



Short communication

Incidence of post-harvest fungal pathogens in guava and banana in Allahabad

Renu Srivastava and Abhilasha A. Lal

Department of Plant Protection
Allahabad Agricultural Institute – Deemed University
Allahabad-211007, India
E-mail: Renu1srivastava@rediffmail.co.in

ABSTRACT

A survey was conducted to study incidence of pathogens associated with post-harvest losses in fruits in produce from fruit markets of Allahabad. *Rhizopus stolonifer* (20.76%) was a major post-harvest pathogen isolated from the samples, followed by *Pestalotia psidii* (18.46%), *Alternaria sp.* (17.69%), *Penicillium expansum* (11.53%), *Colletotrichum gloeosporioides* (10.76%), *Aspergillus niger* (9.23%), *Tricothecium sp* (8.46%), and *Cladosporium sp.* (4%) in Guava, and, *Fusarium sp.* (28.3%), *Curvularia* (23.39%), *Colletotrichum musae* (16.6%), *Tricothecium sp* (11.6%), *Penicillium* (10.8%), *Alternaria* (5%) and *Rhizopus* (4%) in banana fruit samples.

Key words: Banana, guava, incidence, post- harvest losses

India ranks second in production and area under banana (after mango) over an acreage of 600.3 million hectares and annual production of 20857.8 tonnes. In Uttar Pradesh, the acreage is 1.6 million hectares and annual production is 57.1 million tonnes. Similarly, guava (*Psidium guajava* L.) is an important fruit crop and ranks fourth in area and production after mango, banana and citrus. Its acreage is 178.7 million hectares and annual production is 1856 million tonnes in India. In Uttar Pradesh, its acreage is 15.8 million hectares and annual production is 162.8 million tonnes (National Horticulture Board, 2008). Post harvest diseases of guava and banana presents a peculiar problem. There is colossal wastage with our poor marketing and transit facilities. The most important causal agents responsible for post harvest diseases of guava and banana are fungi. These microorganisms attack fruits and cause considerable damage during transit, storage and final transportation to the market. Around 90-100% fruits have been found to be infected with fungi, namely, *Pestalotia psidii*, *Colletotrichum gloeosporioides*, *Rhizopus stolonifer* and *Aspergillus niger*, during storage (Chaube and Pundhir, 2005).

One hundred thirty and 120 diseased guava and banana fruit samples were collected during summer season and rainy season from 13 and 12 different fruit markets, respectively of Allahabad (Table 1 and 2). Fungal pathogens were isolated from infected guava and banana fruits and

stored at ambient temperature ranging between 33–37± 2°C with 98% RH. Diseased portions of the fruit surface were cut into small pieces (2-3 mm) and surface-sterilized with 0.1% mercuric chloride solution for 30 seconds. These pieces were then washed thrice with sterilized distilled water and aseptically transferred into clear, sterilized petri dishes (6mm dia) containing 85ml solidified potato dextrose agar medium. The petri dishes were incubated in an inverted position at 28°C for 4-5 days (Aneja, 2004). Pathogenicity of the cultures was tested on healthy, uninjured fruits of uniform size. Fruits were surface-sterilized with 0.1% mercuric chloride solution. Wounds were made in the fruit with the help of a sterilized cork-borer (0.2 to 0.5 cm). These wounds were inoculated with pathogen-containing spore load (1x10⁴ conidia / ml) as described by He *et al* (2003). The inoculated fruits were wrapped in sterilized paper and incubated at 28°C and observations were made for development of rot upto 10 days.

Frequency (%) was calculated as per by Singh (2002) :

$$\text{Frequency \%} = \frac{\text{Number of fruit samples infected with certain pathogens}}{\text{Total no. of fruit samples brought from certain fruit market}} \times 100$$

Table 1. Incidence of fungal pathogens associated with post-harvest diseases of guava in fruit markets of Allahabad

