

# Contributions of Maize and Rye Flour for the Microbial Ecology of Sourdough for a Portuguese Traditional Sourdough Bread



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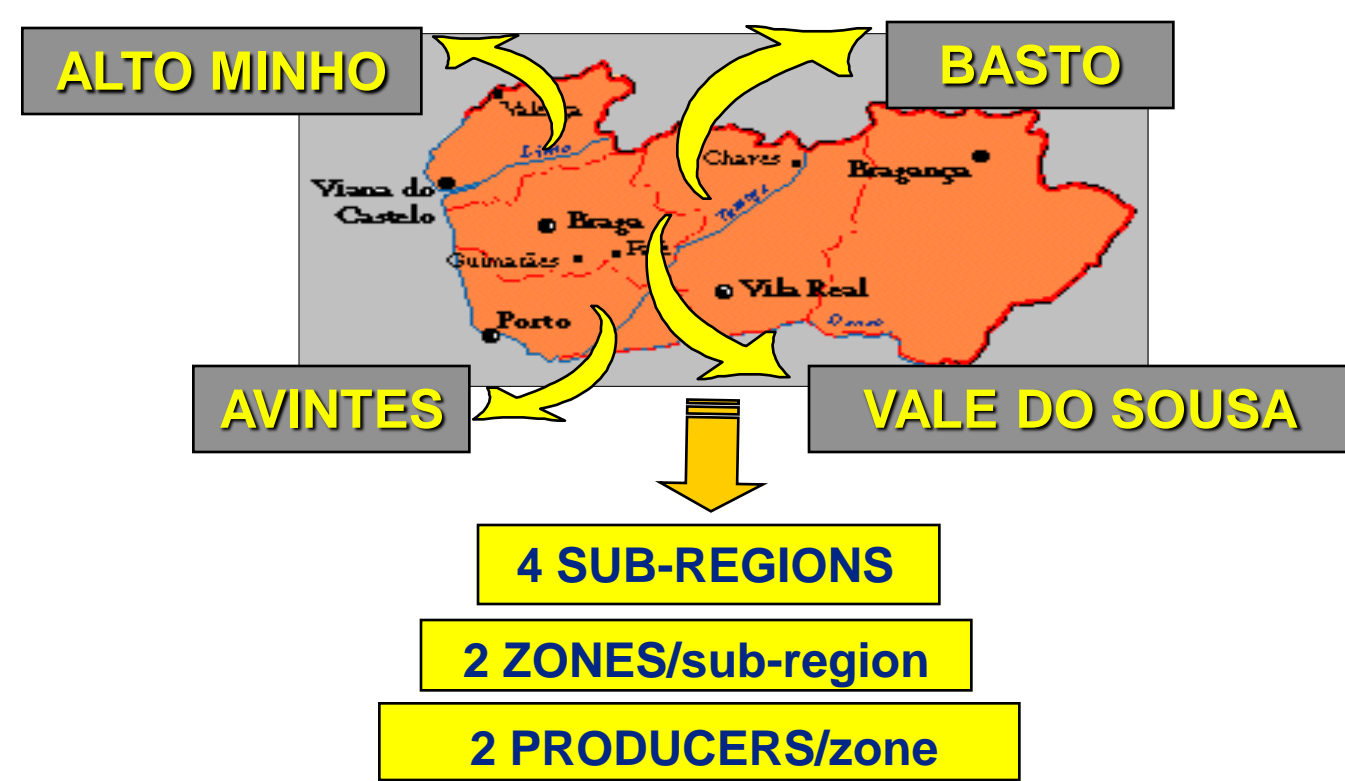
## INTRODUCTION

*BROA* is a traditional type of sourdough bread, which is manufactured at the farm level in Northern Portugal in the absence of a starter culture, following ancient manufacture protocols. The dough is produced from maize and rye flours, and inoculation thereof is via a given amount of previously fermented dough, kept covered from batch to batch.

