Assignment No.1

DATE

* Define Plant Pathology and explain scope and importance of plant Pathology.

• Plant Pathology :-

It is the branch of agriculture science which deals with study of disease of Plant, their development and control.

• Scope of Plant Pathology :-

- Study of Plant Pathology is vital important to agriculture & ultimately to mankind
- Plant disease caused by micro-organism have more important to human because they damage plant & plants products on which human depend for food, clothing, Furniture & housing.
- Millions of farmers all over the world still depend on their own plant Produce for their survival.
- The disease in plants may cause losses in several ways, where the entire Plant is kill or the total crop may be lost depending upon the incidence.
- Plant disease reduce the quality & quantity of Plant Produce resulting in increased Prices of products to consumer & also severe pathological effects on human & animals that eat plant products.

- Sometime market value of fruits & vegetables is lost due to unhealthy appearance & keeping quality.
- Therefore the losses due to plant disease may ranges from 0-100% depending upon the type of damage & intensity of the disease.
- Progress of society & manking depends upon Progress in agriculture & food Production.
- Therefore to increase the food Production, the losses resulting from disease should be reduced.
- Plant Pathology is necessary to safe-guard & Protect agriculture & agricultural Produce from ravages of disease.
- On a global basis about 36.5% of crop is lost annually due to disease insect, pest and weeds.
- It has been estimated that of 36.5% ~~avarage~~ average of total losses, 14.1% are caused by disease 10.2% by insects & 12.2% by weeds.
- Late blight of potato caused severe potato losses in Northen europe in the 1840s.
- Grape downy mildews occured in epiphytotic way during 1878-1882 in france.

- Importance of plant Pathology :-

- They cause qualitative as well as quantitative losses to the agricultural Produce in the field it self & during the storage & transport.
- The money spend on field operations seeds, Fertilizers, irrigation etc is lost.
- In Fruit Plants the Productive life is reduced.
- They are responsible for storage of food leading to the problems like hungers, starvation & famines.
- They may adversely affect the economy of the country & may lead to the economic crisis.
- Increase the cost of Production of agricultural Produce.
- Hamper the agrobase processing industries & transport industries.
- Render the Produce poisonous & unfit for consumption by human & animals. mycotoxicoses.
- Some disease may distroy entire plant species commonly grown in area.
- adversely affects the beauty and landscape of the nature.
- cause environmental (water and air) Pollution.
- Toxic agrochemicals used for controlling plant disease may cause health hazards among the consumers.

Examples of series Diseases that leads to famine.

1) Iris famine (1845)
It is due to late blight of potato which Destroy million hectors of potato crop.

2) Bengal famine (1943)
It is due to Brown spot disease of rice

3) Coffee rust (1868) - Shrilanka industries.

4) Powdery Mildew of grape (1854)
Effect on french vine production 80%.

5) ~~Dowy~~ Downy mildew of grape (1878) =
It leads to Discovery of Boradax mixture.

23/3/2026

Assignment No. 2

* History of plant pathology :-

1) Ancient era = Ancient to 5th century.
2) Dark era = 5th to 16th century.
3) Premodern era = 17th century - 1853
4) Modern era = 1853 - 1906
5) present era = 1906 onwords.

1) Ancient Era - Ancient to 5th century :-

⇒ symptoms & control of disease mentioned in Vrikshayurved by surpal.

⇒ Theophrastus
- Study and write about diseases of trees cereals and legumes in book enquiry into plant.
- He gave theory of spontaneous generation

⇒ lord pliny
- He described plant diseases & suggested remedies.

2) Dark Era -
No increase in knowledge of plant pathology

3) Pre-Modern Era - 18th = 1858

(a) Robert Hooke - 1665
- father of cell theory
- He invented first compound microscope.

b) Anton van leeuven hoek — 1676
- Invented first simple microscope.
- Described unicellular microorganism i.e. Bacteria & Protozoa.

c) P.A. Micheli ⇒ 1729
- studied & described sereral fungi & their morphology
- father of mycology

d) John Needham
Reported plant Parasitic nematode wheat gall.

e) Carl linneaus - 1763
- Established Binomial system of Nomenclature of plant and animal in his book species plantorum.

f) Tillet - 1755
studied & Proved Bunt of wheat is infections controlled by seed treatment.

(g) Prevast - 1807
suggested $CuSO_4$ seed treatment for bunt of wheat.

