



## FUNGAL DIVERSITY IN FRUITS

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**Abstract:**

The present work was carried out on fruits to study fungal diversity. The fruits were purchased and collected from Budhwar Bazar, Sakkardara Chauk, Nagpur and allowed to grow fungus on them. Among these collected 19 fruits those infected by fungus were identified as *Humicola* sp. (*Pyrus malus* L.); *Mucor* sp. (*Psidium guajava* L.); *Fusarium* sp. (*Carica papaya* L.); *Aspergillus niger* (*Punica granatum* L.); *Mucor* sp. (*Syzygium cumunii* (Linn.) Skeels); *Aspergillus* sp. (*Vitis vinifera* L.); *Aspergillus niger* (*Citrus lanatus* L.); *Aureobasidium* sp. (*Annona squamosa* L.); *Aspergillus flavus* (*Phoenix dactylifera* L.); *Aspergillus* sp. (*Aegle marmelos* (Linn.) Corr); *Fusarium* sp. (*Pyrus communis*); *Penicillium* sp. (*Cucumis melon* L.); *Aspergillus* sp. (*Emblica officinalis* Gaertn); *Mucor* sp. (*Cocos nucifera* L.); *Aspergillus* sp. (*Lumonia acidissima* Linn.); *Fusarium* sp. (*Citrus indica* L.); *Trichoderma* sp. (*Citrus reticulata* Syn L.); *Fusarium* sp. (*Carissa carandus* L.); *Aspergillus* sp. (*Manilkara zapota* L.) respectively. This shows that there is a great fungal diversity in fruits.

**Keywords:** Fungal diversity, fruits, Budhwar Bazar, Nagpur.

**Introduction:**

Fungi is the plural of the word fungus which is derived from the Latin word FUNGOUR which means to flourish. The fungi may be defined as non-green, nucleated thallophytes. However, mycologists have defined fungi more scientifically. According to Alexopoulos (1962), the fungi include nucleated spore bearing achlorophyllous organisms that generally reproduce and whose filamentous branched somatic structures are typically surrounded by cell walls containing cellulose or chitin or both. A more technical definition of fungi was later given by Bessey (1968) which says that fungi are chlorophyll-less non-vascular plants whose reproductive or vegetative structures do not permit them to be assigned to positions among recognized groups of higher plants or algae. Fungi grow in diverse habitats. Majority of fungi prefer to grow in darkness and dim light in most habitat (Vashishta and Sinha, 2002).

**Materials and Methods:**

The fruit samples were purchased and collected from Budhwar Bazar, Sakkardara Chowk, Nagpur and fruits were allowed to grow fungus on them. For the identification of fungi, temporary slides were prepared by using cotton blue prepared in lactophenol is used as staining material for staining fungi. The temporary slides were prepared by scrapping small fragments of infected portion and sealed with paraffin wax and observed under Olympus light microscope. On the basis of morphological and reproductive characters, fungi were identified. For this, standard literature was used and experts opinion was taken.

**Results and Discussions:**

The infected fruits were observed to study fungal diversity and on basis of characters

shown by different fungi, they were identified as follows. The observations, so observed are described in following paragraphs.

When fruits like Watermelon (*Citrullus lanatus* L.) and Pomegranate (*Punica granatum* L.) were collected along with the fungus, and when the fungus was observed under the microscope, it was found to be *Aspergillus niger*. While in Kavath (*Lumonia acidissima* Linn.); Bel (*Aegle marmelos* (Linn) Corr.); Awala (*Emblica officinnalis* Gaertn), it was found to be *Aspergillus spp.*

Similarly, when papaya (*Carica papaya* L.), pear (*Pyrus communis* L.) and Lemon (*Citrus indica* L.); Karvand (*Carissa carandas* L.), it was found to be *Fusarium spp.* In Datepalm (*Phoenix dactylifera* L.), it was found to be *Aspergillus flavus*.

