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RESEARCH PAPER

Survey for the prevalence of fungal post harvest diseases of vegetables from Dharwad, Hubballi and Belagavi vegetable markets

VANISHREE HAVANNAVAR[1*], VENKATESH R. KULKARNI[1], SHAMARAO JAHAGIRDAR[1], JONES P. NIRMALNATH[2] AND S. MD. AKBAR[2]

[1]Department of Plant Pathology, [2] Department of Microbiology, College of Agriculture, Dharwad University of Agricultural Sciences, Dharwad - 580 005, India

E-mail: vanihavannavar2000@gmail.com

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Abstract: Vegetables play a crucial role in boosting farm income, ensuring sustainable global food production as well as improving nutritional security. About 25-30 per cent of the vegetable production is lost after harvest due to improper handling, storage and microbial contamination. The primary causes of these losses include spoilage from moisture, molds, microorganisms and pests hence, proper post-harvest care is crucial for all the vegetables. A roving market survey was conducted during August to September 2023-24 to record the incidence of market diseases of vegetables in Dharwad, Hubballi and Belagavi vegetables markets. The maximum per cent incidence of post harvest disease in market was recorded in Keshwapur vegetable market Hubballi (44.00%) in chilli by *Colletotrichum capsici* followed by local super market Dharwad (42.10%) in carrot by *Fusarium* sp. and least per cent disease incidence was recorded in local vegetable market Hubballi (4.67%) in chilli by *Aspergillus* sp. It is due to the mono-cropping, susceptibility of cultivars, structure of the vegetable market, improper storage conditions such as ideal temperature, relative humidity and moisture levels likely contributed to the proliferation of the inoculum.

Key words: Disease incidence, Post harvest diseases, Survey, Vegetables, Vegetable market

Introduction

The fresh and consumable parts of herbaceous plants are commonly referred to as vegetables, which are crucial for a balanced diet. Globally, India ranks as the second largest producer of vegetables followed by China and accounts for approximately 16 per cent of world's vegetable production (Tripathi *et al*., 2020). They play a crucial role in boosting farm income, ensuring sustainable global food production as well as improving nutritional security. These will provide essential vitamins, minerals, dietary fiber and antioxidants (Trichopoulou *et al*., 2003).

The leading country in vegetable production includes China, India, Nigeria, the Dominican Republic and the United States of America. Among them, India being the largest producer of the vegetables stands second with production of 212.55 million tonnes per year (Anon., 2023a). In India, Uttar Pradesh, West Bengal, Madhya Pradesh, Bihar and Maharashtra are the major vegetable producing states. Among them, Karnataka accounts for 7.47 million tonnes production with the productivity of 17.35 t/ha under the acreage of 0.43 million hectares (Anon., 2023b) and stands in ninth position in terms of vegetable production.

The vegetables may get affected from pathogens of fungal or bacterial categories. The fungal pathogens can infect plants before or after harvest. The diseased plant produce is not suitable for consumption and marketing purpose. The fungal infections may occur through surface wounds which may be formed due to mechanical injury (Tripathi *et al*., 2021). In recent years, these markets diseases of vegetables have assumed to be a severe and common problem under storage conditions. Hence there is a need to monitor the causes of vegetable diseases to ensure safer consumption and to extend the storage period without deterioration. There is a limited information on prevalence of post harvest diseases of vegetables in Dharwad, Hubballi and Belagavi, hence these districts were selected to determine the frequency of various post harvest diseases of vegetables in market. Thus, the present investigation is on survey for the assessment of association of fungal diseases of vegetables from Dharwad, Hubballi and Belagavi vegetable markets.

Material and methods

A roving market survey was conducted in Dharwad, Hubballi and Belagavi vegetable markets to record the incidence of post harvest diseases during August to September, 2023-24. The markets in Dharwad, Hubballi and Belagavi were visited for the survey of major fungal diseases of vegetables. Diseased specimens were collected and critically examined for the presence of fungal fructifications and observed under the microscope for preliminary identification of the causal agent.

