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A Survey: Occurrence of Post Harvest Rots of Aonla with New Reported Pathogen (*Penicillium funiculosum* Thom.)

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Abstract: The weekly survey carried out from first week of October to fourth week of January, 2008-09, revealed that the maximum disease incidence of *Penicillium* rot was observed to the tune of 4.93, 4.35 and 2.89% at Vegetable Market, Juni Shak Market, Station Road, Anand and Horticulture Farm Shop, A.A.U., Anand, respectively. The disease incidence of various rots (*Penicillium*, *Alternaria*, *Colletotrichum*, *Aspergillus*, *Phomopsis* and other rots) were found maximum at Vegetable Market and Juni Shak Market, Anand than the Horticulture Farm Shop, Anand. The pure culture was obtained from surveyed of aonla fruit and sent for identification to Indian Type Culture Collection (I.T.C.C.), Division of Mycology and Plant Pathology, I.A.R.I., New Delhi and was identified as a new recorded the *Penicillium funiculosum* (ITCC: 7046.08).

Key words: Aonla, *penicillium*, occurrence, pathology, fungal rot

INTRODUCTION

The Aonla (*Emblica officinalis* Gaertn., Syn. *Phyllanthus emblica* L.) is one of the oldest and important arid fruit crop, belonging to family: Euphorbiaceae, sub-family Phyllanthoideae (Firminger, 1947). It is becoming one of the most important non traditional fruits of Indian origin having immense potentiality for cultivation on wasteland. In India, the area under aonla cultivation is about 50,000 hectares in different states like Uttar Pradesh, Madhya Pradesh, Gujarat, Rajasthan etc. with an annual of production of 2,00,000 metric tonnes (Goyal *et al.*, 2008). Aonla fruit have different nutrients i.e., carbohydrates, proteins, calcium, phosphorus, zinc, vitamin C and B. It is a rich source of vitamin C ranging 400-1300 mg/100 g pulp and vitamin B 300 mg/100 g pulp (Singh, 2006). In India 20-25% of perishables fruits are lost due to post harvest rots (Sharma and Mashkoo Alam, 1998). The post harvest losses are reported that around 35% of produce is lost in storage and transits (Rawal and Saxena, 2005). Aonla fruits are perishable in nature. During harvest, transit and storage, fruits are subjected to minor injuries/wounds resulting in an early and easy invasion by several fungi to cause the post harvest decay. The retailers as

well as wholesalers have to bear losses from the post-harvest rots which ultimately reduce the market value.

MATERIALS AND METHODS

Survey of fruit rots of aonla in Horticulture orchard, AAU; Vegetable Market, Station Road and Juni Shak Market, Anand. To study the incidence of fungal rots, a weekly survey was carried out at all the locations from first week of October to fourth week of January during 2008-2009. Five samples were selected randomly each containing 100 fruits from all the locations and were examined for the incidence of fungal rots caused due to different pathogens. The percent fruit rot incidence was calculated by following standard formula:

$$\text{Disease incidence (\%)} = \frac{\text{No. of infected fruits}}{\text{Total No. of fruits examined}} \times 100$$

Identification of the pathogen was carried out by studying the cultural and morphological characters. The microphotographs of mycelium and spore structure were taken with the help of digital camera. The pure culture was sent to Indian Type Culture Collection (I.T.C.C.), Division of Mycology and Plant Pathology, I.A.R.I., New Delhi-110 012 for identification.

RESULTS AND DISCUSSION

The pure culture was obtained from surveyed of aonla fruit and sent for identification to Indian Type Culture Collection (I.T.C.C.), Division of Mycology and Plant Pathology, I.A.R.I., New Delhi and was identified as *Penicillium funiculosum* (ITCC: 7046.08). The weekly survey carried out from first week of October to fourth week of January (2008-09), revealed the presence of *Penicillium*, *Colletotrichum*, *Alternaria*, *Phomopsis*, *Aspergillus*, Internal necrosis (Boron deficiency) and other fruit rots (*Cladosporium* and Phoma) at Horticulture orchard, A.A.U., Anand, Vegetable Market, Station Road and Juni Shak Market, Anand.

The data presented in Table 1 indicated that at Vegetable Market, Station Road, Anand, incidence of *Penicillium* rot was predominant (4.93%) followed by *Aspergillus* rot (4.40%). The incidence of *Alternaria*, *Colletotrichum*, *Phomopsis*, other fruit rots and internal necrosis were 2.73, 2.56, 2.55, 2.31 and 1.56%, respectively. The highest incidence of *Penicillium* (11.00%) and *Phomopsis* rots (6.40%) were recorded in 4th week of December, while maximum incidence of *Aspergillus* (11.00%), *Colletotrichum* (6.20%) and *Alternaria* rots (6.00%) were recorded in 2nd week of January.

