Deuteromycetes: Asexual Ascomycetes and other Asexual Fungi

The ability of fungi to produce sexual and asexual spores, gives fungi, to great flexibility in the dispersal and survival, during sub-optimal environmental conditions. Those that never produce sexual spores have been referred to as deuteromycetes or fungi imperfecti. Because they are second members among perfect-i.e. sexual, therefore called as deuteromycetes (second). Now a days, these deuteromycetes fungi are discussed as asexual ascomycetes or basidiomycetes. It is said that most of asexual fungi have lost their sexual stage. The evidence indicates that there are many mechanisms by which fungi may loose their sexuality in their life cycles. It is clear that even a single mutation at any one of loci can make disappear sexual stage. Continous Variation in fertility and Hybridization may also disappear sexual stage. Following terms are important to understand further about asexual asco and basidiomycetes.

⇒ Pleomorphy:- A fungus that can produce more than one type of spores in their life cycle.

⇒ Synanamorphs:- ~~May lose~~ Fungi producing

several types of conidia in their life-cycle.

⇒ Teleomorph:- is a meiotic sexual morph that produces ascospores and basidiospores. Teleomorph is replaced with "perfect" term.

⇒ Anamorph:- A mitotic asexual morph, replaced with "imperfect".

⇒ Orphanomorph:- is applied to asexual forms that have obvious connections to sexual fungi with similar anamorphic states.

Deuteromycetes have variations in their genetic make up though these variations are less than the perfect or sexual fungi.

Habitat and importance of Asexual Fungi:-

They are found where their sexual relatives occupy. They are found in marine water, freshwater, and vast majority is terrestrial. Few species can kill nematodes. They form symiotic relationship (lichen), endophyte of angiosperm and gymnosperms, and are mycorrhizal They produce very important antibiotic i.e. Penicillin from Penicillium chrysogenum. They are also serious parasites of plants, animals and humans. Their majority is saprobes and weak parasite.

Somatic Structures:-

Their hyphae are well-developed, septate, branched hyphae that are like those of their sexual relatives. Septa have septal pores, dolipore septum. Deuteromycetes produce appressoria, haustoria, nematodes traps, and lichen thalli.

Structures associated with asexual Reproduction:-

Traditionally, conidial fungi were divided into categories called "sections" which are convenient groups that exhibited the same conidial morphology so far as shape and sections are concerned. This approach is referred as "Saccardoan system." study of following is important to understand asexual reproduction. These are, conidiomata, conidia, conidiogenous cells, conidial secession and scars.

Conidiomata:-

Conidiophores grow singly or in groups to form specialized structures known as conidiomata. These structures are;

