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CHROMOSOMAL INVESTIGATIONS ON FOUR SPECIES OF DUNG BEETLES (INSECTA)

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ABSTRACT

Karyological investigations were carried out on adult male individuals of two species of Staphylinidae beetles viz. *Cryptobium ceylanense* Kr., *C. distinctum* Cam. and two species of Histeridae beetles viz. *Pachylister ceylenus* Mars., *Platylister procerus* Lewis.. Staphylinidae species *Cryptobium ceylanense* Kr. possesses $2n = 28: 13+X_{yp}$ and *C. distinctum* Cam. possesses $2n = 26 : 12+X_{yp}$ sex mechanism and one Histeridae species *Pachylister ceylenus* Mars. exhibited $2n = 22 : 10+X_{yp}$ and other species *Platylister procerus* Lewis. exhibited $2n = 26 : 12+X_{yp}$ sex mechanism. Mitosis and meiosis have been described and discussed.

Key Words: *Coleoptera, Staphylinidae, Histeridae, Karyotype, Sex Chromosome Mechanism*

INTRODUCTION

Coleoptera forms one of the most interesting groups of insects. It is the largest order of not only insecta but also of the whole animal kingdom. The Coleopterans are generally known as beetles. Arnett (1968) recorded 3, 50,000 described species of Coleoptera. Polyphaga is a sub order of Coleoptera. Family Staphylinidae and Histeridae belong to this sub order. Staphylinids are commonly known as Rove beetles whereas Histerids are commonly known as Clown beetles. Staphylinidae is one of the richest families of Coleoptera with species that are mostly predacious. More than 45,000 species are known worldwide and probably over 75% of tropical species are still undescribed (Howard *et al.*, 1998).

Classification of Staphylinidae is ongoing controversial, with some workers proposing an organisation of as many as ten separate families, but the current favoured system is one of 31 subfamilies, about 100 tribes and about 3,200 genera. About 400 new species are being described each year. More than 2000 species of Staphylinidae are from the Indian subcontinent (Cameron, 1930, 1931, 1932 and 1939). Saini (1980) has recorded 94 species from 31 genera belonging to six subfamilies of Staphylinidae from Haryana, western Uttar Pradesh and Himachal Pradesh.

Histeridae contain 3,900 species worldwide (Mazur, 1997). This family occupy almost any kind of niche. Hister beetles have proved useful during forensic investigations to help in time of death estimation. The cytogenetical information of beetles is useful in many ways. It is has great significance in the field of applied economic entomology. So far we have cytogenetical information on about 4000 species only (Smith and Virkki, 1978 and Dange, 1991). Due to lack of information on the cytology of these groups and considering its economic importance the present investigations were under taken. All species are new addition to the cytology of this group.

MATERIALS AND METHODS

Adult male individuals of four species belonging to three genera *Cryptobium ceylanense* Kr., *C. distinctum* Cam., *Pachylister ceylenus* Mars., *Platylister procerus* Lewis constituted the materials for the present investigation. All the beetles were collected under the mercury vapour lamps during October - November 2007 from Ratlam (Madhya Pradesh). Chromosome preparations were made following Yadav and Lyapunova (1983).

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RESULTS AND DISCUSSION

Cryptobium Ceylanense Kr.

The diploid number of 28 chromosomes was observed at the spermatogonial metaphase (Fig. 1). The karyotype consists of thirteen pairs of autosomes, and the X and y sex chromosomes (Fig. 2). Autosomal pairs 1-8 are metacentric, pairs 9-13 are sub metacentric whereas X and y are acrocentric.