Sl. No.	Location	Pathogen isolated	No. of samples tested	Frequency (%)
1.	Naini	<i>Rhizopus stolonifer</i>	3	20
		<i>Pestalotia psidii</i>	3	10
		<i>Aspergillus niger</i>	1	30
		<i>Alternaria sp.</i>	2	30
		<i>Trichothecium</i>	1	10
2.	Chowk	<i>Rhizopus stolonifer</i>	3	30
		<i>Pestalotia psidii</i>	3	30
		<i>Alternaria sp.</i>	1	10
		<i>Aspergillus niger</i>	3	30
3.	Medical Chauraha	<i>Rhizopus stolonifer</i>	2	20
		<i>Penicillium expansum</i>	1	10
		<i>Alternaria sp.</i>	2	20
		<i>Pestalotia psidii</i>	2	20
		<i>Trichothecium sp.</i>	2	20
		<i>Cladosporium sp.</i>	1	10
4.	Mundara Mandi	<i>Rhizopus stolonifer</i>	2	20
		<i>Colletotrichum gloeosporioides</i>	1	10
		<i>Pestalotia psidii</i>	3	30
		<i>Alternaria sp.</i>	2	20
		<i>Penicillium expansum</i>	2	20
5.	Gaughat	<i>Rhizopus stolonifer</i>	3	30
		<i>Colletotrichum gloeosporioides</i>	2	20
		<i>Alternaria sp.</i>	2	20
		<i>Pestalotia psidii</i>	3	30
6.	Mahewa East	<i>Rhizopus stolonifer</i>	3	30
		<i>Alternaria sp.</i>	3	30
		<i>Penicillium expansum</i>	2	20
		<i>Trichothecium sp.</i>	2	20
7.	Katra	<i>Rhizopus stolonifer</i>	2	20
		<i>Alternaria sp.</i>	1	10
		<i>Pestalotia psidii</i>	2	20
		<i>Colletotrichum gloeosporioides</i>	1	10
		<i>Penicillium expansum</i>	2	20
		<i>Aspergillus niger</i>	2	20
8.	Civil Lines	<i>Trichothecium sp.</i>	2	20
		<i>Aspergillus niger</i>	2	20
		<i>Pestalotia psidii</i>	2	20
		<i>Alternaria sp.</i>	1	10
		<i>Colletotrichum gloeosporioides</i>	3	30
9.	Baluaghat	<i>Alternaria sp.</i>	3	30
		<i>Aspergillus niger</i>	2	20
		<i>Pestalotia psidii</i>	1	10
		<i>Colletotrichum gloeosporioides</i>	2	20
		<i>Trichothecium sp.</i>	2	20
10.	Teliarganj	<i>Penicillium expansum</i>	2	20
		<i>Rhizopus stolonifer</i>	2	20
		<i>Alternaria sp.</i>	2	20
		<i>Colletotrichum gloeosporioides</i>	2	20
		<i>Pestalotia psidii</i>	2	20

post-harvest fungal pathogens in guava and banana

Table 1. Continued

Sl. No.	Location	Pathogen isolated	No. of Samples tested	Frequency (%)
11.	Jhunsi	<i>Aspergillus niger</i>	2	20
		<i>Trichothecium sp.</i>	1	10
		<i>Pestalotia psidii</i>	2	20
		<i>Trichothecium sp.</i>	1	10
		<i>Alternaria sp.</i>	2	20
		<i>Colletotrichum gloeosporioides</i>	2	20
12.	Muthiganj	<i>Rhizopus stolonifer</i>	2	20
		<i>Penicillium expansum</i>	1	10
		<i>Pestalotia psidii</i>	2	20
		<i>Trichothecium sp.</i>	1	10
		<i>Alternaria sp.</i>	2	20
		<i>Colletotrichum gloeosporioides</i>	2	20
13.	Zero Road	<i>Rhizopus stolonifer</i>	2	20
		<i>Alternaria sp.</i>	2	20
		<i>Pestalotia psidii</i>	1	10
		<i>Aspergillus niger</i>	3	30
		<i>Penicillium expansum</i>	2	20

Ten diseased guava fruit samples were collected from each location

Table 2. Overall incidence of fungal pathogens associated with post-harvest diseases of guava in Allahabad

