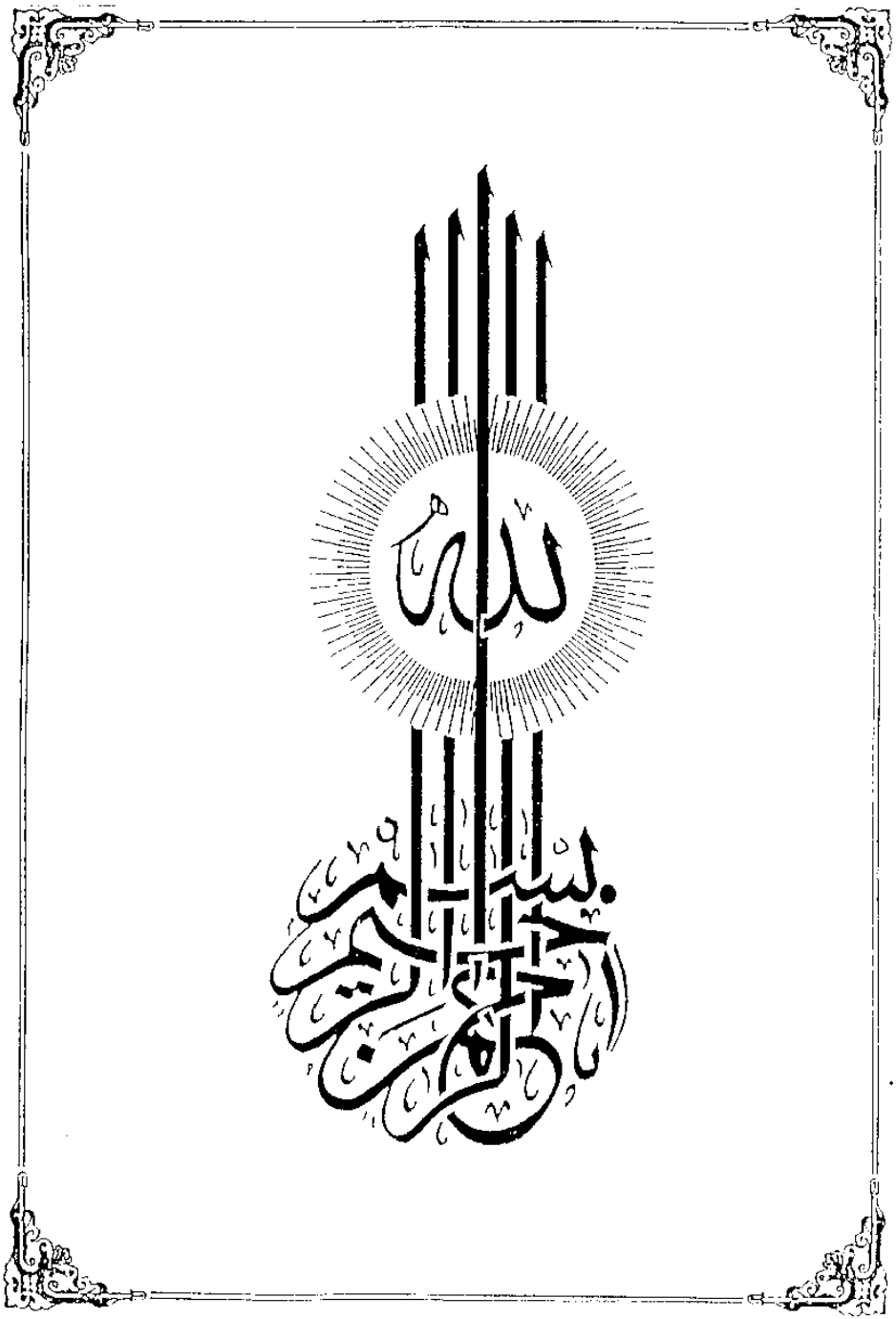

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CHAPTER I

(INTRODUCTION)

INTRODUCTION

Increasing the productive ability of the domestic fowl was, and still is, the primary goal of investigators in the field of poultry production.

There are a very few places in the world where the natural climate is continously optimum for domestic animals tnroughout the year. Wild animals and birds survive, as they are able to move about and select a comfortable environment. Since man began to domesticate wild animals and birds he has progressively restricted their freedom of selecting the best environment. A bird's environment is the total of all external conditions that affects its development, response and growth. It is often convenient, however, to seperate the factors of environment into physical, social and thermal (Folk, 1974). The physical factors are such things as space, light, sound, pressure and equipment. The social factors are the number of birds per cage or pen, behavior and "peck order". The thermal factors are air temperature, relative humidity, air movement and radiation.

