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A STUDY ON THE LIFE CYCLE OF MEMBER OF THE FAMILY COREIDAE

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ABSTRACT

The Heteroptera is a large insect suborder with more than 42,300 species divided into seven infraorders and 89 families. Its key families are the Pentatomidae, Coreidae, Lygaeidae, Reduviidae, and Miridae. There are 2201 species in the Coreidae family, divided into 500 genera. Members of this family are phytophagous, which means they eat grains, legumes, cucurbit crops, soft fruits, and nuts. Coreinae, Pseudophloeinae, Meropachydinae, and Agriopocorinae are the four subfamilies of the Coreidae family. Coreinae is found all throughout the globe, although it is most common in the tropics. Pseudophloeinae is mostly found in the Old World. Meropachydinae and Agriopocorinae are uncommon subfamilies with just a few genera identified for each. Insects are one of the most varied animal groups on the world, with over a million identified species accounting for more than half of all living creatures. The number of living insect species is believed to be between six and 10 million, accounting for over 90% of all metazoan life forms on the planet. There are 30 orders in the class Insecta. The Hemiptera order is the biggest and most successful of the hemimetabolous insect orders. Between the larval and adult stages, they do not change. Instead, their young, known as nymphs, are very similar to the adults. In contrast to holometabolous insects, the final transformation involves the development of functional wings and sexual organs with no pupal stage in between. They are classified into two suborders: Heteroptera and Homoptera, which are usually easy to discern.

Keywords: Heteroptera, Homopterans, Insects

1. INTRODUCTION

Most homopterans have a small pronotum, a large mesonotum, and a slightly smaller metanotum, whereas heteroopterans have a large pronotum, a large mesonotum, and a slightly smaller metanotum. Furthermore, heteropteran wings are normally carried flat over the body, and the forewings, which are hard and rigid, similar to beetle elytra, have a soft and membranous terminal section. Hemi-elytra are the name given to heteropteran forewings because of this feature. Homopterans often drape their wings over their bodies like a tent, and their forewings are completely sclerotised and lack a membranous tip.

Heteroptera is divided into seven infraorders, two of which are largely aquatic (Gerromorpha and Nepomorpha), one semiaquatic (Leptopodomorpha), and the other four terrestrial (Gerromorpha and Nepomorpha) (Enicocephalomorpha, Dipsocoromorpha, Cimicomorpha and Pentatomomorpha). Pentatomomorpha is the second most diverse infraorder in terms of species diversity, after Cimicomorpha . Aradoidea, Pentatomoidea, Coreoidea, Lygaeoidea, and Pyrrhocoroidea are the five superfamilies that make up Pentatomomorpha. Coreidae, Alydidae, Stenocephalidae, Rhopalidae, and Hyocephalidae are the five subfamilies of the Coreoidea superfamily.

Heteroptera is made up of 89 families and more than 42,300 species. Heteroptera have four or five segmented antennae, two or three ocelli, and highly developed compound eyes, and vary in length from less than 1 mm to 10 cm. Wings cross over one another to lay flat across the insect's back while it is at rest. The wing bases do not conceal the scutellum, a conspicuous triangle in the middle of the back. The mouthparts are piercing/sucking in nature. The mandibles and maxillae create two pairs of piercing stylets, which are enclosed in a labium-derived flexible sheath. Metamorphosis is slow, with immatures resembling adults but lacking wings.

Because the majority of Heteroptera species are pests that cause harm to crops, forests, and orchards, it is one of the most significant insect families. Some species are predatory, preying on other insects, and hence serve as pest population controls. Some species are disease carriers and haematophagous. Chagas disease is caused by members of the Triatominae family. Heteroptera's key families are Pentatomidae, Coreidae, Lygaeidae, Reduviidae, and Miridae. The Pentatomidae family, which comprises 642 genera and 4,112 species, is one of the largest among Heteroptera. The Reduviidae family of predaceous terrestrial Heteroptera is the biggest, with 961 genera and 6,601 species. There are at least 500 genera and 4,000 species in the Lygaeidae family. With 1,201 genera and 10,000 species, Miridae is the biggest family.

Coreidae, often known as leaf-footed bugs, pod bugs, or squash bugs, is a family with 2201 species belonging to 500 genera found all over the globe. Coreids are found all throughout the globe, although they are most common in the tropics and subtropics, where they grow to their greatest proportions and most strange forms. Coreids are bugs that range in size from medium to big and have a variety of body shapes, ranging from ovoid to rectangular. Many species are tough, and many have spines and tubercles, which are sharp projections of the pronotum's humeral angles. With the bucculae extending beyond the antennifers, the head is diagnostic for the family. A subcostal vein is seen in the hemelytra, and the membrane contains multiple veins. The legs are rather thick, with the metafemora incrassate and the tibiae flattened on occasion.

