

## Lecture 11 - Diseases of Potato (2 Lectures)

### Late blight of potato: *Phytophthora infestans*

#### Symptom:



It affects leaves, stems and tubers. Water soaked spots appear on leaves, increase in size, turn purple brown & finally black colour. White growth develops on under surface of leaves. This spreads to petioles, rachis & stems. It frequently develops at nodes. Stem breaks at these points and the plant topples over. In tubers, purplish brown spots and spread to the entire surface on cutting, the affected tuber show rusty brown necrosis spreading from surface to the center.

#### Pathogen

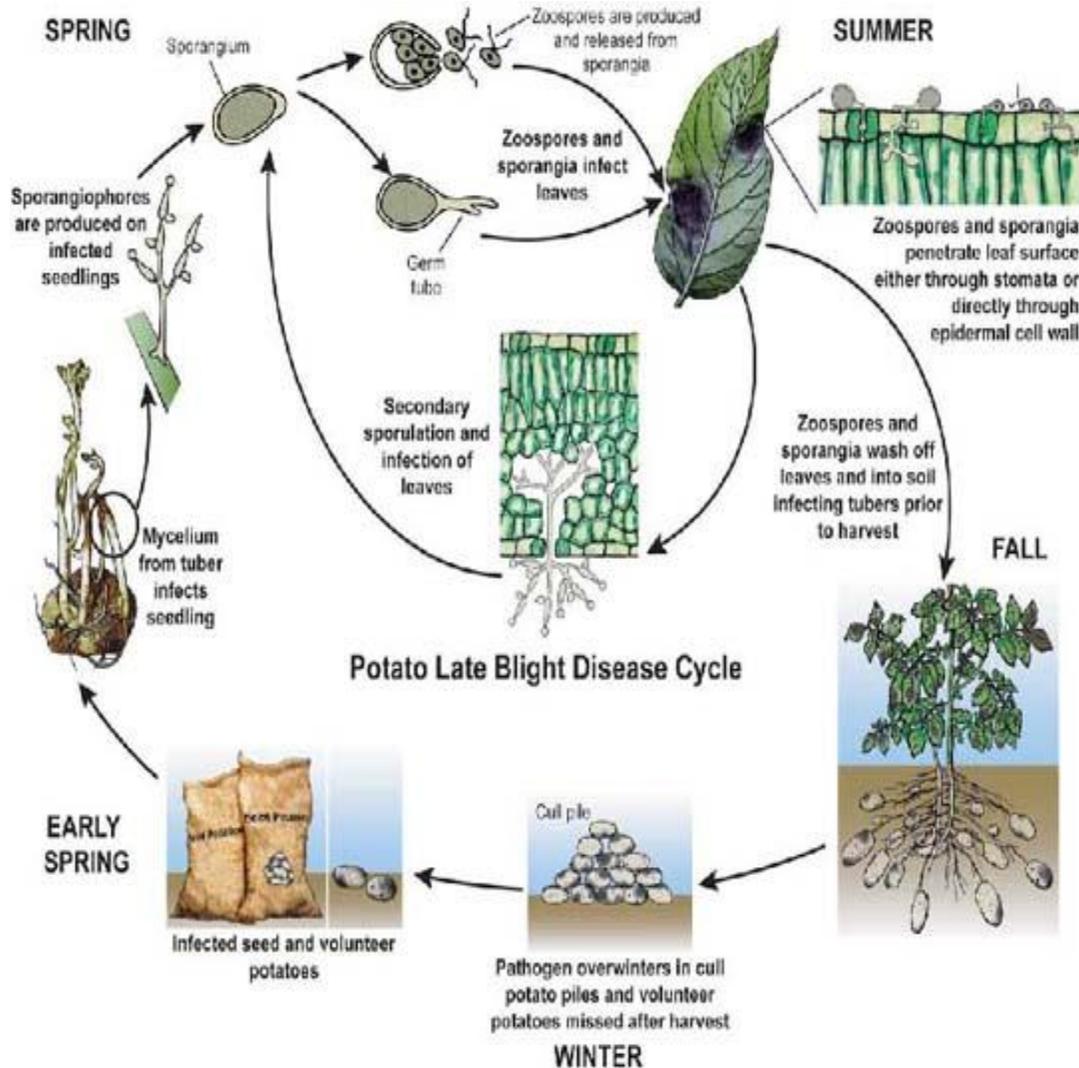
The mycelium is endophytic, coenocytic and hyaline which are inter cellular with double club shaped haustoria type. Sporangioophores are hyaline, branched intermediate and thick walled. Sporangia are thin walled, hyaline, oval or pear shaped with a definite papilla at the apex. The sporangium may act as a conidium and germinate directly to form a germ tube. Zoospores are biflagellate possess fine hairs while the other does not.

