

Microbiological quality of sand beaches in Gran Canaria island

J.R. Betancort Rodríguez, T. de la Cruz Martín

Water Department - Instituto Tecnológico de Canarias (ITC). Playa de Pozo Izquierdo, s/n, 35119 Santa Lucía. Gran Canaria. SPAIN, jbetancort@itccanarias.org

INTRODUCTION

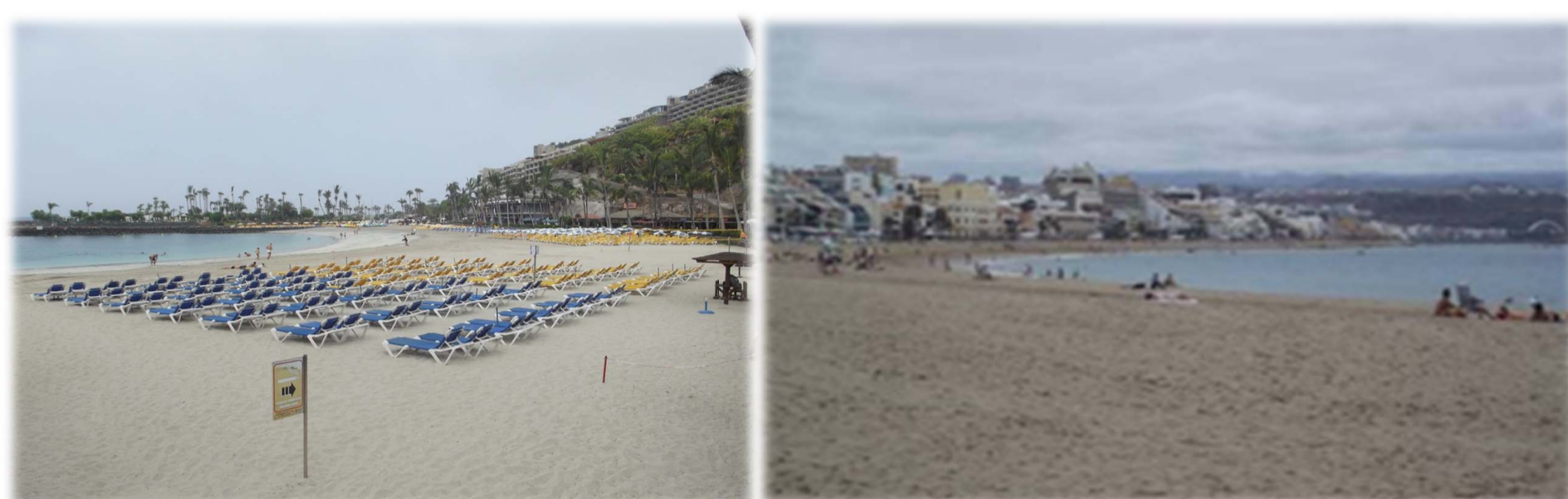
Tourism is the main economic activity in Canary Islands, being the sandy beaches one of the most important tourist attraction. The sand and the water in a beach can share the same sources of pollution, such as, animals droppings (dogs, seabirds, etc.), uncontrolled wastewaters discharges, avenues by heavy rains, etc. Actually, WHO and several authors, have considered the quality of the beach sands as a very important issue because in this diverse microbiota, some potentially pathogenic organisms by direct contact, can also be found, may be the beach sands reservoir or vector of possible infections (WHO, 2003). Pathogenic organisms in the beaches may have different origins, but most of them come from exogenous sources being related to human activity (Halliday and Gast, 2011).

The objective of this study was to evaluate the microbiological (bacteriological and mycological) quality of sand from two beaches. Concentration of total coliforms (TC), *Escherichia coli* (EC) and intestinal enterococci (IE), yeast, filamentous fungi and dermatophytes were evaluated during 1 year. This work has been done under the scope of OMARCOSt project "Strategy for the environmental sustainability of transboundary coastal environment" (www.omarcost.org), funded by the Program of Cross-border Cooperation Spain - External Borders (POCTEFEX).