In Apple (*Pyrus malus* L.), it was found to be *Humicola spp.* In Jambhul (*Syzygium cumunii* (Linn) Skeels), it was found to be *Mucor spp.* In Coconut (*Cocos nucifera* L.) it was found to be *Mucor spp.* In Guava (*Psidium guajava* L.), it was found to be *Mucor spp.* In Custard apple (*Annona squamosa* L.), it was found to be *Aureobasidium spp.*

In Muskmelon (*Cucumis melon* L.), it was found to be *Penicillium spp.* In Orange (*Citrus reticulata* L.), it was found to be *Trichoderma spp.* In Chikoo (*Manilkara zapota* L.), it was found to be *Aspergillus spp.* In Grape (*Vitis vinifera* L.), it was found to be *Aspergillus spp.*

Earlier studies indicate that some of the

pathogens have been reported from different parts of India, either on the same or other host. Study on pathogenic fungi of fruits and vegetables was carried out by Dandge (1998).

Shikha Agblor and Doug Waterer (2001) reported post harvest diseases in cabbage, caused by *Botrytis* and *Sclerotinia*. Chatage and Bhale (2010) reported *Alternaria pluriseptata* and *Geotrichum candidus* on ivy gourd (*Coccinia indica*).

Churde et al. (2011) reported *Alternaria alternata*, *Phoma nebulosa*, *Curvularia lunata*, *Colletotrichum capsic*, *Curvularia senegalensis*, *Fusarium equiseti* etc. on *Brassica oleracea var. capitata* L., *Spinacea oleracea* L., *Abelmoschus esculentus* L., *Capsicum annum* L., *Dolicus lablab* L., and *Solanum tuberosum* L. respectively.

Exposure and /or consumption of such infected vegetables may cause health hazards (Bauri 2007). Hence, there is a need to explore possibilities of their control to prevent loss of product and injuries to human health.

According to Tournas (2005) after harvest, vegetables are often spoiled by a wide variety of microorganisms including many bacterial and fungal species. Fungi commonly causing spoilage of fresh vegetables are *Botrytis cinerea*, various species of the genera *Alternaria*, *Aspergillus*, *Cladosporium*, *Colletotrichum*, *Phomopsis*, *Fusarium*, *Penicillium*, *Phoma*, *Phytophthora*, *Pythium* and *Rhizopus spp.* *Botrytis cinerea*, *Ceratocystis fimbriata*, *Rhizoctonia solani*, *Sclerotinia sclerotiorum* and some mildews. A few of this organism show a substrate preference whereas other such as *Botrytis cinerea*, *Colletotrichum*, *Alternaria*, *Caldosporium*, *Phytophthora* and *Rhizopus spp.* affect a wide variety of vegetables causing devastating losses.

According to Sekhon and Shivapuri (1971), a number of fungi were found associated with stored cauliflower, common bean and pea seeds, but only *Helminthosporium spp.* on cauliflower, *Fusarium sp.* on common bean and *Alternaria sp.* on pea were proved to be pathogenic.

According to Wiley (1994), fungi are the third group of microorganism that affect the quality of fruits and make them unpalatable. These organism can be divided further into several categories but mould and yeasts are of the greatest concern in foods. The fungi are capable of independent life. The moulds and yeast are much more tolerant of acidity and reduced moisture. Moulds and yeast are the fungi of primary concern in fruits. It is conceivable that almost any microorganism might be found on a given fruits in a specific circumstances.

When Ann et al. (2004) inoculated Litchi (*Litchi chinensis* (Gaertn). Sonn on PDA medium

at 8.32 °C, with optimum growth at 28 °C. They produced abundant conidia of *Colletotrichum gloeosporioides* on PDA plates at 24 °C.

Fungi responsible for the spoilage of some berry, namely pawpaw (*Carica papaya*), sweet orange (*Citrus sinensis*), banana (*Musa acuminata*), garden egg (*Solanum melongena*), Lemon (*Citrus limoni*), and tangelo (*Citrus tangelo*). Fungi isolated include the genera of *Aspergillus*, *Penicillium*, *Rhizopus*, *Articulopsora*, *Gonatobotryum*, *Varicosporium*, *Trichoderma*, *Blastomyces*, *Fusarium*, *Pleurothecium* and *Yeast*, *Saccharomyces* (Akinyele and Akinkunmi, 2012).

