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Wide Variability In Sex Chromosomes Of Some Ophidians From UT Of Jammu And Kashmir

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Abstract

Cytogenetic studies were carried out on 11 species of Indian Snakes collected from Jammu region using Air Drying Technique of Gorman *et al* 1979. Among all *E. johni* and *E. conicus* belonging to primitive family Boidae exhibits diploid number, 2n=34 with undifferentiated sex chromosomes in both male and female. In family Colubridae (an intermediate family) there exist huge variation as far as sex chromosomes are concerned i.e *Ptyas mucosus* has 2n=34, *Oligodon arnensis* has 2n=44 with undifferentiated sex chromosomes, *Lycodon arnensis* and *Boiga trigonata* both have 2n=36 with differentiated sex chromosomes(as per literature) while *Natrix stolata* has 2n=36 with distinct 'ZW' female. In Family Elapidae *Naja naja naja* has 2n=38 with undifferentiated sex chromosomes but *Bungarus caerulus* has 2n=44 with 'ZW' female having submetacentric 'Z' and largest telocentric ' W' but members of family Viperidae viz. *Vipera russelli* and *Echinis carinatus* both have 2n=36 with well differentiated 'ZW' where 'W' is smaller and ' Z' larger representing final step in the evolution of sex chromosome

Keywords:- Cytogenetics, Boidae, Colubridae, Elapidae and Viperidae

Introduction

Animal taxonomist always faces the difficulty of finding reliable morphological character while attempting to break down a wide spread and variable shapes into more acceptable taxonomist units but cytogenetic studies of individuals from different population can often provide more in depth understanding of the problems. The chromosome number and karyomorphology are important species specific character. Nature favors one karyomorphology over other depending on the degree of phenotype fitness it provide, as karyotypic variation would affect the phenotype thus from genetic stand point, it offers genotypic information unique for study. Moreover it is realized that karyological information could be of use towards the elucidation of taxonomical problem that can contribute to our knowledge of the degree of affinity between species belongs to some genus or family or even higher systematic categories.

Snakes constitute the most fascinating group among the reptiles but their phylogenetic affinity in poorly understood because of poor fossil records hence chromosomal studies can prove to be useful for determining to evolutionary history. Snakes karyology is fascinating because they show wide variations as far as their sex chromosomes are considered that is primitive families possess undifferentiated sex chromosomes, less advanced families like colubridae possess both differentiated and undifferentiated sex chromosomes while highly advanced families of poisonous snakes possess well differentiated sex chromosomes .

During present investigation snakes from all the three major groups were studied and is observed that the present study further substantive the existing data.

Materials and methods:

Live/injured specimens of 10 different species of snakes belong to family elapidae, viperidae, colubridae and boidae were collected from different places of Jammu regions in the month of March-October. Generally the specimens were denoted by local peoples as these were the snakes which were encountered by common public because of the fare of snakes peoples usually injured the poor creatures.
The specimens were brought to the laboratory where they were injected intraperitoneally 1% colchicines (1ml/100gm of) for 24hours prior to dissection. Somatic tissues like spleen kidneys and bone marrow (aspired from) were extracted and hyphotenised tissues were then put in to the fixation in carnoy's fixative (3methonol:1acetic acid) for 30 minutes, slides were prepared by dabbing, air dried and stained in 2 % Giemsa stain for 10 minutes (Gorman *et al* 1967 and Gorman & Atkin , 1967). Well spread metaphase stages were micro photographed and karyotyped following the schemes of levan *et al* 1964.

RESULTS

Family Boidae
1. *Eryx conicus*:- At least 100 well spread metaphase complement from different somatic tissues of one male and two female revealed diploid count of 2n=34 with 16 macro and 18 microchromosomes. The sex chromosomes could not be distinguished in either sex (Figure 1).
2. *Eryx johni*- After analyzing 50 good metaphase plates from different somatic of 2 male and a female specimens revealed 34 as diploid chromosome number (2N=34) consisting of 16 macro and 18 micro chromosomes (figure 2). There is no heteromorphic pair both in male and female specimen.

