

# Studies on Post-harvest Deterioration of Some Solanaceous Vegetables in Selected Markets in Jabalpur, Madhya Pradesh, India

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**Abstract:** Post harvest deterioration of Tomato (*Lycopersicon esculentum*), Potato (*Solanum tuberosum*), Brinjal (*Solanum melongena*) and Chilli (*Capsicum annum*) from three selected markets in Jabalpur, Madhya Pradesh were surveyed. Both healthy and diseased samples were collected from three different markets of Jabalpur. Six different fungal species *Geotrichum candidum*, *Aspergillus flavus*, *Rhizopus stolonifer*, *Mucor sp.*, *Penicillium digitatum*, and *Alternaria solani* caused deterioration of *Lycopersicon esculentum* while *Aspergillus niger*, *Aspergillus flavus*, *Fusarium oxysporum*, *Fusarium moniliforme*, and *Rhizopus stolonifer*, were found associated with *Solanum tuberosum*. *Alternaria solani*, *Aspergillus flavus*, *Fusarium oxysporum*, and *Cladosporium cladosporioides* were isolated from *Solanum melongena*. *Colletotrichum curvuli*, *Alternaria solani*, *Rhizopus stolonifer*, *Fusarium oxysporum* and *Aspergillus niger* were associated with deterioration of *Capsicum annum*. All fungi isolated from these vegetables were pathogenic and cause considerable losses in the markets and storage of these vegetables.

**Keywords:** *Lycopersicon esculentum*, *Solanum tuberosum*, *Solanum melongena*, *Capsicum annum*, Post-harvest deterioration, fungal species

## 1. Introduction

Post harvest vegetables generally provide necessary carbohydrates, vitamins, fats, minerals, and proteins in appropriate proportion to maintain growth and development. Post-harvest vegetables face a great threat to their existence. These include change in climatic conditions, rainfall, improper transportation, storage practices, marketing and fungal infection. Spoilage refers to change in the conditions of fruit vegetable in which these becomes less palatable and even toxic. These changes result in alteration in food material as well as change in smell, appearance or texture (Paul and Sainsbury, 1981). It has been reported that about 20- 25 % of the harvested fruits are lost via the activities of fungal pathogens during post harvest chain (Drobby 2006., Zhu., 2006).

Tomato (*Lycopersicon esculentum*) belongs to family solanaceae and is widely cultivated. Tomato ranked second to potato and first among processing crops. Tomato is cultivated as it is edible and is an important source of vitamin A,B,C and minerals (Anon., 2004). Diseases caused by fungal pathogens have been a great challenge to post harvest losses in agriculture, health as well as national economy.

Chilli (*Capsicum annum*) is an important crop on the basis of its high consumption for nutritional and economical basis to farmers. Capsicum suffers immense loss to farmers by microbial infection. Maximum losses are caused by fungi compared to that of bacteria and viruses.

Potato (*Solanum tuberosum*) popularly known as king of vegetables ranks fourth important crop of India after rice, wheat, maize. Due to lack of post harvest management glut situations rise every year and ultimately results in decline of the economy. Diseases cause immense loss to potatoes in different markets of Jabalpur. Injured tubers were found to

be easily affected by fungal diseases. Several *Fusarium sp.* easily affect tubers in Indian markets.

Brinjal (*Solanum melongena*) is an important vegetable of solanace family (Gill and Tomar, 1991). It is one of the most common vegetable grown throughout the country except at high altitudes. Fungal infection is one of the most limiting factors for accelerating yield potential of brinjal. The severity in any particular fungal disease depends on season and area in which vegetable is to be marketed. Rotting due to *Rhizopus stolonifer* has been reported by (Sharma and Sumbali 1993).

This study was done to investigate and document the fungi responsible for infection for spoilage of solanaceous vegetables from three selected markets of Jabalpur, Madhya Pradesh India.

