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Chromosome Complement of Crested Bunting and Gold Fronted Chloropsis

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ABSTRACT

Chromosomal studies were carried out on two species of the order Passeriformes - The Crested Bunting, *Melophus lathami* (Gray) of the family Emberizidae and The Golden-fronted leaf bird, *Chloropsis aurifrons* Temminck of Chloropseidae.

The blood samples were drawn from two male and three female buntings at the site itself. In all, twenty well spread metaphase plates were examined and the modal diploid number was found to be 80. There were four pairs of large sized macrochromosomes and thirty two pairs of tiny microchromosomes. In leaf-bird, as much as 78 chromosomes were clearly visible in its cellular garniture. In all, three pairs of large metacentric, two pairs of medium acrocentric, three pairs of small telocentric macrochromosomes and thirty one pairs of dot shaped microchromosomes were found.

Keywords: Gold, *Melophus lathami*, macrochromosomes, Emberizidae.

1. Introduction

India has a vast territorial expanse, forest cover and eventually it offers habitat to myriad bird species. However, extensive deforestation and reckless exploitation of nature by homonids have threatened the survival of countless species of birds. The number of species likely to become rare, threatened, endangered or near extinction in the Red Data Book of IUCN is accruing with time. Unfortunately, we do not have any significant cytological information about them [1-6]. Unless, the genetic constitution of our bird fauna is properly known, neither their evolution can be understood, nor their conservation be fully ensured. To fill up this gap, it seemed worthwhile to explore the chromosomal constitution of the Crested Bunting, *Melophus lathami* and the Gold Fronted Chloropsis, *Chloropsis aurifrons*.

2. Material

The Crested Bunting, *Melophus lathami*, (Gray, 1831) belongs to family Emberizidae (Passeriformes: Aves) and is monotypic in its genus, *Melophus*. It inhabits subtropical or tropical dry lowland grassland in Bangladesh, Bhutan, China, India, Laos, Burma, Nepal, Pakistan, Thailand, and Vietnam.

The Golden-fronted leaf bird, *Chloropsis aurifrons*, Temminck (1829) is a common resident breeder in India, Sri Lanka, and parts of Southeast Asia. It inhabits forest and scrub, eats insects & berries and builds its nest in a tree, laying 2-3 eggs. The body surface is green with black face and throat, orange forehead and blue moustachial line. Young birds have a plain green head.

2.1 Methodology

The specimens were traced in nature. Blood cells were drawn from the *vena basilica* at the point where it crosses radius and ulna. Sometimes in long-legged species, it was obtained from the *vena sphanea* approximately midway the tarso-metatarsus. Approximately 0.1 ml of a sterile solution of Na-heparin (5000 I.U./ml) is drawn into a disposable syringe and 0.5 to 2.0 ml of blood sample was drawn. Small syringes (up to 2 ml) were preferred since the vacuum produced by larger syringes causes the *vena basilica* to collapse during suck up. The syringe was shaken to mix the blood cells and heparin thoroughly. The cell plates were prepared after Garg [7-9].

2.2.1 Flame drying and Staining

Commercially available microscopic glass slides (preferably PIC-1) were taken and submerged overnight in 1:4 sulphuric acid - water. The slides were cleansed under running tap water for an hour, dipped in 70% alcohol for 2-4 hr and kept in refrigerator. Now, the cell suspension was taken and a large drop of it was dispersed on a clean wet slide. The slide was then lifted and moved gently over the flame of the spirit lamp or alternatively kept on a hot plate, depending on circumstances, until the fixative got evaporated. The slides were stained in Giemsa (merk) solution (diluted 1:50 with Sorenson's buffer) at pH 6.8 for 15 min. The slides were finally rinsed in tap water, dried in air and mounted in glycerine.

2.2.2 Cytobiometry

Morphometric analysis of chromosomes were carried out from enlarged photomicrographs of five well spread metaphase plates of each sex.

The Relative length ($\%^{R}_{L}$), the Arm Ratio (r) and/or the Centromeric Index ($^{C}_{I}$) were calculated as follows:

$$\text{Relative Length } (\%_L{}^R) = \frac{\text{Length of macrochromosome}}{\text{Total Haploid Macrochromosomal Length}} \times 100$$

$$\text{Arm Ratio (r)} = \frac{\text{Length of long arm of the chromosome}}{\text{Length of short arm of the chromosome}}$$

$$\text{Centromeric Index } (I^C) = \frac{\text{Length of the short arm}}{\text{Total length of that chromosome}} \times 100$$

3 Results

3.1 The Crested Bunting, *Melophus lathami* (Gray, 1831)

Two male and three female specimens were procured from different parts of the state. The blood samples were drawn at the site itself. In all twenty well spread metaphase plates were investigated and the modal diploid count was found to be 80. This count was indicated by 60.00% of the cells scored.

There were four pairs of large sized macrochromosomes, including the sex element, Z-W. All autosomal pairs had median centromere whereas Z was an acrocentric and W was a telomeric component.

Group II comprised medium sized chromosomes, all metacentric with respect to the position of their centromere. They were almost identical and lacked bimodality.

