Editorial

Recent advances in antimicrobial and bacterial resistance

The emergence of bacterial strains resistant to one or more antibiotics has been observed over the last decades at increasing rates. Antimicrobial resistance is a complex global phenomenon that is constantly changing, despite the fact that it does not affect all countries to the same degree. Several countries have implemented corrective measures to prevent the spread of antimicrobial resistance, with variable results.

One of the current major problems is the resistance of Enterobacteriaceae owing to carbapenemase production. Dziri et al. present a research paper describing the production of metallo- β -lactamases and class D carbapenemases in South East Tunisia, including a special focus on the implication of mobile genetic elements in their dissemination [1]. Another study describes the high prevalence of extraintestinal pathovar and the occurrence of non-extended-spectrum β -lactamase (ESBL)-producing *Escherichia coli* colonising healthy children in Tunisia belonging to sequence type 131 (ST131) clone [2]. The incidence of different ESBLs is described by Kharrat et al. following epidemiological and molecular characterisation of Enterobacteriaceae-infected haematopoietic stem cell transplant recipients hospitalised at the Tunisian National Bone Marrow Transplant Center [3]. Another study by Rad-daoui et al. on Gram-positive bacteria reports a high prevalence of multidrug-resistant international clones among macrolide-resistant *Streptococcus pneumoniae* strains isolated in immunocompromised patients in Tunisia [4]. In addition to β -lactamase production, porin alteration is a significant resistance mechanism. In this context, Hamzaoui et al. describe the role of association of OmpK35 and OmpK36 alteration and *bla*_{ESBL} and/or *bla*_{AmpC} in conferring carbapenem resistance among non-carbapenemase-producing *Klebsiella pneumoniae* [5]. The most recent metallo- β -lactamase, NDM-1, is particularly described in this Special Issue by Kanzari et al. who describe the first report of an extensively drug-resistant *Proteus mirabilis* isolate carrying plasmid-mediated *bla*_{NDM-1} [6] and by Maamar et al. who describe the incidence of NDM-1- and OXA-23 among clinical isolates of *Acinetobacter baumannii* [7]. In addition, Jaidane et al. present a metagenomic analysis of the whole genome of NDM-1-producing ST85 *A. baumannii* isolates from Tunisia. They identified a single clone spreading the *bla*_{NDM-1} gene in Tunisia and conclude that this clone has been circulating for at least 5 years in this country [8]. Other studies of Gram-positive bacteria evaluated virulence determinants, biofilm production and antimicrobial susceptibility in *Staphylococcus aureus* causing device-associated infections [9]; the detection and characterisation of methicillin-resistant and -susceptible coagulase-negative staphylococci in milk from cows with clinical mastitis [10]; and the

emergence of *vanA* and *vanB2* responsible for antimicrobial resistance and the genetic lineages of faecal enterococci of wild birds [11].

The last part of this themed issue consists of a special focus on *Candida albicans*. The first study shows that *Cutibacterium acnes* can protect *C. albicans* from the effect of micafungin in biofilms [12]. Finally, Dutreix et al. raise the question. 'Do raspberry extracts and fractions have antifungal or anti-adherent potential against *Candida* spp.?'. They highlight for the first time the potential of red raspberry extracts and enriched fractions to prevent oral *C. albicans* biofilms [13].

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