MATERIAL AND METHODS

Site Description

Two beaches, Las Canteras and Anfi del Mar, located in Gran Canaria (Canary Island, Spain) were selected for this study. Las Canteras beach is located in the north of the island, has a length of 2250 m and an average width of 50 m, with a gently sloping. Anfi del Mar beach, is an artificial beach of white shells crushed and calm waters, located in the SO of the island. Bathing season for both beaches goes from January to December.



Sample collection

Samples were monthly collected from each beach from November 2012 until December 2013. Sampling points in each beach (dry sand area) were located in those areas with highest concentration of users. Dry sand samples were collected aseptically at a depth of about 10 cm. Samples were processed within 18 hours and transported refrigerated to the laboratory.



Sample analysis

Mycological: 40 gr of dry sand sample was diluted in 20 ml of sterilized distilled water, agitated for 30 min at 100 rpm. Two aliquots of 0.2 mL were spread, onto Petri dishes containing Mycobiologic agar for dermatophytes (15 days of incubation at 25 ± 2°C) and Malt Extract agar for non-dermatophytes fungi (5 days of incubation at 25±2°C). Fungi were identified by macroscopic and microscopic (using lactophenol blue and fuchsine staining) observation of colonies, using identification atlases and using the biochemical identification galleries ID32C (bioMérieux SA) for yeasts. **Bacteriological:** TC, EC and IE were analyzed by MPN technique using chromogenic and fluorogenic substrates (Colilert and Enterolert from IDEXX Laboratories). 50gr of dry sand were extracted with 500 ml of sterile distilled water and agitated for 30 min at 100 rpm. 10 ml of suspension were diluted up to 100 ml with distilled water and processed according to manufacturer's instructions.



RESULTS AND DISCUSSION

Microbiological sand analysis reveals that filamentous fungi are the most frequent and most predominant microorganisms in the sand of both beaches (Table 1).

Table 1.- Positive (+) and negative (-) samples for investigated parameters.

	Anfi del Mar		Las Canteras	
	+	-	+	-
Yeast	8	3	2	9
Filamentous	11	0	8	3
Dermatophytes	0	11	0	11
Bacteria	5	6	1	10

Sand microbiological quality of monitored beaches was evaluated comparing the 95 percentiles values for each microbiological parameters analyzed with the maximum recommended value (MRV) proposed by Instituto Nacional de Saúde Dr. Ricardo Jorge of Portugal (Brandao et. al 2010). As it is shown in Table 2, Las Canteras beach has "better sand quality" since all the 95th percentiles are lower than MRV. However, Anfi del Mar beach does not meet the proposed standards for EI and filamentous fungi.

Table 2.- 95th percentile value of colony counts obtained for each parameter.

	MRV (cfu/g)	Anfi del Mar	Las Canteras
CT	100	23	1
EC	20	1	1
EI	20	82	1
Yeast	60	32	2
Filamentous	85	119	43
Dermatophytes	15	1	1



In Las Canteras beach sand samples, the most frequently genera of filamentous fungi identified were *Aspergillus spp*, followed by *Acremonium spp* and *Penicillium spp*. During the sampling period no dermatophyte was identified. Yeast was detected only in 18,2 % of the sand samples, being *Rhodotorula spp* and *Candida spp* the main genera identified (Fig. 1). The presence of pathogenic bacteria in this beach was very low. In the only positive sample, colonies were identified as EC.

