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Seasonal Variation of Post-harvest Contaminating Micro Flora of Tomato and Beans

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ABSTRACT

The post harvest contaminating microflora (surface and internal) of tomato and beans was analyzed during the month of March, August and November. The sampling of these vegetables were done both in field and market. The samples collected from the market contain more microflora than that from the field, while the samples collected in the month of August showed maximum fungal load and those collected in March showed maximum bacterial growth. In the month of November, the growth of fungi and bacteria is similar when compare to the month of August.

Key words: Post-harvest, bacteria, fungi, actinomycetes, tomato, beans

INTRODUCTION

The tomato and beans are the most important vegetables with great market demand. These vegetables are perishable products with active metabolism during post harvest period .Therefore proper handling and post harvest care is essential in maintaining product quality and availability. As vegetables continue to become more popular with consumers, the safety of these products against spoilage microorganisms and human pathogens will like to assume importance.

The microflora present on the fresh vegetable is from several external sources such as soil, air, water, fertilizers, animals and humans. In case of most vegetables, the microenvironment is such that there is ample of moisture and a neutral pH. Such conditions mostly favor the growth of bacteria but fungi are not prevented. Although, molds are found at low populations during harvest of vegetables (Webb and Mundt, 1978). Further contamination may occur after harvest, in transit or storage, during processing and marketing (Senter *et al*., 1984; Brackett, 1987; Splittstoesser, 1991). Some microorganisms present on the vegetable cause spoilage or health hazards (Omar and Mahmud, 1994). The presence of coliform bacteria indicates fecal contamination and thus presence of pathogens. There is a report saying that about 29 per cent of the vegetables were positive for fecal coliform (Splittstoesser and Corlett, 1980). In this view an experiment was conducted to find out the population of post-harvest contaminating microorganisms such as bacteria, filamentous fungi, yeast and actinomycetes during different seasons in Dharwad (Karnataka, India) market with special reference to the vegetables tomato and beans.

MATERIALS AND METHODS

Sampling of tomato and beans: The healthy samples of tomato and beans were collected from the local market as well as from the fields in and around Dharwad (Karnataka, India) in sterile poly bags. Sampling was done once in August and November months. Samples were immediately brought to laboratory for microbial analysis.

Enumeration: The healthy samples brought to laboratory were analysed for surface and internal populations of bacteria, filamentous fungi, yeast and actinomycetes by standard dilution plate count method using nutrient agar (Anonymous, 1957), Martin's rose bengal agar (Martin, 1950), Wickerham's agar (Wickerham, 1951) and Kuster's agar (Kuster and Williams, 1964; Haritha *et al*., 2012), respectively.

Surface microflora: The surface microflora of tomato fruits was collected by swabbing the entire surface area with sterile wet cotton swabs and then suspended in 90 mL water blanks. The aliquot after shaking for five minutes, they were serially diluted and used for plating. The surface microflora of beans was enumerated by suspending 10 g of fresh beans into 90 mL of sterile water blank and serially diluting it. The 1 mL aliquot from appropriate dilutions were transferred aseptically into sterile plates and molten lukewarm agar were poured to respective plates. The plates were gently rotated to uniformly distribute the inoculum before the medium was solidified. The plates were then incubated at 30±1°C temperature for 3-7 days and colony counts were recorded.

Internal microflora: For enumeration of internal microflora, the samples were washed with tap water, surface sterilized by dipping in 70% ethyl alcohol for three minutes followed by washing in six changes of sterile water. The samples were macerated aseptically in a sterile homogenizer and then transferred to sterile water blank. The aliquots serially diluted and used for enumeration of bacteria, filamentous fungi, yeast and actinomycetes as explained above.

RESULTS

In general surface microbial population was higher in samples collected from the market than those collected from field (Table 1, 2). In case of both the vegetables, bacterial population was highest during march and least during November whereas the surface fungal population was highest during August month, while the tomato fruits showed very low population of yeast (10-30 cells cm^{-2} area) compared to bacteria and fungi, beans samples did not yield any yeasts.

Table 1: Surface and internal micro flora of tomato during different seasons

		Surface micro flora (CFU×10^{-2} cm^{-2})				Internal micro flora (CFU×10^{-2} cm^{-2})			
Place of sampling	Month of sampling	Bacteria	Fungi	Yeast	Actinomycetes	Bacteria	Fungi	Yeast	Actinomycetes
Market	August	18.39	5.50	0.14	0.00	0.10	0.00	0.00	0.00
	November	17.61	2.93	0.12	0.00	0.16	0.00	0.00	0.00
	March	25.26	0.53	0.33	0.00	0.66	0.00	0.00	0.00
Field	August	7.61	2.24	0.13	0.00	0.00	0.00	0.00	0.00
	November	4.93	2.03	0.10	0.00	0.00	0.00	0.00	0.00
	March	9.53	0.46	0.16	0.01	0.10	0.00	0.00	0.00

Table 2: Surface and internal micro flora of beans during different seasons

		Surface microflora (CFU×10 g^{-1} DW)				Internal microflora (CFU×10 g^{-1} DW)			
Place of sampling	Month of sampling	Bacteria	Fungi	Yeast	Actinomycetes	Bacteria	Fungi	Yeast	Actinomycetes
Market	August	40.60	24.33	0.00	0.00	0.22	0.00	0.00	0.00
	November	31.66	24.00	0.00	0.00	0.25	0.00	0.00	0.00
	March	67.53	3.40	0.00	0.00	0.25	0.00	0.00	0.00
Field	August	35.66	20.66	0.00	0.00	0.00	0.00	0.00	0.00
	November	32.54	22.33	0.00	0.00	0.00	0.00	0.00	0.00
	March	41.66	17.33	0.00	0.00	0.00	0.00	0.00	0.00

Similarly no actinomycetes were detected in case of both the vegetables irrespective of their source and time of collection.