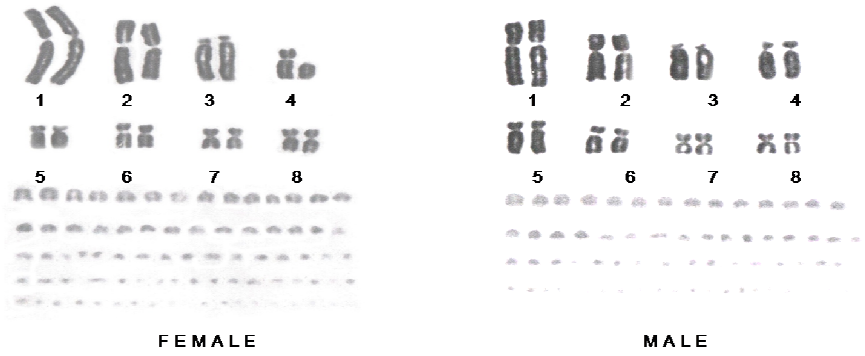

Fig 3: Female and Male karyotype of *Melophus lathami*

The remaining thirty two pairs formed a gradated series with identical morphology and hence they were grouped together in the category of microchromosomes.

3.2 Golden-fronted Leaf bird, *Chloropsis aurifrons* Temminck (1829)

Only one female individual could be tracked for procuring blood sample. Hardly six cell plates were perceptible under microscope, with 78 scattered chromosomes. The chromosomes were sharply demarcated into two conventional categories - macro- and micro-chromosomes. No satellite like structure was perceptible in the cell plates analysed.

In all there were three pairs of large metacentric, three pairs of small telocentric and two pairs of medium acrocentric chromosomes. Z was fifth in size with sub telomeric centromere, whereas W was the smallest telomeric macrochromosome.

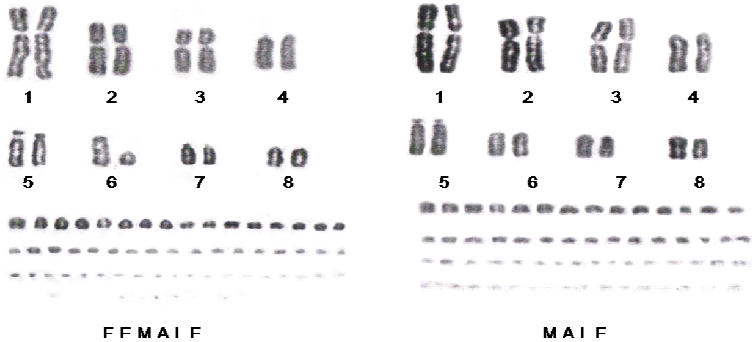

Fig 4: Female and Male karyotype of *Chloropsis aurifrons*

A total number of thirty one dot shaped pairs, other than eight described so far, formed a continuous series and were placed together as microchromosomes.

4 Discussion

The somatic chromosomes of seven species of Passeriformes, belonging to six families, have been studied. The diploid chromosome number fluctuates from 68 to 80. Each of these species possesses seven or eight pairs of macrochromosomes, except *Acridotheres tristis* and *Acridotheres ginginianus*, which possess six pairs of macrochromosomes including the Z-Z chromosomes. An exclusive W-chromosome has been found in all these species. It is either transitional in size between the macro- and micro-chromosomes or it is as small as a large microchromosome. It has been found to be m, sm or t type chromosome. On the basis of these facts, it seems valid to infer that Passerine birds have maintained chromosomal homology to a great extent. However, inter-chromosomal rearrangements may also account for the karyotypic differentiation in some cases.

The most impressive fact in avian cytogenetics is the conservation of number of chromosomes. A standard karyotype for birds seems to be one encompasses 2n=80 with 8 macrochromosomes and 32 micro-chromosomes. This karyotype is over and over again expressed in the orders Tinamiformes, Anseriformes, Galliformes, Strigiformes and Passeriformes. In correlation studies, between the number of macro- and microchromosomes, the two types of chromosomes were found to be negatively correlated within an order. When the number of macrochromosomes increases, the number of microchromosomes decreases. This indicates an evolutionary connection between the numbers of chromosomes of the two different sizes.

While comparing the karyotypes of the present species, *Chloropsis aurifrons* (2n=78) and its congeneric form, *C. cochinchinensis* (2n=74) [10], it is evident that the Z and W chromosomes are metacentric in *C. aurifrons* and submetacentric in *C. cochinchinensis*. Further, there are 16 macrochromosomes in the former taxa whereas the latter one embraces 18. This disparity of macrochromosome number is attributed to the fusion of 2 unequal telomeric pairs of C. *aurifrons* into one sm pair in *C. cochinchinensis*.

There seem to be arguments supporting the idea that, within a certain order, there is a process of microchromosomal fusion to macrochromosomes, especially giving rise to smaller macrochromosomes. As indicated above, this tendency of chromosomal fusion might be connected with the speciation process and consequently the rapidly evolving orders would show this tendency more than others. Slizynski [11] proposed three hypotheses for the existence of microchromosomes. He proposed that, in the meiotic microchromosomes, the chiasmata are scarce or absent. This probably reduces the amount of genetic variation present in a species. The tendency towards reduction in number of microchromosomes in certain species might reflect an increase in genetic variation caused by microchromosomal fusion.

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