The data presented in Table 2 revealed that during 2008-09 at Juni Shak Market, Anand, maximum incidence of *Penicillium* rot (4.35%) was observed, followed by *Aspergillus* (3.89%) and *Colletotrichum* rots (2.41%). The incidence of *Alternaria*, *Phomopsis*, Internal necrosis and other fruit rots were 2.17, 1.72, 1.24 and 2.03%, respectively. The highest incidence of *Penicillium* (11.30%), *Colletotrichum* (6.5%), *Alternaria* (5.30%) and *Phomopsis* rots (4.50%) were recorded in 4th week of December, while *Aspergillus* (10.50%) and internal necrosis (2.5%) rots were recorded in 1st week of January.

The data presented in Table 3 revealed that during 2008-09 at Horticulture Farm Shop, A.A.U., Anand, highest incidence of *Penicillium* rot (2.89%) was observed followed by *Aspergillus* (2.73%) and *Colletotrichum* rots (2.35%). The incidence of *Alternaria*, *Phomopsis*, Internal necrosis and other fruit rots were 2.10, 1.51, 0.90 and 1.32%, respectively. The highest incidence of *Penicillium* (6.20%) and *Colletotrichum* rots (4.60%) were observed in 4th week of December, while maximum incidence of *Aspergillus* (6.00%) and *Alternaria* rots (4.20%) were recorded in 1st week of January and *Phomopsis* rot (3.40%) was recorded in 2nd week of January.

Disease incidence of various rots were found maximum at Vegetable Market, Station Road, Anand followed by Juni Shak Market, Anand and minimum disease incidence of the rots were observed at Horticulture Farm Shop, Anand. Thus, at all the locations *Penicillium* rot was found predominant over all other rots. The incidence of different fruit rots found more in the markets rather than Horticulture Farm Shop. The major reason behind this is the fruits are injured during picking, packaging and transportation, which make major avenues for infection by the various pathogens.

Rathod and Patel (2004) surveyed the occurrence of post harvest diseases of aonla fruits (Gujarat Aonla-1) at Juni Shak Market, Anand and Horticulture Farm Shop, Anand, during 2002-03 and 2003-04 and revealed the presence of five rots i.e., *Penicillium* (5.39 and 3.17%), *Colletotrichum* (3.25 and 2.21%), *Alternaria* (2.63 and 1.58%), *Aspergillus* (1.65 and 0.84%) and *Cladosporium* rots (0.85 and 0.69%), respectively. Further Choubey (2007) carried out survey on incidence of post harvest diseases of aonla fruits (Gujarat Aonla-1) at Super Market Station Road, Anand and Horticulture Farm Shop, Anand, during 2006-07, he noted the presence of five rots i.e., *Penicillium* (5.92 and 2.9%), *Colletotrichum*

Table 1: Incidence of aonla fruit rots at vegetable Market, Station Road, Anand

Fruit rots	Average percent disease incidence																Meant(%)
	October				November				December				January				
	Week				Week				Week				Week				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
<i>Penicillium</i>	0.40	0.7	0.80	1.2	1.7	2.00	2.20	3.5	5.20	6.30	8.5	11.00	9.80	10.20	8.4	7.0	4.93
<i>Colletotrichum</i>	0.20	0.2	0.40	0.5	0.8	1.10	1.20	2.0	2.40	2.50	3.2	5.50	5.20	6.20	4.5	3.0	2.56
<i>Alternaria</i>	0.40	0.5	0.80	1.2	1.5	1.50	1.70	2.5	2.80	3.20	4.5	5.20	4.80	6.00	4.2	3.0	2.73
<i>Phomopsis</i>	0.50	0.4	0.80	1.0	1.2	1.50	1.80	2.3	2.00	3.50	5.4	6.40	5.20	4.20	2.5	2.2	2.55
<i>Aspergillus</i>	0.50	0.7	0.80	1.2	1.5	1.80	2.00	3.2	3.50	4.50	6.5	8.80	10.20	11.00	7.8	6.5	4.40
Internal necrosis	0.00	0.0	0.20	0.4	0.7	0.80	1.00	1.3	1.50	2.00	2.3	2.70	3.00	3.40	3.5	2.3	1.56
Other	0.30	0.4	0.70	0.8	1.0	1.30	1.60	2.0	2.30	3.40	3.8	5.40	5.70	3.80	2.5	2.0	2.31
Weekly Av. incidence (%)	0.32	0.4	0.68	0.9	1.2	1.42	1.64	2.4	2.81	3.62	4.9	6.42	6.27	6.39	4.8	3.7	2.99

