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## CORRELATION BETWEEN CYTOCHROME *C* AND MYOGLOBIN CONTENTS OF THE DIFFERENT LEG MUSCLES AND M. PECTORALIS WITH REFERENCE TO SEX OF THE DOMESTIC FOWL

FACTORS affecting the percentage of myoglobin in muscle[1] had confirmed that a high concentration of this pigment is usually found in muscles of high physiological activity. This is of particular interest in view of the strong affinity of myoglobin for oxygen which enables it to act as an intramuscular oxygen store for the tissue's principle oxidizing catalysts, the cytochromes[2-3]. Cytochromes are heme proteins in which iron forms the core of the heme and it is the iron that is oxidized and reduced in electron transport. Keilin[4] as early as 1925 had pointed out that all aerobic cells contain cytochromes (as determined spectroscopically) and is highest in the most actively respiring cells. However, the concentrations of cytochromes has been reported both as being higher or lower in myoglobin rich or 'red' muscles than in the 'white' variety.

In the course of our investigation on the myoglobin content of certain muscles of the domestic fowl, it has been noted that certain muscles involved in walking are rich in myoglobin, fat and lipase and others contain less of these; also that these substances are less in the M. pectoralis of the fowl[6]. It was therefore thought advisable to find out if there is any correlation between myoglobin content and that of cytochrome *C* content in the leg muscles and breast muscles of the male and female domestic fowl.

The birds used were (18 months old male and female) those of Karnatak University breed. The bird was killed by decapitation and the leg as well as breast muscles were removed immediately and stored at 0°C until used. The myoglobin concentration of different muscle preparations was estimated as described elsewhere[7]. The cytochrome *C* content of the different leg as well as breast muscle was extracted and estimated according to the procedure described by Potter and Dubois[8].

The cytochromes are the natural hydrogen acceptors of the dehydrogenase system in the cell. The best known member of the cytochrome system is cytochrome *C*, the soluble cytochrome. Myoglobin is involved in the hydrogenation process and as such one can expect a correlation between the myoglobin and cytochrome *C* content in a muscle; if more of these two components occur, such a muscle is expected to be more active than others. The results given in Table I show that M. gastrocnemius pars externa and semitendinosus in the male domestic fowl show more of myoglobin and cytochrome *C* content than other leg muscles. In the female M. sartorius shows more of these substances than the two muscles M. gastocnemius and semitendinosus as well as other muscles. Though this is a sexual difference, the explanation for this has to be sought in the stress to which M. sartorius is subjected to in the female as a result of development of ovary and oviduct. In the ultimate analysis the differences between the muscles in cytochrome C and myoglobin content can be attributed to their specific individualities on the one hand, and the use or strain to which they are subjected to on the other hand; this use in males may be due to higher exercise.

TABLE I
*Correlation between cytochrome C and Myoglobin contents of the different leg muscles and M. pectoralis with reference to sex of the domestic fowl*

| Muscle | microgram/gm wet wt. | | | |
|---|---|---|---|---|
| | Cytochrome C | | Myoglobin | |
| | Male | Female | Male | Female |
| Sartorius | 22 | 53* | 1070 | 2806 |
| Biceps femoris | 14 | 13 | 1830 | 1742 |
| Semitendinosus | 25 | 22 | 3250 | 1223 |
| Tibialis anterior | 16 | 14 | 1290 | 1196 |
| Gastrocnemius pars externa | 70 | 31 | 4530 | 2657 |
| Pectoralis | 6·5 | 6·0 | 44 | 35 |

* The results are averages of three determinations in each case.
Myoglobin values are used for comparison purpose (unpublished results).

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## REPRODUCTIVE ADAPTATIONS IN THE INDIAN RHINOLOPHID BAT, *RHINOLOPHUS ROUXI* (TEMMINCK)

THE breeding behaviour of several Indian bats has been studied[1-7] based on specimens collected from a restricted locality. However, variations in the breeding behaviour of any Indian species inhabiting different regions and occurring in markedly different climatic conditions have not been studied so far. Hence, a study of the reproduction of *Rhinolophus rouxi* at two different regions of this subcontinent was undertaken to determine if this species exhibits reproductive adaptations to different environmental conditions. The specimens were collected at frequent intervals at Bangalore (Latitude 12°, 58′, Longitude 77°, 38′) in South India and from the mountain tunnels at Khandala (Latitude 18° 52′, Longitude 71° 32′) in Western Ghats. In both the localities this species has an annual reproductive cycle, and each adult female carries a single conceptus invariably in the right uterus.

At Bangalore, the females are in oestrus during the last week of November. Unfertilized ova, stages of fertilization and early cleavage were noticed in the Fallopian tubes of specimens collected on 27th November. Early uterine morulae were found between 6th and 8th December and free unilaminar and early biaminar blastocysts were noticed in the uteri of specimens collected between 12th and 14th December. Early implanted blastocysts were noticed in specimens collected on 21st December and the embryos with early amniotic folds were observed on 12th January. During the following weeks all pregnant females collected on any given date had embryos nearly at the same stage of development and all the females in the colony delivered their young between 26th April and 8th May.

At Khandala, the adult females collected on 13th December had each a large preovulatory follicle but hadn ot mated. Late uterine morulae were noticed in the specimens collected between 7th and 23rd January. In all the specimens collected during this period, the morula was nearly at the same stage of development. Unimplanted blastocysts were noticed in the uterus of specimens collected between 1st February and 12th February. Adult females collected on 23rd February had each an early implanted blastocyst. Progressively advanced stages of development were present in the females collected during the following weeks until 21st May when each adult female had a full term conceptus which, judging from the weight of the foetus, would have delivered within a week. The fact that all pregnant females collected on any given date after the 23rd February had embryos at nearly the same stage of development indicates that ovulation and fertilization are nearly synchronous in all the females in the colony. Since this occurs in the first week of January, it is evident that the embryos remain free in the uterine lumen between the first week of January and about the 23rd of February.

The above data lead to the following conclusions:

1. The breeding season of *Rhinolophus rouxi* commences at Bangalore about a month earlier than at Khandala.

2. The gestation period of this species is $150 \pm 8$ days in both places.

3. While early embryonic development of this species is considerably slowed down at Bangalore, the morula and the unattached blastocyst stages of development are unusually prolonged in the specimens at Khandala. Hence, the implantation of the embryo is delayed in the specimens at Khandala, and the embryo remains free in the uterus for about 40 to 45 days.

4. In both the localities the young are delivered just before the onset of the rainy season. Evidently, the setting of the monsoon is an important ecological factor which determines the period when the young are delivered in this species. At Bangalore, deliveries occur about 4 weeks earlier than at Khandala and this is also reflected in the time of onset of the monsoon which is about 4 weeks earlier at Bangalore than at Khandala. The delivery of the young just before the onset of monsoon is apparently an adaptation to the environment to ensure that mothers in lactation and the weaned young have a plentiful supply of insects, which are abundant during the rainy months. The gestation period is same in both the localities. It is evident that the other differences in the reproductive pattern of this species at the two localities, namely the retarted development of the early embryos at Bangalore and the occurrence of delayed implantation of the embryo at Khandala, are adaptations to the differences in the ecological factors in the two localities. The occurrence of delayed implantation in the species at Khandala can be expected since the bat comes to heat in December.

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