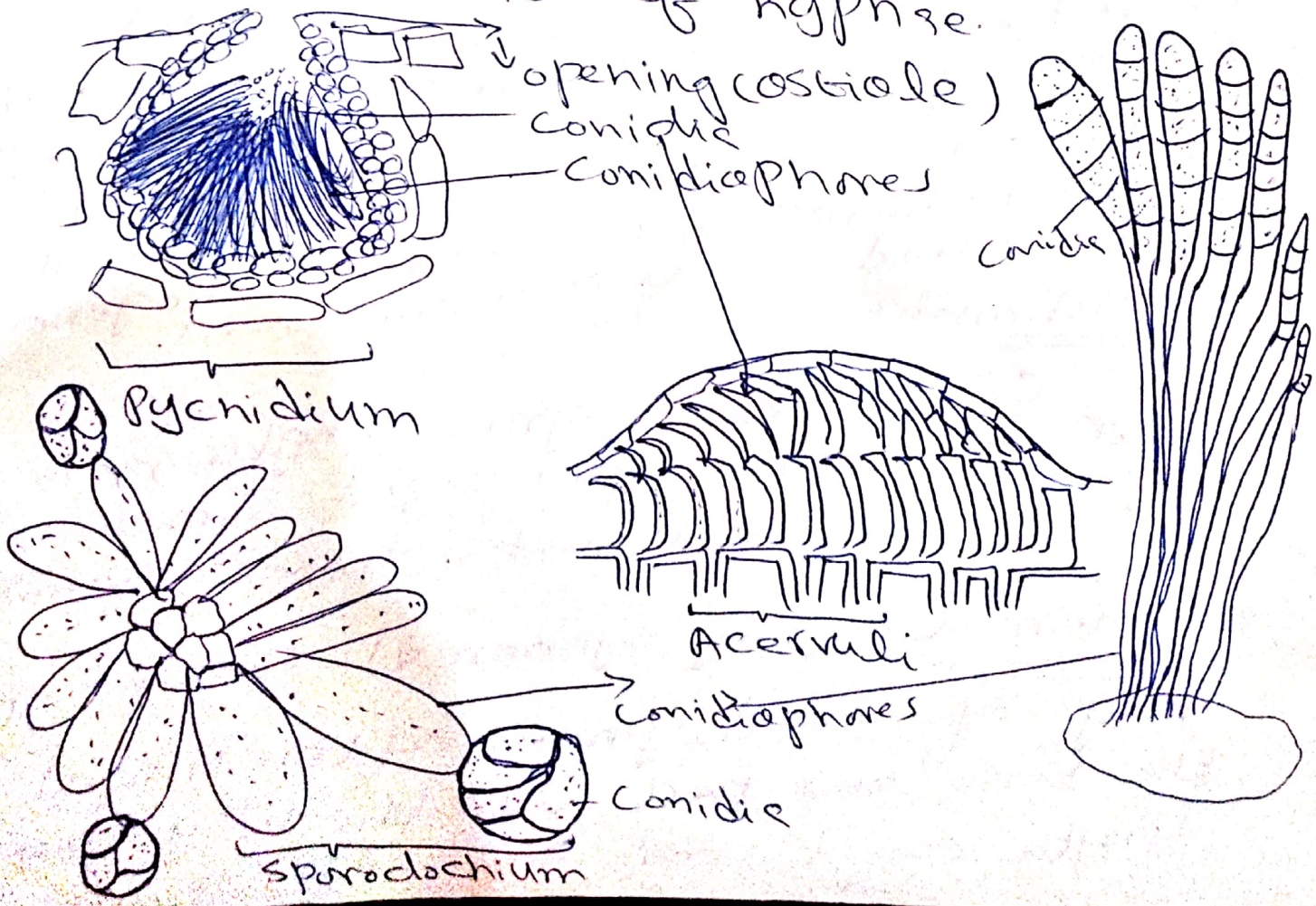
⇒ **Synnemata**: (Sing. synnema): Consists of group of conidiophores often united at the base and apart of the way up their length. Conidia are formed along the

length of synnema.

Sporodochium:- The conidiophores arise from a central ~~portion~~ cushion shaped pseudo-parenchymatous stroma. The conidiophores are packed closely together and are generally shorter than those composing a synnema.

Pycnidium:- Globose or flask-shaped pseudo-parenchymatous structure that is lined on the inside with conidiophores. Pycnidia may be closed or with an opening (ostiole).

Acervulus:- A typically saucer-shaped bed of short conidiophores growing side by side and arising from a more or less stromatic mass of hyphae.



The presence or absence, and variation in the morphology of conidiomata in different fungi depends upon the environment and substrate on which they are growing. Some deuteromycetes may stop production of conidiomata under drastic environment.

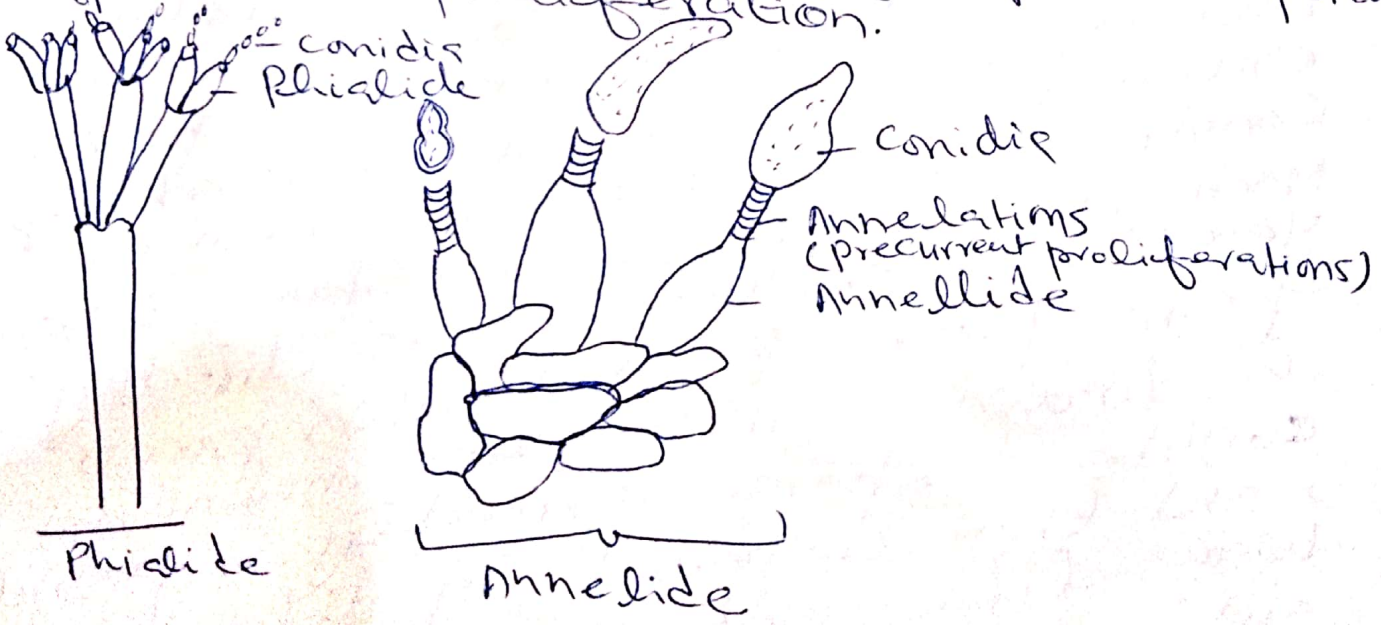
Conidia :- (Sing. Conidium)