The internal microflora of both the vegetables constituted only bacteria that too in the samples collected from the market. The tomato fruits contained 10-66 bacterial cells g^{-1} DW of fruits internally whereas ,beans contained 22-25 cells g^{-1} DW of pods. Once again internal bacterial load was higher during March ,but was lowest during August month.

DISCUSSION

In the present study microflora of both the vegetables was higher in samples collected from the market than those of field samples. This can be expected as the vegetables after harvest are subjected to contamination during handling, transport and storage before they are sold in the market. The increased microbial population during the operation involving an extended holding time after harvest and attributed it to contamination particularly in transit (Senter *et al.*, 1984).

The two vegetables showed least population of bacteria during November compared to March and August months and can be ascribed to prevalence of low temperature during November. Population of fungi on the other hand was higher during August and can be attributed to higher rainfall and relative humidity during August month. There was an increase in mold population on green beans and cucumber with increase in rain fall three days before harvest. In the present study population of yeast was very low on both the vegetables compared to that of bacteria and fungi indicating their poor competitive ability to survive with bacteria and fungi (Bulgarelli and Brackett, 1991).

The internal microflora of both the vegetables in the present study consisted of only bacteria that too in the samples collected from the market. The fresh and healthy tomato cucumber to harbour internally the species of *Pseudomonas, Enterobacter, Achromobacter, Micrococcus* and *Corynaebacterium* and microorganisms were known to gain entry into fruits or vegetables before, during or after harvesting (Meneley and Stanghellini, 1974; Sujaya, 1991). Therefore, the presence of bacteria only in the market sampled vegetables in the present study may be due to the entry of bacteria after harvest.

CONCLUSION

This study was conducted with an intension to study the hygienic condition of vegetables purchased from the market. The vegetables directly brought from the field contained less surface and internal microflora than those sampled from the market. The season also has influence on the microbial load of vegetable samples.

REFERENCES

Anonymous, 1957. Manual of Microbiological Methods. McGraw-Hill Book Co. Inc., New York, pp: 127.

Brackett, R.E., 1987. Vegetables and Related Products. In: Food and Beverage Mycology, Beuchat, L.R. (Ed.). Van Nostrand Reinhold, New York, pp: 129-154.

Bulgarelli, M.A. and R.E. Brackett, 1991. Importance of Fungi in Vegetables. In: Handbook of Applied Mycology: Food and Feed, Arora, D.K., K.G. Mukerjii and E.H. Marth (Eds.). Marcel Dekker Inc., New York, pp: 179-199.

Haritha, R., K. SivaKumar, A. Swathi, Y.S.Y.V.J. Mohan and T. Ramana, 2012. Characterization of marine *Streptomyces carpaticus* and optimization of conditions for production of extracellular protease. Microbiol. J., 2: 23-35.

Kuster, E. and S.T. Williams, 1964. Selection of media for isolation of streptomycetes. Nature, 202: 928-929.

Martin, J.P., 1950. Use of acid, rose bengal and streptomycin in the plate method for estimating soil fungi. Soil Sci., 69: 215-232.

Meneley, J.C. and M.E. Stanghellini, 1974. Detection of bacteria with locular tissue of healthy cucumber. J. Food Sci., 39: 1267-1268.

Omar, S.A. and A.L.E. Mahmud, 1994. Post-harvest rots of tomato in relation to lyases and mycotoxin production *in vivo* and *in vitro*. Crypt. Mycol., 15: 273-281.

Senter, S.D., N.A. Cox, J.S. Bailey and F.I. Meredith, 1984. Effects of harvesting, transportation and cryogenic processing on the microflora of southern peas. J. Food Sci., 49: 1410-1411.

Splittstoesser, D.F. and D.A. Corlett, 1980. Aerobic plate counts of frozen blanched vegetables processed in the United States. J. Food Prot., 43: 717-719.

Splittstoesser, D.F., 1991. Fungi of Importance in Processed Fruits. In: Handbook of Applied Mycology: Food and Feed, Arora, D.K., K.G. Mukerjii and E.H. Marth (Eds.). Marcel Dekker Inc., New York, pp: 201-220.

Sujaya, G.V., 1991. Post-harvest studies on microbiological, physicochemical and sensory aspects of papaya and cucumber stored at room and refrigerated temperatures. M.Sc. (Agric.) Thesis, University of Agricultural Sciences, Bangalore.

Webb, T.A. and J.O. Mundt, 1978. Molds on vegetables at the time of harvest. Applied Environ. Microbiol., 35: 655-658.

Wickerham, L.J., 1951. Criteria and Methods Used in Classification. In: The Yeasts: A Taxonomic Study, Lodder, J. (Ed.). North Holland Pub. Co., Amsterdam, pp: 39.