Coreids are phytophagous, meaning they feed on the vascular system of plants that are above ground. Many coreid bugs have precise relationships with certain plant groupings, according to the researchers. The majority of species are polyphagous. Coreids wreak havoc on cereals, legumes, cucurbit crops, soft fruits, and nuts all over the world. There are distinct eating preferences among Coreidae species when it comes to plant components, with some species preferring targeting vegetative tissue and others preferentially attacking reproductive organs.

Coreinae, Pseudophloeinae, Meropachydinae, and Agriopocorinae are the four subfamilies of the Coreidae family. The great majority of coreids belong to the Coreinae subfamily, which is found all over the globe. It is made up of 31 tribes. Only Coreini (38 genera) and Hydarini (six genera) are found across the world, whereas 19 tribes (Acanthocorini, Amorbini, Anhomoeini, Cloresmini, Colpurini, Daladerini, Dasynini, Gonocerini, Homoeocerini, Latimbini, Manocoreoini, Mecocnemini, Mictini, Petasceli Pseudophloeinae is a subfamily of Pseudophloeinae that includes 166 species in 28 genera and is mostly found in the Old World. Meropachydinae and Agriopocorinae subfamilies are uncommon, with just a few genera identified for each.

2. REVIEW OF LITERATURE

In the taxonomy of insects, cytogenetic information has been utilized to split complexes and identify sister species, as well as in evolution, taxonomy, and phylogeny. Although karyotypic information can only be used in conjunction with other factors to create phylogenies of big insect species, chromosomal characters are nonetheless significant for phylogenetic purposes since their evolution is more or less independent of the environment. Understanding the process underlying the transfer of genetic information, and hence speciation, has relied heavily on cytological data. [1]

Both simple and numerous sex chromosomal systems have been found in Heteroptera. XY/XX (71.4%) and X0/XX (14.7%) are simple sex chromosomal systems, whereas XnY/XnXn, Xn0/XnXn, and XYn/XX are multiple systems (13.5 percent). Neo-sex chromosomal systems are very uncommon, with just 7 species accounting for 0.4% of the 1600 cytogenetically examined species. [2]

During male meiosis, several heteropteran families, notably the Coreidae, contain a minute chromosome pair with a unique meiotic activity that differs from both autosomes and sex chromosomes. Following that, microchromosomes were discovered in the karyotypes of a variety of insect species. Their origin and role in genomes, however, are yet unknown. Microchromosomes in males typically show negative heteropycnosis during meiotic division, remain unpaired and non-chiasmatic during early meiotic prophase, associate as a coorienting pseudobivalent (the so-called "touch-and-go" pairing) at metaphase I, and segregate pre-reductionally during anaphase I. [3]

Heteropteran insects are additionally distinguished by the occurrence of a distinct stage of prophase I known as the diffuse stage, during which autosomal bivalents decondense and sex chromosomes condense. A further wave of condensation happens after this step, and bivalents return in condensed form in the diplotene. There have been reports of differences in the length and amount of decondensation across species, which correlate to differences in the interval of disintegration between the meiotic and mitotic chromosomal structure. [4]

3. LIFE CYCLE OF MEMBER OF THE FAMILY COREIDAE

Sex chromosomes in Heteroptera display reversed meiosis. For autosomes, the initial meiotic division is reductional, while for sex chromosomes, it is equational. For autosomes, the second division is equational, while for sex chromosomes, it is reductional. Many creatures have been found to have this inverted sex chromosome sequence, which is especially frequent in organisms with holocentric chromosomes.

The family Coreidae is distinguished by the existence of a pair of microchromosomes and the lack of a Y chromosome, in addition to possessing holocentric chromosomes and postreductional division of sex chromosomes (heteropteran characteristics). The family's diploid number varies from 13 to 29, with a mode of 21 found in 48 of the 120 species studied cytogenetically. In 94 species, a pair of microchromosomes has been discovered. The X0/XX (/) sex chromosomal system is found in 86 species, followed by the multiple system X1X20/X1X1X2 One population of Coreus marginatus has been linked to a multiple X1X2X30 system in males. The XY/XX system has been documented in three species of Acantocephala (as Metapodius), notably A. femorata, A. granulosa, and A. terminalis.

Coreinae and Pseudophloeinae are two of the four Coreidae subfamilies for which cytogenetic data is known. Cytogenetic data is known for 116 species belonging to 51 genera and 18 tribes in the Coreinae family. In 48 species, a modal number of 2n=21 has been found. X0, which is found in 84 species, is the most prevalent sex mechanism in males, followed by X1X20, which is found in 24 species. One population of Coreus marginatus Linnaeus has been linked to a multiple X1X2X30 system in males (Xavier, 1945). In 92 species, there are two microchromosomes.