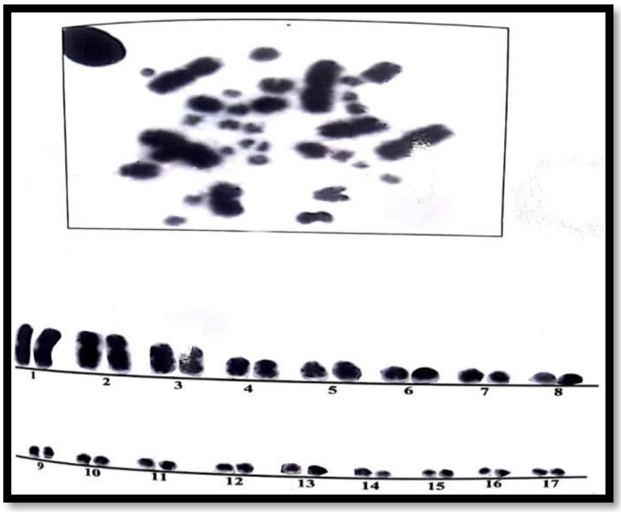
Family Colubridae
3. *Natrix stolata*:- A study of atleast 40 well spread metaphase stages yields 2n=36 with 14 macro and 22 microchromosomes. The macrochromosomes can be classified into 2 groups the first group consists of 5 pair of chromosomes having median centromere the 'Z' chromosome is included in this pair with 'W' chromosome having subterminal centromere (Figure 3).
4. *Boiga trigonata*:- Spermatogonial metaphase exhibits a diploid count of 36 chromosomes (2n=36) consists of 18 macro and 18 microchromosomes. Male were found to be homogametic with ZZ sex mechanism (Figure 4) in this species, unfortunately we are not able to study female specimen but again as per the data available *Boiga trigonata* also possess female heterogamety (Sharma Nakashi, 1979) .
5. *Ptyas mucosus*:- Two male and 1 female individuals have been used for chromosomal analysis and revealed 2n=34 with 16 macro and 18 microchromosomes (Figure 5). No heteromorphic pair of chromosomes is detected in either sex of this species.
6. *Lycodon aulicus:*- Somatic and spermatogonial metaphase complement exhibits a diploid count of 36 chromosomes (Figure 6) comprising 16 macro and 20 microchromosomes. Though we have not been able to study female karyotype but literature of this species (Singh et al 1972) clearly signifies that female are heterogametic among this species (ZW is metacentric and subtelocentric).

Family Elapidae
7. *Naja naja naja*:- 2 female were analysed for chromosomal studies and revealed 2n=38 as diploid number comprising of 16 macro and 22 microchromosomes, the sex chromosomes could not be distinguished (Figure 7).
8. *Bungarus caerulus*:- 2 females were analysed and a total of 40 metaphasic plates from different somatic tissues reveals 2n=44 as the diploid number having 24 macro and 20 microchromosomes (Figure 8). All the macrochromosomes are telocentric and show a continuous gradation in size. 'W' chromosomes is similar in morphology to other macrochromosomes (telocentric) but is largest of all, "Z" is the only submetacentric chromosome in the complement.

Family Viperidae
9. *Echis carinatus*:- 50 well spread metaphase complement from different somatic tissues of female exhibits 36 chromosomes comprising of 16 macro and 20 microchromosomes, the macrocomplement bears a

heteromorphic pair of sex chromosomes viz. a larger metacentric ‘Z’ and a smaller submetacentric ‘W’ indicating ZW sex mechanism in female (Figure 9).

10. *Vipera russelli*:- Diploid complement from 45 well spread metaphase complement of female *Vipera* observed was 2n=36 with 16 macro and 20 microchromosomes (Figure 10). Metaphasic complement of female revealed a heteromorphic pair of sex chromosomes, a smaller ‘W’ (Submetacentric) and larger ‘Z’ which is metacentric.



