OUTBREAK OF PARALYTIC SHELLFISH POISONING IN MANGALORE, WEST COAST OF INDIA

INDRANI KARUNASAGAR, H. S. V. GOWDA, M. SUBBURAJ,
M. N. VENUGOPAL and I. KARUNASAGAR
Department of Fishery Microbiology, University of Agricultural Sciences, College of Fisheries, Mangalore 575002, India.

ABSTRACT

An outbreak of paralytic shellfish poisoning occurred in Kumble near Mangalore following consumption of clams. These clams were found to contain paralytic shellfish poison (PSP) at a level of >18,000 MU/100 g. Oysters from the same region also had dangerous levels of PSP. Toxin levels were retained in oysters for a longer period than in clams.

INTRODUCTION

PARALYTIC shellfish poisoning (PSP) is caused by a neurotoxin produced by certain marine dinoflagellate algae. Various mussels, clams, scallops and whelks become toxic if they feed on toxigenic dinoflagellates[1]. However the shellfish are not detrimentally affected by the toxin. Incidence of paralytic shellfish poisoning has long been known along the Pacific and Atlantic coasts of North America and Canada where many fatal cases have been recorded[2]. Outbreaks have also been reported in Western Europe[3] and Japan[4] and according to Tufts[5], documentation of paralytic shellfish poisoning outside the temperate zone, 30–60° north and south latitudes is yet to be achieved. However, Maclean[6] cited evidence to show that cases of paralytic shellfish poisoning had occurred in Papua New Guinea and in Sabah which are located in tropical/sub-tropical zone. From India, so far, there has been only one unpublished investigation of an incidence of mussel poisoning in Tamil Nadu which is thought to be due to toxins produced by dinoflagellates (Ramesh V. Bhat, personal communication). However no data are available on the toxin levels and on the period of retention of toxins by the mussels. The present paper describes a detailed investigation of an outbreak of shellfish poisoning which occurred in Mangalore, West Coast of India.

MATERIALS AND METHODS

On 4 April 1983, local newspapers in Mangalore reported death of a 14-year old boy and hospitalisation of several people following consumption of clams harvested from Kumble estuary (figure 1). The affected people complained of numbness of lips within 30 min of consumption of clams, followed by vomitting, numbness of arms and legs leading to paralysis. Except for the 14-year old boy who died due to respiratory paralysis, all others recovered by 48 hr. Samples of the clams left over (*Meretrix casta*) from the houses of affected people were collected for examination. Further, clams (*M. casta*) and oysters (*Crassostrea cucullata*) were also collected from the natural bed in Kumble estuary.

Presence of PSP in shellfish samples was tested by the mouse bioassay technique of AOAC[7]. Briefly, the shellfish extract acidified to pH 3 was diluted so that 1 ml aliquot when injected intraperitoneally to white mice weighing 19–21 g gave a median death time from 5–7 min. Mouse units (MU) of PSP were calculated from a table that related median death time to mouse units as described by AOAC[7]. A minimum of three mice was used for each dilution and the PSP standard kindly supplied by Mr. Gilchrist, Food and Drug Administration, USA was used as the reference material. Toxin levels in clams and oysters from Kumble estuary were monitored for a period of 2 months.

RESULTS AND DISCUSSION

Clam samples from both the natural bed as well as from the houses of affected people had PSP levels >18,000 MU/100 g (table 1). Sommer and Meyer[8] estimated that sickness may result from about 1,000–20,000 MU and the minimum amount to cause death is about 20,000 MU. Bond and Medcof[9], on the other hand, found sickness from about 600 MU and death from 3,000–5,000 MU. The lower figures noted by these workers have been explained on the basis that those who had not consumed shellfish regularly and

