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SHORT COMMUNICATIONS

Determination of the levels of indicator bacteria and *Salmonella* spp. in *Chamelea gallina*, L. and seawater on the coastline of Sile, Turkey

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Indicator bacteria and *Salmonella* spp. were investigated in both *Chamelea gallina* and seawater from six stations on the coastline of Sile, Turkey. Studies were carried out on 15 days from June to December in 1998–1999. *Chamelea gallina* samples which were collected at approximately 5–10 metres depth from the chosen stations were examined for faecal *coliform*, *Escherichia coli* and *Salmonella* spp. Bacteria numbers were highest in July and August. Bacteria distribution was found to be statistically significant between stations. No *Salmonella* spp. were detected in the samples.

Analyses were carried out in Sile on the coast of the western Black Sea where the production of *Chamelea gallina* is high (Deval, 1991; Oray & Deval, 1991). The population rises to 200,000 during the months of July and August due to recreational activities, compared with 50,000 during the other months. The purpose of this research project was to determine the effect of the increasing anthropological activity on the bacteriological pollution of the seawater and *C. gallina* samples.

One hundred samples of seawater and 96 groups of *C. gallina*, which were collected from the study stations from June to December in 1998–1999, were analysed. *Chamelea gallina* samples were caught by mechanical dredge at approximately 5–10 metres depth.

Analyses of faecal *coliforms* and *E. coli*, utilized at least six individuals as a group and a total of 10 g were taken from six individuals to form a sample group. In the analyses of *Salmonella* spp., 25 g were taken from each group, and 96 groups of *C. gallina* samples were examined. Faecal *coliform* and *E. coli* analyses were done according to the Most Probable Number Method (MPN) (FAO, 1992; FDA, 1998; Harrigan, 1998).

Salmonella spp.: analysis depends on identification with biochemical and serologic tests of suspicious colonies from selective solid medium after selective enrichment and unselective prior enrichment at 37°C in liquid medium (ICMSF, 1978; Harrigan, 1998).

Results of sample analysis, which were taken on each of 15 days, were evaluated on a monthly basis. Measurements were made every 15 days and the higher value was taken for each particular month. Similarly the higher value for each particular month in 1998 and 1999 was taken as the value for the two year period. In *C. gallina* samples faecal *coliform* and *E. coli* were highest as 3500 MPN/100 g and 2545 MPN/100 g in July. In water samples, faecal *coliform* and *E. coli* were highest as 70 MPN/100 ml and 40 MPN/100 ml in July. Faecal *coliforms* reached maximum level as 700–3500 MPN/100 g in July (Figure 1). In *C. gallina* samples the highest level of *E. coli* analyses were reported in July in the range of 490–2545 MPN/100g. Bacterial number was at the lowest level in June and November. No *Salmonella* spp. were detected in the samples. Faecal *coliforms* and *E. coli* analyses showed different values. The significance of the stations on faecal *coliform* and *E. coli* distribution has been shown statistically (Khi-kare test $P<0.001$). While the third station showed the highest differences, the fifth and second stations followed (Figure 1B,C&E).

Results of water samples analyses were higher in July than the other months (Figure 2). Faecal *coliforms* reached the highest level at the fourth station as max 70 MPN/100 ml (Figure 2D) *E. coli* reached the highest level at the first station as 40 MPN/100 ml (Figure 2A).

In the samples taken from six stations representing the Sile coastline, the number of bacteria were generally highest in July and August and lower later. But *C. gallina* samples from the third and sixth stations in September had higher values than August. The situation at the third and sixth stations can be explained as different effects of environmental factors (Edwards et al., 1997). Frequency of bacteria was highest in July but distribution of frequency was different for every station. There are a lot of factors which affect this situation. Points of waste water discharge are the most important factor, and results demonstrated that this area is under the influence of faecal pollution, because waste water discharge is made directly to the sea. Population increases during the months of July and August is 3 to 4 fold higher compared to winter. Temperatures during the months of July and August are more suitable than other months for *coliform* growth (ICMSF, 1980).

Seawater analyses demonstrated that faecal *coliform* and *E. coli* values in July and August showed the highest values compared to other months and that water carries less faecal *coliform* and *E. coli* than *C. gallina* samples. Due to the sensitivity of organisms and accumulation of environmental contamination more contamination can be found in the mussels than in the sea samples surrounding them. Due to their filtration property they can reflect bacterial changes around them (Walne, 1974), and accumulation rate can change depending on microbial species (Martinez et al., 1991).