Most deuteromycetes are reproduced by means of special spores known as conidia. A conidium is non-motile asexual spore formed at the tip or side of sprogenous cell. It should be cleared out that conidia are not produced as a result of progressive cleavage of cytoplasm (as in formation of sporangiospores); consequently they are not surrounded by an additional sporangial wall. Their dispersability is high, but viability is shorter than the sexual spores. Most conidia germinate by germ tube formation to produce extensive mycelium and then, eventually conidia again. This process is known as Macrocyclic conidiation. Some fungi like yeast may produce conidia directly from previous conidia, this process is known as microcyclic conidiation. conidia discharge forcibly or passively, and then dispersed by different ways like; water, wind, rainsplashes and, animal and human sources. They may be of different shapes like spherical, ovoid, elongate, cylindric thread like, spirally curved, or branched. Conidia may single or many celled with longitudinal and transverse

septa. Conidia may be green, black, pink and yellow. These characters are base of saccardoan system of classification.

Conidiogenous cells :-

The hyphal cell from which or on which conidia are produced are called conidiogenous cells. Conidiogenous cell is different from conidiophores. Two terms are used to designate different types of conidiogenous cells. These terms are Phialide and annellide. A phialide is a conidiogenous cell with an open end through which conidia emerge out. An annellide is a conidiogenous cell that produces conidia by repeated percurrent proliferation.



Conidia have two walls layers.

Conidium ontogeny (Formation)

Conidia may originate from conidiogenous cells in several ways.

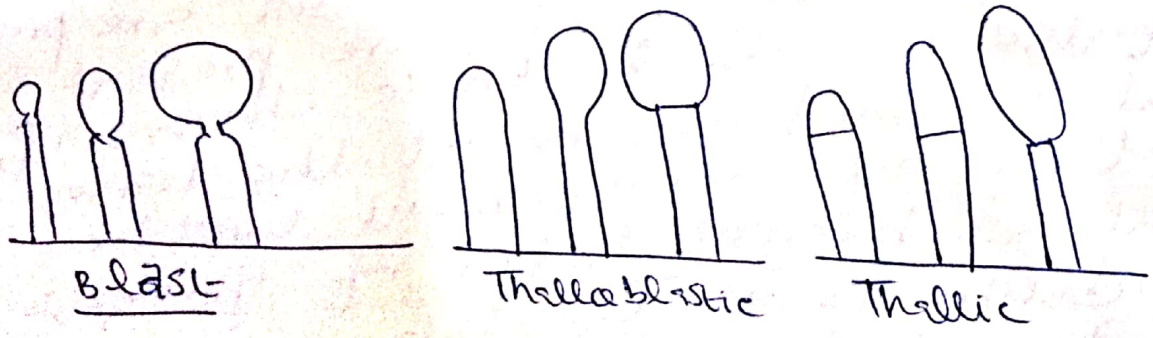
1-Blastic. or Blastic ontogeny, conidium

elongates and swells before being cut off by a septum; the conidium usually originates at a narrow point on the conidiogenous cell.

II - Thallablastic ontogeny: conidium originates at a broad area, usually the width of conidiogenous cell, and, as occurs in blastic mode, swells before the delimiting septum is formed.