Sl. No.	Pathogen isolated	Post-harvest disease	No. of fruit infected	Frequency (%)
1.	<i>Rhizopus stolonifer</i>	Soft watery rot	27	20.76
2.	<i>Pestalotia psidii</i>	Fruit canker	24	18.46
3.	<i>Alternaria sp.</i>	Fruit rot	23	17.69
4.	<i>Penicillium expansum</i>	Penicillium rot	15	11.53
5.	<i>Colletotrichum gloeosporioides</i>	Anthraxnose	14	10.76
6.	<i>Aspergillus niger</i>	Aspergillus rot	12	9.23
7.	<i>Trichothecium sp.</i>	Trichothecium rot	11	8.46
8.	<i>Cladosporium</i>	Fruit rot	5	4.00

Fungal pathogens isolated from fruits were identified as *Pestalotia psidii*, *Rhizopus stolonifer*, *Aspergillus niger*, *Penicillium expansum*, *Trichothecium spp.*, *Fusarium sp.*, *Colletotrichum sp.* and *Alternaria sp.* From the pathogenicity tests it was confirmed that canker was caused by *Pestalotia psidii*, soft rot caused by *Rhizopus stolonifer*, fruit rot caused by *Alternaria sp.* and anthracnose by *Colletotrichum sp.* in guava. Incidence of various diseases in different fruit markets on guava is presented in Table 1. Maximum disease incidence (30%) in guava was found in Naini, Chowk, Mundara Mandi, Gaught, Mahewa East, Mahewa west, Civil Lines, Baluaghat and Zero Road, followed by 20% incidence in Medical Chouraha, Teliarganj, Jhunsi, Mutthiganj and Katra. *Rhizopus stolonifer* was isolated from guava collected from all the fruit markets surveyed in Allahabad. Mean incidence

of post harvest fungal pathogens associated with guava fruits in Allahabad was 18.4%. *Rhizopus stolonifer* was the dominant disease followed by *Pestalotia psidii*, *Alternaria sp.*, *Penicillium expansum*, *Colletotrichum gloeosporioides*, *Aspergillus niger*, *Trichothecium sp.* and *Cladosporium sp.* (Table 2).

Incidence of various diseases from different fruit markets in banana are presented in Table 3. Maximum disease incidence of *Fusarium sp.* (36%) was found in Zero Road, Gaught, Naini East, Mahewa West, Jhunsi, Mundara Mandi, Naini West, Chowk, Civil lines, Katra and Medical Chouraha followed by *Curvularia sp.* (24 – 36%) in Zero Road, Teliarganj, Gaught, Naini East, Mahewa west, Jhunsi, Mundara Mandi, Naini west, Chowk, Civil Lines, Katra and Medical Chouraha. *Colletotrichum sp.* and *Penicillium sp.* were found to be the next most serious post harvest diseases on banana in Allahabad. Mean incidence of post harvest fungal pathogen associated with banana fruits in Allahabad was 17.1. Thus, *Fusarium sp.* was the major post-harvest pathogen isolated, followed by *Curvularia sp.*, *Colletotrichum musae*, *Trichothecium sp.*, *Penicillium sp.* and *Alternaria sp.* (Table 4).

Factors such as inoculum density, presence and concentration of microbiotic components on fruit surface, physiological state of the fruit and interaction of these factors with temperature and relative humidity may influence the incidence of fruit rot in Allahabad. Similiar findings have been reported by Majumdar and Pathak (1989) from Jaipur. Incidence of *Pestalotia psidii* in guava and

Table 3. Incidence of fungal pathogens associated with post-harvest diseases of banana in fruit markets of Allahabad