#### Mode of spread and survival

The infected tubers and the infected soil may serve as a source of primary infection. The diseased tubers are mainly responsible for persistence of the disease from crop to crop. The air borne infection is caused by the sporangia.

#### Favourable conditions

RH->90% , Temp.-10-25°C and Night temperature:10°C. Cloudiness on the next day  
Rainfall at least 0.1mm, the following day.



## Management

A regular spraying and dusting during the growing season give effective control. First spraying should be given before the commencement of the disease and subsequent should follow at regular interval of 10 -15 days. Protective spraying with mancozeb or zineb 0.2 % should be done to prevent infection of tubers. Destruction of the foliage few days before harvest is beneficial and this is accomplished by spraying with suitable herbicide. Tuber contamination is minimized if injuries are avoided at harvest time and storing of visibly infected tubers before storage. The resistant varieties recommended for cultivation are Kufri Naveen, Kufri Jeevan, Kufri Alenkar, Kufri Khasi Garo and Kufri Moti.

**Early blight:** *Alternaria solani*

## Symptoms



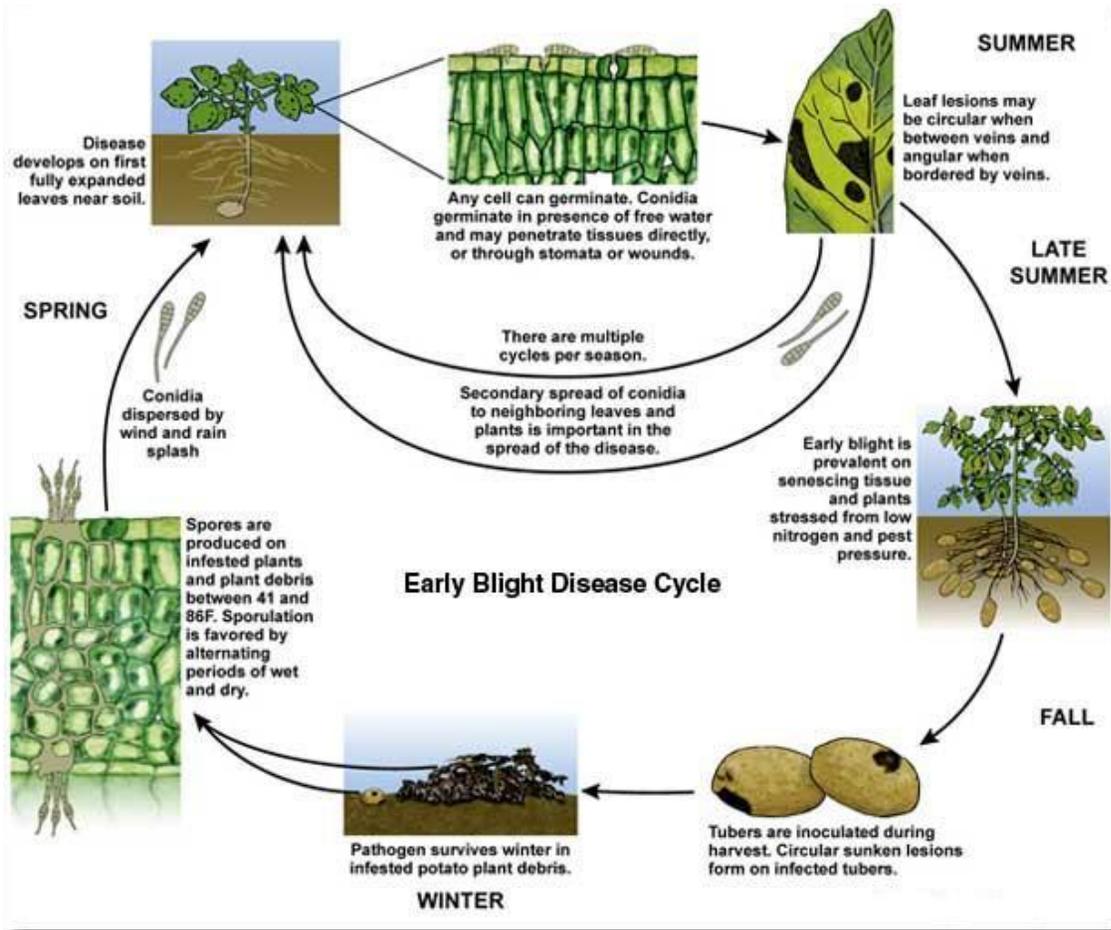
It is present in both hills & plains. Brown-black necrotic spot-angular, oval shape characterized by concentric rings. Several spots coalesce & spread all over the leaf. Shot holes on fruits.

