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Erwinia Species on Lagenaria Siceraria Causing Soft Rot of Fruit in Eastern Zone of Nepal and Adjoining Area of India

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ABSTRACT

Soft rot of fruit causing disintegration of cells and dissolution of middle lamellae due to the action of enzymes secreted by Erwinia sp.The colour of fruit also changes to brown-blackish in a part or the whole part damaging tissues of the fruit and the watery secretions leads to 10-15% loss in the productivity in the Districts of Sunsari and Morang of Province No. 1 and adjoining area of India. Bacterial wilt is also produced by Erwinia sp. Singh (1968)[16]. Toxins also produced by *Erwinia sp*., which cause disturbance in metabolic activity of Lagenaria siceraria (Mol.) Standl. Erwinia sp. is seed borne and soil borne pathogen.

1. Introduction

Host

Bottle gourd or calabash- Lagenaria siceraria (Mol.) Standl. is believed to be a native of Africa but the archaeological remains of the fruits have been discovered in Peru dates to before 10,000 B.C. and in the both Mexico and Thailand dated to about 7000 B.C., i.e. this demonstrates possible pre-columbian contacts between the old and new worlds. Whitaker and Carter (1954)[21] have revealed that calabash gourd can float in seawater for as long as two years without the seeds losing their ability to germinate. Thus, the gourds may have drifted across the Atlantic ocean, without man`s aid. The cucurbit is characterized by a very extensive (ramifying) but shallow root system and hollow, angled stems with bicollateral bundles. The leaves are large, alternate simple, long petioled and palmately lobed. Born in the leaf axil are a flower, a leafy branch and a tendril. The colour of the flower is white. They are large, occurring singly on generally monoecious plants but dioecious and andromonoecious (with male as well as bisexual flowers but never female forms are known. The stamens show a varying degree of cohesion, often fused all along their length forming a staminal column (synandrous) with various contorted or twisted thecal (or anther) lobes. The gynoecium consists of a tricarpellary, syncarpous, inferior ovary, surmounted by a thick fleshy style topped by a three forked stigma. Initially the ovarian chamber is unilocular with three parietal placentae but becomes trilocular later owing to the inward growth of the placentae, which after meeting in the centre soon deflect backwards and then bifurcate near the peripheral portion. At the tips of these placentae are borne many ovules. The placentation is thus false axile. The fruit is large and called pepo. Bottle gourd is a warm season crop and susceptible to cold. This crop grows best in well- drained sandy loams, silt loams and clay loams. An average monthly temperature 20-27℃ is essential. Irrigation should be given at frequent intervals during the vigorous growth period of the plant. This plant is cultivated in Sunsari and Morang districts of Nepal and adjoining area of India. The fruit is used as vegetable and making ‘haluwa’. The juice of fruit has medicinal use as advised by Sri Ram Dev baba of Patanjali, Haridwar, India. The seeds yield a medicinal oil. The leaves are purgative. The dried shell of the bottle shaped gourd is used by people to hold water or as oil bottles, while small wild form ‘ tumri’ is used for making the straight instrument, the sitar and the wind instrument the bin.

Variety- pus summer Prolific Long. Fruit 40-50cm long and 20-25cm in girth, when young yellowish green in colour. It is suitable for both wet and dry (hot) seasons.

According to Gopalan et al. (2007)[4] 100gms of bottle gourd contains the following constituents –

Moisture-96.1g, Protein-0.2g, Fat-0.1g, Minerals-0.5g, Crude fibers-0.6g, Carbhohydrates-2.5g, Energy-12kcal, Calcium-20mg, Phosphorus-10mg, Iron-0.46mg, Carotene-0mg, Thiamine-0.03mg, Riboflavin-0.01mg, Niacin-0.2mg, Mg-36, Sod- 1.8, Pot.-87, Cu-0.03, Mn-0.06, Zn-0.22, Cr-0.046, S-10, Cl-5 all in mg/100 gm. Approximate total N g/100gms- 0.03, Arginine-100, Histidine-40, Lysine-350, Tryptophane-30, Phenylalanine-140, Methionine-30, Threosine-170, Leucine-350, Isoleucine-320, Valine-230 all mg per g N. Total Dietry fibre-2g, Insoluble dietry fibre-1.7g, Soluble dietry fibre-0.3g.