In 1845 late blight of potato was appeared in Ingland / Inland.

4) Modern Era – 1853 – 1906

a) Anton De Bary – 1853
- studied and proved late blight of potato caused by phytophthora infestans.

Father of Plant Pathology.

b) T.J. Burril :-
- He proved Bacterial nature of fire blight of Apple & pear caused by Envinia amylovara.

c) Robert Koch – 1876 :-
- Gekin used as solifying agent in culture media.
- Described theory i.e. Koch's Postulates.

d) P.A. Millardet – 1882 – 85 :-
- Use Boredeaux mixture (CuSO4 + lime) for control of Downey mildew of Grapes.

e) Adolf Mayer – 1886 :-
- Describe TMV infectious & saptions missiable.

f) Jenson (1887) :-
- Use hot water treatment for loose smut of wheat.

g) E.F. Smith – 1890
– father of plant bacteriology
worked on bacterial wilt of cucurbit
studied crown gall disease.

h) Iwanowski – 1892
- Demonstarted that TMV can pass through bacteria proof filter paper.

5) Present Era – 1906 onward.

a) J.C. Luthra
- Used solar heat treatment for loose smut of wheat.

b) W.M. stanley
– He proved crystalline nature of virus.

c) Beijerinck.
- Father OF Plant virology.
TMV is infectious particle he named as Contagium Vivirum fluid called virus.

d) Bowden & pierie.
Nucleoproteinous nateire of virus.

e) Dai.et.al.
– Discovered mycoplasma like organism.

* Indian scientist :-

1) E.J. Butler
- He wrote book fungi and disease in plants.
- Father of plant Pathology in india.
- Studied different fungal diseases i.e. wilt of cotton, Pigean pea, diaseqses, of rice, sugarcane, potato.
- wrote monograph on "Pythiaceous & Allied fungi.

2) K.C. Mehta.
- Studied life cycle of Rust
- Monograph of cereal rust

3) B.B. Mundkar
- work on cotton wilt.
- Established indian phytophathological society in 1947.
- He worked on ~~on~~ smut fungi
- wrote book fungi and plant diaseases.

4) J.F. Dastur -
- studied genus phytophthora.
- worked on Anthrocnose of cotton, cotton wilt

5) B.N. Uppal
- worked on downey mildew of maize, Bajra

6) G.S. Kulkarni
- Downey mildew of sorghum & pearl millet

7) P.N. patel.
- worked on Bacterial Diseases of plants.

classification on the basis of type of host Pl. affected.

1) Cereal disease :- e.g. Blast of rice, smut of Sorghum, downy mildew of bajra.

2) Vegetable disease :- e.g. White rust of raddish, Tomato wilt.

3) Fruit diseases :- e.g. Anthracnose of mango, Papaya mosoic, guava wilt.

4) Oilseed crop diseases :- tikka of Gnut, Coconut wilt.

5] Cash crop diseases :- e.g. Red root of scane Root rot of cotton.

classification of on the basis of p'l organ parts they affected.

1) Root disease - e.g. Root rot of cotton
2) foliar disease - e.g. leaf spot, leaf smust
3) Stem disease - Stem dust of wheat
4) Vasculor disease - e.g. Bacterial wilt
5) Fruit disease - e.g. fruit rot

classification on the basis on made of spread.
Seed - borne disease - e.g. Errgost of bajra.
Soil - borne disease - Root rot, collar rot
Air - borne disease - powdery mildew, leaf rust.

Assignment NO.3

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classification of plant disease on the basis of prevalance & periodicity :-

1) Non-infectious disease :- (Abiotic) :-
- These are the disease in which no parasite is associated, Hence these disease also known as non-infectious disease.

- They are caused due to non-living factors like moisture, nutritional defficiency etc.

- These disease cannot be transmitted from one diseased plant to another healthy plant.
- e.g. Khaira disease of rice caused by zn defficiency.

2) Infectious disease (Biotic) :-
- These are the diseases which are incited by living organisms under suitable environment.

- A specific pathogen is responsible for the disease.

- These disease are transmitted from one diseased to healthy plant.

3] ~~Ed~~ Endemic diseases :-
When the disease is constantly present in a moderate to severe from and which is

confined to a particular country or district.
e.g. club root disease of cabbage endemic in nilagiri district, wart disease of potato endemic in Darjeeling.