### Pathogen

Hyphae are light brown or olivaceous which become dark coloured with age. The hyphae are branched, septate and inter and intra cellular. The conidiophores emerge through the stomata or between the epidermal cells. The conidia are club shaped with a long beak which is often half the length of the whole conidium. The lower part of the conidium is brown while the neck is colorless. The body of the conidium is divided by 5 – 10 transverse septa and there may or may not be a few longitudinal septa.

### Favourable condition

Dry warm weather with intermittent rain. Poor vigor. Temperature: 25-30°C. Poorly manured crop.



### **Mode of spread and survival**

The conidia and the mycelium in the soil or in the debris of the affected plants can remain viable for more than 17 months. These conidia or the new conidia found on the overwintered mycelium bring about the primary infection of the succeeding potato crop. Secondary infection is more important in the spread of the disease. The conidia formed on the spots developed due to primary infection are disseminated by wind to long distances. The conidia from the affected plant may also be disseminated to the adjoining plants by rain and insects.

### **Management**

Disease free seed tubers should be used for planting. Removal and destruction of infected plant debris should be done because the spores lying in the soil are the primary source of infection. Very early spraying with Zineb or captan 0.2% and repeating it for every 15 – 20 days gives effective control. The variety Kufri Sindhuri possesses a fair degree of resistance.

### **Post-harvest tuber rots - *Sclerotium rolfsii***

#### **Symptoms**

Wilting is the initial symptom. Yellowish brown coloured Sclerotia appeared on the infected tuber. Rotting of the tuber. Milky white and floccose appearance of the tuber.

#### **Pathogen**

The mycelium is silky white and floccose. It is comprised of septate and branched hyphae. The branching take place just below the septum. The cells are large in size. Sclerotia of the fungus are white to begin with and become clove brown at maturity. They are globose and smooth surfaced.

#### **Favorable condition**

Optimum temperature 30-35°C. Alternate period of wet and dry soil condition.

### **Mode of spread and survival**

The mycelium and sclerotia of the organism subsist in the soil and are responsible for the infection of the crop. The pathogen is disseminated with infected soil, in running water and on farm implements. Mycelium and sclerotia may also be carried to soil with the seed tubers. In dry soil sclerotia can remain viable for more than two years.