Faecal *coliform* and *E. coli* analyses which were carried out for six month terms for two years showed that *C. gallina* led to

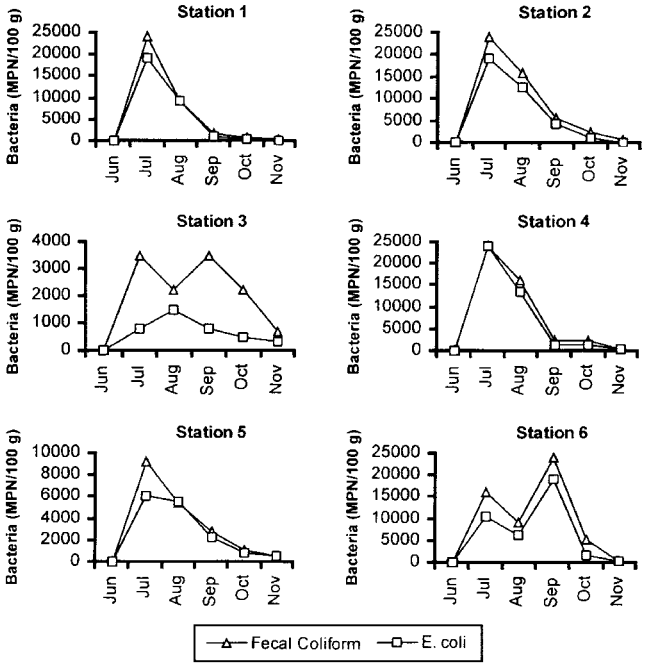

Figure 1. *C. gallina*. faecal *coliform* and *E. coli* distribution (max MPN/100 g) 1998–1999.

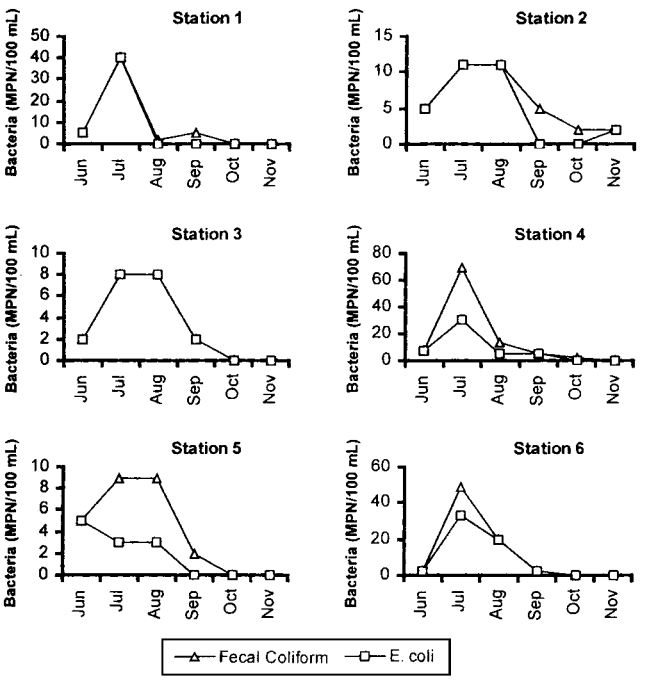

Figure 2. Seawater. Stations and Frekans distribution of faecal *coliform* and *E. coli*.

contamination in the area. These areas must be observed and protected for ecological and sanitary purposes. *Salmonella typhi* was isolated frequently in bivalve molluscs which were caught from a contaminated sea region (Inal et al., 1979), but no *Salmonella* spp. were detected in the samples.

REFERENCES

Deval, M.C., 1991. *Investigations on the reproduction stages of* C. gallina *L. in the northern parts of the Marmara Sea and Black Sea* 1990. PhD thesis, University Fisheries Faculty, Istanbul, Turkey.

Edwards, E., Coyne, M., Daniel, T., Vendrell, P., Murdoch, J. & Moore, P., 1997. Indicator bacteria concentrations of two northwest Arkansas streams in relation to flow and season. *American Society of Agricultural Engineers*, **40**, 103–109.

FAO, 1992. *Manual of food qualty control*, 4th rev 1. Microbiological Analyses. Food and Agricultural Organization of the United Nations Press.

FDA, 1998. *Bacterial analytical manual*, 8th edn. Rev. A. AOAC International Washington Press.

Harrigan, W.F., 1998. *Laboratory methods in food microbiology.* San Diego: Academic Press.

ICMSF, 1978. *Microorganisms in foods*. Toronto: University of Toronto Press.

ICMSF, 1980. *Microbial ecology of foods*. New York: Academic Press.

Inal, T., Bese, M., Ugur, M. & Tantaş, A., 1979. Izmir seaport waters and *Salmonella* contamination. *Research Bulletin* TUBITAK, *Ankara* no. 293, 20 pp.

Martinez, M.E., Egea, F., Castro, D., Morngo, M.A., Romeo, P. & Borrego, J.J., 1991. Accumulaton and depuraton of pathogenic and indicator microorganisms by the bivalve mollusc *Chamelea gallina* L., under laboratory conditions. *Journal of Food Protecton of the USA*, **54**, 612–618.

Oray, I.K. & Deval, M.C., 1991. Investigations on the reproduction stages of *C. gallina* L. in the northern parts of the Marmara Sea and in the Black Sea. In *Aquatic Products Fishing & Processing Seminar, International Rotary Club, Istanbul March 1992* (ed. I. Oray), pp. 68–72. Istanbul: Rotary Club Press.

Walne, P.R., 1974. *Culture of bivalve mollusc*. London: The Whitefriars Press.

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