

Contaminations of AMR genes linked to the presence of genetically modified microorganisms in the food and feed chain

Fraiture Marie-Alice¹ • De Keersmaecker Sigrid¹ • Roosens Nancy H.C.¹

¹ Transversal activities in Applied Genomics, Sciensano, Brussels, Belgium

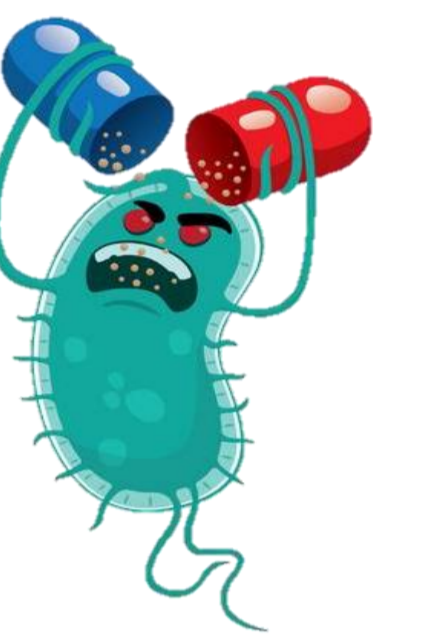
Introduction

 Several genetically modified microorganism (GMM) contaminations, viable cells and DNA, notified in commercial fermentation products (e.g., additives, enzymes).



GMM, commonly used by the industry to produce such food/feed products, carried frequently antimicrobial resistance (AMR) genes as selection markers.

These GMM contaminations in the food/feed chain raised therefore public health concerns related to potential horizontal transfer of AMR genes to other microorganisms, including pathogens, present in gut microbiota and the environment.




Consequently, to guarantee the food/feed safety and traceability, tools to control and monitor GMM carrying AMR genes in commercial fermentation products were developed.

Methodology

Using publicly available patents related to genetically modified (GM) bacteria commonly used to produce fermentation products, PCR-based methods specific to key targets allowing to screen and identify GMM carrying AMR genes were developed.



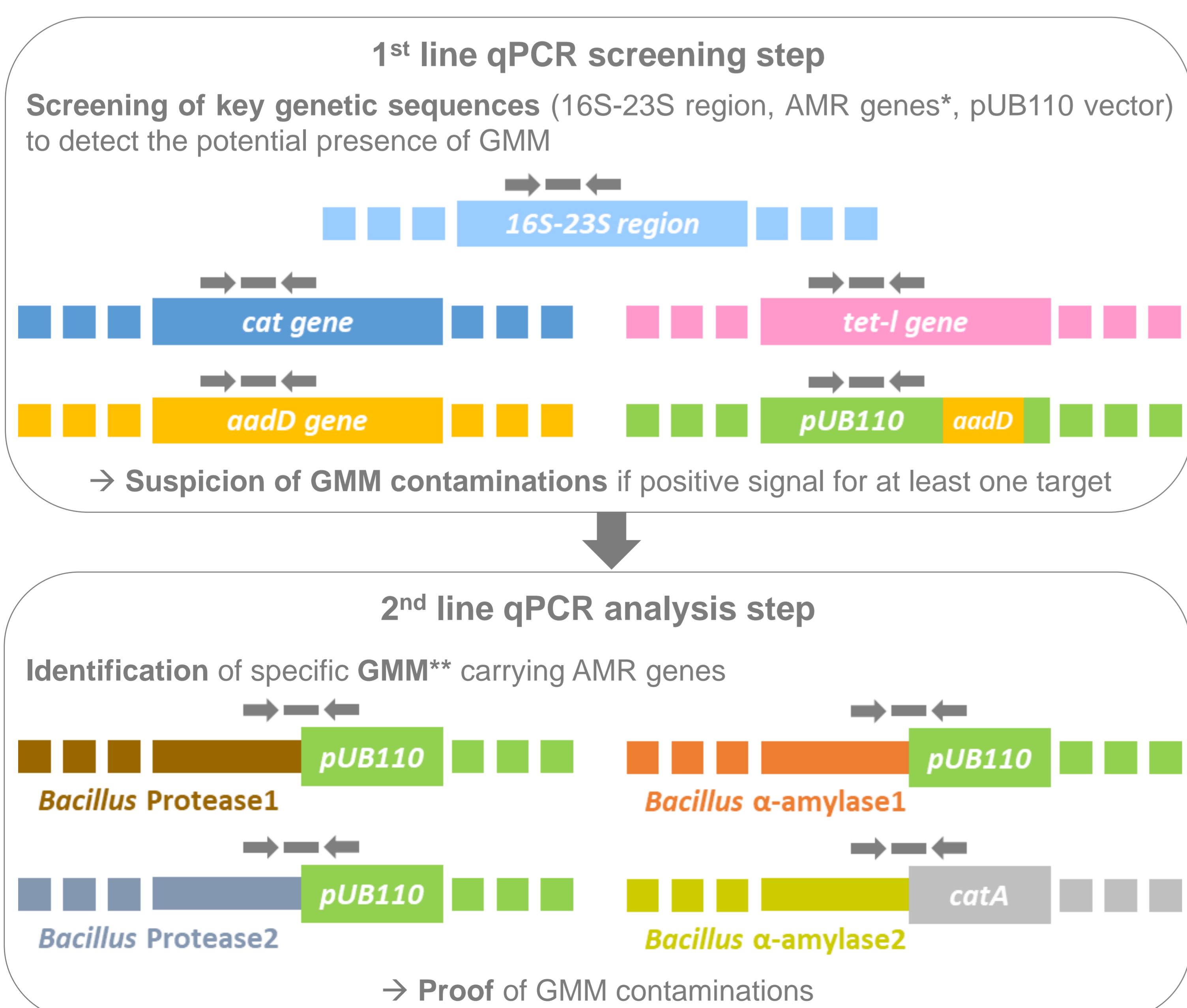
-  (i) qPCR methods specific to screening genetic sequences frequently found in GM bacteria (16S-23S region specific to the *B. subtilis* group, AMR genes (*cat*, *aadD* and *tet-I*) and pUB110 shuttle vector)
- (ii) qPCR methods specific to unnatural associations between the pUB110 shuttle vector and *Bacillus* sp. from currently known GMM
- (iii) PCR methods followed by Sanger sequencing to assess the full-length AMR genes

These methods were applied on 156 fermentation products collected from the European food/feed market, comprising different brands, forms and sectors.



Results and conclusion

A GMM detection strategy was developed.



* Full-length of detected AMR genes is evaluated given potential public health concerns,

** Suspicion of new GMM if signals from the 1st line are not explained by the 2nd line.

→ Monitoring of GMM contaminations 

- Identification of DNA specific to known GMM carrying AMR genes in 70 products
- Isolation of viable GMM carrying AMR genes (*aadD*) in 4 products
- Detection of AMR genes (*cat*, *aadD* and *tet-I*) in 40 products for which the presence of unknown GMM suspected

Based on these results, a first overview of AMR genes linked to GMM contaminations in the food/feed chain was established.

References

Fraiture et al., 2020 (Food Control); Fraiture et al., 2020 (Sci. Rep.); Fraiture et al., 2020 (Int. J. Food Microbiol.); Fraiture et al., 2020 (Food Anal. Methods); Fraiture et al., 2021 (Food Control); Fraiture et al., 2021 (Int. J. Food Microbiol.); Fraiture et al., 2021 (Food Anal. Methods); Deckers et al., 2021 (Food Control); Fraiture et al., 2022 (Fermentation).

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