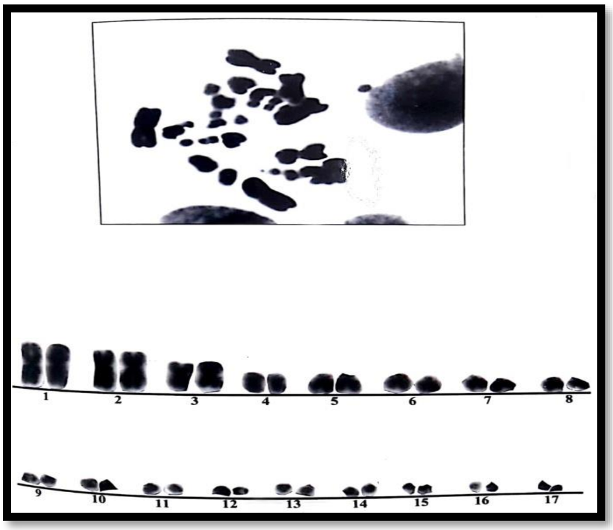
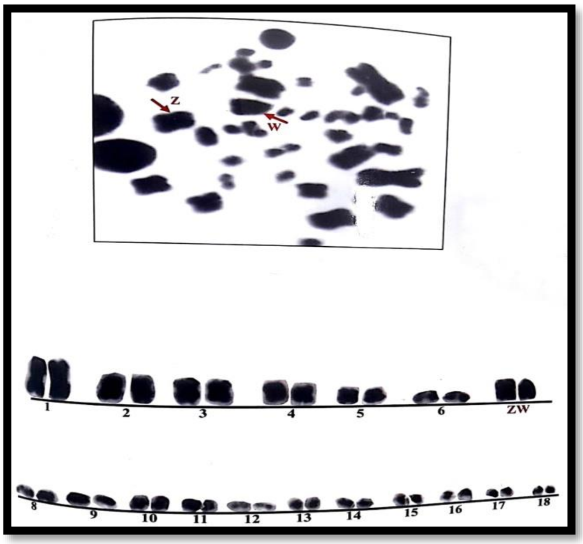


Figure 1 **Figure 2**

Figure 1: Showing Chromosomal complement and karyotype of *Eryx conicus*

Figure 2: Showing Chromosomal complement and karyotype of *Eryx johnii*.



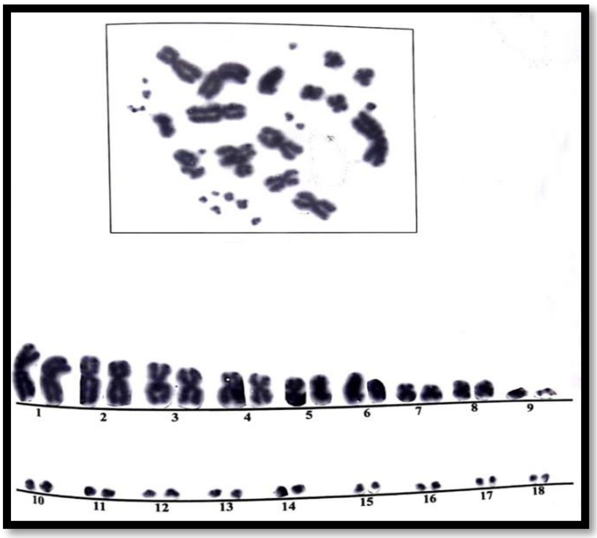
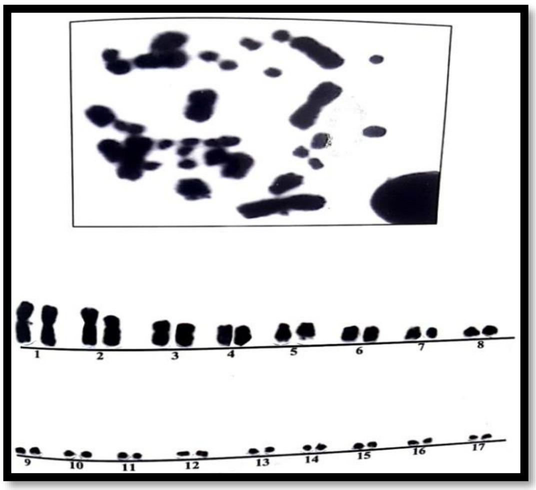