## 2. Materials and Methods

Markets in Jabalpur, Madhya Pradesh: Sadar vegetable market, Fuwara vegetable market, and Ranital vegetable market were surveyed. Diseased solanaceous vegetables viz, Potato, Tomato, Brinjal and Capsicum were collected. All vegetables were inspected for infected area and were stored in clean polythene bags. All samples were brought to Mycological lab Department of Biological Science Rani Durgavati University Jabalpur Madhya Pradesh for further analysis.

### Isolation of Associated fungi

Infected vegetables were first washed with running tap water. An appropriate size of infected area was cut and then surface sterilized with 70% ethanol and rinsed it in distilled water. Infected sliced portions were plated on sterile Potato Dextrose Agar medium as per practical procedure and incubated at 26±1°C. Pure cultures were obtained by repeated sub culturing. Isolates were identified based on

cultural and microscopic characteristics compared with the aid of standard Mycological texts (Donsch *et al.*, 1980). Barnett and Hunter (1992).

### Pathogenicity Test

An incision was made with sterile scapel on each of the four fresh solanaceous vegetable fruit and infected with fungal isolates in each incision. The holes were then sealed with vaseline to prevent contamination and incubated at 26 °C for ten days. The fruits were arranged in batches of four in clean polythene bags. Transverse sections of these infected fruits were cut along the area of inoculation and converted to rot indices. Indexes used were of different measurements (Agrios, 2005) and (Trigiano *et al.*, 2004).

### 3. Results

*Aspergillus flavus*, *Mucor sp.*, *Fusarium oxysporum* were isolated from all of the four solanaceous fruits collected from Sadar vegetable market and Fuwara vegetable market Jabalpur respectively. Six different fungi were isolated from *Lycopersicon esculentum* and they were *Geotrichum candidum*, *Aspergillus flavus*, *Rhizopus stolonifer*, *Mucor sp.*, *Penicillium digitatum* and *Alternaria solani*.

From potato, *Aspergillus niger*, *Aspergillus flavus*, *Fusarium oxysporum*, *Fusarium moniliforme*, *Rhizopus* and *mucor sp.* were isolated. *Aspergillus* infection on *solanum tuberosum* were mostly found in Fuwara vegetable market Jabalpur. *Rhizopus stolonifer* and *mucor sp.*, were mostly isolated from samples collected from Sadar vegetable market and Ranital vegetable market Jabalpur. From brinjal and capsicum both *Alternaria solani* and *Aspergillus flavus*, were isolated from infected samples. *Colletotrichum curvuli*, *Fusarium oxysporum*, and *Rhizopus stolonifer* were also isolated from capsicum species. *Cladosporium cladosporioides* were not found in Sadar vegetable market and Ranital vegetable market but mostly found in Fuwara vegetable market Jabalpur.

Distribution of isolated fungi from *Lycopersicon esculentum* in different markets of Jabalpur Madhya Pardesh India

Organisms	Sadar Market	Fuwara Market	Ranital Market
<i>Geotrichum candidum</i> .	+	+	+
<i>Aspergillus flavus</i> .	+	+	+
<i>Mucor Sp.</i>	-	+	-
<i>Penicillium digitatum</i> .	+	-	+
<i>Alternaria solani</i> .	-	-	+

KEY: -Absent + Present

Distribution of isolated fungi from *Solanum tuberosum* in different markets of Jabalpur Madhya Pardesh India

Organisms	Sadar Market	Fuwara Market	Ranital Market
<i>Aspergillus niger</i>	-	+	+
<i>Aspergillus flavus</i>	-	+	-
<i>Fusarium moniliforme</i> .	+	+	+
<i>Fusarium oxysporum</i>	+	+	+
<i>Rhizopus stolonifer</i> .	+	-	+
<i>Mucor Sp.</i>	+	-	+

KEY: - Absent + Present

Distribution of isolated fungi from *capsicum annum* in different markets of Jabalpur, Madhya Pardesh India.

Organisms	Sadar Market	Fuwara Market	Ranital Market
<i>Colletotrichum curvuli</i> .	-	+	-
<i>Alternaria solani</i> .	+	+	+
<i>Rhizopus stolonifer</i> .	+	+	+
<i>Fusarium oxysporum</i> .	-	+	+
<i>Aspergillus flavus</i> .	+	+	+

KEY: - Absent + Present.