Location	Pathogen isolated	No. of samples tested	Frequency
Zero Road	<i>Fusarium sp.</i>	3	36%
	<i>Colletotrichum musae</i>	2	24%
	<i>Curvularia sp.</i>	3	36%
	<i>Alternaria alternata</i>	1	12%
	<i>Trichothecium sp.</i>	1	12%
Teliarganj	<i>Fusarium sp.</i>	2	24%
	<i>Curvularia sp.</i>	2	24%
	<i>Trichothecium sp.</i>	2	24%
	<i>Rhizopus sp.</i>	2	24%
	<i>Alternaria alternata</i>	2	24%
Gaughat	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia sp.</i>	2	24%
	<i>Alternaria alternata</i>	1	12%
	<i>Trichothecium sp.</i>	1	12%
	<i>Penicillium sp.</i>	2	24%
	<i>Colletotrichum</i>	1	12%
Naini East	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia sp.</i>	1	12%
	<i>Trichothecium sp.</i>	1	12%
	<i>Penicillium sp.</i>	1	12%
	<i>Alternaria</i>	2	24%
	<i>Colletotrichum</i>	1	12%
Mahewa West	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	2	24%
	<i>Trichothecium</i>	1	12%
	<i>Penicillium</i>	1	12%
	<i>Colletotrichum</i>	2	24%
	<i>Rhizopus sp.</i>	1	12%
Jhunsi	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	2	24%
	<i>Penicillium</i>	1	12%
	<i>Rhizopus sp.</i>	1	12%
	<i>Colletotrichum</i>	2	24%
	<i>Trichothecium</i>	1	12%
Mundara Mandi	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	2	24%
	<i>Penicillium</i>	2	24%
	<i>Colletotrichum</i>	2	24%
Naini West	<i>Trichothecium</i>	1	12%
	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	2	24%
	<i>Penicillium</i>	2	24%
	<i>Trichothecium</i>	1	12%
	<i>Colletotrichum</i>	2	24%
Chowk	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	3	36%
	<i>Penicillium</i>	1	12%
	<i>Trichothecium</i>	1	12%
	<i>Colletotrichum</i>	2	24%
Civil Lines	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	3	36%
	<i>Trichothecium</i>	1	12%
	<i>Colletotrichum</i>	2	24%
	<i>Penicillium</i>	1	12%

Table 3. Continued

Location	Pathogen isolated	No. of samples tested	Frequency
Katra	<i>Fusarium sp.</i>	3	36%
	<i>Curvularia</i>	3	36%
	<i>Trichothecium</i>	1	12%
	<i>Colletotrichum</i>	2	24%
	<i>Penicillium</i>	1	12%
Medical Chauraha	<i>Fusarium sp.</i>	2	24%
	<i>Curvularia</i>	3	36%
	<i>Colletotrichum</i>	2	24%
	<i>Trichothecium</i>	2	24%
	<i>Penicillium</i>	1	12%

Ten diseased banana fruit samples were collected from each location; 120 samples from 12 fruit market

Table 4. Overall incidence of fungal pathogens associated with post-harvest diseases of banana in Allahabad

S. No.	Pathogen isolated	Post-harvest disease	No. of fruits tested	Frequency
1.	<i>Fusarium sp.</i>	Fruit rot	34	28.3%
2.	<i>Curvularia sp.</i>	Fruit rot	28	23.3%
3.	<i>Colletotrichum musae</i>	Crown rot	20	16.6%
4.	<i>Trichothecium sp.</i>	Fruit rot	14	11.6%
5.	<i>Penicillium expansum</i>	Penicillium rot	13	10.8%
6.	<i>Alternaria alternata</i>	Alternaria rot	6	5.0%
7.	<i>Rhizopus sp.</i>	Fruit rot	5	4.0%

Fusarium sp. in banana was found to be maximum. Therefore, in future, an intensive survey of the guava and banana growing area of Allahabad should be carried out as these are important fruit of this district. Information obtained from this study can be effectively utilized to develop suitable post-harvest management practices to increase the shelf-life of guava and banana.

References

- Aneja, K.R. 2004. Experiments in Microbiology, Plant Pathology and Biotechnology (Fourth edition). New Age International (P) Ltd., Publishers, New Delhi, pp. 437-450
- Chaube, H.S. and Pundhir, V.S. 2005. Crop diseases and their management. *Prentice Hall of India Pvt. Ltd., New Delhi*. India, pp. 641-642
- He, D., Zhang, X., Yin, Y. Sun, P., and Zhang, H. 2003. Yeast application controlling apple post-harvest disease associated with *Penicillium expansum*. *Bot. Bull. Acad. Sin.*, **44**:211-216
- Majumdar, V. L. and Pathak, V.N. 1989. Incidence of major post-harvest diseases of guava fruits in Jaipur markets. *Indian Phytopath.*, **42**:469-470
- National Horticulture Board, 2008. The production and productivity of fruits. Database, pp.1-4
- Singh, R.S. 2002. Introduction to principles of plant pathology. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, (IV edition), pp. 290

(MS Received 13 October 2008, Revised 12 February 2009)