## Management

Treating seeds with mercury compounds after harvest reduces tuber rot. Treating the furrows at planting with PCNB @ 15kg/ ha reduces the disease incidence. Cultural practices like heavy earthing and irrigation at regular intervals can also check the disease. The disease is low in the variety Kufri Sindhuri. Among the Indian commercial cultivars, Kufri Bahar, Kufri Chamatkar, Kufri Jyothi, Kufri muthu and Kufri swarna are resistant. The disease can be controlled to a certain extent by growing non susceptible crops like corn and sorghum.

## Black scurf- *R. solani*

### Symptoms



Black speck, black speck scab, russet scab on tubers. At the time of sprouting dark brown colour appear on the eyes. Affected Xylem tissue causes to wilting of plants. Infected tuber contains russetting of the skin. Hard dry rot with browning on internal tissue. Spongy mass appear on the infected tuber. Seed tubers are source of spread. Moderately cool, wet weather and temp 23 °C are the favourable for the development of disease.

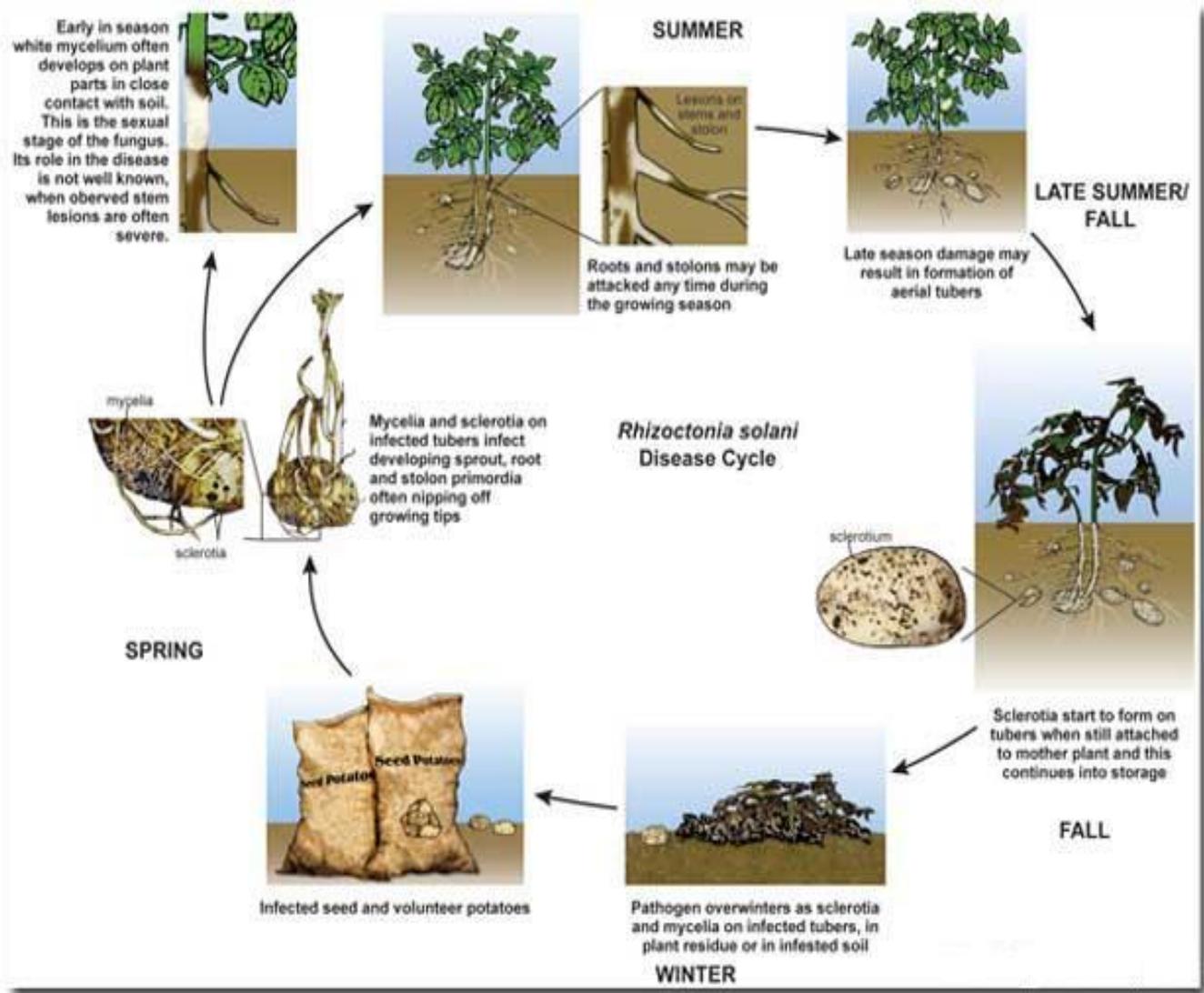
### Pathogen

The mycelium is hyaline when young and brown at maturity. Hyphae are septate and branched with a characteristic constriction at their junction with the main hyphae. The branches arise at a right angle to main axis. Sclerotia are black. A basidium bears four sterigmata each with a basidiospore at the end. The basidiospores are hyaline, elliptical to obovate and thin walled. They are capable of forming secondary basidiospores.