According to Akinyele and Akinkunmi (2012), the fungi found to be associated with the spoilage of pawpaw were *A.niger*, *A.fumigatus*, *A.inflata*, *G.apiculatum*, *V.elodea*, *P.italicum*; the fungi found to be associated with the spoilage of sweet orange were *A.niger*, *A.inflata*, *P.italicum*, *B.dermatitidis*, *T. vivide*, *S.cerevisiae*; the fungi grown on banana were *A.fumigatus*, *P.chrysogenum*, *F. oxysporum*; the fungi grown on garden egg were *A.flavus*, *R.stolonifer*; the fungi grown on lemon were *A.niger*, *A.flavus*, *P.italicum*, *T. viride*; the fungi grown on Tangelo were *P.recurvatum*, *B.dermatitidis*, *S.cerevisiae*.

According to Al-Hindi et al. (2011), the fungi grown on banana and grapes was *Fusarium oxysporum*, the fungi grown on Pokara and apricot was *Aspergillus japonicus*, fungi grown on orange was *Aspergillus oryzae*, fungi grown on lemon was *Aspergillus awamori*, fungi grown on tomato was *Aspergillus phoenicis*, fungi grown on peach was *Aspergillus tubingensis*, fungi grown on apple was *Aspergillus niger*, fungi grown on mango was *Aspergillus flavus*, fungi grown on kiwi was *Aspergillus foetidus*, fungi grown on date was *Rhizopus stolonifer*.

*A.niger* is a fungus commonly found on grapes (Chuze et al., 2006), apples (Oelofse et al., 2006) and tomatoes (Yildz and Baysal, 2006). Okereke et al. (2010) reported that the fungi spp. isolated from the infected mangoes were *A.niger*, *Alternaria sp.*, *Botrydiolodia theobromae* and *Colletotrichum gloeosporioides*.

*Fusarium equiseti*, *A.flavus* and *A.niger* grown on tomato fruits (Olaridan and Iwu, 1993). *A.flavus* and *A.fumigatus* grow on tomato (Adisa, 1993), peach and orange were infected by a no. of *Aspergillus spp.*, *A.niger*, *A. nidulans*, *A.variecolour*, *A.fumigatus*, *A.candidus* (Sinha, 1946).

It is reported that *Erysiphe cichoracearum* grow on cucumbers, endive, lettuce, melons, potato, pumpkin, squash.

*Erysiphe cruciferarum* grow on broccoli, Brussels sprouts, cauliflower and other cale crops; radicchio, radishes, turnips. *Erysiphe pisi* grow on peas. *Erysiphe heraclei* grow on carrots, parsley, parsnips. *Erysiphe polygoni* grow on beets. *Leveillula taurica* grow on artichoke, egg plant, peppers, tomatillo, tomatoes.

*Spharotheca fuliginea* grow on beans, black-eyed peas, cucurbits, okra (Powdery Mildew on Vegetables Management Guidelines-UCIPM, 2012). The fungi grown on Lettuce were *Alternaria sonchi* (*Alternaria* leaf spot), *Microrodochium ponattonianum* = *Marssinia panattonana* (Anthracnose), *Rhizyotomia solani/ Thanatephorus cucumeris* (telemorph) (Bottom rot), *Cercospora longissima* (*Cercospora leaf spot*), *Pythium* spp./ *Pythium ultimum* (Damping-off, *Pythium*), *Rhizoctonia solani* (Damping-off-Rhizoctonia), *Bremia lactucae* (Downy mildew), *Sclerotinia sclerotiorum* (Drop Sclerotinia rot), *Botrytis cinerea* (Gray mold), *Phymatotrichopsis omnivora* (*phymatotrichum* root rot), *Erysiphe cichoracearum* (Powdery mildew), *Puccinia dioicae* (Rust), *Septoria lactucae* (*Septoria* leaf spot), *Sclerotium rolfsii* (Southern blight), *Stemphylium botryosum* (*stemphylium* leaf spot), *Pythium tracheiphilum* (Wilt and leaf blight).