Figure 3 **Figure 4**

Figure 3: Showing complement and karyotype of *Natrix stolata*

Figure 4: Showing complement and karyotype of *Boiga trigonata*



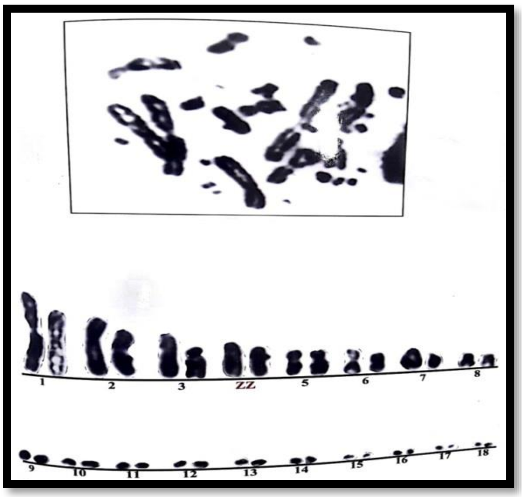
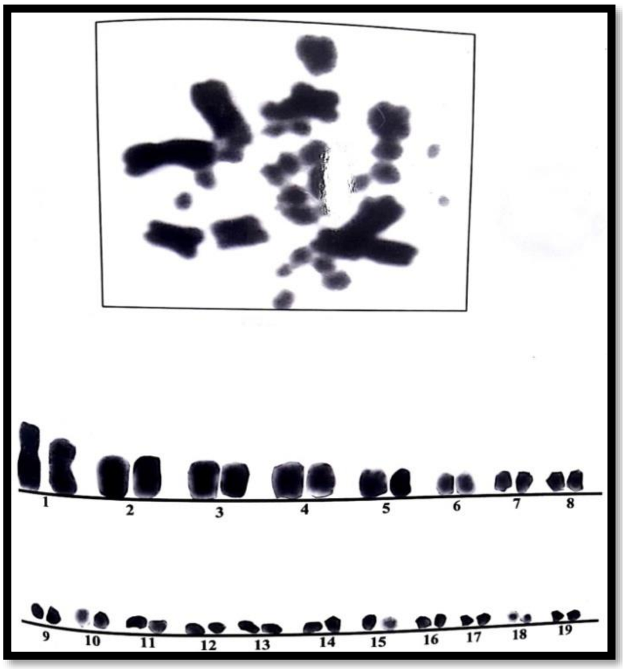


Figure 5 **Figure 6**

Figure 5: Showing complement and karyotype of *Ptyas mucosus*

Figure 6: Showing complement and karyotype of *Lycodon aulicus*



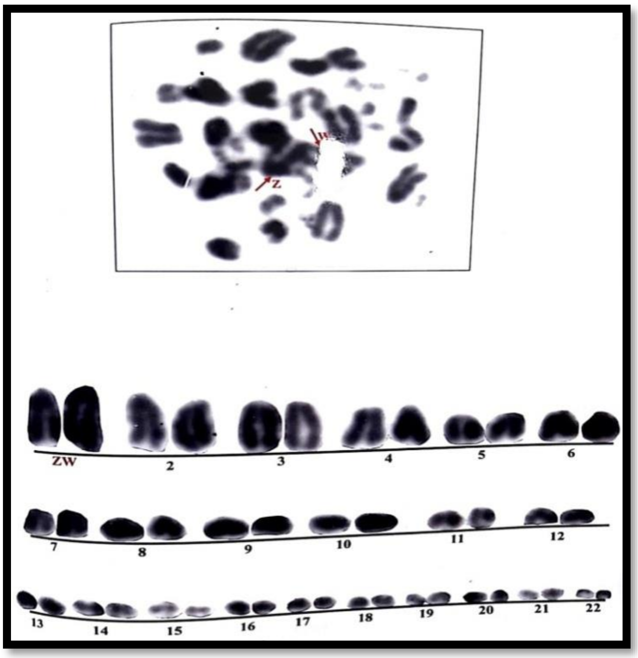
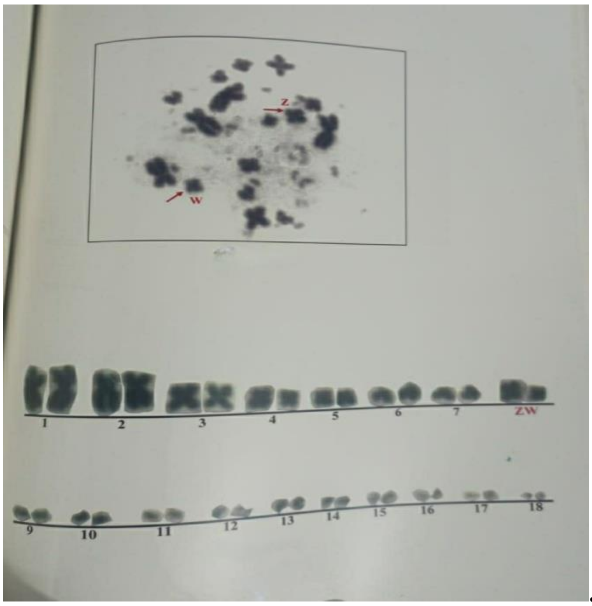