Pathogen and diseases-

Soft rot of fruit of *Lagenaria siceraria (M0l.) Standl.* is caused by the bacterium *Erwinia sp.* Rangaswami (1994)[15].

Soft rot of fruit causes disintegration of cells and dissolution of middle lamellae due to the action of enzymes secreted by *Erwinia sp.* Disintegration of fruit of *Lageneria siceraria* also causes changes in colour from green to brown-blackish in a part or sometimes the whole fruit is damaged

10-15% loss in fruit is very common in the Districts of Sunsari and Morang of Province No.1 of Nepal. Bacterial wilt is also caused in cucurbits by *Erwinia sp.* Singh (1968)[17], causing plugging of vessels and toxins produced the pathogen. Seed borne and soil borne (being saprophytic) nature of *Erwinia sp.* is very common and enters in plants through the soft part eg: Root-hair, roots or passage made by nematodes in the plant and finally reaches to the reaches to the fruit. The immature or mature fruits of *Lagenaria siceraria* infected.

2. Review of Literature

Whitaker & Carter (1954)[22] reported oceanic Drift of gourds. Pandey (1998)[11], Kochhar (1998)[8] & Prakash & Sharma (1975)[14] mentioned the economic value of gourds in their books. Gopalan et al. (2007)[4] gave chemical constituents related nutritional value. Mehrotra (1980)[10], Rangaswamy (1994)[15] and Singh (1968)[17] described the pathogen and hosts of bottle gourd. Burkholder & Smith (1968)[1] reported about the pathogens *Erwinia atroseptica* and *E. carotovora, while* Maleolmson (1959)[9] studied the isolates obtained soft rots and blackleg of potatoes. Patel and Kulkaeni (1951 & 1953)[12, 13] reported the nomenclature of bacterial plant pathogens and a review of bacterial plant disease investigations in India. Smith (1950)[19] studied pathogenic differences of *Erwinia atroseptica* and *E. carotovora.* Stapp (1961)[20] & Sinha and Srivastva (1995)[18] described bacteria in their textbooks. Hingorani and Addy (1952 & 1953)[5, 6] mentioned the factors influencing bacterial rot of potato and comparative study of *E. corotovora, E. arodeae and E. atroseptica.* Hingorani, Grant and Singh (1959)[7] mentioned *E. corotovora f. sp.* zeae a destructive pathogen of maize. Thin (1970)[21] mentioned bacterial stalk rot of maize in his Ph.DThesis. Dawson (1941 & 1957)[2, 3] gave identification of bacteria causing soft rot in plants and plant diseases due to Bacteria.

3. Collection of fruit

A large fruit from the market on Date: 15/03/2022, while as a small fruit seen at the field of Sunsari on Date: 14/03/2022. Externally the fruit of *Lagenaria siceraria* didn`t show any disease symptoms. It was green in colour. But was cut, 1/3 symptoms suffering from soft rot of fruit on Date: 16/03/2022 and was taken to the laboratory.

4. Symptoms

Rotten portion of fruit was brown- blackish.

5. Characteristics of the pathogen

a. Small flagellated, size- 0.5-0.9 × 1.5-5.0µ Singh (1968)[17]

b. Temperature affected organism i.e. small size – at temperature 24 to 25℃ Singh (1968) Longer size – at temperature 27℃ Singh (1968) At higher temperature – filamentous in nature Singh (1968)

c. Minimum temperature of growth – 0 to 4℃ Singh (1968)

d. Maximum temperature of growth – 36 to 42℃ Singh (1968)

e. Thermal death point lies between 47 to 53℃ Singh (1968)

f. Ability to survive in soil up to 20 years or more. Singh (1968)

g. Identification – According to Patel and Kulkarni (1951 & 1953)[12, 13], Stapp (1961)[20], Rangaswami (1994)[15], Singh (1968)[17] & Mehrotra (1980)[10], the pathogen is *Erwinia sp.*

pH of soil of Morang and Sunsari District of Nepal – 6.5

6. Control Measures

I. Seed treatment

II. Use of antibiotics – Agrimycine-100 and Agrimycine-500 is effective against *Erwinia sp.*

III. Use of resistant varieties.

IV. Rotation of crop plant or vegetable plants.

V. Soil fumigation, soil flooding and soil heating.

VI. Burning of infected fruit and parts of plants.

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