According to Morton (1987), the guava crop (mainly from wild trees) may be ruined by the uncontrollable fungus, *Glomerella cingulata*. 80% of the mature green fruits may be ruined by *Mucor hiemalis*. During rainy season, the fungus *Phytophthora parasitica* is responsible for much infectious fruit rot. *Botryodiplodia* spp., *Dothiorella* spp., *Macrophomina* spp. and

The infected fruits were observed for fungal diversity and identified as follows-

*Gladiolus roesum* grow on guava fruit. *Colletotrichum gloeosporioides* (Anthracnose) may attack the fruits in rainy season. *Pestalotia psidii* sometimes cause canker on green guavas.

It is reported that the fungi grown on strawberry were *Botrytis cinera*, *Phytophthora cactorum*, and *Colletotrichum ocutatum* (UCONN IPM Strawberry Diseases).

It is reported that the fungi grown on mango were *Fusarium mangiferae* (Britz et al., 2002); *Fusarium sterilihyphosum* (Marasas et al., 2006), *Fusarium pseudocircinatum*, *Fusarium mexicanum* (Otero-colina et al., 2012). Morsy et al. (2009) reported that *Fusarium oxysporum*, *Fusarium solani*, *Sclerotium rolfsii*, *Rhizoctonia solani*, *Macrophomina phaseolina* cause damping-off to cucumber.

Different workers have reported various fungi from mango viz., *Colletotrichum gloeosporioides* (Rawal, 1998; Savant and Raut, 2000; Ploetz et al., 1996; Sharma, 1993), *P. mangiferae*, *Phoma* spp. and *Fusarium solani* (Sharma, 1993; Sarvottam et al., 2009), as a cause of decline in quality of mango. *P. mangiferae* (Henn), *Steyaet* (Synonym *Pestalotia mangiferae* Henn) causes grey blight of leaves (Verma et al., 1991), grey leaf spots, stem end rots, brown spots or rots of mango fruits (Mordue, 1980).

Babu et al., (2008) reported that *Fusarium wilt* on brinjal crop is due to the species *Fusarium solani*. Waller (1992) proposed that *Colletotrichum musae* (Berk and Curt) causes anthracnose in banana fruit and is confined to mature fruits.

**Table 3:-** Fungi identified on fruits of Bhadrawati and Warora Market.

Sr.No.	Name of fruits	Fungus identified on fruits
1	<i>Pyrus malus</i> L.	<i>Humicola</i> spp.
2	<i>Psidium guajava</i> L.	<i>Mucor</i> spp.
3	<i>Carica papaya</i> L.	<i>Fusarium</i> spp.
4	<i>Punica granatum</i> L.	<i>Aspergillus niger</i>
5	<i>Syzygium cumunii</i> (Linn.) Skeels	<i>Mucor</i> spp.
6	<i>Vitis vinifera</i> L.	<i>Aspergillus</i> spp.
7	<i>Citrullus lanatus</i> L.	<i>Aspergillus niger</i>
8	<i>Annona squamosa</i> L.	<i>Aureobasidium</i> spp.
9	<i>Phoenix dactylifera</i> L.	<i>Aspergillus flavus</i>
10	<i>Aegle marmolos</i> (Linn) Corr.	<i>Aspergillus</i> spp.
11	<i>Pyrus communis</i> L.	<i>Fusarium</i> spp.
12	<i>Cucumis melon</i> L.	<i>Penicillium</i> spp.
13	<i>Emblica officinalis</i> Garetn	<i>Aspergillus</i> spp.
14	<i>Cocos nucifera</i> L.	<i>Mucor</i> spp.
15	<i>Limonia acidissima</i> Linn	<i>Aspergillus</i> spp.
16	<i>Citrus indica</i> L.	<i>Fusarium</i> spp.
17	<i>Citrus reticulata</i> Syn. L.	<i>Trichoderma</i> spp.
18	<i>Carissa carandas</i> L.	<i>Fusarium</i> spp.
19	<i>Manilkara zapota</i> L.	<i>Aspergillus</i> spp.

### Conclusion:

It is concluded that there is a great fungal diversity in fruits. *Aspergillus* sp., and *Mucor* sp., was found to be dominant on fruits. Hence, there is a need to explore possibilities of their control to prevent loss of product and injuries to human health.

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