III Thallic ontogeny :- conidium is delimited by a septum before swelling occurs.

IV Arthric conidia :- Also known as arthrospores, are specialized thallic conidia that often are formed in chains and disarticulate readily



* Successive Development of Conidial Loci

From single loci, single or many conidia may be developed. If conidia develop apically after delimitation process is called "progressive conidia" locus

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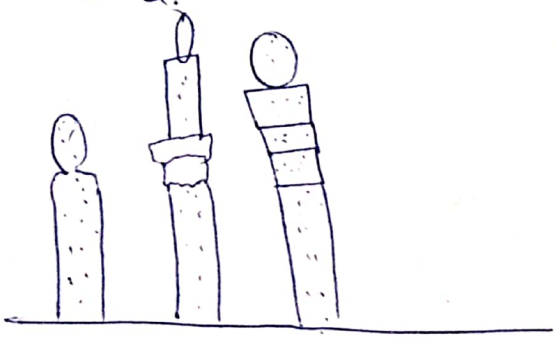
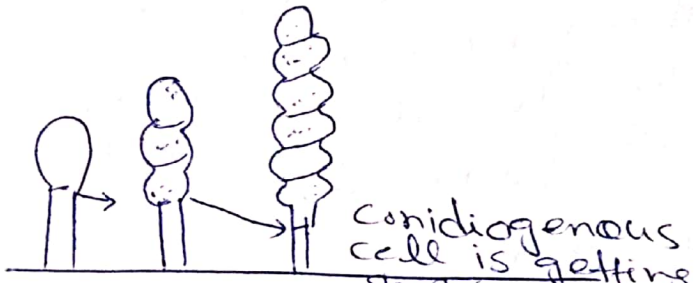
formation". However, when Conidigenous cell shortens after Conidium production, that process is called "Retrogressive Conidial locus formation". Retrogressive may be of two types i.e. stationary and sympodial.



Progressive



Retrogressive

Arrangement of conidia at a locus

Conidia may be formed singly (solitary) or in groups at a locus. Conidia produced in groups may be catenate or seriate. Catenate is a condition in which true chains of conidia are present while in seriate conidia are present in false chains. On these chains, if, smallest conidium is at the base, this type of arrangement will be called as basipetal, but if youngest conidium is at the top, then will be acropetal.

Conidium secession :-

It is the discharge (Schizolytic) (rhexolytic) of conidia from the conidiogenous cell. OR Removal of conidia from the conidiogenous cell. These may be of two types i.e. schizolytic and rhexolytic.

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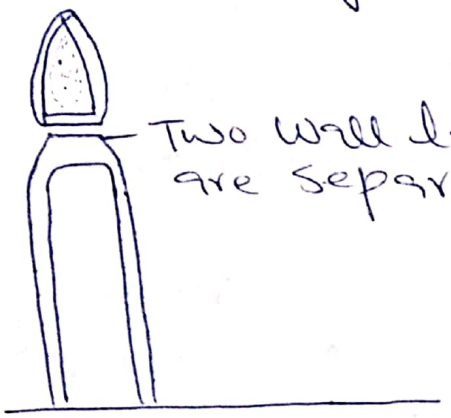
Schizolytic secession occurs when two wall layers of the delimiting septum separate, while rhexolytic secession occurs when entire septum separates with the conidium, or tearing occurs in entire septum



Schizolytic

rhexolytic

Scars :- These develop after conidial secession on the conidigenous cell. They may be of different types- May be projected ("denticles"), and bear 'frills' remains of conidiogenous cell walls, are of "pores" with circumferential thickening, 'collarettes' produced from outer wall of the conidiogenous cell and annellation which are indeed succession of collarettes.

Other ASexual Propagules :-

Not all asexual fungi produce conidia. They produce either sclerotia, stromata, bubils and ~~chlamydospores~~ chlamydospores. Bubils are masses of pseudoparenchymata that are not internally differentiated and often

are hyaline. The difference between spermatia and conidia is this, that spermatia are male sex cells, but spermatia do not produce hyphae.

Establishing Teleomorph-Anamorph Connection ~~Connection~~

These can be determined through;

1- Isolation of single spores and observation of both morphs in pure culture.

2- Molecular techniques, DNA sequencing helps in determining connections between teleomorph and anamorph.

Nomenclature and classification:

These have 20,000 diverse species. Deuteromycetes are classified on the basis of biochemical, physiological and molecular characters. Although deuteromycetes are no longer classified in hierarchical order. Remnants of the system found in references, classify fungi deuteromycetes on the basis of production of conidia on the mycellium. According to this system;

(1) Hyphomycetes- These produce conidia free on the mycelium.