### Mode of spread and survival

The fungus is capable of leading a saprophytic life on the organic material and can remain viable in the soil for several years. The sclerotia on the seed tubers is the principal source

of infection of the subsequent crop raised with these tubers. On return of favourable conditions the mycelium present in the soil may develop producing new hypae.

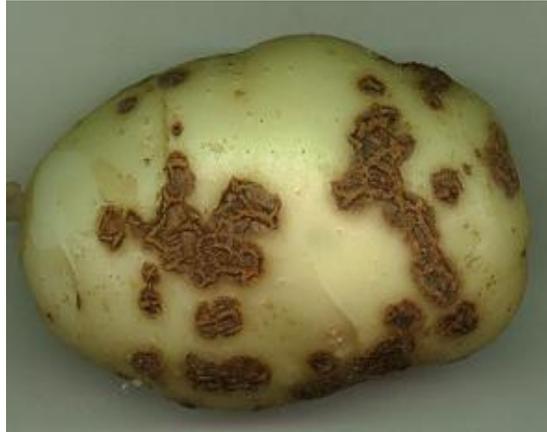


## Management

Disease free seed tubers alone should be planted. If there is a slight infection of black scurf that can be controlled by treating seed tubers with mercuric chloride solution for 1.5 hr with acidulated mercuric chloride solution for 5 min. Treating the soil with pentachloroni trobenzene at the rate of 70 kg/ ha lowers the incidence of the disease, but it is too expensive and cumbersome. Well sporulated tubers may be planted shallow to control disease. The disease severity is reduced in the land is left fallow for 2 years.

## **Common scab or corkey scab – *Streptomyces scabies***

### **Symptoms**



Corkiness of the tuber periderm is the characteristic symptom. 1/4 inch into the tuber surface are russet appearance. Slightly pitted on the infected tuber. Light brown to dark brown lesion appears on the infected tuber. Affected tissue will attract insects.

