The division of chromosomes while, second division involves

The meiosis maintains the constant number of chromosomes in each species by reducing the diploid (2n) chromosomes of germ cells to haploid (n) chromosomes of gametes. The process of meiosis seems to depend on the balance of nucleic acid in the nucleus or certain hormones. When amount of DNA increased as compared to RNA; the process start however, exact chemical nature is unknown.

Meiotic division consists of few successive divisions of a cell at the end of which four cells result. First division is accompanied with reduction in chromosome number without any division of chromosomes while, second division involves separation of chromatids of the chromosomes. Consequently, number of chromosomes which are reduced in first division remains constant (haploid) during second division. Meiosis consists of two divisions: 1. First meiotic division (Meiosis I) 2. Second Meiotic division (Meiosis II) I. Meiosis I: It is more important than second division.

It consists of following stages. 1. Prophase I a) Leptotene b) Zygotene c) Pachytene d) Diplotene e) Diakinesis. 2. Metaphase -1 3.

Anaphase -1 4. Telophase -1

1. Prophase I:

It is of long duration and also complex during which amount of DNA is doubled.

It again consists of different sub-stages. a) Leptotene /Leptonema: Chromosomes appear extremely thin long and slender threads which are loosely interwoven. They are not divided longitudinally into two chromatids.

A series of beaded structures may be seen along their length called chromomeres which are constant in number, size and position.

Nucleus is having two sets (2n) of chromosomes i. e. one from female and other from male parent. Each chromosome in one set has a similar partner from other parent thus nucleus has pairs of similar chromosomes. b) Zygotene/Zygonema: It is characterized by pairing of homologous chromosomes. They come together side by side and pair with one another gene by gene over entire length.

The process of pairing or approximation is called synapsis. It starts from the end and continues towards centromere (proterminal) or from the centomere towards the end (procentric). Sometimes it takes place at random at various points. As the threads (chromosomes) pairs, they begin to shorten and thicken. Nuclear membrane and nucleous is present. c) Pachytene: The pairing is brought about in a zipper like fashion and is completed. The paired chromosomes are called bivalents.

They become shorter and thicker and are coiled. Each chromosome splits up longitudinally into two chromatids except centromere. Thus each bivalent consist of four chromatids with common centromeres. Hence, this stage is called four strand stages. The chromosomes are twisted around each other with relational coiling.

The chiasmata are formed due to twisting and coiling. During late stage, non sister chromatids may break and then unite with each other by the process of crossing over. Nuclear membrane and nucleolus are still present. d) Diplotene/Diplonema: The chromosomes become still shorter and thicker and

generate pressure long the length of chromosomes and hence, homologous chromosomes repel from each other however, they remain together at certain points or chiasmata. At these points, the non-sister chromatids may exchange their segments. The number of chiasmata depends on length of chromosome. The chromosomes may show X or O or many shape. e) Diakinesis: Chromosomes continue to contractions and coiling due to which chiasmata tend to lose their original position and move towards ends of the chromosome called terminalization.

Nucleolus and nuclear membrane start disappearing. The bivalents are evenly distributed throughout the nucleus and appear rounded darkly stained bodies.

2. Metaphase I:

It is characterized by complete disappearance of nuclear membrane and nucleolus as well as development of spindle fibers.

Bivalents orient themselves at random on the equatorial plate due to movement called congression in such a way that all chiasmata are in one plane and one chromosome of bivalent lying on either side of equator.

3. Anaphase I:

The homologous chromosomes, each consisting of two chromatids move towards opposite poles. However sister chromatids do not separate but go to same pole and hence called re- ductional or disjunctional division. This result in the reduction of chromosome number from the diploid (2n) to haploid (n).

4. Telophase I:

Two groups are formed at each pole.

The chromosomes get uncoiled, nuclear membrane and nucleolus reappear thus two daughter cells are reconstituted each with ‘ n’ number of chromosomes. Spindle fibers disorganized and cell plate may or may not be formed, both cells may pass through short inter phase and then the second division starts. First meiotic division which is completed at first telophase may be followed by cytokinesis giving rise to dyads. First meiotic division is followed by a second meiotic division with or without intervening inter phase. II. Meiosis II (Equational division): The second division is an essentially mitotic division.

The different phases are designated as :

a) Prophase II:

In each of the nucleus of dyad, the chromosomes reappear. However, two chromatids of each chromosome are still associated at their centromere. Nuclear membrane and nucleolus disappear.

b) Metaphase II:

The spindle fibres are developed at right angle to the first division and are attached to the centromere. The chromosomes with their chromatids lie at equatorial plane.

c) Anaphase II:

The centromere of each chromosome in each cell divides forming two daughter chromosomes. They separate and start moving towards opposite poles.

d) Telophase II:

Four daughter nuclei are formed from original micro/mega sporophyte.

These four groups get reconstituted into daughter nuclei. Cytokinesis results in the formation of four daughter cells. The new chromosomes uncoil and get original shape. Thus each cell contains haploid (n) chromosomes are dissimilar with each other as well as original cell. Significance: 1.

It maintains definite and constant chromosome number in all organisms. 2. Due to crossing over it provides an opportunity for exchange of genes (genetically variation) which is useful in crop improvement. 3. It results in formation of four daughter cells which are dissimilar with each other having haploid (n) chromosome number. 4. It provides physical basis for the segregation and independent assortment.