On the Chromosomes of an Agamid Lizard, *Calotes versicolor*, Boulen.

RESEARCHES on the Lacertilian chromosomes date as far back as 1897 when Tellyesniczki[1] studied them in *Lacerta agilis* and found that there are 24 chromosomes in that species. Many substantial contributions to our knowledge of the chromosomes of this group, however, have been made during the past few years only, mainly by Dalcq,[2] Painter,[3] Hogben,[4] Nakamura,[5] Matthey,[6] Keenan,[7] and Kan Oguma.[8] Out of these authors the results obtained by Painter, Nakamura, Matthey and Oguma are of great theoretical importance, inasmuch as, they throw a good deal of light on the phylogeny of this group and the relationship of its species *inter se*. Matthey (1931), for example, has been able to show on the basis of the chromosome complex of Agamidæ-Iguanidæ group that it is closely allied to the group of Veranidæ-Chamæleonidæ, and therefore, can be grouped under what he calls '*le complexe iguanoide*'.

It is well known that the representatives of almost all the families of lizards are found in the Indo-Malayan region, and yet, very few of them have been examined cytologically. In fact, with the exception of the work done by one of us (J.J.A.[9]) and Bhattacharya and his collaborators[10,11] on the female gonads, very little work has been done in India on the cytology of the male gonads of this interesting group of animals. It is, therefore, hoped that this first contribution to the study of chromosome numbers in Indian lizards will stimulate interest and inquiry among workers engaged in cytological studies in this country.

Calotes, the common blood-sucker, is a lizard which is commonly found in many parts of India, Ceylon, Burma and China and belongs to the ancient family of Agamidæ. According to Smith[11] (1935, pp. 180–208) there are 23 species of this genus in the Indo-Burman region and China and they are fairly well distributed over these countries. For the purpose of the present investigation, *Calotes versicolor* was

chosen on account of its being easily available in the vicinity of Ahmedabad, Western India. Animals were dissected regularly all the year round at an interval of about 20 days and testes fixed in various fixatives like Flemming's strong and weak fluids, Champy-original, Nakamura, Allen and Bouin, PFA3, and Schaffner's fixative. By far the best results were obtained by using Allen and Bouin, PFA3 and Nakamura's fixative. Considerable difficulty was experienced in finding out the period of active cell division in the testes, as *Calotes* happens to be a cold-blooded animal and hibernates in winter months in India. A series of microscopical observations on gonads fixed in the beginning and early part of the year, however, revealed that spermatogonia begin to divide actively from about the beginning of the fourth week of February till about the first week of March. In late March and early April, animal after animal comes out from its winter quarters and moves about in search of food in the early hours of the morning. The spell of winter torporation still lingers in their eyes and they usually retire to their shady homes during the hot part of the day and pass it there quietly. When testes of such animal are examined, considerable activity is noticeable in their constituent cells. Many primary spermatogonia are found to be in an active state of division and some clear metaphase plates in which chromosomes are distinct and lie well apart are obtained. The present note is mainly based on the study of chromosomes obtained in such primary spermatogonia (Fig. 1).

FIG. 1

Calotes versicolor—Polar views of two primary spermatogonial metaphase plates in male gonads showing 34 chromosomes. × 3,600.

Curiously enough it was also observed that such division figures were not many in the testes of animals that were opened during daytime; whereas, they were comparatively many in the material fixed at night between 11 p.m. and 3 a.m. Possibly, light seems to affect the condition of the sex cells in lizards also, as has been found to be the case in the gonads of birds and mammals.

Fig. 1 illustrates two metaphase plates observed in two primary spermatogonia. From these and the examination of some other plates it was determined that the chromosomal complex in the gonads of male *Calotes versicolor* consists of the following:—

(1) 12 large V-, U- or J-shaped chromosomes with atelomitic attachment, arranged in a ring at the periphery of the spindle,

(2) 6 medium-sized slightly elongated chromosomes with telomitic attachment, spread peripherally inside the ring of 12 V-shaped chromosomes, and

(3) 16 small dot-like microsomes, *m*-chromosomes, distributed in the central portion of the metaphase plate.

In all there are, thus, 34 chromosomes in male *Calotes versicolor*.

That there should be 12 V-shaped chromosomes in this complement also is a striking confirmation of Matthey's (1931) predictions; because, according to him, the whole '*le complexe iguanoide*' comprising six families of Autosauria, *viz.*, Anguidæ, Xantusidæ, Veranidæ, Helodermatidæ, Iguanidæ, and Agamidæ, is characterised by a peripheral ring of 12 V-shaped chromosomes with a varying number of microsomes in the centre of the spindle; and this has been found to be quite true in all the species of Agamidæ in which the chromosomes have been so far recorded. Thus, in *Agama stellio*, and *Uromastrix hardwickii* studied by Matthey (1931), and in *Japalura swinhonis* studied by Matthey (1929) and Nakamura (1931), there are 36, 36, and 46 chromosomes respectively out of which 12 are V-shaped. In *Calotes* also there are 12 V-shaped chromosomes, but the number of microsomes

in it is smaller than that observed in other Agamid lizards. This may be due to its primitive condition in the family. The only other lizard in which the same number of this category of chromosomes has been recorded is *Holbrookia texana* studied by Painter (1921); but that lizard does not belong to Agamidæ. According to Painter (1921), there are 12 macrosomes and 22 microsomes in that lizard, as against 12 macrosomes, 6 medium-sized chromosomes, and 16 microsomes in *Calotes versicolor*. The chromosomal constitution of the latter, therefore, differs much from that of the former.

Another important point that emerges from the present study of the chromosomes of male *Calotes versicolor* is in respect of its sex-mechanism. As the number of chromosomes in male *Calotes* is *even*, it is very likely that the chromosome complex in it may be of XX-type, as has been observed in a Japanese lizard, *Lacerta vivipara*, by Kan Oguma (1934).

Investigations illustrating these points and several others have been carried out in this laboratory and would be published elsewhere.

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July 25, 1940.

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[10] Bhattacharya, D. R., *Les Inclusions Cytoplasmiques dans l'oogenese de certain Reptiles (Thèse de Paris)*, 1925

[11] Bhattacharya, D. R., *Allahabad Univ. Studies*, 1929, **6.**