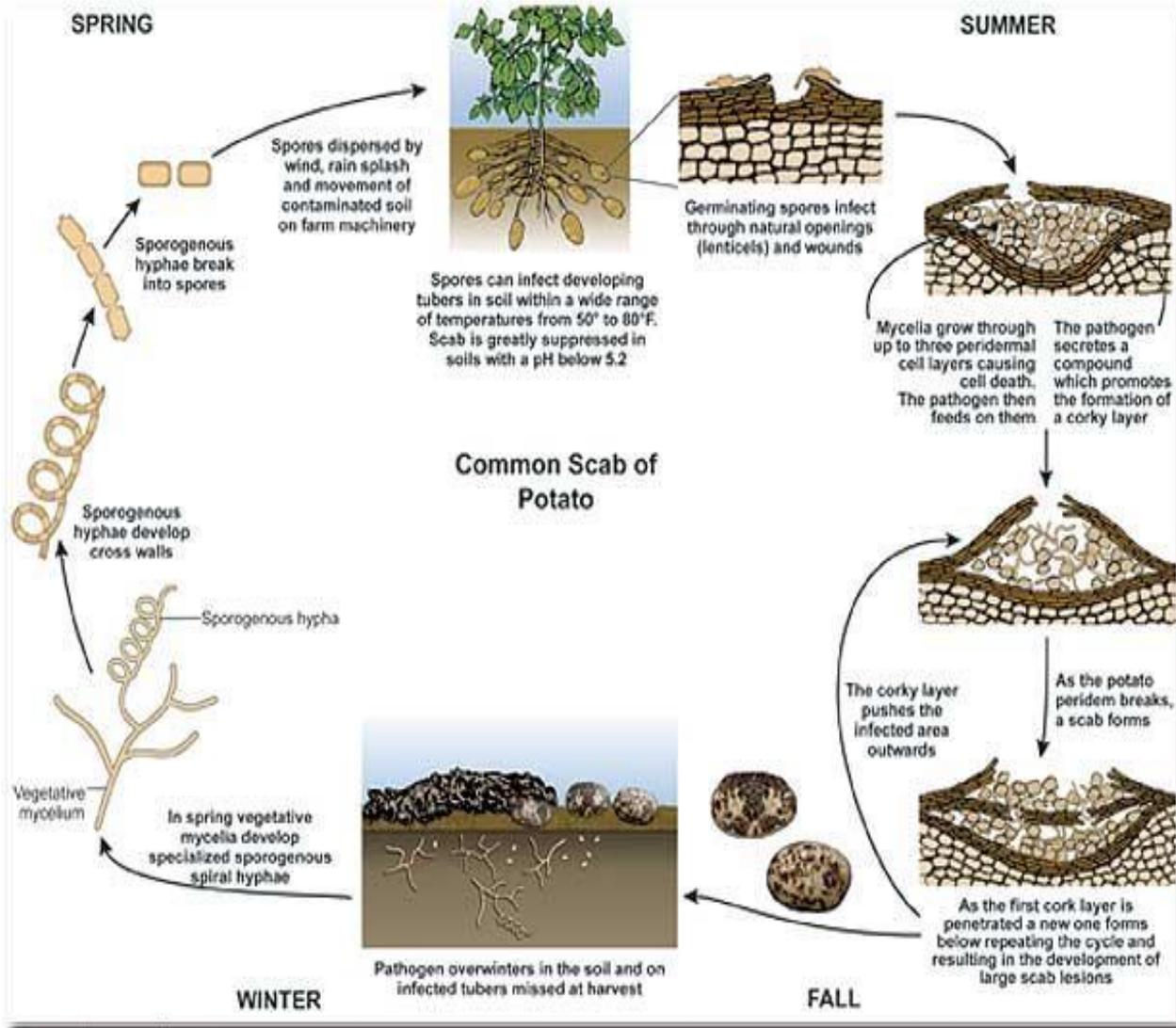
### **Pathogen**

Aerial mycelium in pure culture has of prostrate branched threads. Sporogenous hyphae are spiral in form. Conidia are produced by the formation of septa at intervals along the hyphae, which contract to form narrow isthmuses between the cells. Conidia are roughly cylindrical and hyaline. The conidia can germinate even at higher temperatures. The growth of the organism is good in slightly alkaline medium and is checked at pH 5.2.

### **Mode of spread and survival**

It attacks cabbage, carrot, egg plant, onion, radish, spinach and turnip. The causal organism perpetuates in soil and infects the crop every year. Infected potato tubers serve as the main source of long distance spread of the disease. The pathogen may survive passage through digestive tract of animals and hence it may spread with farm yard manure.