This investigation pertains primarily to the effects of air temperature on Dokki 4 birds(crossbred of Fayoumi which is a local breed and Barred Plymouth Rock which is an American breed). The environment is of great importance to us in obtaining the fullest genetic expression from the

Dokki 4 breed and all the breeds bred in Egypt.

So we are concerned with: (1) How will the birds respond to the cold and hot environments? and if the bird will resist the stress, can we find measurable differences between individuals? (2) What is the genetic potential of birds under environmental stress? and does it differ from the optimum environment? (3) Is heat or cold tolerance in chickens an inherited trait? and what is the feasibility of artificial selection for this trait?

It is attempted to have some answer to these questions through an understanding of (1) the physiological and hematological bases for the birds responses to the environment, and (2) heritability estimates of the important characters of the body under both cold and hot conditions.

The use of radioactive or stable isotopes as tracers in living organisms probably represents the biggest development in biological research technique, these techniques are now well established as a powerfull research tool. One of the radioactive isotopes that is of special value in biological work is "Tritium" and is used in this investigation, as tritiated water, in the measurement of body water pool size, in vivo instead of using the desication method, and its rate of turnover as an indication of free water consumption or loss which is very difficult to access by direct method.

Together, with the other measurements undertaken like body weight, body temperature, respiration rate and the hematological parameters, they developed indices for heat and cold tolerance in Dokki 4 chickens.

CHAPTER II

(REVIEW OF LITERATURE)

REVIEW OF LITERATURE

STRESS

The term stress denotes, generally, any factors in the external environment of the individual that result in changing or influencing the normal physiological condition of the animal. Also customarily thought of as "a condition of the atmospheric environment which provokes a physiological response (a strain)".

Such factors include muscular fatigue, anoxia, administration of certain drugs and chemicals, high altitude, and environmental temperature which is considered to be one of the most important factors of stress.

The imposition of any farm of stress on the individual must be met with adequate adaptibility by the animal if it is to live, the most conspicuous components of the response mechanism, namely Cannon's emergency function of the sympatho-adrenal system and Selye's General Adaptation Syndrome (GAS).

Cannon emphasized two types of stimuli when he described his syndrome: After Folk (1974).

1) The condition of danger
2) Exposure to environmental extremes.

In other words, when an animal is challenged by a hostile environment or danger, there is a rapid total body response reffered to as Cannon's Emergency Syndrome, or the "flee,frieght or fight" syndrome.

The Emergency Syndrome is usually dramatically revealed to a person who has nearly had a violent or traumatic accidant. One to two minutes later the knees of the individual may shake violently with an accompanying over all weakness. The delayed response is considered evidence for the endocrine component of the syndrome. The importance of this response in environmental physiology is illustrated by exposing to extreme cold a cat with the sympathetic nerve chain removed on one side. In the cold room the hair is not erected to increase insulation on the side without a sympathetic chain. If the sympathetic chains are removed on both sides, the cat is completely unable to tolerate cold exposure.

Selye (1950), stated: "Anything that causes stress endangers life, unless it is met by adequate adaptive responses".

These adaptive responses to any form of stress have become known as Selye's "General adaptation syndrome". The basic phases of Selye's syndrome are divided into four stages, Rola (1974) summarized these stages as follows:

A) Phase of shock: This phase is characterized by one or more of the following conditions:

1- Reduction in body temperature.

2- State of hypotention.

3- Generalized tissue breakdown.

4- Decrease in blood chlorides.

5- Increase in blood potassium.

6- State of acidasis.

7- Initial increase, then decrease in blood sugar.

8- A decrease, then increase in blood lymphocytes.

9- Gastrointestinal erosions.

10- Secretion of certain adrenal hormones might occur in this phase as a result of corticotrophin, but this usually takes place in the next phase.

B) Phase of counter shock: The animal tries to bring about its defensive mechanisms. An atrophy of the adrenal occurs suggesting increased activity of the gland. A marked involution of lymphatic tissues and glands is noticed. This phase is also characterized by reversal of most of the changes that occur during the phase of shock.

C) Stage of resistance: The defense mechanisms of the animal against stress stimuli are extended during this stage.