The Per cent Disease Incidence of the pathogen was calculated using the formula given by Wheeler (1969) as follows:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected fruits}}{\text{Total number of fruits observed}} \times 100$$

Collection and isolation of the pathogens

Thoroughly washed diseased samples were utilized for isolation of the pathogens by following the tissue isolation technique as detailed below. The infected samples collected from the vegetable markets were subjected for isolation of fungal pathogens by following tissue isolation technique (Patil *et al*.,

Table 1. Details on the incidence of post harvest diseases of vegetables in Dharwad, Hubballi and Belagavi vegetable markets during August to Septemeber, 2023-24

Taluk	Place	Date of visit	Vegetable	Pathogens detected				Stage of the vegetable	Per cent disease incidence
				Colletotrichum sp.	*Aspergillus* sp.	*Fusarium* sp	*Helmintho sporium* sp		
Dharwad	Local super market	16/08/23	Carrot	-	-	+	-	Ripened	42.10
			Tomato	-	+	-	-	Ripened	11.53
			Brinjal	-	+	-	-	Matured	8.67
	Local vegetable market	20/08/23	Tomato	-	-	-	+	Ripened	41.33
			Chilli	+	-	-	-	Ripened	32.67
			Chilli	-	+	-	-	Ripened	5.33
			Carrot	-	-	+	-	Matured	16.00
			Taluk mean						22.52
Hubballi	Keshawapur vegetable market	23/08/23	Tomato	+	-	-	-	Matured	39.33
			Chilli	+	-	-	-	Fully matured	44.00
			Brinjal	+	-	-	-	Matured	17.33
	Local vegetable market	27/08/23	Carrot	-	+	-	-	Matured	13.33
			Chilli	+	-	-	-	Ripened	38.00
			Chilli	-	+	-	-	Matured	4.67
			Tomato	+	-	-	-	Matured	26.67
			Taluk mean						26.19
			District mean						24.35
			District: Belagavi						
Bailhongal	Bailhongal	06/09/23	Tomato	-	-	-	+	Ripened	37.67
			Carrot	-	-	+	-	Matured	12.00
	Belavadi	11/09/23	Chilli	+	-	-	-	Matured	32.00
			Taluk mean						27.22
Savadatti	Inchal	19/09/23	Tomato	-	-	-	+	Ripened	17.00
			Tomato	-	+	-	-	Matured	7.67
			Carrot	-	-	+	-	Matured	28.00
	Mutwad	25/09/23	Brinjal	+	-	-	-	Matured	16.00
			Chilli	+	-	-	-	Matured	26.67
			Taluk mean						19.07
			District mean						22.12

2022). Diseased vegetable was cut into small bits and washed well in tap water and surface sterilized using one per cent sodium hypochlorite solution for 60 seconds and washed repeatedly thrice in sterilized distilled water to remove the traces of sodium hypochlorite if any before transferring them to sterile potato dextrose agar (PDA) plates under aseptic conditions. The plates were incubated at a temperature of 27±1°C to obtain good fungal growth.

Results and discussion

The findings regarding the prevalence of post harvest diseases of vegetables in market are illustrated in Table 1, Fig. 1 and 2. The survey was carried out in Dharwad, Hubballi and Belagavi vegetable markets during August to September, 2023-24 to assess the incidence of post harvest diseases of vegetables in markets. The mean per cent incidence of post harvest diseases of vegetables in market was highest in Dharwad district (24.35%) followed by Belagavi (22.12%). Taluk wise mean per cent incidence of post harvest diseases of vegetables in markets was highest in Bailhongal (27.22%) followed by Hubballi (26.19%) and it was least in Savadatti (19.07%).

Four vegetable markets were surveyed in each district. Keshwapur vegetable market recorded the maximum post harvest disease incidence of 44.00 per cent in chilli followed by local super market Dharwad with 42.10 per cent disease incidence in carrot. The least incidence of the post harvest disease was recorded in local vegetable market, Hubballi (4.67%) in chilli. In Belagavi, Bailhongal vegetable market recorded the maximum post harvest disease incidence of 37.67 per cent in tomato followed by vegetable market of Belavadi (32.00%) in chilli and the lowest per cent disease incidence was recorded by Inchal vegetable market (7.67%) in tomato.

The survey revealed that the occurrence of post harvest diseases of vegetables differed from location to location, season to season and site to site, likely influenced by factors such as temperature, relative humidity, rainfall and potentially by the variability among the pathogens. It may be due to mono-cropping, susceptibility of cultivars, structure of the vegetable market and improper storage conditions such as ideal temperature, relative humidity and moisture levels likely contributed to the proliferation of the inoculum. Rodrigues and Kakde (2019) reported that the vegetable and fruit rots are typically caused by opportunistic fungi that usually reside on packaging materials and plant debris. However, these fungi can infect tissues that are wounded or exposed to the air.