For the subfamily Pseudophloeinae, cytogenetic data is known for four species from three genera that belong to two tribes, and three of the five species have a complement of 2n=10A+2m+X0.

The majority of cytogenetic investigations on Heteroptera have used traditional approaches to get information on chromosome number, sex chromosome mechanisms, and chromosome behavior during meiosis. The first issue for a real insect cytogeneticist is identifying individual chromosomes and particular chromosomal regions in a karyotype. If evolutionary rearrangements, both interchromosomal and intrachromosomal, can be discovered in holokinetic chromosomes, significant advancement in the research is envisaged. In the comparative karyology of insects, differential staining techniques have been used to reveal specific segments of chromosomes according to their structure and composition.

C-banding, which is used to selectively stain constitutive heterochromatin (high-repeat DNA sequences), silver staining, which is used to locate nucleolar organizer regions (NORs), G-banding, which is used to reveal structural features, and fluorescent banding, which is used to characterize constitutive heterochromatin, are some of the most common techniques. Because of the structural properties of insect chromosomes, G-banding is less often utilized in insects than in vertebrates, resulting in lesser specificity.

Despite the widespread belief that constitutive heterochromatin is an inert substance, evidence is mounting showing it may play a key role in chromosomal pairing and segregation, position impact variegation, and even contain genes and other functional DNA sequences . Since a result, heterochromatin has been a hot topic of study in recent years, as its composition, structure, and function are just starting to be understood. It has been discovered that it may be an active component of heteropteran chromosomes, and that its acquisition and accumulation in the karyotype of various species is controlled rather than random. Differences in heterochromatin composition, amount, and location are prevalent across insect species and are thought to be connected to karyotypic evolution and genetic divergence among related species. Closely related species may vary not only in the quantity of heterochromatin present, but also in the number, location, and composition of heterochromatic blocks. Because it stains practically all constitutive heterochromatin segments, C-banding is one of the most widely used methods for identifying heterochromatin. C-banding investigations on Coreidae had hitherto been limited to just 9 species, revealing significant variations in the quantity, distribution, and base composition of constitutive heterochromatin.

Heterochromatin may range in composition from highly A-T to extremely G-C rich DNA, and in length from a 2-bp repeat to hundreds or thousands of base pair repeating units. Heterochromatin may be made up of distinct nucleotide repeats even within a same species or chromosome. The base makeup of heterochromatin is studied by staining chromosomes with certain fluorochromes. G-C-rich chromosomal segments are studied with the antibiotic chromomycin A3 (CMA3), and segments with a high frequency of A-T base pairs are studied with 4', 6-diamidino-2-phenylindole (DAPI).

Insect karyology has just lately been brought to these methodologies, and data is still scant. According to cytogenetic data for Coreidae species, heterochromatin quantity, composition, and placement are very variable in this heteropteran family.

The chromosomal regions that contain a cluster of multiple copies of ribosomal RNA genes (rDNAs; 18S, 5.8S, and 28S) (major) that form active nucleoli are known as nucleolar organizer regions. Silver nitrate, which binds to NOR-associated proteins in the stalks and satellites and dyes them dark black, is used to pinpoint their position. Ag-NORs are a complex of acidic residual proteins associated with the nucleolar fibrillar core that are used to study rDNA expression. They are not rDNAs themselves. Another multiple copies of ribosomal gene are found in the 5S rDNA region (minor), but they are not involved in the formation of nucleoli and are not silverstainable.

Different cytogenetic techniques (C-banding, fluorescent banding, and NOR banding) have been used on Heteroptera, but due to the holokinetic nature of heteropteran chromosomes, they have not yielded the expected results. These approaches, however, have allowed a few markers to be revealed in karyotypes thanks to constant efforts and minor improvements in methodology. Nonetheless, it has become obvious that, while having the same chromosomal number, taxonomically closely related species do not have similar karyotypes owing to the accumulation of multiple rearrangements since separation from the common ancestor.

4. CONCLUSION

Only 33 species of Coreidae have been studied cytogenetically in India. In India, research on constitutive heterochromatin, nucleolar organizer areas, and sequence-specificity is completely absent. Considering the economic importance of Coreidae and the lack of knowledge on cytogenetic aspects of this family, the current study was designed to investigate normal chromosomal complement, meiosis, the distribution and base composition of constitutive heterochromatin, and the localization of nucleolar organizing regions in some Coreidae representatives. Finally, the data was evaluated to determine cytoevolutionary tendencies, as well as the identification of a few cytological indicators.

CONFLICT OF INTERESTS

None.

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