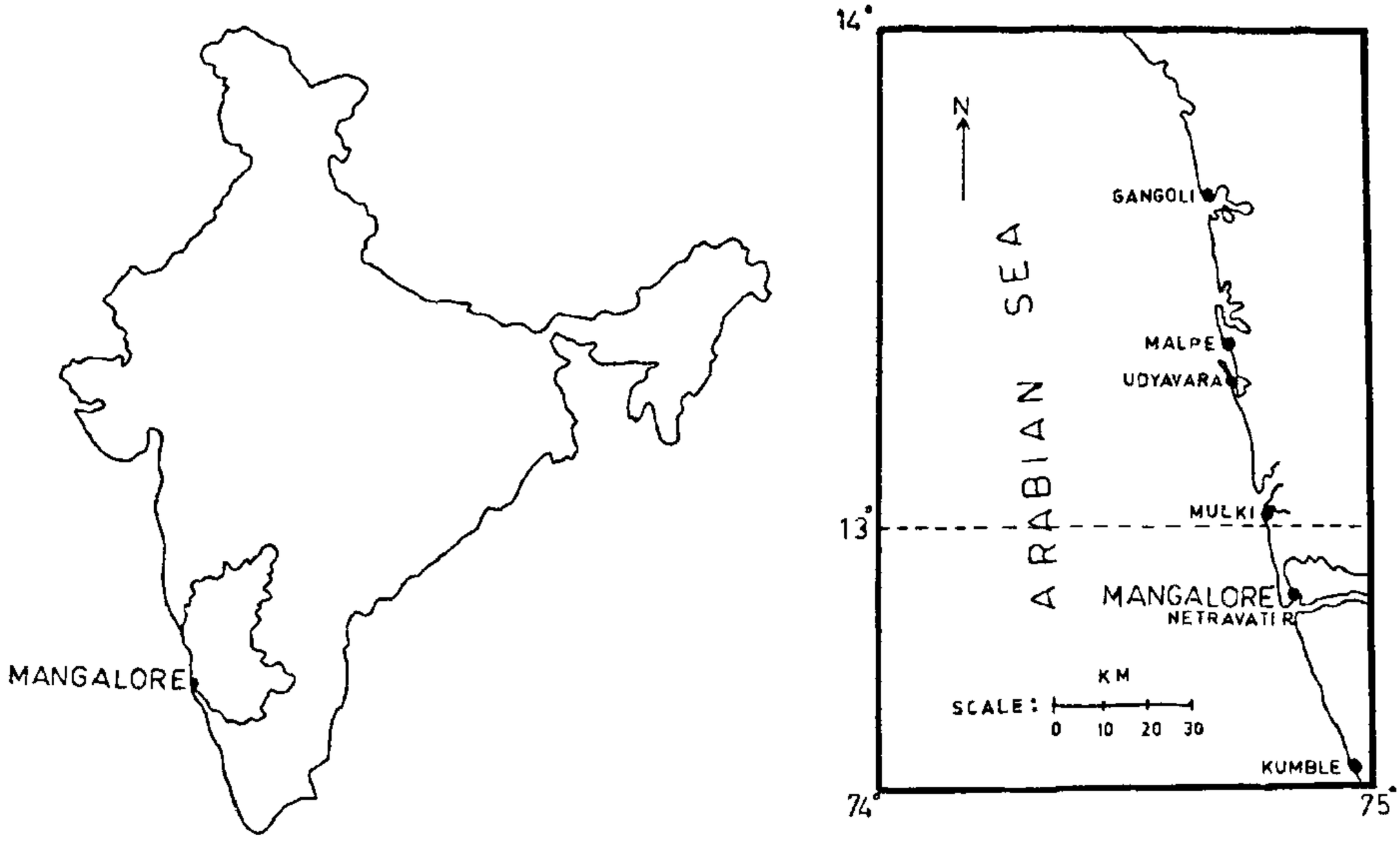

Figure 1. Locations from where shellfish samples were collected.

had not acquired any tolerance to the poison were sensitive to small doses[10]. The Food and Drug Administration (FDA) of USA therefore promulgated a regulation that shellfish with a toxin level of 400 MU/100 g or more are unsafe for human consumption[4]. The results in table 1 indicate that both oysters and clams from Kumble estuary were not only unsafe for consumption, but also contained lethal levels of PSP. Significantly, the toxin levels in clams were three times that noted in oysters. This may perhaps be related to the fact that clams being benthic forms may ingest large number of dinoflagellate cysts which have been reported[11] to be ten times as toxic as free swimming forms. Oysters being intertidal forms may accumulate toxin from free swimming dinoflagellates ingested during their filtering activity.

