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Topic : Parasexuality in fungi

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Parasexuality in fungi

You might have seen small children playing with glass marble balls in your childhood. The balls are of several colours. If I ask you to keep your eyes closed and pick five balls randomly from a large mass of balls of different colours, you will most probably pick a new combination of colours each time. If you pick larger number of marbles, colour diversification would be greater each time.

Aim of sexual reproduction in organisms is to create new combination of genes for the offspring by involving two events i.e. random mating and recombination of genes during meiosis. If this aim is fulfilled by some other novel but easy method, there would not be any need to invest so much resources and energy to produce sex organs, meiotic complications, gametogenesis or other associated phenomena.

Certain fungi do this by very much adopting a method like picking glass marbles randomly. They recombine their genes by some novel non-sexual process. That is called parasexuality.

Guido Pontecorvo (1956) first reported it in the mold *Aspergillus nidulans*. In a typical parasexual cycle, two different hyphae of the fungus fuse together (anastomosis) to bring two different nuclei (heterocaryons) in each of the resultant fused cells. Fusion of their cytoplasm (plasmogamy) is followed by the fusion of the heterocaryons (karyogamy).

The diploid nuclei of the cells undergo mitosis after a time. During metaphase of mitosis, homologous chromosomes exchange segments very much like that

in meiosis. It is mitotic crossing over. It results into recombinant chromosomes with new gene combinations.

During anaphase, many chromosomes of the diploid cells may not segregate properly due to non-disjunction. Aneuploid cells ($2n+1$; $2n-1$ etc.) are produced in the hyphae.

Non-disjunction is when homologous chromosomes, which entangled together for crossing over, fail to separate even by the end of the anaphase and daughter cells get one/two or many more or many less chromosomes than the normal diploid.

Haploid recombinant cells are later produced by losing chromosomes gradually.

These haploid cells may cause growth of recombinant hyphae which further may undergo the same cycle of events leading to unique offspring (daughter hyphae) of new gene combinations all the time.

Look to the three figures to understand the parasexual events in *Aspergillus nidulans* (figs. 1,2 and 3).

The significant properties of parasexual life cycle are -

1. The organism needs not to invest in the elaborated sexual processes.
2. Recombinant offspring are produced as more random events.
3. Processes like plasmogamy and karyogamy do occur like those of sexual mechanism but they do not occur at any definite or specific point of the life cycle.

Parasexual mode of recombination is very useful for those fungi which lack sexual stages. In microbiology labs too, especially related to industrial purposes, the mechanism of parasexual reproduction is useful in creating strains of fungi with desirable combination of properties. Genetic engineering experiments may also employ the opportunist parasexual mode of reproduction in fungi.

Parasexual cycle of events with slight variations has been reported in many fungi. Some common examples are *Penicillium roqueforti*, *Verticillium* sps., *Candida albicans* etc.





