

# Isolation of *Phytophthora Palmivora* (Butl.) Pathogenic to Papaya Plant in Thiruvavur Dt

M.Mahadevi<sup>1</sup> V.Latha<sup>2</sup> K. Umamageswari<sup>3</sup> A.Panneerselvam<sup>4</sup>

<sup>3</sup>Department of Chemistry <sup>4</sup>Department of Botany and Microbiology

<sup>1,2</sup>K. N. Govt. Arts College for Women (Autonomous), Thanjavur. Tamil Nadu, India <sup>3</sup>Manonmaniam Sundaranar University, Tirunelveli-627 012, India <sup>4</sup>A.V.V.M Sri Pushpam College (Autonomous), Poondi 613 503, Thanjavur, Tamil Nadu, India

**Abstract**— *Phytophthora palmivora* (E. J. Butler) E. J. Butler is an important plant pathogen with a wide host range, including some very important economic crops such as cacao, papaya, black pepper, rubber, coconut, and citrus. In the present investigation, fungal organism was isolated from root rot disease affected papaya plant using PDA medium and identified as *P. palmivora* (Butl.) based on its macroscopic and microscopic features. The present study demonstrated that *P. palmivora* (Butl.) is the causative organism of the root rot disease found on Papaya tree.

**Key words:** *Phytophthora Palmivora*, Plant Pathogen, Papaya Plant, Root Rot Disease

## I. INTRODUCTION

*Carica papaya* L. (Papaya) belongs to the family Caricaceae and is a dicotyledonous, polygamous (having male, female or hermaphrodite flowers on the same plant). The plant is a short-lived, fast-growing, woody, herb-like tufted tree that can grow up to 10 m in height (OECD, 2005; Heywood et al., 2007). Economically, *C. papaya* is the most important plant and cultivated widely for consumption as a fresh fruit and for use in drinks, jams, jellies and ice-cream. Nutritionally, the ripe papaya fruit is a good source of calcium and an excellent source of vitamins A and C (Nakasone and Paull, 1998; USDA National Nutrient Database, 2010).

Papaya is now ranked fourth in total tropical fruit production after bananas, oranges, and mango in the world. Global papaya production has grown significantly over the last few years, mainly as a result of increased production in India (Evans and Ballen, 2012). The global production of papaya is around 2890476 metric tones of which India contributes 43.7% (Indian Horticulture Database, 2014; FAOSTAT, 2015). Papaya has become an important agricultural export for developing countries, where export revenues of the fruit provide a livelihood for thousands of people, especially in India.

*Phytophthora palmivora* (E. J. Butler) E. J. Butler is an important plant pathogen with a wide host range, including some very important economic crops such as cacao, papaya, black pepper, rubber, coconut, and citrus (Erwin and Ribeiro, 1996; Drenth and Sendall, 2004; Hung et al., 2015). The center of origin is southeastern Asia (Huang et al., 1976; McHaw and Coffey, 1994). The causative organism was first identified as *Phytophthora palmivora* by Butler in 1917. The pathogen causes root rot, stem rot and fruit rot in papaya plant. Papayas are highly susceptible to *Phytophthora* root rot. The pathogen damage and kill roots, causing the eventual mortality of the entire plant, especially seedlings. Consequently in the present investigation was designed to assess the isolation and

identification of causative organism of root rot in papaya plant.

## II. MATERIALS AND METHODS

### A. Collection of root rot infected papaya root

Root rot disease affected papaya root (*C. papaya* L.) was collected from papaya field at Perumalagaram, Thiruvavur Dt. (Fig. 1 & 2).

### B. Isolation and Identification of *P. Palmivora* (Butl.)

The infected root of papaya plant was cut into small bits of about 2-3 mm. These were surface sterilized with 0.1% mercuric chloride ( $HgCl_2$ ) solutions for 60 seconds and washed separately in sterilized and distilled water for three times to remove the traces of mercury if any and then transferred to sterilized petriplates containing potato dextrose agar (PDA) medium (Potato - 200 gms, dextrose-20 gms, agar - 15 gms, distilled water -1000 ml, pH - 6.5) supplemented with one percent streptomycin sulphate solution for preventing bacterial growth.