(2) Dematiaceous Hyphomycetes:- Produce conidia and conidiophores which are dark in colour.

(3)- Moniliaceous Hyphomycetes:- Produce hyaline or bright coloured conidia.

(4)- Coelomycetes:- These produce pycnidia or

aceivuli.

On the basis of these classification systems, different manuals are available for the identification of fungi.

Deuteromycetes: Predation and low-nitrogen Habitats

Many fungi destroy small animals in their habitat. These species generally utilize cellulose and lignin substrates that are low in nitrogen. These species produce extensive mycelia and capture nematodes by producing various somatic structures, including constricting and non-constricting hyphal rings and adhesive branches, nets, and knobs. Lectins and other substances are involved in attachment of the nematode to fungi. Once the animal is trapped the nearby fungi digest its body. Examples of these fungi are Dactylella spp. Other well-known fungi e.g. Arthrobotrys spp. produce traps that kill and digest the nematodes. Other species such as Dactylaria spp. produce sticky knobs, and kill the nematodes. Nematodes and nematode-destroying fungi can be isolated by placing dung, decaying wood and mushrooms, bryophytes or soil on agar plates. Killing of nematodes can be seen on agar plates under the compound microscope.

Arthropode-associated conidial fungi:-

Many asexual fungi are associated with arthropods, primarily insects. The range of interactions is broad, varying from casual spore dispersal to obligate mutualism to necrotrophic parasitism. Two species; Metarhizium and Beauveria spp. are being used as biological control of insects-pests. These fungi produce mycotoxins and secondary metabolites that kill the insect-pests. These fungi can kill beetles, bugs, wasps and flies. These fungi live in the gut of the insect and kill them. These fungi may also kill insects by destroying their foods. Some other species like Acremonium and verticillium spp. live in the mucilaginous heads and kill them.

Medically important species:-

Fungi attack the animals when their immune system is not working properly. Asexual fungi cause many diseases in animals that ultimately cause the death of animals. Among these Athelet's foot is more common. Rest of medical diseases causes the failure of life saving organs like liver, kidneys and lungs.

Aeromycology :- That deals with asexual fungi that are suspending in the air. These includ; cladosporium, Alternaria

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Curvularia, Aspergillus, Acremonium, Nigrospora, Fusarium, Zygosporium and Penicillium. These fungi cause allergic rhinitis, and asthma. The acuteness of these diseases sometimes causes failure of lungs. These sero-fungi can be isolated through special trapping devices. The simplest way to isolate these fungi is open-lid petri-dish having media. spores with a greater terminal velocity can easily be separated/~~with~~ isolated with petri-dishes.

Examples of Asexual Fungi by Taxonomic Group

1- Archiascomycetes:-

This class includes Taphrina, Protomyces and Schizosaccharomyces. It has one important order i.e. Saccharomycetales, which include yeast-like fungi.

2- Anamorphs of cleistothecial Ascomycetes clade:-

This class has one important order i.e. Eurotiales, which include Aspergillus and Penicillium genera. Conidial ontogeny in this class is blastic and Conidia are produced in basipetal succession.

3- Anamorph of perithecial Ascomycete clad:-

A large number of anamorphs and conidial species are found within this group of Ascomycetes. Conidia are produced via blastic ontogeny. The genera which are important include, Verticillium, Trichoderma and Fusarium. These genera are ubiquitous in soil. They produce white, yellowish or green colonies. The order of this genera is Hypocreales.

3- Anamorphs of Apothecial Ascomycetes

The fungi include in this group produce dichotomously branched conidiogenous cells. These anamorphs have one important class Discomycetes. Discomycetes class is either operculate or inoperculate. Inoperculate discomycetes have important genera i.e. Botrytis that cause very important disease known as grey mould. operculate discomycetes have different genera like Melanconium sp. that causes bitter rot of grapes.

4- Anamorphs of Loculoascomycetes:-

These anamorphs have important genera which include; Alternaria, Cochliobolus, Drechslera, curvularis, Septoria and Mycosphaerella. Conidia are produced via blastic ontogeny. It has one important order i.e. Pleosporales.

5- Other Ascomycetes:- These include important order Erysiphales which causes very important diseases i.e. Powdery mildow.

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6:- Anamorphs of Basidiomycetes:-

It includes two important genera i.e. Sclerotinia and Rhizoctonia. These two genera cause serious diseases of Plants.

The End