

Fungi in Salted and Dried Fish from Coastal Andhra Pradesh

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Halotolerant fungi viz., *Aspergillus niger*, *A. flavus*, *A. fumigatus*, *Penicillium* sp., *Mucor* sp., and *Wallemia sebi* were isolated from salted and dried fish samples from the coast of Andhra Pradesh. *A. niger* was the most common fungus during rainy season in all places. Visible fungal growth appeared on the fish and the growth was rapid in rainy season, but it took longer time in winter. Seasonal variations in the levels of moisture, sodium chloride, total volatile base nitrogen and water activity were also observed.

Key words : Fungi, dried fish, Andhra Pradesh

Dried fish and fishery products are preferred in areas where fresh fish is either not available or inadequate to meet the demand. Salting of fish followed by drying is a cheap processing technique and often the only method available to processors in rural areas. It is a common traditional practice to dry small fish such as anchovies, small silver bellies, small lesser sardines, etc., without salting. Other fish are salted by either dry salting or wet salting, followed by sun drying.

The dried fishery products reach consumer through long marketing chain. Salted and dried, unsalted and dried fish are consumed mainly by the tribals in the hinterland of Andhra Pradesh and North Orissa. Some processors send dried products to distant places such as the North Eastern States. Dried Bombay duck, ribbonfish, anchovies, croakers, shrimps (*Acetes* spp.), etc., preferably unsalted, have a good market in the above states. Salted and dried mackerel, seer and sea perch have good demand in the delta areas of the Krishna and Godavari. There is also good demand for wet salted shark meat in Kerala. Storage of the both salted and unsalted dried fish in marketing channels is normally rare. However, occasionally dried and salted and dried fish are stored in godowns up to six months to obtain higher margin.

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The quality of salted and unsalted dried fish products is often adversely affected by the growth of fungi, especially during movement through long marketing channels to the consumer's end. The presence of different types of fungi in dried fish was reported by several workers (Phillips & Wallbridge, 1976; FAO, 1982; Gupta & Samuel, 1985; CIFT, 1984; Chakrabarti & Varma, 1997, 1999).

Apart from contaminated salt and fish and unhygienic handling practices, other common sources of fungi are air and dust in and around fish processing area and store rooms (FAO, 1982). The tropical ambient temperature and humidity favour the growth of fungi during processing, storage, transportation and marketing of dried fish products. Time taken for the growth of fungus to become visible in different types of salted and dried fish vary with the season (Chakrabarti & Varma, 1997). This paper reports the results of the survey on the occurrence of fungi in dried fish available in coastal regions of Andhra Pradesh.

Materials and Methods

Salted and dried fish samples from the fish processors of the different coastal districts of Andhra Pradesh were brought to the laboratory. Each sample was cut into small pieces mixed, and 5 g of mixed sample were transferred aseptically to 50 ml potato dextrose broth in a conical flask. After incubation for 3 days at $28\pm 2^{\circ}\text{C}$, 0.1 ml inoculum was spread on potato dextrose agar (PDA) in triplicate and incubated at $28\pm 2^{\circ}\text{C}$ for 5 days. Different types of fungal colonies which appeared on the plates were isolated, purified and identified (Pitt & Hocking, 1985).

Results and Discussion

Though there was no visible fungal growth in some dried samples, the presence of different types of fungi were noticed after enrichment in potato dextrose broth (PDB) followed by plating on potato dextrose agar (PDA). Table 1 shows that the incidence of fungi in salted and dried fish samples collected during summer, rainy and winter seasons. The common fungi were *Aspergillus niger*, *A. flavus*, *Penicillium* sp. and *Mucor* sp. These fungi, except *Mucor* sp. were noticed in all the three seasons. *Aspergillus fumigatus* was isolated only from the samples from Kakinada, while *Aspergillus chevalieri* and *Rhizopus* sp. were isolated only from the samples from Visakhapatnam. The dominant fungi in rainy season in all the three places was *A. niger*, but the dominant fungi in summer and winter varied with the

places. Gupta & Samuel (1985) also reported about the common occurrence of *A. niger* in dried fish samples in rainy season in Cochin coast.

Table 1. Incidence of fungi in salted and dried fish samples from coastal Andhra Pradesh

| | Kakinada | | | Visakhapatnam | | | Bhimunipatnam | | |
|-------------------------------|---------------|--------------|--------|---------------|--------------|--------|---------------|--------------|--------|
| | Summer season | Rainy season | Winter | Summer | Rainy season | Winter | Summer | Rainy season | Winter |
| <i>Aspergillus niger</i> | + | 3+ | + | 2+ | 3+ | 3+ | + | 2+ | + |
| <i>Aspergillus fumigatus</i> | 3+ | + | 3+ | - | - | - | - | - | - |
| <i>Aspergillus flavus</i> | + | + | + | 2+ | 3+ | + | + | 2+ | + |
| <i>Aspergillus chevalieri</i> | - | - | - | + | - | - | - | - | - |
| <i>Penicillium</i> sp. | + | + | + | 2+ | 2+ | + | + | + | + |
| <i>Polypaecilium pisce</i> | - | - | - | - | 2+ | - | - | + | - |
| <i>Mucor</i> sp. | + | + | + | - | - | + | - | - | - |
| <i>Rhizopus</i> sp. | - | - | - | + | - | - | - | - | - |
| <i>Wallemia sebi</i> | - | - | - | - | - | + | - | - | + |

Sensitivity of fungal isolates to different sodium chloride concentration was tested by using potato dextrose agar (PDA) with 3% agar content. Fungal isolates were spread on PDA (3% agar) containing 0, 10, 14 and 18% sodium chloride. After incubation for 5 days at $28 \pm 2^\circ\text{C}$, the extent of fungal growth was observed.

Table 2. Salt tolerance of fungi from salted and dried fish

| Species | Concentration of sodium chloride | | |
|-------------------------------|----------------------------------|-----|-----|
| | 10% | 14% | 18% |
| <i>Aspergillus flavus</i> | + | + | + |
| <i>Aspergillus niger</i> | + | + | + |
| <i>Aspergillus fumigatus</i> | + | + | - |
| <i>Aspergillus chevalieri</i> | - | - | - |
| <i>Penicillium</i> sp. | + | + | - |
| <i>Polypaecilium pisce</i> | - | - | - |
| <i>Mucor</i> sp. | + | - | - |
| <i>Rhizopus</i> sp. | - | - | - |
| <i>Wallemia sebi</i> | + | + | - |

+ indicates growth in 5 days; - indicates no growth

A. flavus, *A. niger*, *A. fumigatus*, *Penicillium* sp., *Mucor* sp. and *Wallemia sebi* could grow on PDA containing 10% sodium chloride, while

the remaining isolates could not grow on the above media (Table 2) *A. flavus* and *A. niger* could grow even on PDA with 18% sodium chloride. *A. niger*, *A. flavus* and *Penicillium* sp. were the dominant halotolerant species in the salted and dried fish samples in the Andhra Pradesh coast.

The results show that *Aspergillus niger*, *A. flavus*, *A. fumigatus*, *Penicillium* sp., *Mucor* sp., and *Wallemia sebi* were the halotolerant fungi present in salted and dried fish in the coastal districts of Andhra Pradesh. The dominant fungus in rainy season in Andhra Coast was *Aspergillus niger*, but the dominant fungus in summer and winter season varied with places. Time taken for the fungal growth to visible range was different in different types of salted and dried fish and it also varied with season.

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