Fishery Technology
1999, Vol. 36(1) pp : 28 - 31

Halotolerant Fungi in Salted and Dried Fish at Lower Visakhapatnam Coast

R. Chakrabarti and P.R.G. Varma*
Research Centre of Central Institute of Fisheries Technology
Visakhapatnam - 530 003, India

Aspergillus flavus, Aspergillus niger, Penicillium sp. and *Mucor* were the common halotolerant fungi present in salted and dried fish at lower Visakhapatnam coast. The time required for growth of fungal colony to visible range was different in different types of salted and dried fish and it also varied with the season. Visible fungal colonies appeared rapidly in rainy season and it took longest time in winter season. Seasonal variations in the levels of moisture, sodium chloride, total volatile bases and water activity were also observed.

Keywords: Halotolerant fungi, salted dried fish, seasonal changes, Visakhapatnam coast.

Curing is a traditional method for preservation of fish, especially in rural areas. The quality of such products is often adversely affected by the growth of fungi. The dominant fungi in salted and dried fish varied from place to place. The presence of fungi in dried fish at different places along the West coast of India was reported by Rao *et al.*, (1962); Gupta & Samuel (1985) and CIFT (1994). A survey on the presence of fungi in fish and fishery products of the east coast of India is in progress. As a part of this work Chakrabarti & Varma (1997) reported that *Aspergillus fumigatus, Aspergillus niger* and *Mucor* were the common fungi in salted and dried fish at Kakinada coast. This paper reports the results of the study on the different types of fungi present in dried fish available at the lower Visakhapatnam coast.

Materials and Methods

Samples of salted and dried fish, free from visible fungal colony, were brought to the laboratory from fish processors. Each type of fish sample was divided into two parts. One part of the sample was used for isolation of fungi using potato dextrose agar (PDA) after enrichment in potato dextrose broth (Chakrabarti & Varma, 1997). Fungal colonies were transferred to PDA slants, incubated for 5 days at 28±2°C and then stored in refrigerator for purification and identification as per Pitt & Hocking (1985). Sensitivity of fungal isolates to different salt concentration was tested using PDA with 3% agar content. Isolates from PDA slants were spread on PDA (3% agar) containing 0, 10, 14 and 18 percent sodium chloride separately. After incubation for 5 days at 28±2°C, the extent of fungal growth was observed.

The other part of the dried fish sample was stored in polyethylene tape woven bags at tropical ambient temperature (27±10°C). Moisture, sodium chloride and fat in fish muscle were estimated by standard methods (AOAC, 1975). The stored fish samples were observed at regular intervals. Total volatile base nitrogen (TVBN) in fish muscle was determined by the micro-diffusion method (Conway, 1947), using trichloro acetic acid extract of muscle. Water activity of fish muscle was measured from moisture sorption isotherms at different humidity levels for 48 h and the corresponding water

* Central Institute of Fisheries Technology, Matsyapuri P.O., Cochin-682 029, India

contents (Ross, 1975). Potato dextrose agar plate was exposed to air in and outside the laboratory for 30 min and the different types of fungal colonies appearing on the plate were isolated and identified as described earlier.

Results and Discussion

The fish samples were free from visible fungal colonies initially, but enrichment in potato dextrose broth and plating on PDA revealed the presence of different types of fungi (Table 1). The dominant fungi in all the fish samples were *A. flavus, A. niger* and *Penicillium* sp. throughout the year. *A. niger* was comparatively most dominant and present in all fish samples during rainy season. This species has been reported to be of common occurrence in dry fish during rainy season along the Cochin coast (Gupta & Samuel, 1985) and Kakinada coast (Chakrabarti & Varma, 1997) also. Seasonal variations in the fungal populations were observed in all the samples.

The time for growth of fungal colony to visible range was different in five types of fish samples and it varied with the season (Table 2). Visible fungal colonies appeared quickly on the fish samples in rainy season due to high moisture content in fish samples and high relative humidity in atmosphere (Rao *et al.*, 1962). During winter season the time taken for the appearance of visible fungal colonies was the maximum.

Table 1. Fungi in dried fish during different seasons

Fish	Season		
	March-June	July-October	November – February
Gutted, salted sun dried pomfret (*Stromateus sinensis*)	*Aspergillus flavus*	*Aspergillus flavus*, *Aspergillus niger*, *Polypaceilum pisce*	*Aspergillus flavus*, *Aspergillus niger*
Gutted, salted sun dried moon fish (*Mene maculatus*)	*Aspergillus flavus*	*Aspergillus flavus*, *Aspergillus niger*	*Aspergillus niger*
Whole salted sun dried mackerel (*Rastrelliger kanagurta*)	*Penicillium* sp.	*Penicillium* sp. *Aspergillus niger*	*Penicillium* sp.
Gutted, salted sun dired jew fish (Sciaenid)	*Aspergillus niger*, *Penicillium* sp. *Rhizopus* sp.	*Aspergillus niger* *Polypaceilum pisce*	*Aspergillus niger* *Mucor* sp.
Gutted salted, sun dried lizard fish (*Saurida tumbil*)	*Aspergillus niger*, *Aspergillus chevalieri*	*Aspergillus niger*, *Penicillium* sp. *Aspergillus flavus*	*Aspergillus niger*

