Unit I
Lecture 12

I Factors affecting Plant Diseases

Temperature:- Plants as well as pathogen require a certain minimum temperature to grow & carry out their activities.

1) Pathogens differs in their preference for higher or lower temperatures. Some fungi grow much faster at lower temperatures than others. Significant difference between races of the same fungus is found.

2) Temperature affects the number of spores formed in a unit plant area and the number of spores released in a given time period. for eg. some sp. of fungus Typhula ~~& Fusarium~~ which causes snow mold of cereals & turf grasses grow in cold season

Phytophthora infestans is a serious problem during cold. Whealher favoured by high temperature, Fusarium wilts, anthracnoses caused by Colletotrichum? are favoured by high temperatures limited to hot areas.

Monilinia fructicola → Fungi – Ascomycetes (infect fabric of & Peaches) causing brown rot of stone fruits is favoured → soil fungi hyphomycetes

3) temperature also affects the ~~&~~ completion of an infection cycle ~~so~~, the more the number of infection cycle the more inoculum for the new infection in that season and in the subsequent season.

for eg. for completion of infection cycle of rust caused by Puccinia graminis on wheat (from inoculation by Uredospores to the formation of new uredospores is 22 days at 5°C, 15 days at 10°C, & 5 to 6 days at 23°C.

If the minimum, optimum & maximum temperatures for the pathogen, the host & the disease are the same, the effect of temperature in disease development is apparently through its influence on the pathogen. The latter becomes so activated at the optimum temp. that the host, even at its optimum growth rate, cannot contain it,

In many cases, the optimum temp. for disease dev. seems to be different from those of both pathogen & host. for eg. in ~~Their~~ Thielaviopsis basicola, causing black root rot of tobacco the optimum temperature range for the disease is 17 to 23°C, & that for tobacco is 28° to 29°C & the pathogen is 22 to 28°C thus ~~nor~~ neither the pathogen nor the host grows well in at 17-23°C but the host grows so poorly that weakened pathogen can also cause disease. In the Foot rot of wheat & corn, caused by the fungus Gibberella zea the maximum disease development in

the distribution & spread of many of these pathogens on the same plant and on their spread from one plant to other fungal infection cycles/season is closely related to rainfall.

4) Moisture increases the succulence of host plant increasing susceptibility to certain pathogens, which affect the extent & severity of disease.

Late blight of potato, apple scab, downy mildew of grapes & fire blight are severe in areas with high rainfall.

In apple scab continious wetting of the leaves, fruits etc for at least 9hrs. is req. at optimum temperature of (18-23°c). ~~If the~~ At ~~min~~ or lower or higher temperatures minimum wetting period required is higher. If the length of the wetting period is less than the minimum the pathogen fails to establish ~~ints~~ itself in the host & fails to produce disease.

Most fungal pathogens require free moisture on the host or high relative humidity in the atmosphere for spore release or for the germination of spores.

Some pathogens like late blight of potato & the downy mildews must have high relative humidity or free moisture, the growth, sporulation of the pathogens, & the production of symptoms, come to a halt as soon as dry hot ~~wh~~ weather

sets in. However the spores of powdery mildew fungi can germinate, penetrate, and cause infection in high humidity In presence of free moisture on plant surface the infection is lower.

In many diseases affecting the underground parts such as roots, tubers, & young seedlings for eg. Pythium damping off; the disease is proportional to the amount of moisture present in soil helping in the movement of zoospores.

Certain fungi like Fusarium solani causing dry rot of beans, Fusarium roseum cause of seedling blights grow well in dry environment also Streptomyces scabies, which causes common scab of potatoes, becomes severe in soil drying out after wetting.

Bacteria reach thru stomata/natural opening & wounds & multiply rapidly in moisture increased bacterial activity in wet weather causes inc. bac. infection

Effect of wind

Most plant diseases spread rapidly & assume epidemic proportion when carried by wind. Such as fungi, bacteria & viruses, that spread directly by wind or by vector by air.

carried by wind over long distances.