4) Epidemic disease :-
- A disease usually occurs widely but periodically in destructive forms is called epidemic disease.
e.g. powdery mildew disease of grapes.

5) Sporadic disease :-
- The disease which occurs at very irregular intervals & locations knows as sporadic disease.
eg. udbatta disease of rice.

6) Pandemic disease :-
- These disease occurs all over the world & results in mass mortality.
e.g. Damping off disease off tomato.
late blight of potato.

Assignment No. 4

Q.1 Define fungus & write down general characters of fungi.

fungus :-
fungi are eukaryotic, achlorophyllous having definite cell wall ~~rich~~ which is made up of either chitine or cellulose, inatake food by means of absorption, reproduce by means of several or asexual method.

* General characters of fungi :-

1) The body of the fungus is called as thallus.

2) A single thread like filament is called as hypha.

3) A group of hypha / network of hyphae constituting the body of fungus is called as mycellium, mycellium may be septate or aseptate.

4) Non septate or aseptate
=when mycellium is not divided by cross walls called as non-septate mycellium.
- Depending upon the nature of parasitism, with the host plant mycelium is either ecotophytic or endophytic.

5) Septate mycellium -
-when mycellium is divided by cross walls

or septa called as septate mycellium.

6) Ectophytic mycelium
- The hyphae grows on external surface or epidermal cells.

7) Endophytic mycelium :-
- when hyphae grows inside the epidermal layer of plant or host tissues, is called as endophytic mycelium.
e.g. powdery mildew fungi.

8) Intercellular mycelium :-
- mycelium growing in between the cells.
e.g. Rust fungi.

9) Intracellular mycelium -
- mycelium growing within the host cell.
e.g. smut fungi.

10) Vascular mycelium -
- mycelium growing in vascular tissue of the plant
e.g. wilts.

11) Cell wall
- Cell wall is well defined, typically chitinised which contains chitine or cellulose or both.

12) Nutrition -
-In fungi, nutrition is heterotropic i.e. photosynthesis lacking & absorptive.

- Nuclear status :-
- Eukaryotic multinucleate mycelium being homocaryotic or heterokaryotic or haploid or diploid or dikaryotic. (limited duration).
well defined structures i.e. nuclear membrane & nucleolus, chromatin material.

- Sexuality :-
-Sexual or asexuals and homo or heterothallic

- life cycle :-
- Simple to complex.

- Sporocarps
-microscopic or macroscopic and showing limited ~~de~~ differentition.

- Distribution
- ~~Com~~ cosmopolitan.

Assignment No. 5

Reproduction of fungi :-

Reproduction is the formation of new individual having typical characters of the species fungi reproduce by spores. Spore is an unit of reproduction.

There are main 2 types of reproduction in fungi :-

1) Asexual reproduction
2) Sexual reproduction

1) Asexual Reproduction :-

- Also known as somatic and vegetative reproduction.
- It ~~deals~~ does not involve union of sex organ