Table 2. Seasonal variation of selected parameters in dried fish

Sample	March – June	July – October	November – February
Gutted salted sun dried jew fish			
Moisture %)	26 – 39	30 – 40	27 – 35
Sodium chloride (%)	7.5 – 11.6	9.3 – 10.8	11.5 – 12.4
Water activity	0.84 – 0.85	0.87 – 0.9	0.85 – 0.87
TVBN (mg%)	150 – 185	159 – 190	133 – 182
Fungal growth period* (month)	3	2	4 – 5

Gutted salted sun dried lizard fish			
Moisture %)	27 – 34	36 – 46	29 – 36
Sodium chloride (%)	8.5 – 9.5	7.0 – 8.3	8.3 – 9.1
Water activity	0.82 – 0.84	0.85 – 0.9	0.82 – 0.85
TVBN (mg%)	144 – 160	140 – 194	148 – 182
Fungal growth period* (month)	2	1	4 – 5
Whole salted sun dried mackerel			
Moisture %)	44 – 46	45 – 49	36 – 44
Sodium chloride (%)	8.3 – 9.3	7.3 – 8.0	8.9 – 10.2
Water activity	0.84 – 0.85	0.87 – 0.9	0.85 – 0.87
TVBN (mg%)	170 – 184	155 – 194	143 – 187
Fungal growth period* (month)	2	2	4
Gutted salted sun dried moon fish			
Moisture (%)	22 – 31	39 – 42	31 – 37
Sodium chloride (%)	7.1 – 8.3	6.1 – 7.2	8.1 – 10.5
Water activity	0.82 – 0.85	0.87 – 0.9	0.84 – 0.86
TVBN (mg%)	158 – 181	170 – 185	145 – 193
Fungal growth period* (month)	2	1	4
Gutted salted sun dried pomfret			
Moisture (%)	23 – 28	27 – 44	29 – 33
Sodium chloride (%)	11.6 – 12.4	9.0 – 10.5	11.1 – 12.0
Water activity	0.83 – 0.85	0.85 – .87	0.84 – 0.86
TVBN (mg%)	135 – 172	159 – 198	152 – 189
Fungal growth period* (month)	3	2	4

* Time taken for the growth of fungal colony to visible range

Seasonal variations of moisture content, sodium chloride content and water activity of the different types of salted and dried fish samples are also presented in Table 2. TVBN content in samples was within 200 mg per 100 g muscle.

Table 3. Sensitivity of the isolated fungi to different concentration of salt in potato dextrose agar (3%)

Species	Concentration of sodium chloride		
	10%	14%	18%
Aspergillus flavus	+	+	+
Aspergillus niger	+	+	+
Penicillium sp.	+	+	–
Aspergillus chevalieri	–	–	–
Mucor sp.	+	–	–
Rhizopus sp.	–	–	–
Polypaceilum pisce	–	–	–

+ indicates growth; – indicates no growth

A. flavus, A. niger, Penicillium sp. and *Mucor* sp. could grow on PDA containing 10% or more sodium chloride (Table 3), while the remaining isolates could not grow on the above media. It was also observed that the above halotolerant fungi were the dominant species in the salted and dried fish samples.

Aeromycological study showed that *A. flavus, A. niger* and *Mucor* were common air borne fungi.

The authors are grateful to Dr. K. Ravindran, Director, Central Institute of Fisheries Technology, Cochin for permission to publish this paper and to Shri G. Narayanappa, Scientist-in-Charge, Research

Centre of CIFT, Visakhapatnam for encouragement. Thanks are due to Shri P.S. Babu, N. Venkata Rao and P.Radhakrishna for technical assistance.

Reference

AOAC (1975) *Official Methods of Analysis*, 12th edn., Association of Official Analytical Chemists, Washington DC, USA

Chakrabarti, R. & Varma, P.G.R. (1997) *Fish. Technol.* **34**, 4

CIFT (1994) *Annual Report 1993-94*, Central Institute of Fisherie Technology, Cochin, India

Conway, E.J. (1947) *Microdiffusion Analysis and Volumetric Error*, Crossby, Lockwood and Sons, London

Gupta, R. & Samuel, C.T. (1985) *Fish. Technol.* **22**, 132

Pitt, J.I. & Hocking, A.D. (1985) *Fungi and Food Spoilage*, p. 29 Academic Press, Orlando, USA

Rao, S.V.S., Valsan, A.P., Kandoran, M.K. & Nair, M.R. (1962) *Indian J. Fish.* **9**, 156

Ross, K.D. (1975) *Food Technology*, **26**, 96