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Different types of variability in fungi

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INTRODUCTION: -

Variability means the property of an organism to change its characters from one generation to the other. Food losses due to crop infections from pathogens such as fungi, bacteria and viruses are major issues in agriculture at the global level knowledge about variability help in, advance disease detection and diagnosis. To assist the breeding programs the evaluation of the genetic diversity of pathogen and its molecular characterization are crucial. Genetic analysis of pathogen populations is fundamental to understanding the mechanisms generating genetic variation, host-pathogen co-evolution, and the management of resistance (Aradhya *et al.*, 2001). Different pathogen develops a different mechanism for the generation of variability. For the survival of the pathogen, Variability is played an essential role.

Variability in fungi

- Mutation
- Recombination
- Heterokaryosisis
- Parasexuality
- Hetroploidy

Mutation

- Gassner and Straib (1993) were the first to suggest mutation as a mechanism for the formation of new races in *P. striiformis*.
- It represents changes in the sequence of bases in the DNA either through the substitution of one base for another or through the addition or deletion of one or many base pairs.
- Mutations are spontaneous.

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Recombination

- Recombination in fungi is a similar process to that of sexual reproduction. In sexual reproduction ploidy levels of individuals get altered. Haploid gametes which are carrying a single set of chromosome fuses to form a diploid zygote with a double set of chromosomes. The gametes are formed from diploid progenitor cells by meiosis, which involves genetic recombination—the key evolutionary aspect of sexual reproduction (Schoustra *et al.*, 2007).
- Recombination two haploid nuclei (1N) containing different genetic material unite to form a diploid (2N) nucleus called a zygote when undergoing meiotic division produces new haploid.
- It is a genetic factor that occurs during the meiotic division of the zygote as a result of cross over in which part of chromatid of one chromosome of a pair is expressed with that of the other.
- A good example is the black stem rust fungus.

Heterokaryosisis

- In some fungi, hyphae or parts of hyphae contain nuclei, are genetically different, generally of two different kinds. This condition is known as heterokaryosis.
- In Ascomycotina and Basidiomycotina some fungi possess cells containing numerous nuclei and these may be heterokaryotic. The underlying implication of this state is that the fungus may respond to selection by varying the proportion of the dissimilar nuclei in the cells.
- Example - fungal variation in Cochliobolus sativus, Leptosphaeria avenaria and Helminthosporium gramineum due to heterokaryosis.

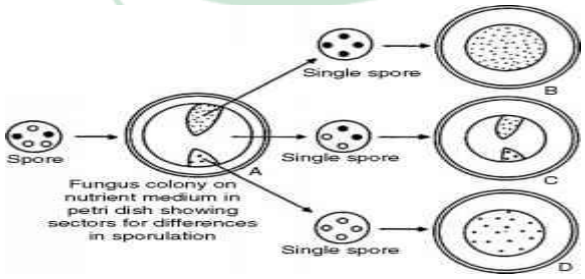

Figure 1: Heterokaryosis in thermophilic fungi

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Parasexuality

- A process in which plasmogamy, karyogamy and haploidization takes place in sequence but not at specified points in the life cycle of an individual.
- First discovered by Pontecorvo and Roper (1952) in Aspergillus nidulans.
- In heterokaryotic fungal mycelium, there is always the opportunity for dissimilar nuclei to fuse and produce diploids or what is known as mitotic recombination. Mitotic recombination can then occur producing a random re-assortment of genetic material that is released in progeny after haploidization. This sequence of events has been described in the parasexual cycle.
- Example - Many rusts, including P.graminis tirtici, P. coronata and in some smuts Ustilago hordei and U. maydis parasexuality found.

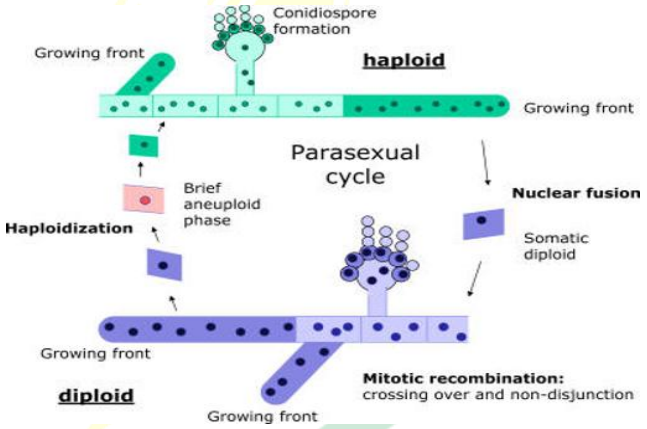

Figure 2: Parasexuality and parasexual cycle

Hetroploidy

- Heteroploidy is the existence of cell tissues or whole organisms with numbers of chromosomes per nucleus.
- Heteroploids may be haploids, diploid, triploid or tetraploidy i.e. have one or more extra chromosomes from normal euploid number e.g. N+1
- Hetroploidy represents a normal situation in eukaryotes.

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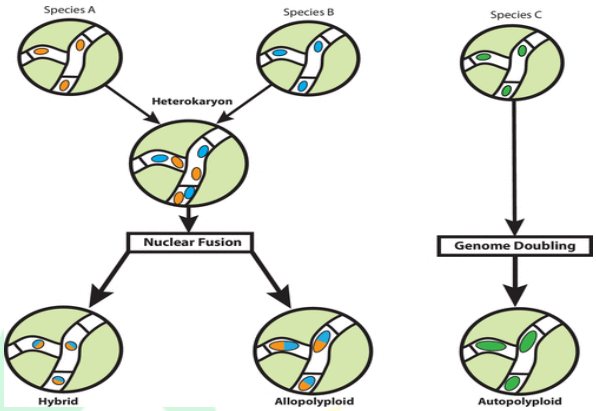

Figure 3: Fungal polyploidy

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