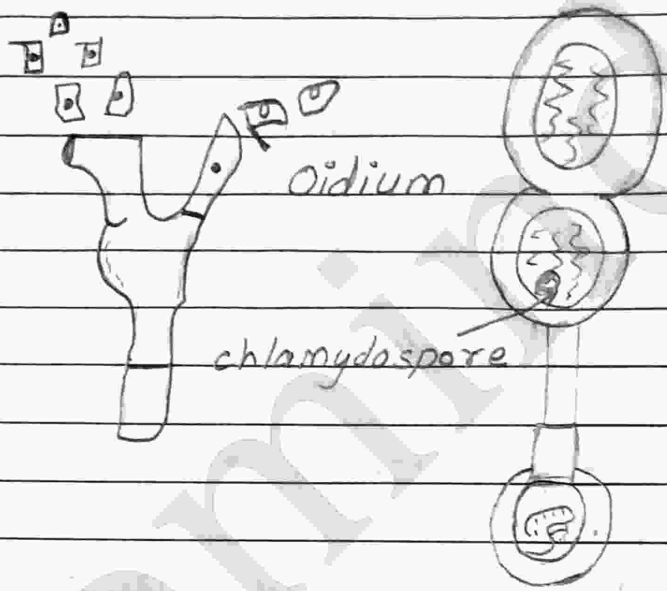
Method of asexual reproduction -

1) Fragmentation
2) Binary fission
3) Budding
4) Production of spores

1] Fragmentation -

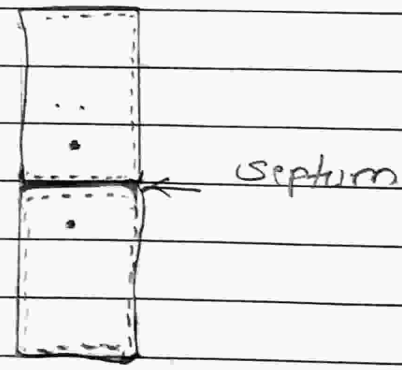
- A detached fragment of hyphae grows into a new individuals.
- The hyphae break up into their component cells known as ~~Oidia~~ which behave like spore.

- Each fragment further germinate to form new hyphae.
e.g., oidia of powdery mildew.

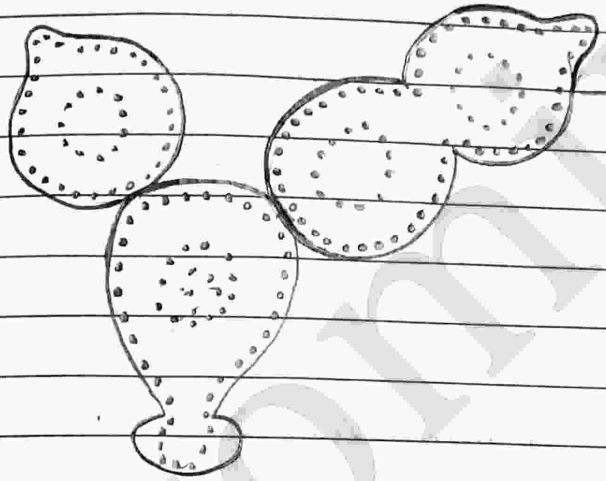


2) Binary fission —

In fission the parent cell divides into two by the formation of transverse septum or divider
eg., Yeast



3] Budding :-
- It is the production of bud from a Parent cell.
- A soft zone appears on the cell wall which bulges but, constricts & finally pinches off to form a daughter cell.
e.g :- Rust & smut fungi.



4) Production of spores -
- fungi produce different types of asexual spores.
- i.e. Zoospores, aplanospores, sporangio-spores conidia.

II. Sexual Reproduction :-

- This process involve the union of male & female nuclei or nuclei of opposite sex potential.
- The sex organ in are called as gametangia it is form differentiated sex cells called gametes.

- There are 5 methods of sexual reproduction
  1) Planogametic copulation
  2) Gametangical contact
  3) Game tangial copulation
  4) Spermatization.
  5) somatogamy

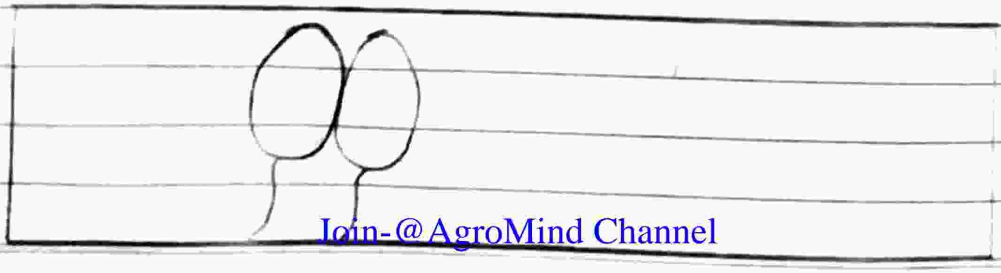
1) Planogametic copulation :-

Depending on the size and motility of fusion gamates, there are 3 types of planogametic copulation.

i) Isogamy -

when 2 fusion gamates are of same shape and size, they are called as 'isogamate' & thier fusion is 'isogamy'.