Shellfish have been reported to show marked species variation in their ability to retain the toxin[12]. While the Bay mussel, *Mytilus edulis* retained the toxin for about two weeks, the soft shell clam *Mya arenaria* released the toxin more slowly[2]. The Alaska butter clam, *Saxidomus giganteus* has been reported to hold

Table 1 *Levels of PSP in different samples of shellfish collected from Kumble estuary*

Date of collection	Levels of PSP in MU/100 g		
	Clams obtained from house of affected people	Clams from natural bed	Oysters
4.4.1983	18,720	18,936	6,680
21.4.1983	—	1,080	2,628
7.5.1983	—	298	1,044
24.5.1983	—	Nil	336
14.6.1983	—	Nil	Nil

the toxin as long as two years[5] whereas the Japanese scallop remained toxic only for six weeks[13]. The results of the present study indicate that the clams, *Meretrix casta* rapidly lose the toxicity over a month's time whereas the oysters *Crassostrea cucullata* retain the toxin for a longer period. Thus the oysters had toxin levels above the acceptability limit of 400 MU/100 g after a month though their initial toxin levels were much lower than in clams whereas in the latter, the toxin levels dropped down to below the acceptability limit during this period (table 1). It would be of interest to study the mechanism of detoxification in these two shellfishes and as such there is very little information about this even in other shellfish. It remains to be seen whether it is related to the rate and volume of filtration and the location of shellfishes.

Following this outbreak, clam, oyster and mussel samples obtained from other estuaries around Mangalore were surveyed for the presence of PSP (table 2). None of these shellfish contained any detectable amounts of PSP.

Table 2 *Shellfish surveyed for the presence of PSP and their source*

Source of shellfish	Shellfish studied
Netravathi estuary	*Vellorita cyprinoides*
Mulky estuary	*Meretrix casta*
Gangoli estuary	*Meretrix casta*
Malpe coast	*Perna viridis*
Kumble estuary	*Meretrix casta*
	Crassostrea cucullata

This outbreak of paralytic shellfish poisoning has opened up a new area for investigation inasmuch as it has far-reaching influence on the public health and on the fishery in the Indian coast. PSP has been known to cause extensive herring kills in Bay of Fundy[14]. Though no samples were available for study, local population in Kumble reported fish kills the day before this outbreak occurred. This calls for a study of the dinoflagellate population of Indian waters, and their toxigenicity.

ACKNOWLEDGEMENT

The authors wish to thank Prof. H. P. C. Shetty, Director of Instruction of the College for his encouragement and to Mr. Gilchrist, Food and Drug Administration, USA for kindly supplying the Standard PSP.

25 May 1983; Revised 5 December 1983

1. Bryan, F. L., *J. Food Protec.*, 1980, **43**, 859.
2. Prakash, A., Medcof, J. C. and Tennant, A. D., *Bull. Fish. Res. Bd. Can.*, 1971, **177**, 88.
3. Luthy, J., In: *Toxic dinoflagellate blooms* (eds) D. L. Taylor and H. H. Seliger, Elsevier North Holland, 1979, p. 15.
4. Hashimoto, Y., *Marine toxins and other bioactive marine metabolites*, Japan Scientific Societies Press, Tokyo, 1979, p. 40.
5. Tufts, N. R. In: *Toxic dinoflagellate blooms* (eds) D. L. Taylor and H. H. Seliger, Elsevier North Holland, 1979, p. 403.
6. Maclean, J. L. In: *Toxic dinoflagellate blooms* (eds) D. L. Taylor and H. H. Seliger, Elsevier North Holland, 1979, p. 173.
7. Horwitz, W. (ed.) *Official methods of analysis of the association of official analytical chemists.* AOAC, Washington, 1975, p. 319.
8. Sommer, H. and Meyer, K. F., *A. M. A. Arch. Pathol.*, 1937, **24**, 560.
9. Bond, R. M. and Medcof, J. C., *Can. Med. Assoc. J.*, 1958, **79**, 19.
10. Schantz, E. J., In: *Microbial safety of fishery products* (eds) C. O. Chichester and H. D. Graham, Academic Press, New York, 1963, 153.
11. Dah, B., Yentsch, C. M. and Hurst, J. W., *Science*, 1978, **201**, 1223.
12. Schantz, E. J. and Magnusson, H. W., *J. Protozool.*, 1964, **11**, 239.
13. Iioka, K., Nakano, W., Ishimoda, S., Nagayama, K. and Sato, T., *J. Food Hyg. Soc. Japan*, 1964, **5**, 391.
14. White, A. W., *J. Fish. Res. Bd. Can.*, 1977, **34**, 2421.