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Studies on Post-Harvest Fungal Pathogens of Papaya Fruits (*Carica papaya* L.)

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A B S T R A C T

Present investigation focusing on the post-harvest fungal pathogens, fungal diseases and economic losses of papaya fruits (*Carica papaya* L.). Matured, ripened and infected fruits of papaya were subjected to isolation of their associated fungal pathogens. Fruit bating method was followed for isolation of fungi from infected papaya fruits. Total 10 fungal genera and 12 species *viz*. *Aspergillus flavus*, *Alternaria alternata*, *Alternaria* sp., *Mucor mucedo*, *Rhizopus stolonifer*, *Fusarium thapsinum*, *Fusarium chlamydosporum*, *Helminthosporium cassiicola*, *Colletotrichum gloeosporioides*, *Penicillium chrysogenum*, *Psathyrella candolleana* and *Ascochyta graminicola* were reported as post-harvest fungal pathogens of papaya fruits.

Introduction

Papaya (*Carica papaya* L.) is cultivated in tropical and subtropical regions of all over the world (Baiyewu *et al.*, 2007). In India it is largely cultivated in Andhra Pradesh, Karnataka and Maharashtra. Due to its high nutritional values it is major and economically important fruit crop of India. It also widely used in pharmaceuticals, nutraceuticals, cosmetics and beverage industries (Aravind *et al.*, 2013). After harvesting, during storage and transportation these fruits are subjected to several biotic and abiotic stresses (Bhale, 2011), which plays a pivotal role in association of different pathogens and establishment of diseases over papaya fruits. Among these, the fungal pathogens causes several diseases to papaya fruits for example *Rhizopus* rot, *Aspergillus* rot, *Penicillium* rot (Sharma, 2015), *Fusarium* rot, *Alternaria* rot and *Anthracnose* (Singh *et al.*, 2012).

Fungal infection affected on quality and quantity of the fruits (Rathod and Chavan, 2012), which decreases the market value of fruits and ultimately hampers its economy (Singh *et al.*, 2012). Considering these things, present attempt has been emphasizing on study of post-harvest fungal pathogens, fungal

diseases, their incidence and economic loss of papaya fruits from Baramati area of Pune district of Maharashtra.

Materials and Methods

Matured, ripened and infected fruits of papaya were collected from local fruit markets of Baramati (Dist. Pune, Maharashtra, India) at an interval of one week during the study period December 2017 to January 2019. Fruits were brought to laboratory using sterilized polythene bags.

Fruit bating method was followed for isolation of fungi from infected papaya fruits. In which infected part of fruits were cut into small pieces and inoculated on Potato Dextrose Agar medium (6.5 pH) plates in aseptic conditions (Rahman *et al.*, 2008, Bhale, 2011 and Gadgile, 2017). These plates were incubated at room temperature for 7 days in fungal incubation chamber. During the incubation period the fungal growth was observed regularly and observations were noted.

After incubation period the photographs of plates were taken for comparative study of fungal colonies. Size, shape, structure, number and colour of colonies were also recorded. Isolated fungal colonies were used for preparation of slides. The slides were prepared by using cotton blue stain and lactophenol as a mounting medium. Slides were observed under light microscope and micro-photography was also done. Fungi were identified on the basis of morphological characters of spores and using standard literature. Ainsworth's (1973) classification was used for classification of isolated and identified fungi.

Results and Discussion

In the present study total 10 fungal genera and 12 species were noticed as the pathogenic fungi to papaya fruits. They were identified on the basis of morphological characters, spores structure and fruiting bodies. *Aspergillus flavus*, *Alternaria alternata*, *Alternaria* sp., *Mucor mucedo*, *Rhizopus stolonifer*, *Fusarium thapsinum* and *Fusarium chlamydosporum* were found frequently throughout the study. On the contrary *Helminthosporium cassiicola*, *Colletotrichum gloeosporioides*, *Penicillium chrysogenum*, *Psathyrella candolleana* and *Ascochyta graminicola* were reported uncommonly. The frequency of Deuteromycotina fungi were dominant (08) followed by Zygomycotina (02), Ascomycotina and Basidiomycotina (01) (Table 1).