## Disease Cycle



## Management

Only scab free seed potatoes should be planted as this will help in checking the spread of the inoculum and infection to be subsequent crop. Infection of the seed tubers can be removed by 1.5hrs dip in mercuric chloride 0.1% solution or by 2h dip in 1 part formaldehyde in 240 parts of water. This disease can be reduced by soil application of PCNB at the time of planting. Four to six years crop rotation with alfalfa satisfactory under irrigated conditions. The disease incidence can be effectively reduced by green manuring the fields before planting potatoes. Common scab is severe in alkaline soil and application of alkaline fertilizers like calcium ammonium nitrate should be avoided.

## **Brown rot or Bangle blight** -*Ralstonia solanacearum*

### **Symptoms**



At the time tuber formation wilt is the main characteristic symptom. In leaf symptom - wilt, stunt and yellowing. Browning of xylem tissue. Eye buds are black in colour. Bacteria ooze coming on infected tuber surface and emits a foul odour.

### **Pathogen**

G –ve, short rod, 1-4 flagella. Colonies are white to brown in colour

### **Favourable condition**

Temp 25to 35°C , RH above 50 % and PH 6.2-6.6 favours for the development of disease. Acid soil is not favourable.

### **Mode of spread and survival**

Infected soil and seed tubers form the main source of the primary infection. Brown rot affected plant parts decay and release masses of bacteria in the soil where these may remain viable from season to season. The bacteria in the soil are disseminated by wind from one field to the other. The infection usually occurs through wounds in the root system.

### **Disease cycle**

*R. solanacearum* is a soilborne and waterborne pathogen; the bacterium can survive and disperse for various periods of time in infested soil or water, which can form a reservoir source of inoculum. In potato, the brown rot pathogen is also commonly tuber borne. The bacterium usually infects potato plants through the roots (through wounds or at the points of emergence of lateral roots).



Under favorable conditions, potato plants infected with *R. solanacearum* may not show any disease symptoms. In this case, latently infected tubers used for potato seed production may play a major role in spread of the bacterium from infected potato seed production sites to healthy potato-growing sites. *R. solanacearum* can survive for days to years in infected plant material in soils, infested surface irrigation water, infected weeds, and infected potato washings and sewage. From these sources of inoculum, bacteria can spread from infested to healthy fields by soil transfer on machinery, and surface runoff water after irrigation or rainfall. Infected semi-aquatic weeds may also play a major role in disseminating the pathogen by releasing bacteria from roots into irrigation water supplies.

#### **Soft rot- *Erwinia carotovora* subsp *carotovora***

#### **Symptoms**



*Erwinia carotovora*

Infection at two phases are black leg and soft rot. Black lesion appear on the base of the plant .Systemic and browning of infected tubers. Yellow appearance of the plant. Finally the plants wilt and die. Lenticels (water soaked brown rot). Rot and collapse of tubers. Soft, reddish or black ring appear on the infected tuber.

#### **Pathogen**

It is a gram negative rod shaped bacterium with 1 to 6 peritrichous flagella.

### **Mode of spread and survival**

Infected tubers attract the flies (*Hymelia* and *Phorlin* sp). Spread through immature contaminated soil and tuber. Optimum temperature 21 to 29 °C and RH 94%

### **Management**

The pathogen is difficult to control because of long survival both on seed tubers and in soils. However using disease free seed tubers could minimize the disease incidence. Before planting the seed tubers are treated with Boric Acid (3% for 30 minutes) and dried in shade. The same treatment is repeated before the storage of the tubers.

The disease can be reduced by soil application of PCNB (30 kg/ha) at the time of planting. Following crop rotations with wheat, pea, oats, barley, lupin, soybean, sorghum and bajra checks the disease development. In plains, treatment of the seed tubers with TBZ + acetic acid + 0.05% Zinc Sulphate solution or Carbendazim 1% for 15 minutes effectively controls the disease. Soaking of tubers in Mercuric chloride 0.1% formalin.