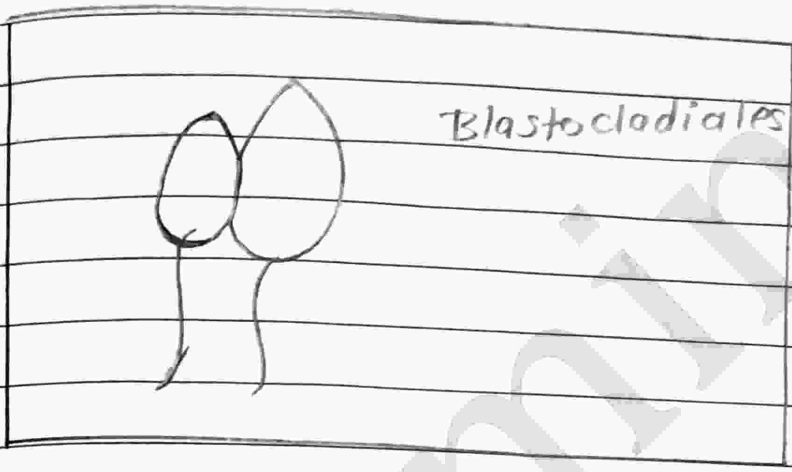
e.g. Synchtrium sp.



ii) Anisogamy –

When 2 fusing gamates are of same shape but different size, they are called as anisogamates & their fusion is 'anisogamy'

-eg. Blastocladiales.

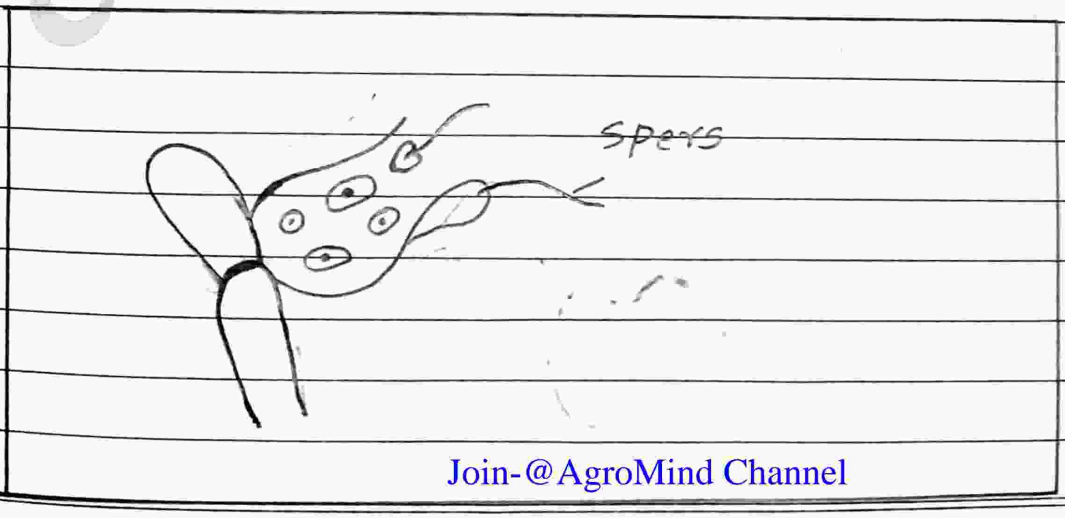


iii) Heterogamy :-

Among the two gamates one is small & motile & the other is large & non-motile.

Then they are called as heterogamates & their fusion is heterogamy.