Similar study was conducted by Raju and Naik (2007) who have conducted roving survey during *kharif*, 2004 in the

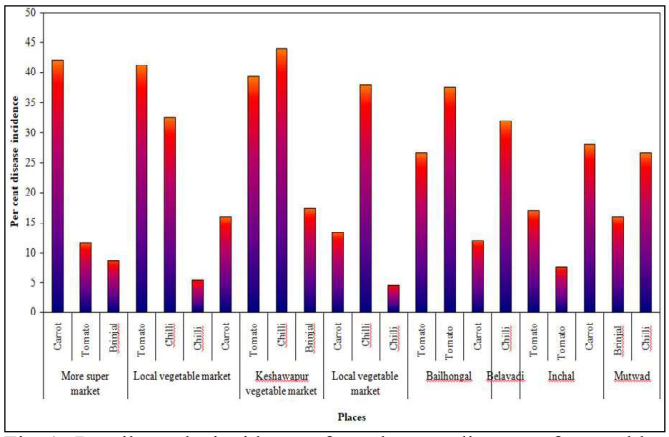

Fig. 1. Details on the incidence of post harvest diseases of vegetables in Dharwad, Hubballi and Belgavi vegetable markets during August to September, 2023-24

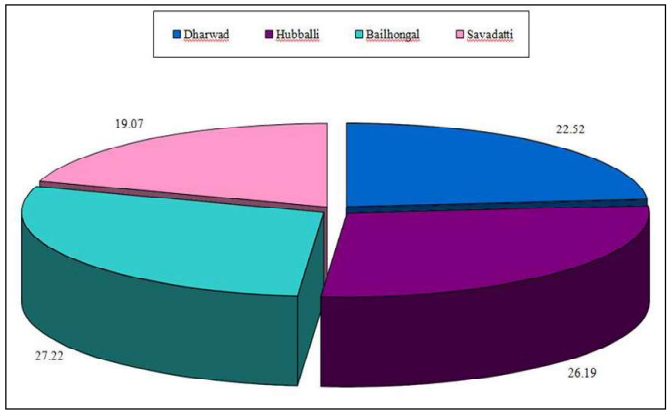

Fig 2. Taluk wise mean per cent incidence of post harvest diseases of vegetables during August to September 2023-24

vegetable market of Raichur, Gulbarga and Bellary and the northeastern part of Karnataka on onion post-harvest diseases revealed that the maximum disease incidence (16.52%) of black mould (*Aspergillus niger*) in Gulbarga vegetable market followed by Bellary (14.76%) and Raichur (14.68%). The maximum disease incidence of blue mould (*Penicillium digitatum*) was observed in Gulbarga (6.88%) followed by Bellary (6.72%) and Raichur (6.00%).

Collection and isolation of the pathogens

The infected vegetables from markets were collected and used for isolation of the pathogens causing post harvest diseases of vegetables. After surface disinfection, standard tissue isolation procedure was followed to isolate the pathogens as described in material and methods. The pure cultures of the fungal pathogens were obtained by single spore isolation technique. Such pure cultures obtained were further sub cultured on PDA slants and kept in the refrigerator at 4ºC for further studies. The pathogens such as *Colletotrichum capsici* (chilli), *Colletotrichum coccodes* (tomato), *Helminthosporium* sp. (tomato) and *Fusarium* sp. (carrot) obtained were recorded the maximum frequency of isolation. Identification of fungal pathogens causing post harvest diseases of vegetables was carried out by observing growth on media. Conidial characteristics and microscopic observations were made from the microscopic mounts on glass slides prepared directly from seven days old active cultures. Current findings are in agreement with Renuka *et al*. (2022) who have isolated *Colletotrichum* sp. and *Fusarium* sp. from chilli.

Conclusion

The current study summaries the incidence of post harvest diseases of vegetables in Dharwad, Hubballi and Belagavi vegetable markets. The major fungi associated with the post harvests disease of vegetables were *Colletotrichum capsici* (chilli), *Colletotrichum coccodes* (tomato), *Fusarium* sp. (carrot) and *Helminthosporium* sp. (tomato). Out of these pathogens, some are originated from the field itself but the majority of the fungi are sourced from the post-harvest handling. Mono-cropping, susceptibility of cultivars, structure of the vegetable market and improper storage conditions such as ideal temperature, relative humidity and moisture levels likely contributed to the proliferation of the inoculum.

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