The petriplates were incubated at room temperature ( $27\pm 2^\circ C$ ) for 3 - 5 days and observed periodically for the growth of pure colonies which developed from the root bits. The growth and sporulation of the fungus was observed under the microscope. The pure colonies which developed from the root bits were transferred to PDA slants.

### C. Identification of *P. palmivora* (Butl.)

Fungal morphology was studied macroscopically by observing colony features (Colour and texture) and microscopically by staining with lacto phenol cotton blue (LPCB). A portion of the growing edge of the colony was picked up with the help of a pair of needles and mounted on a clean slide with lactophenol cotton blue stain. The slide was gently heated in a spirit lamp so as to facilitate the staining and remove air bubbles, if any. The excess stain was removed with the help of tissue paper and then the cover slip was sealed with transparent nail polish. The slide was observed under Nikon microscope. Microphotography of the fungus was also taken using Nikon phase contrast microscope (Nikon, Japan). Identification and characterization of the pathogen were made with the help of authentic manuals of fungi namely, A Manual of Soil fungi (Gillman, 1957) and Fungi in agricultural Soils (Domsch and Gams, 1972).

## III. RESULTS

### A. Isolation of *P. Palmivora* (Butl.) Causative Agent of Root Rot Disease

The fungal organism was isolated from infected root of papaya plant using PDA medium and identified as *P.*

palmivora (Butl.) based on the macroscopic and microscopic features (Fig 3 & 4). *P. palmivora* has four types of spores that may directly or indirectly cause infection: sporangia, zoospores, oospores, and chlamydospores.

**B. Scientific Classification of *P. Palmivora* (Butl.)**

- Class : Oomycetes
- Order : Peronosporales
- Family : Pythiaceae
- Genus : Phytophthora
- Species : palmivora
- Synonymy : *Pythium palmivorum* E.J. Butler,

**C. Macroscopic Observation of *P. Palmivora* (Butl.)**

Colony morphology on PDA medium is a stellate pattern with aerial mycelium; hyphae are coralloid. Growth occurs over the temperature range of 11° to 35 °C; optimal temperature for growth is 27° to 30° C.

**D. Microscopic Observation of *P. Palmivora* (Butl.)**

Hyphae fairly uniform, 5 µm diam. Chlamydospores often abundant and formed early, 30-35 µm diam. Sporangiohores narrow, developing as well defined, simple sympodia. Sporangia formed readily on solid media, ellipsoid or ovoid, 35-60 x 20-40 µm or up to 90 x 45 µm, caducous, pedicel short (up to 5 µm long), broad and occluded papilla prominent. Oospores nearly filling the oogonium, wall 2 µm thick. Cultures uniform, slightly radiate, aerial mycelium sparse.



*P. palmivora* (Butl.) colonies on PDA medium  
Fig. 3: Macroscopic view of *P. palmivora* (Butl.)



LPCB mount (40 x)

Fig. 4: Microscopic view of *P. palmivora* (Butl.)



Fig. 1: Root rot disease infected papaya plant

Figure 1. Study site and root rot disease affected papaya plant at Perumalagaram, Thiruvarur Dt.



Fig. 2: Collection of infected root at papaya field

#### IV. DISCUSSION

*P. palmivora* (Butl.) has a wide host range of over a thousand plant species, including ornamental plants as well as horticultural and agricultural crops. In the present investigation, the fungal species isolated from root rot affected Papaya plant using PDA medium. The fungal species was identified as *P. palmivora* (Butl.) by its macroscopic and microscopic features. In the same way, Hung et al. (2015) identified *P. palmivora* (Butl.) from root rot symptoms of *Citrus maxima* in Thailand. Serious root rot disease of citrus caused by *P. palmivora* has been recorded in India (Graham and Timmer, 1992), America (Zitko et al., 1991; Naqvi, 2004).

Recently, Türkölmez et al. (2015a) reported forty-nine *Phytophthora* isolates were obtained from roots and crown of apricot trees with symptoms of decline grown in commercial orchards in Malatya, Elazığ and Diyarbakır provinces, Turkey, in 2011 and 2013. All of the recovered isolates were identified as *Phytophthora palmivora* on the basis of morphological characteristics. Türkölmez et al. (2015b) also reported *Phytophthora* crown and root rot of cherry caused by *Phytophthora palmivora* in eastern Turkey. The present study demonstrated that *P. palmivora* (Butl.) is the causative organism of the root rot disease found on Papaya tree.

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