Table 2: Incidence of aonla fruit rots at Juni Shak Market, Anand

Fruit rots	Average percent disease incidence																Mean(%)
	October				November				December				January				
	Week				Week				Week				Week				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
<i>Penicillium</i>	0.5	0.70	1.00	1.2	1.50	1.50	1.8	2.5	4.20	4.50	7.60	11.3	10.50	9.5	8.0	6.2	4.35
<i>Colletotrichum</i>	0.5	0.50	1.00	1.2	1.20	1.40	1.8	2.0	2.00	3.20	4.40	6.5	5.20	3.2	2.5	2.0	2.41
<i>Alternaria</i>	0.3	0.50	0.70	1.0	1.20	1.50	1.6	1.8	2.20	3.50	5.00	5.3	3.50	2.5	2.2	2.0	2.17
<i>Phomopsis</i>	0.3	0.40	0.50	0.7	0.80	1.20	1.5	1.8	2.00	2.20	3.50	4.5	2.80	2.0	1.8	1.6	1.72
<i>Aspergillus</i>	0.5	0.70	1.00	1.2	1.40	1.50	2.2	2.5	3.50	4.00	7.00	8.5	10.50	7.5	5.8	4.5	3.89
Internal necrosis	0.0	0.20	0.50	0.5	0.80	1.00	1.2	1.2	1.50	1.70	2.00	2.2	2.50	1.9	1.4	1.3	1.24
Other	0.0	0.40	0.40	0.5	0.70	0.80	1.2	1.5	2.30	3.00	3.50	5.5	5.00	3.4	2.8	1.5	2.03
Weekly Av. incidence (%)	0.3	0.48	0.72	0.9	1.08	1.27	1.6	1.9	2.52	3.14	4.71	6.3	5.71	4.3	3.5	2.7	2.57

Table 3: Incidence of aonla fruit rots at Horticulture Farm Shop, AAU, Anand

Fruit rots	Average percent disease incidence																Mean(%)
	October				November				December				January				
	Week				Week				Week				Week				
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
<i>Penicillium</i>	0.50	0.50	0.7	1.00	1.20	1.30	1.5	2.20	3.50	4.0	5.5	6.20	5.2	4.8	4.2	4.0	2.89
<i>Colletotrichum</i>	0.20	0.30	0.5	0.80	1.00	1.20	1.5	2.00	3.20	3.2	4.0	4.60	4.1	3.4	4.5	3.2	2.35
<i>Alternaria</i>	0.20	0.20	0.4	0.50	0.80	1.10	1.2	2.00	2.40	2.5	3.2	3.50	4.2	3.2	3.5	3.0	2.10
<i>Phomopsis</i>	0.00	0.00	0.2	0.40	0.70	0.80	1.0	1.20	1.50	1.8	2.5	2.70	3.2	3.4	2.6	2.3	1.51
<i>Aspergillus</i>	0.40	0.50	0.8	1.20	1.50	1.50	1.7	2.50	2.80	3.2	4.5	5.20	6.0	4.8	4.2	3.0	2.73
Internal necrosis	0.00	0.00	0.0	0.00	0.20	0.20	0.4	0.50	0.50	0.7	1.0	1.20	2.5	3.0	2.4	1.8	0.90
Other	0.00	0.00	0.2	0.50	0.50	0.70	0.9	1.00	1.20	1.3	2.2	2.10	3.4	3.2	2.5	1.5	1.32
Weekly Av. incidence (%)	0.18	0.21	0.4	0.62	0.84	0.97	1.2	1.62	2.15	2.4	3.3	3.64	4.1	3.7	3.4	2.7	1.97

(3.12 and 2.22%), *Aspergillus* (3.02 and 2.06%), *Alternaria* (2.72 and 1.64%) and *Phomopsis* (2.20 and 1.32%), respectively.

CONCLUSION

The isolated culture of pathogen was sent for identification to Indian Type Culture Collection (I.T.C.C.), I.A.R.I., New Delhi-110012 and was identified as a new pathogen (*Penicillium funiculosum*) (ID No: 7046.08). The weekly survey carried out from first week of October to fourth week of January, 2008-09, revealed that the maximum incidence of *Penicillium* rot (4.93, 4.35 and 2.89%) and *Aspergillus* rot (4.40, 3.89 and 2.73%) were observed at Vegetable Market, Juni Shak Market, Station Road, Anand and Horticulture Farm Shop, AAU, Anand, respectively.

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