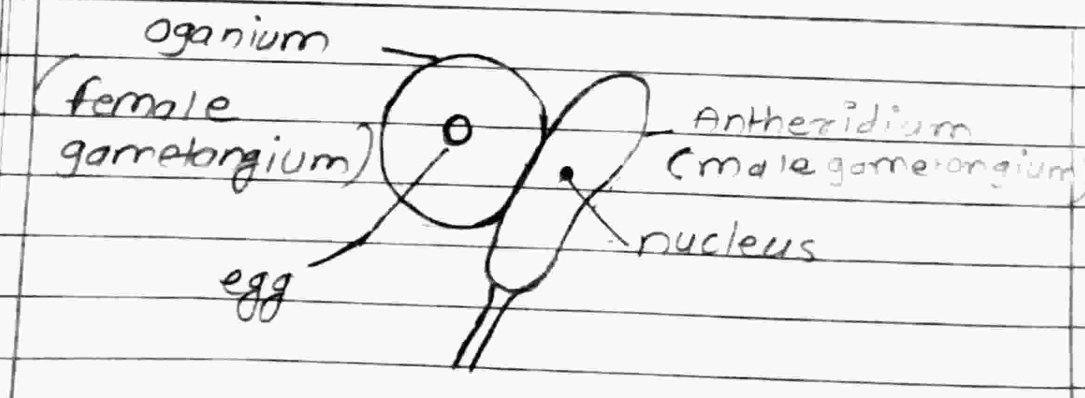
e.g., Monoblepharidales



2) Gametangial contact -

- This method involves fusion of two gametangia of opposite sex.
- In the method, the male gamete is usually represented by nucleus contained inside the antheridium, while female gamete is represented by the egg contained inside the oogonium.
- In care of this method, male and female gametangia come in contact & the male nucleus enter into the female gametangium through a pore which is developed by the dissolution of gametangium wall of the point of contact
- While in case of some fungi, a specially developed fertilization tube (trichogyne) acts as a passage for the male nuclei to enter into female gametangium.
- After a passage of male nuclei, male gamatangium starts to disintegration
- female gamatangium grows continuously to from spore.

eg., fungi belonging to ascomycotina.



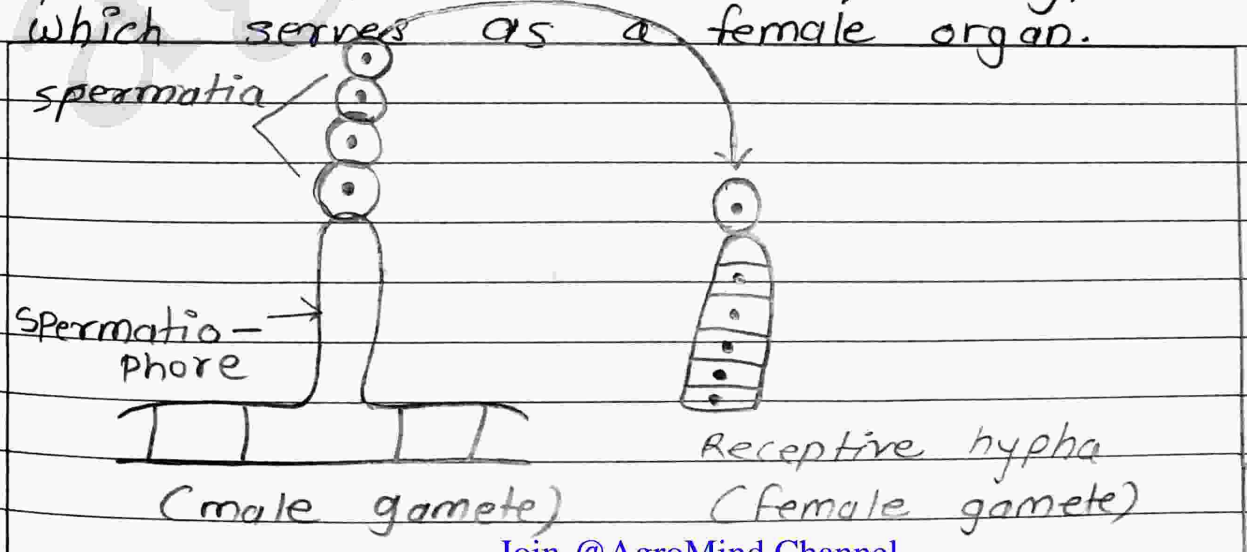
3) Gametangial copulation :-

The difference from the gametangial contact lies in only passing the entire contents of one gametangium to another gametangium instead of passage of only the nuclei.

4) Spermatization :-

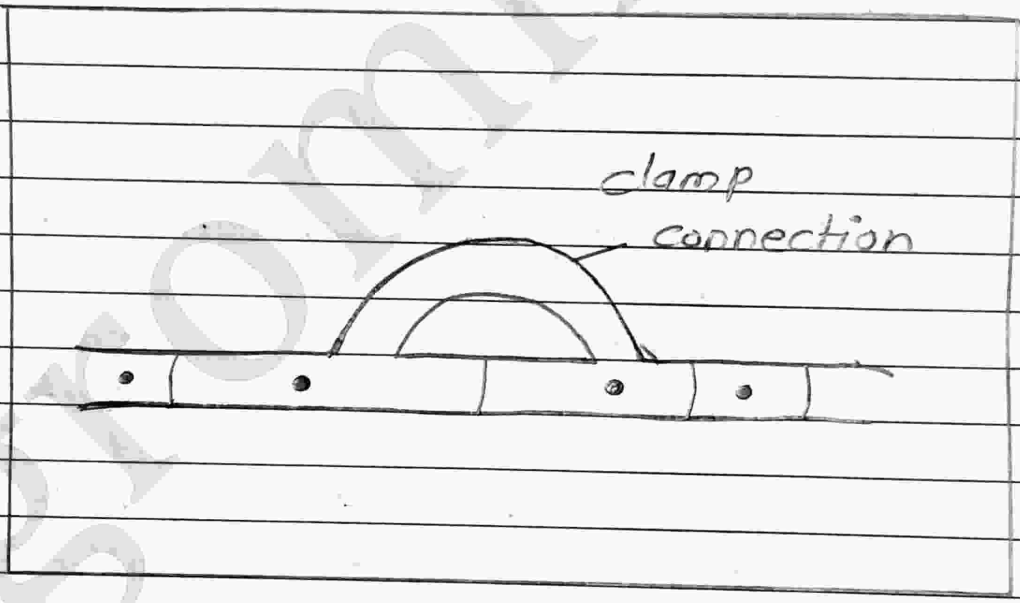
Some fungi produces numerous non-motile, minute spore like structure known as spermatia produced on spermatiophore.