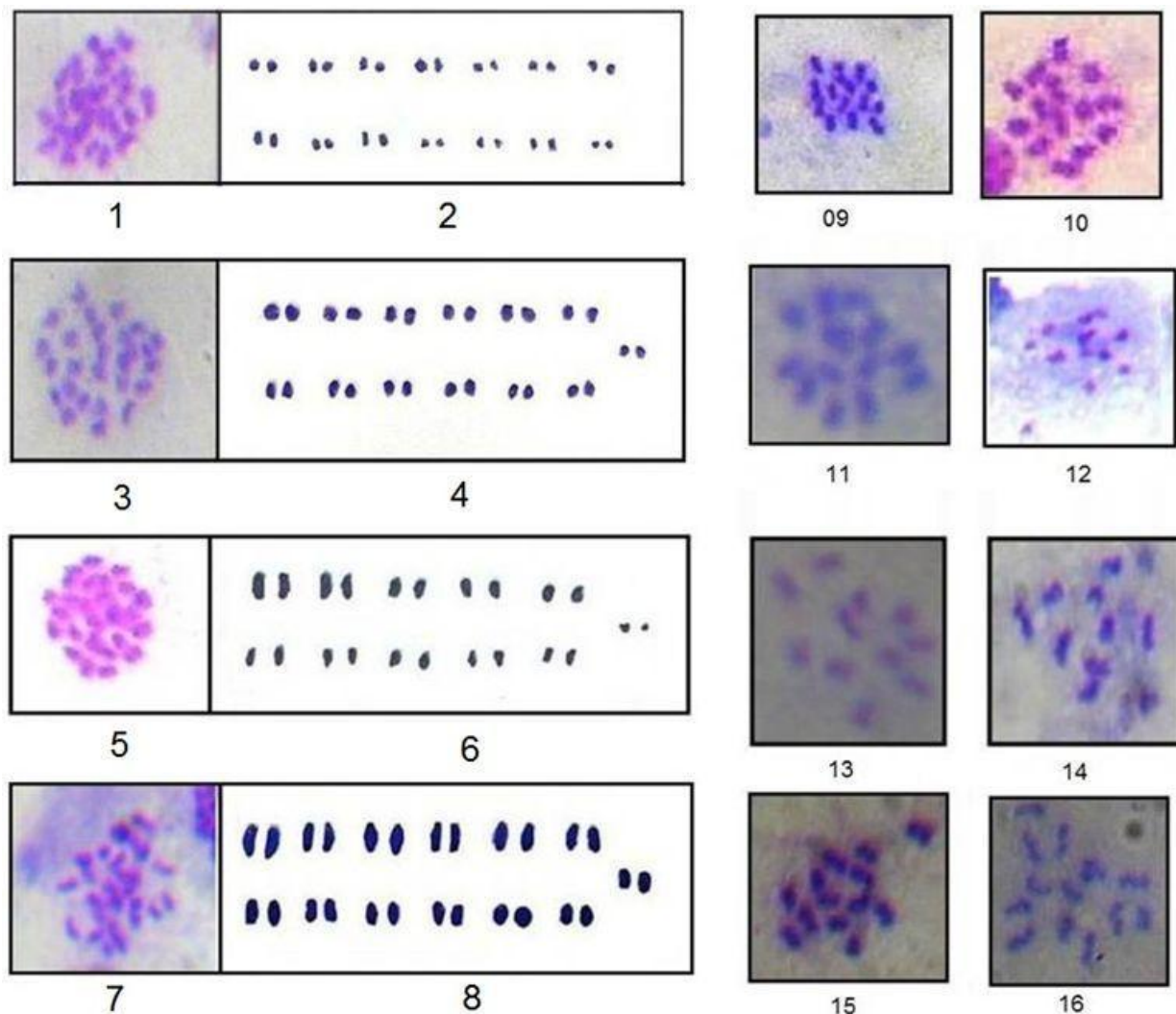


Figure 1: Spermatogonial metaphase of *Cryptobium ceylanense* Kr.

Figure 2: Karyotype of the same

Figure 3: Spermatogonial metaphase of *C. distinctum* Cam.

Figure 4: Karyotype of the same

Figure 5: Spermatogonial metaphase of *Pachylister ceylenus* Mars.

Figure 6: Karyotype of the same

Figure 7: Spermatogonial metaphase of *Platylister procerus* Lewis.

Figure 8: Karyotype of the same

Figure 9: *Cryptobium ceylanense* Kr. (Metaphase I)

Figure 10: *C. ceylanense* Kr. (Metaphase II)

Figure 11: *C. distinctum* Cam. (Metaphase I)

Figure 12: *C. distinctum* Cam. (Metaphase II)

Figure 13: *Pachylister ceylenus* Mars. (Metaphase I)

Figure 14: *P. ceylenus* Mars. (Metaphase II)

Figure 15: *Platylister procerus* Lewis. (Metaphase I)

Figure 16: *P. procerus* Lewis. (Metaphase II)

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13 dumbbell shaped autosomal bivalents and the sex bivalent Xy_p constituted the metaphase I (Fig. 9). The reductional division result in the formation of the two types of metaphase II plates one with X chromosome (Fig. 10) and the other with y chromosome.