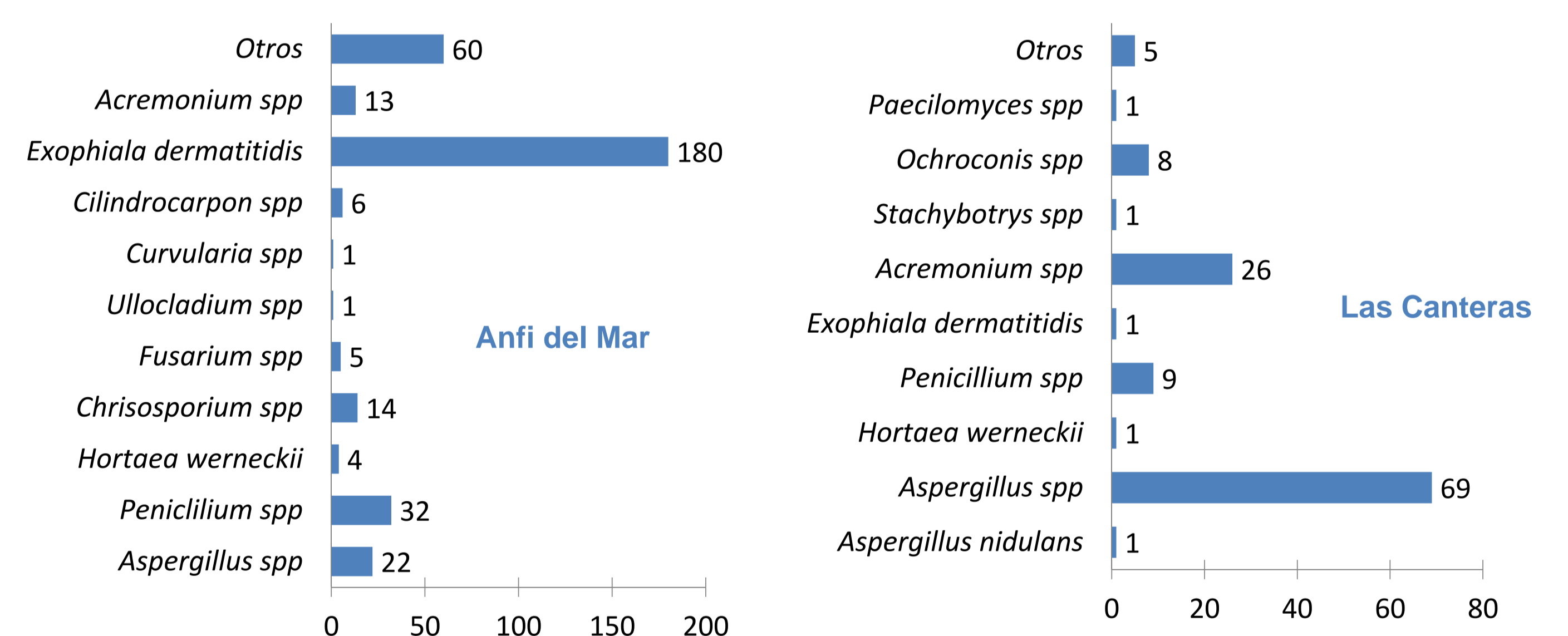


Figure 1.- Predominant fungi species in monitored beaches.

The most frequently genera of filamentous fungi identified in Anfi del Mar beach sand samples, were *Exophiala spp*, *Penicillium spp* followed by *Aspergillus spp* (Fig. 1). During the sampling period no dermatophyte was identified. Yeast was detected in 72,7 % of the sand samples, being *Candida spp* the predominant genera found (65,4 % of total colonies isolated). Other relevant yeast species identified using biochemical test were *Cryptococcus spp*, and *Rhodotorula spp*. The predominant bacteria group in the sand on this beach was the IE (80% of total bacteria counts). Total coliforms accounted the remaining 20% . No EC was identified in any sample.

CONCLUSIONS

- ✓ Microbiological predominant groups for both beaches are filamentous fungi and intestinal enterococci.
- ✓ Higher concentrations of bacteria and fungi occurred during winter season (from November to March).
- ✓ The lower total concentration of pathogenic species in sand samples from Las Canteras beach, can be related with the beach management actions carried out.

REFERENCES

- Brandao J. et al. (2010) Monitorização da qualidade das areias em zonas balneares – Época Balnear de 2010. Associação Bandeira Azul da Europa. And Instituto Nacional de Saúde Dr. Ricardo Jorge.
- Halliday, E., Gast, R. J. (2011) Bacteria in Beach Sands: An Emerging Challenge in Protecting Coastal Water Quality and Bather Health; Environmental Science & Technology; Vol. 45, No. 2, p. 370-379.
- WHO (2003) Microbial aspects of beach sand quality in: Guidelines for safe recreational water environments, Volume 1, Geneva; Chapter 6, p. 118-127.