- This spermatia acts as a male gamete are usually carried carried by inseets, wind & water to receptive hap hypha (female gametangium)
- In this method, when the male gamete i.e., spermatia comes in contact with female gamete, a pole developed at the point of contact & the contents of the spermatia passes into receptive hypha which serves as a female organ.



5) Somatogamy :-

- No gametes are involved
- vegetative hypha itself acts as a both male & female gamete & bring about sexual reproduction.
- In this method, fusion of somatic cells takes place trough clamp connection & the nuclei of opposite mating type are brought together in one cell.



Assignment No.6

General Terms in plant pathology :-

Disease :-
Malfunctioning process that caused by continuous irritation by pathogen & environment factor resulting & producing symptoms.

Disorders :-
Disease or abnormal condition caused by deficiency of nutrient or unfavourable environment termed as disorder.

Pathogen :-
Any agent responsible for inciting pathos i.e., ailment or damage.

Infection :-
Establishment of parasite within a host plant

Pathogenesis :-
Chain of events leading to disease development.

Pathogenicity :-
Ability of Pathogen cause disease under environmental condition.

Symptoms :-
Visible change occur in host plant in responce to infection by Pathogen.

— OR —

External Apperance of the die diseased plant due to host - pathogen interaction.

Sign :-
Physical evidence of ~~preg~~ presence of disease agent affecting plant part

Syndrome :-
Various types of symptom characterizing a disease are collectively known as syndrome.
- set of various type of symptoms.

Parasite
Organism which derived form food material from other living organism (The host)
e.g., Mycorrhizae.

Biotroph / obligate parasite
obtain their food from living tissue only in nature and complete their life cycle.
eg Rust, smut.

Saprophyte :-
Organism derived their nutrition from dead organic matter.

Facultative Parasite :-
Primarily Saprophyte but can live as Parasite.

Facultative Saprophyte :-
Primarily Parasite but grow as Saprophyte

obligate Saprophyte :-
feed & reproduce on dead material.

Virulence :-
Degree of pathogenicity of pathogen.

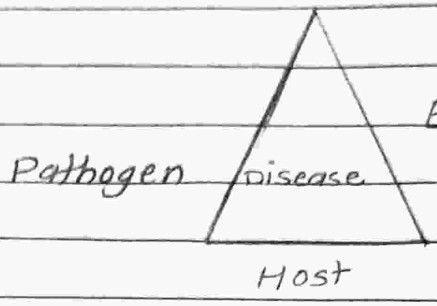
Disease resistance :-
Ability of an organism to overcome completely or some degree effect of pathogen.

Infection :-
Establishment of parasite relationship between pathogen & host following entry / penetration.

Incubation period :-
Time / period between penetration & complete infection.
i.e. development of disease symptoms.

Invasion / Colonization :-
Growth & multiplication of pathogen.

Disease Triangle :-
The intraction of three components of disease.
i.e., Pathogen, environment & host generally reffered as " Disease Triangle ".



The large number of group of living organism like, fungi, bacteria, nematode virus, Algae, Parasitic higher plant invode host plant, feed and proliferate and induce disease.)

Plant in disease condition mostly attacked by Biotic and Abiotic factors.

~~Plant in disease condition~~

IF host & Pathogen come in contact & interact but environmental condition not favourable then disease not develop.

Therefore third component environmental condition.