The male chromosome formula is $13AA+Xy_p$.

C. distinctum Cam.

Spermatogonial metaphase revealed the diploid number of 26 chromosomes (Fig.03). In the karyotype autosome pair 1-4, 6,7 and 9 are metacentric pair 5, 8, 10-12 together with the X and y chromosomes are sub metacentric (Fig. 4).

13 rod shaped autosomes and the sex bivalent Xy_p constituted the metaphase I plate (Fig. 11). The reductional division result in the formation of the two types of metaphase II plates with one with X chromosome (Fig. 12) and the other with y chromosome.

The male chromosome formula is $12AA+Xy_p$.

Pachylister Ceylenus Mars.

Diploid number of 22 chromosomes was revealed at the spermatogonial metaphase (Fig.05). The karyotype comprises 10 pairs of autosomes and the sex chromosomes X and y (Fig. 6). The first pair of autosomes is metacentric, autosome pairs 2-6 are sub metacentric whereas the remaining four pairs (pairs 7-10) of autosomes and the X chromosome are acrocentric, the y chromosome is spherical and is the smallest element of the diploid complement.

Metaphase I revealed 10 autosomal bivalents and the sex pseudo bivalent (Fig. 13). The first meiotic division being reductional for all the chromosomes two types of metaphase II plates one with the X chromosome and the other with y chromosome in addition to ten autosomes were encountered (Fig. 14).

The male chromosome formula is $10AA+Xy_p$.

Platylister Procerus Lewis.

Spermatogonial metaphase exhibited a diploid set of 26 chromosomes (Fig. 07). The karyotype is composed of 12 pairs of autosomes and the sex chromosomes X and y (Fig.08). Autosome pairs 1-4 and 7, 8, 10, are metacentric, pairs 5, 6, 9, 11 and 12 are sub metacentric, X is acrocentric, whereas y chromosome is spherical.

12 autosomal bivalents, rings and rods, and the Xy_p constituted the metaphase I plate (Fig. 15). The first reduction division result in the formation of two types of metaphase II plates one with the X chromosome and the other with y chromosomes (Fig. 16).

The male chromosomal formula is $12AA+Xy_p$.

Staphylinidae exhibits variation in the diploid chromosome number from $2n = 18$ to $2n = 56$ (Yadav *et al.*, 1994). Histerid karyotypes have evolved only in one direction. Total 26 species have been cytologically investigated so far. The lowest chromosome number in Histeridae is $2n = 20:9+Xy_p$ (Yadav and Dange, 1988, 1989, 1990 and Dange, 1991). All the species show Xy_p type of male sex chromosome system. Some of the important cytological contributions in families Histeridae and Staphylinidae are by Chand (1989), Smith (1950, 1953, 1960), Stevens (1906, 1909), Vorontsov *et al.*, (1984), Yadav and Chand (1986), Yadav and Dange (1988, 1989, 1990), Yadav and Pillai (1975) and Yadav *et al.*, (1987). During present investigation the total chromosome length was found to be maximum in *Platylister procerus* Lewis. (45.86μ) and minimum in *Cryptobium ceylanense* Kr. (15.33μ). All chromosomes show a gradual decrease in size. The size of X chromosome is smallest in *C. ceylanense* Kr. (0.81μ) and largest in *Pachylister ceylenus* Mars. (1.86μ). *P. ceylenus* Mars. has the largest y (1.72μ) whereas y was smallest in *C. ceylanense* Kr. (0.69μ).

Comparative studies of the karyotypes of beetles are presented in table 1.

ACKNOWLEDGEMENT

We are thankful to the Head Department of Zoology, Govt. P. G. Arts and Science College, Ratlam for providing the necessary laboratory facilities and Dr. Neena Chouhan, forest Entomologist FRI, Dehradun for their help in identification of beetles.

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