(2) Some spores like basidiospores some conidia & zoospores are delicate & cannot be carried over long distances whereas, uredospores, & many kinds of conidia are carried several kilometres

(3) Wind blown rain helps release of spores & bacteria from infected tissue & then carries them through air & deposit on wet surfaces & if susceptible host causes immediate infection.

(4) Wind also causes injury to plant surfaces when they rub against each other and causes an increase in infection by many fungi & bacteria & few mechanically transmitted viruses.

(5) Wind sometime helps prevent infection by accelerating the drying of the wet plant surface on which fungal spores or bacteria have landed.

Effect of light - The effect is less than temp. & moisture but several diseases are known where the intensity and duration of light increases or

or decreases susceptibility of plant, recently to infection

etiolated plants in absence of light
This increases the susceptibility of plants to infection by non obligate parasites for example, of lettuce and tomato plants to Botrytis or of tomato to Fusarium but decreases their susceptibility to obligate parasites, for example, of wheat to stem rust fungus Puccinia.

Reduced light intensity generally increases the susceptibility of plants to virus infection. Plants kept in the dark for 1-2 days before sap inoculation with a virus produced more local lesions than plants kept in the normal light-dark regime. No effect of light occurs if it occurs after inoculation. On the other hand, low light intensities following inoculation tend to mask the symptoms of some diseases. In these diseases the symptoms are much more severe when the plants are grown in normal light than when they are shaded.

The pH of soil & soil structure

1) Clubrot of crucifers caused by Plasmodiophora brassicae prevalent at pH 5.7, dev. drops sharply at

pH 5.7 & 6.2 and is completely checked at 7.8.

⇒ Common scab of potato caused by Streptomyces scabies is severe at pH 5.2 to 8.0 or above but dev. drops sharply at pH 5.2

* Weakening of host thru altered nutrition by soil acidity or alkalinity affect the incidence & severity of diseases.

Cotton root rot fungus grow in soil with high pH (7.2-8.0) but the soil shd also contain Calcium.

effect of soil nutrient content

Nitrogen abundance causes succulent & prolonged vegetative growth, making plant more susceptible. On the other hand less nitrogen results in weaker, slower growing & faster aging plants - more susceptible to pathogens.

fertilization with high nitrogen increases - susceptibility of pear to

Fire blight Erwinia amylovora, rust of wheat Puccinia

Reduced N_2 increases susceptibility to Fusarium wilt ; Alternaria solani infection of solanaceous plants. the form of nitrogen (ammonium or nitrate) is also imp. Fusarium spp., Plasmodiophora brassicae showed increased severity with ammonium fertilizers (as it lowers the soil pH). Alternatively Streptomyces scabies scab of potato

Gaeumannomyces graminis take all of wheat favoured by nitrate more severe at neutral to alkaline pH

Phosphorous reduce the severity of take all disease and potato scab but increased severity of cucumber mosaic virus and blotch of wheat caused by Septoria inc. resistance by improving the balance of nutrients & by accelerating the maturity of crop - so that crop escape infection to pathogen that prefer younger tissues.

Calcium reduces severity of sev. diseases caused by soot & stem pathogens like Rhizoctonia, Sclerotium & Botrytis & nematode Ditylenchus dipsaci but increases the black shank disease of tobacco caused by Phytopthora parasitica & common scab of potato.

Micronutrients

Application of Copper reduced ergot disease, Iron reduced Verticillium wilt, Manganese reduced potato scab & late blight of Potato. Fusarium wilt increased by Cu & Fe & Mn increased tobacco mosaic of tomatoes.

Silicon - in green house dec. disease. by Magnaporthe grisea Rice blast & Rice brown spot Caused by Bipolaris oryzae

In general plants require a balanced nutrition.

Herbicides inc. Rhizoctonia solani infection on sugar beets & cotton. Fusarium wilt of tomatoes & cotton decrease → foot rot of wheat & Phytopthora collar rot of various crop. by stimulating or retarding the growth of pathogen