During the investigation, majority fungi were found as pathogenic to papaya fruits. According to literature survey they causes soft rot (*Fusarium* and *Rhizopus*), fruit rot (*Aspergillus*), fruit spot (*Alternaria*), anthracnose and damping-off (*Colletotrichum*), blue mold rot (*Penicillium*) and brown spot (*Helminthosporium*) of papaya fruits (Nishijima, 1999). According to Gadgile (2017) *Aspergillus* rot, *Alternaria* rot and soft rot, *Anthracnose* and fusarial rot were reported as common fungal diseases of papaya fruits from Palam. Singh *et al.*, (2012) reported *Fusarium* sp., *Rhizopus* sp., *Aspergillus* sp., *Penicillium* sp., *Alternaria* sp. and *Colletotrichum* sp. were common and major post-harvest pathogens of papaya fruits from Gorakhpur city. In the present study we also found similar results. Prasad and Verma (1970) noticed that *Colletotrichum* sp. is the most common and major post-harvest fungal pathogen of papaya fruit from Bihar (Tasiwal, 2008).

Fungal infection negatively affected on the organic and inorganic constituents of fruits and ultimately the nutritional profile of fruits becomes hampering (Singh and Sharma, 2007). Jurandi and Angela (2011) have

noticed that, physical disorder of fruits due to unfavourable environmental factors and endogenous factors which decrease the quality and shelf life of papaya fruit. Physiological disorders are associate with biochemical changes in fruit ripening and host senescence such as host pH, sugar content and cell-wall components, fat, carbohydrate, protein and oxidation of wounded tissue quickly responses by the infecting fungus (Oliveira *et al.*, 2018).

Table.1 Isolated fungi from infected papaya fruits

Sr. No.	Name of Fungus	Sub-division
1	*Mucor mucedo*	Zygomycotina
2	*Rhizopus stolonifer*	Zygomycotina
3	*Ascochyta graminicola*	Ascomycotina
4	*Psathyrella candolleana*	Basidiomycotina
5	*Alternaria alternata*	Deuteromycotina
6	*Alternaria* sp.	Deuteromycotina
7	*Aspergillus flavus*	Deuteromycotina
8	*Colletotrichum gloeosporioides*	Deuteromycotina
9	*Fusarium thapsinum*	Deuteromycotina
10	*Fusarium chlamydosporum*	Deuteromycotina
11	*Helminthosporium cassiicola*	Deuteromycotina
12	*Penicillium chrysogenum*	Deuteromycotina

Rathod and Chavan (2012) studied the sugar, pectin acid, ascorbic acid, calcium and phosphorus content from infected papaya fruits and found decreasing trend compared to healthy fruits. *Rhizopus stolonifer*, *Aspergillus falavus*, *Penicillium digitatum*, *Fusarium moniliforme* were responsible for decreasing in mineral content of papaya fruits due to secretion of cell wall degrading enzyme and mycotoxin by fungal pathogens (Sawant and Gawai, 2011). Yakoby *et al.*, (2000) had reported that, *Colletotrichum gloeosporioides* was expressed when the pH was above 5.7 that decaying tissue of ripened fruit of papaya. On the contrary Dov Prusky and Amnon Lichter (2008) noted that, *Alternaria alternata* found above 6.0 pH, which was characteristic of decayed tissue in ripened papaya fruit.

Alkan and Fortes (2015) reported that 30% papaya fruits were unable to consumption due to post-harvest losses. Considering these things farmers are discourage from producing and marketing fresh fruits of papaya (Mulualem Azene *et al.*, 2014). Incidence of insect pest, mites, rodents or from handling, physical changes or biochemical changes or by contamination of mycotoxins and pesticide residues fruit gets qualitative and quantitative losses (Dov Prusky and Amnon Lichter, 2008).

Considering in to above discussion it is concluded that, farmers and fruit sellers should aware about the proper and scientific methods of harvesting, handling, storage and transportation of papaya fruits. Thus, shelf life of fruits can be increased and quality of fruits will be maintained.

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