Distribution of isolated Fungi from *Solanum melongena* in different markets of Jabalpur Madhya pardesh India

Organisms	Sadar Market	Fuwara Market	Ranital Market
<i>Mucor sp.</i>	+	+	+
<i>Alternaria solani</i> .	-	+	-
<i>Aspergillus flavus</i> .	+	+	+
<i>Fusarium oxysporum</i> .	-	-	+
<i>Cladosporium cladosporioides</i> .	-	+	-
<i>Rhizopus stolonifer</i> .	+	+	-

Key : - Absent + Present.

### 4. Discussions

The vegetables namely *capsicum annum*, *Lycopersicon esculentum*, *Solanum melongena* and *Solanum tuberosum* are of high economic value. Many fungal infections have been affecting its production but most challengeable are the post-harvest infections. It has been reported (Booth 1974) that losses were due to physical, physiological or pathological factors or combination of three. *Fusarium oxysporum* were among the organisms implicated for causing huge losses to *solanum tuberosum*. In this study *Aspergillus flavus*, *Rhizopus stolonifer*, and *Mucor sp.*, were isolated from *solanum tuberosum* causing damage as well as losses to consumers. (Amadioha and Adisa 1993) reported that these organisms were responsible for tuber rot of potatoes. Brinjal fruits face great losses due to post harvest infection. *Rhizopus nigricans* causing soft rot act as a new pathogen but *Rhizopus stolonifer* have been reported already (Sharma and Sumbali, 1993). The injuries sustained during harvest and storage plays a great chance for growth of fungal infection. Symptoms shows variation upon climatic factors and storage practices. *Fusarium oxysporum* also causes huge losses to farmers from different markets in Jabalpur India. Other fungi associated with brinjal infection were *Mucor sp.*, *Alternaria solani*, *Aspergillus flavus*, and *Cladosporium cladosporioides*, *Fusarium oxysporum* and *Alternaria solani* causes maximum losses and were observed throughout the study. The result obtained from this study have indicated that Tomatoes are mostly contaminated by *Geotrichum candidum*. *Geotrichum candidum* is a causal source of sour rot in tomatoes. It is a major limiting factor of tomatoes in all fruit markets of Jabalpur India. *Geotrichum candidum* is most severe after wet harvest conditions. Abrupt rainfall and improper handling are mainly responsible for *Geotrichum infection* (Bartz, 2007; Bartz *et al.*, 2012). *Mucor sp.*, were of relatively minor importance as a post harvest as compared to other fungal infection in Jabalpur markets. In this work after *Geotrichum candidum*, *Aspergillus niger* and *Penicillium digitatum* are the most virulent pathogens. *Penicillium digitatum* appears greenish

blue on PDA plates while *Aspergillus niger* appears black on PDA plates.

In chilli warm, wet and humid conditions favours symptoms of *Colletotrichum curvuli*. Free moisture is suitable for infection. It shows brown and black lesions on infected regions. *Aspergillus niger* and *Aspergillus flavus* were mostly isolated from *Capsicum annum* and were huge pathogenic on pepper fruits (Balogun *et al.*, 2005). Pathogenicity test revealed that *Rhizopus stolonifer*, *Aspergillus flavus* and *Alternaria solani* were most virulent on *Capsicum annum*. *Alternaria alternata* gets less chance to enter via wounds or natural openings (Gomez K.A. and Gomez A.A. 1984).

## 5. Conclusion

The post-harvest losses mainly occur due to faulty methods of harvesting, threshing, cleaning, drying, storage, transportation, processing, packaging and distribution of agricultural commodities. High moisture content of vegetable fruit is a serious limiting factor in their preservation. Farmers who harvest these vegetable fruits should take necessary precautions in preventing contamination and also create an environment that would reduce the growth and multiplication of microorganisms. Establishment of cold storage units would help to reduce storage losses in vegetables.

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