

**FACULTY OF AGRICULTURE SCIENCES AND
ALLIED INDUSTRIES**

Course Material

Course Name: Fundamentals of Plant Pathology
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LECTURE 8

CLASSIFICATION OF BACTERIAL PLANT PATHOGENS

CLASSIFICATION

Traditionally bacteria have been included in Plantae kingdom under Thallophyta; however, Haeckel in 1966 proposed the kingdom Protista to include all unicellular organisms and placed various organisms of Thallophyta plants and Protozoa animals in Protista. Later, the nucleus character was given more importance.

Chatton proposed the most appropriate conceptual basis for taxa at the highest level by recognizing two general patterns of cellular organelles as prokaryotes and eukaryotes in 1937.

Stanier (1969) considered prokaryotes as lower protists including blue green algae, myxobacteria and eubacteria; and eukaryotes as higher protists including algae, fungi and protozoa. Prokaryotae was recognised a separate kingdom. However, the correct concept is that of 5 kingdoms according to Whittaker (1969) including Plantae, Animalia, Fungi, Protista and Monera (Prokaryotes).

In Bergey's Manual of Determinative Bacteriology' the phytopathogenic bacteria have been classified into three divisions:

Division I – Gracilicutes

They include prokaryotes with thin cell walls consisting of outer membrane with fatty acid glycerol ester-type lipids and are usually gram negative. They do not form endospores.

Division II – Firmicutes

It included prokaryotes with thick (firm) cell wall consisting of peptidoglycan and unit membrane but without any outer membrane. Some of them produce endospore. They are gram positive.

Division III – Tenericutes

They lack cell wall and cells are enclosed by a unit membrane only. They include mollicutes or mycoplasma like organisms (now called phytoplasma).

Detailed Classification of Phytopathogenic

Bacteria Kingdom: Prokaryotae

Division I: Gracilicutes

Class: Proteobacteria (mostly single-celled, non-photosynthetic)

Family 1: Enterobacteriaceae (They are peritrichous bacteria)

Genus: *Erwinia*;

E. amylovora causing fire blight of apple and pear

E. carotovora pv. *carotovora* causing soft rot of vegetables

E. carotovora pv. *atroseptica* causing black leg of potato

Family 2: Pseudomonadaceae

Genus: *Pseudomonas*

P. syringae pv. *syringae* causing stone fruit bacterial canker

P. syringae pv. *tabaci* causing wild fire disease of tobacco

Genus: *Ralstonia*

R. solanacearum causing bacterial wilt of solanaceous crops

Genus: *Xanthomonas*

X. campestris pv. *campestris* causing black rot of cabbage,

X. campestris pv. *phaseoli* causing common bean blight

X. campestris pv. *vesicatoria* causing tomato bacterial spot

X. oryzae pv. *oryzae* causing bacterial leaf blight of rice

X. axonopodis pv. *citri* causing citrus canker

Family 3: Rhizobiaceae

Genus: *Agrobacterium*

A. tumefaciens causing crown gall of stone fruits

A. rhizogenes causing hairy root of apple

Family: Still unnamed

Genus: *Xylella*

X. fastidiosa [earlier called RLO's rickettsia like organisms]

xylem-inhabiting causing Pierce's disease of grapevines, phony peach, almond leaf scorch

Candidatus liberobacter asiaticus,

phloem-inhabiting causing citrus greening Unnamed, latex-inhabiting, causing bunchy top disease of papaya

Division 2: Firmicutes

Class 1: Firmibacteria (Simple gram positive bacteria) *Bacillus subtilis* – biocontrol agent

Class 2: Thallobacteria (Gram positive, branching bacteria) *Streptomyces scabies* causing common scab of potato

Clavibacter michiganense pv. *sepedonicum* causing ring rot of potato

Clavibacter michiganense pv. *michiganense* causing bacterial canker of tomato

Curtobacterium (*Corynebacterium*) *flaccumfaciens* causing bacterial wilt of bean

Division 3: Tenericutes

Class: Mollicutes (wall less prokaryotes)

Family: Spiroplasmataceae

Spiroplasma citri causing citrus stubborn

Spiroplasma kunkelii causing corn stunt

Several organisms called phytoplasma have been reported to cause various yellows and witches broom type diseases are included in this group and have been given *Candidatus* status for the time being due to the inability of their culturing.