Figure **Figure 8**

Figure 7: Showing Chromosomal complement and karyotype of Naja Naja

Fig. 8: Showing Chromosomal complement and karyotype of B. *caerulus*



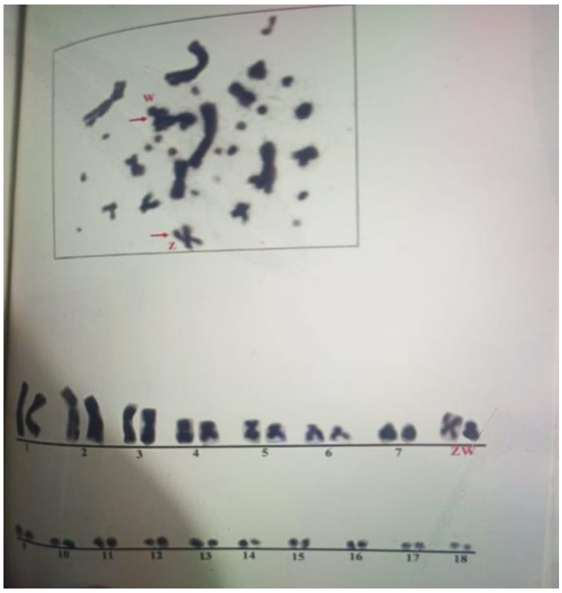


Figure 9 **Figure 10**
Figure 9: Showing Chromosomal complement and karyotype of *Echis-carinatus*
Figure 10: Showing Chromosomal complement and karyotype of *Vipera Russeli*

Discussion

Sub order ophidian has attracted special attention of cytogenetics regarding sexual dimorphism of chromosomes. Snakes shows a step by step sex chromosome differentiation from the morphologically undifferentiated condition to the grossly differentiated status, they exhibits various stages of differentiation of 'Z' and 'W' chromosomes apparently according to evolutionary status of the family. In general the fourth largest pair of basic karyotype is regarded as the sex pair in ophidians regardless of the family (Ohno, 1967). They have homomorphic pair in primitive families, intermediate condition in Family colubridae and well differentiated as well as multiple sex chromosomes in highly evolved families (Becak and Becak, 1969, Ray Choudhary *et al,* 1971, and Singh *et al,* 1972). Moreover lack of morphological differentiation does not indicate the absence of sex chromosomes because in the species with differentiated sex chromosomes the masculizing and feminizing genes may have accumulated in one or more pair of chromosomes.
Family Boidae includes the most primitive non poisonous snakes with morphologically undifferentiated sex chromosomes, during the present investigation also we find no differentiated sex pair in *E.johni* and *E.conicus* which coincides with the observations of Singh 1972, moreover that time these species have been worked from southern India but now its from Northern India but we do not find any difference in the structure of Karyotype which further strengthened the fact that snakes karyotype is highly conserved.
Family Colubridae which is again a family of non poisonous snakes but is advanced than Boids and is considered as intermediate family with great diversity. This family shows great variation in morphology of sex chromosomes which ranges from absence of heteromorphic to accentuated differentiated size and shape of sex chromosomes. During present investigation also we have studied 4 species of colubrids of which *Ptyas mucosus* possess undifferentiated sex chromosomes but rest 3 possess well differentiated sex chromosomes, moreover 4th pair is here also generally considered as the sex pair, these species have already been worked out from other parts of world but not from J&K but our data coaccords with the previous results.
Family Viperidae also includes poisonous snakes and possess well differentiated sex chromosomes (Baker *et al,* 1972, Becak et al 1964, Becak, 1962, 1965, Becak and Becak 1969). Both 'Z' and 'W 'in family Viperidae are very conservative. According to Singh, 1972 relative length of 'Z' varies from 9% to 11% and of 'W' from 5-7% which is further substantiated from the present study i.e during the present investigation also we find the same results.
Among the Family Elapidae and subfamily Elapinae which includes highly advanced snakes among these we have studied two species viz *Naja naja naja* and *Bungarus caerulus. N.naja naja* do not possess any well differentiated sex pair though its advanced snake but our results were similar to that of Singh 1972.
Bungarus caerulus have been studied by Singh *et al* , 1979 , Sharma and Kour 2005,and found them as polymorphic with 2n=43,44,45 though same species has been studied during present investigation but the multiple sex chromosomes could not be observed. The present results coaccord to Singh *et al,* 1979 type IV

West Bengal population where 'Z' is the only submetacentric chromosome in the diploid complement and 'W' is the largest acrocentric from which by fusion multiple sex chromosomes evolved.

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