Assignment No. 7

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Survival / Prepetuation of plant pathogens :-

In the absence of the main host plant, the pathogens find some alternate source or mode of survival to have continuous chain of infection.

Prepetuation means, survival of the pathogen in different forms in the absence of main host or under unfavourable conditions of environment.

Source of survival of plant pathogens :-

I) Infected host as reservoir of inoculum
II) survival as saprophyte outside the host.
III) survival as dormant spores, resting structure
IV) survival in association with insects, nematode and fungi.

I) Infected host as reservoir of inoculum →

The infected host serving as reservoir of active inoculum is grouped into :-

1] Seed :—

Seed may be externally or internally infected by plant pathogens during the course of development and maturation of fruit or pods.

e.g :- ① same pathogen enter through the

stigma & style of the flower & infect the young seed further.

2] Collateral hosts :- (wild hosts of same families) :-

- Collateral hosts are those which are susceptible to the plant pathogens of crop plants & provide adequate facilities for their growth during offseason.

- Weed which live & survive during non-cropping season helps to bridge the gap between two crop seasons.

- So this weed & main crop plant belonging to same botanical family. Hence it is known as collateral host.

e.g. Yellow vein mosaic of okra have collateral host is Hibiscus. They both belonging to same family i.e., malvaceae.

3] Alternate host :- (wild hosts of other families) :-

Certain fungi, especially the rust fungi, require more than one host for completion of their life cycle.

The other host, which is belonging to other families known as alternate host.

e.g., Black stem rust of wheat having Barberry as alternate host.

4] self sown crops :-

Self sown crops are mostly the reservoir of many plant pathogens.
e.g.→ self sown rice plants are the reservoir of plant pathogens (Rice tungro virus).

5] Ratoon crops :-

Ratoon practice is most commonly followed by farmers espeacilly in sugar-cane.

These ratoon crops also harbour the plant pathogen.
e.g.→ Sugarcane mosaic.

6] Survival by laternt infection :-

Latent infection means conditions in which the plant pathogens may survive for a long time in plant tissue without development of visual symptoms.
e.g.→ Xylella fastidiasa, the causal agent of piercels disease of grape infect different weeds without developing visible symptoms.

II survival as a saprophyte outside the host :-

In the absence of the cultivated host, plant, fungi are capable of surviving as saprophytes & can be studied under three categories.

a] Soil inhabitants :-
Those organisms which survive in soil as saprophyte in the absence of host plant known as soil inhabitants.
e.g.:- Pythium sp.

b] Root inhabitants :-
Thoose organisms which survive in soil in close association with their host. i.e., roots of host known as root inhabitants.
e.g.:- fusarium sp.

c) Rhizosphere colonizers :-
Thoose organisms which colonize the dead substrates in the rhizosphere region known as rhizosphere colonizers.
e.g.:- Leat mold in tomato -
Cladosporium fulvum.

III] survival as dormant spore / resting structures :-

Among the plant pathogens, viruses, bacteria & ~~fot~~ flowering plant paracites are not able to produce resting structures.
But only fungi & nematodes are able to form resting structures that enable them to survive long periodic / periods.

without a suitable host or when the environmental conditions are unfavourable.

Nematodes produce eggs & cyst as a resting structures & fungi produce spores like oospores, chlamydospores, etc.

III] Survival in association with insects, nematodes & fungi →

Several important plant pathogens may survive within insect body.

e.g.; Corn wilt pathogen - survive inside insect body i.e., Corn flea beetle.

Tobacco rings pot pathogen - survive inside nematode.

Dispersal of plant pathogens

	symptoms	Sign
1)	Indirect evidence of disease	Direct evidence of pathogen.
2)	They show how the plant is reaching to the infection	you can often see the disease -causing organism or it's structure.
3)	Depends on has condition environment	Depends mainly on pathogen growth.
4)	use for initial field identification.	Mycelium, spores fruiting bodies.
5)	May very depending on host Pathogen and environment	More renable than symptoms
6)	cannot be easily verified	Can be verified clinically
7)	May be in accurate or exaggerated	More accurate and dependable
8)	Can not be measured with instruments.	can be measured using tools / tests.

9)	These are the internal or visible changes in the plant caused by diseases.	These are the actual physical presence of the pathogen on the plant.
10)	e.g., wilting, Yellowing (Chlorosis) stunted growth. leaf spots, necrosis.	e.g., fungal spores, mycellium, bacterial ooze, fruiting bodies,