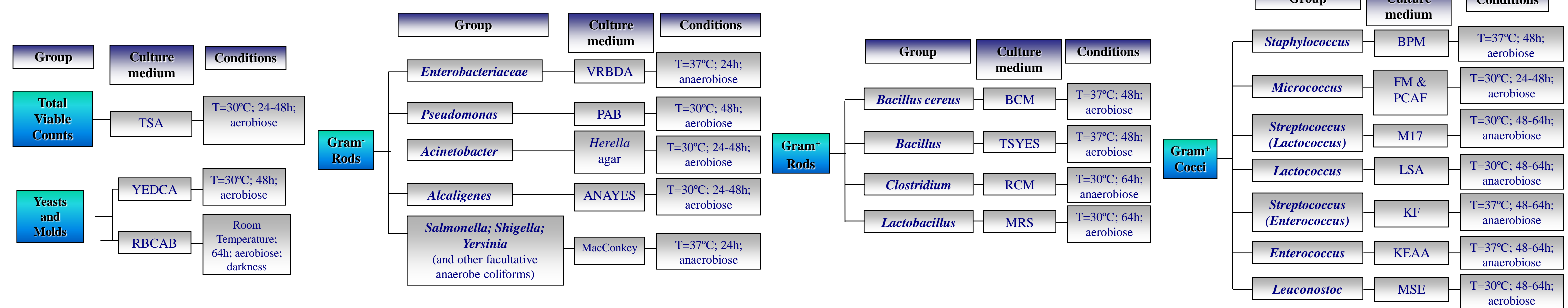
The manufacture of *BROA* has important impacts, from both economic and social standpoints, but a long way is yet to be tracked before such speciality food can be officially certified. To this goal, a thorough microbiological study of maize and rye flours was made, after a previous study has shown that sourdough for *BROA* contains a diverse, unique and rather complex wild microflora. Total viable counts for a wide group of microorganisms were obtained after inoculation of samples of maize and rye flours, supplied by several traditional producers in Northern Portugal, on 19 selective culture media, which were in turn incubated under a total of 22 distinct conditions: such microorganisms encompassed yeasts, molds, Gram<sup>-</sup> rods, Gram<sup>+</sup> rods (endospore-forming and nonsporing), Gram<sup>+</sup> cocci (catalase<sup>+</sup> and catalase<sup>-</sup>), and general mesophilic and thermophilic viable forms (vegetative and spores).

## EXPERIMENTAL METHODS

Samples of maize (*m*) and rye (*r*) flours were obtained from producers located in several different geographical locations (*I,II,...,XV*) and in two different periods, cold (*c*) and warm (*w*) season. Only two producers used to add some wheat (*w*) to the dough, and these samples were also analysed:

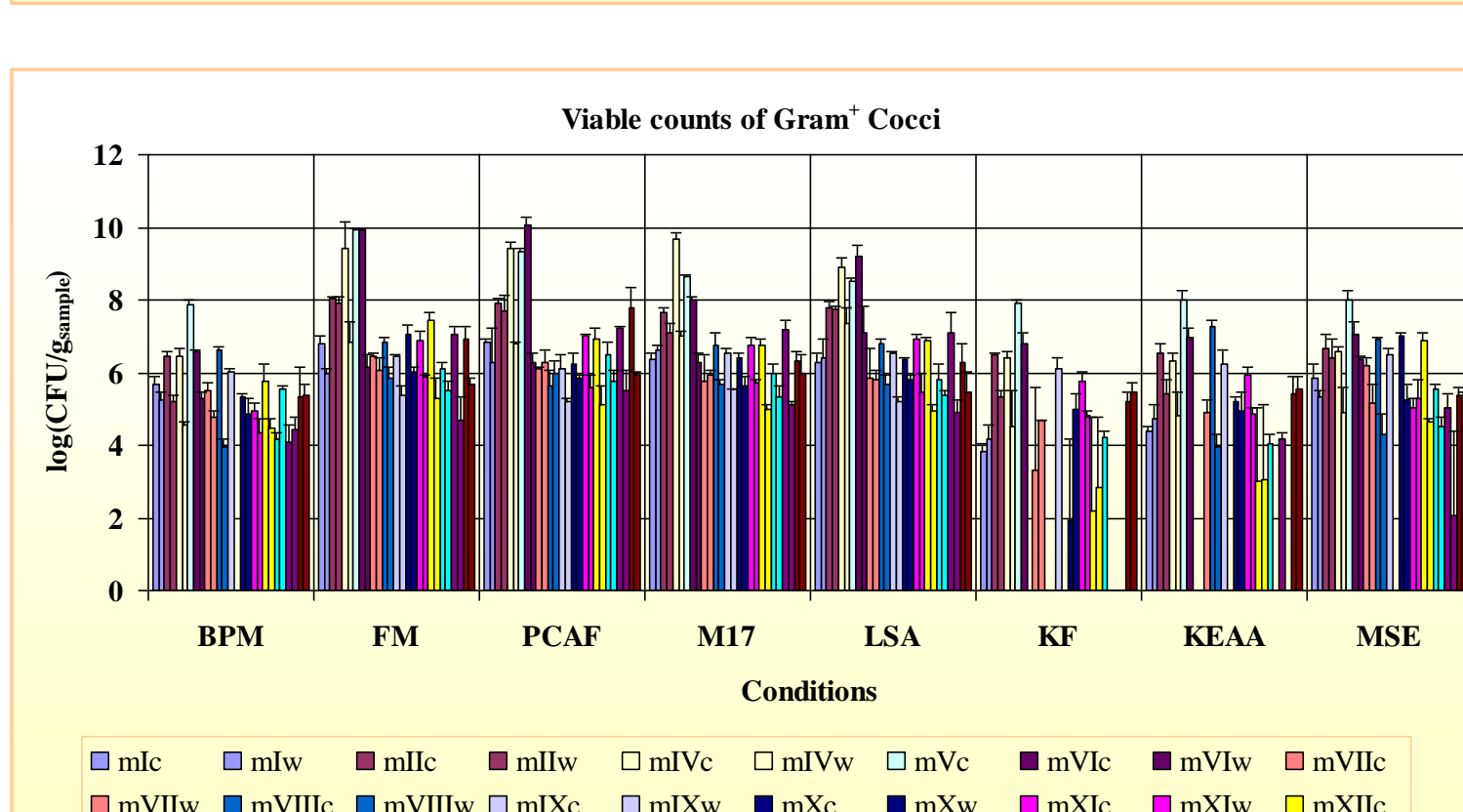
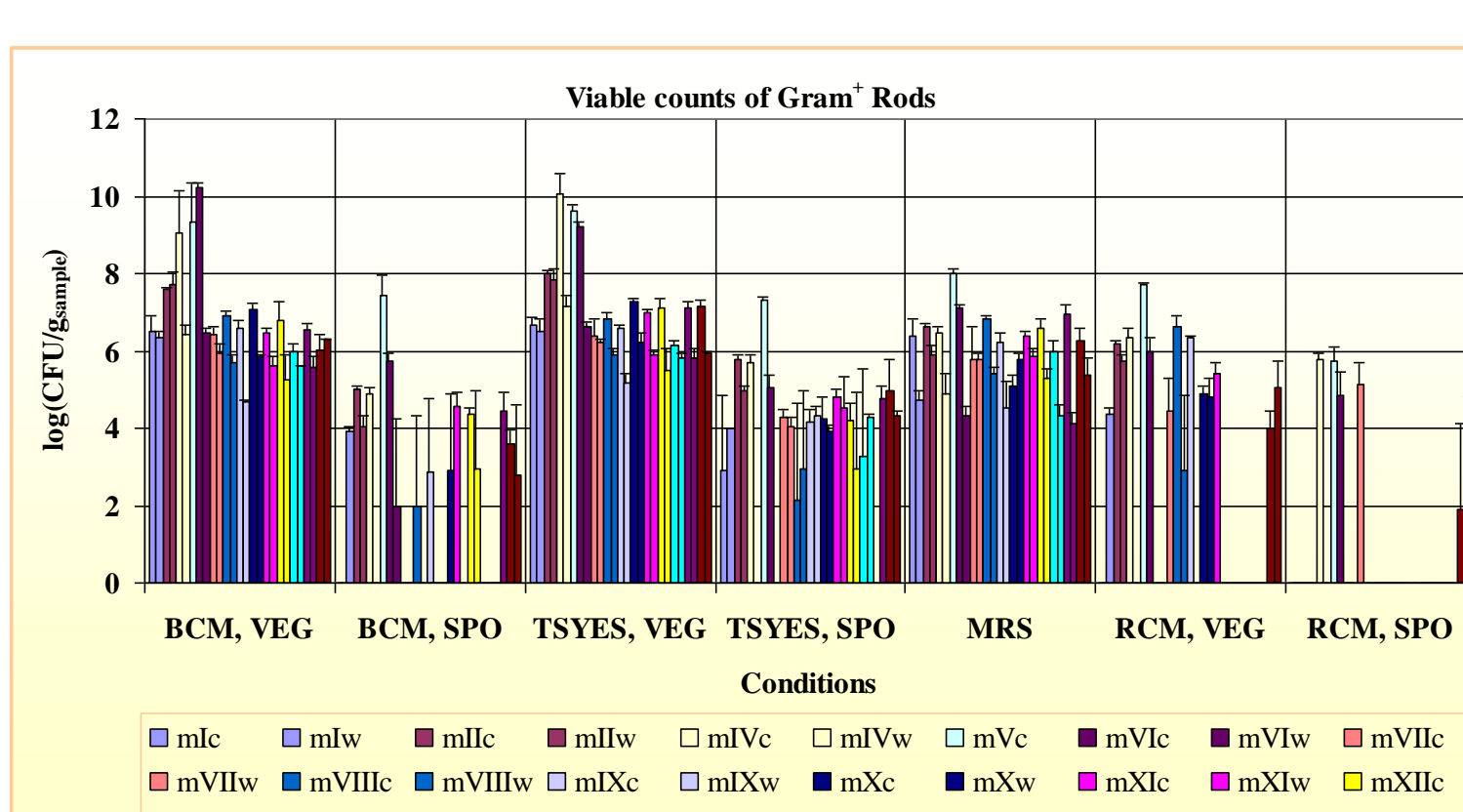
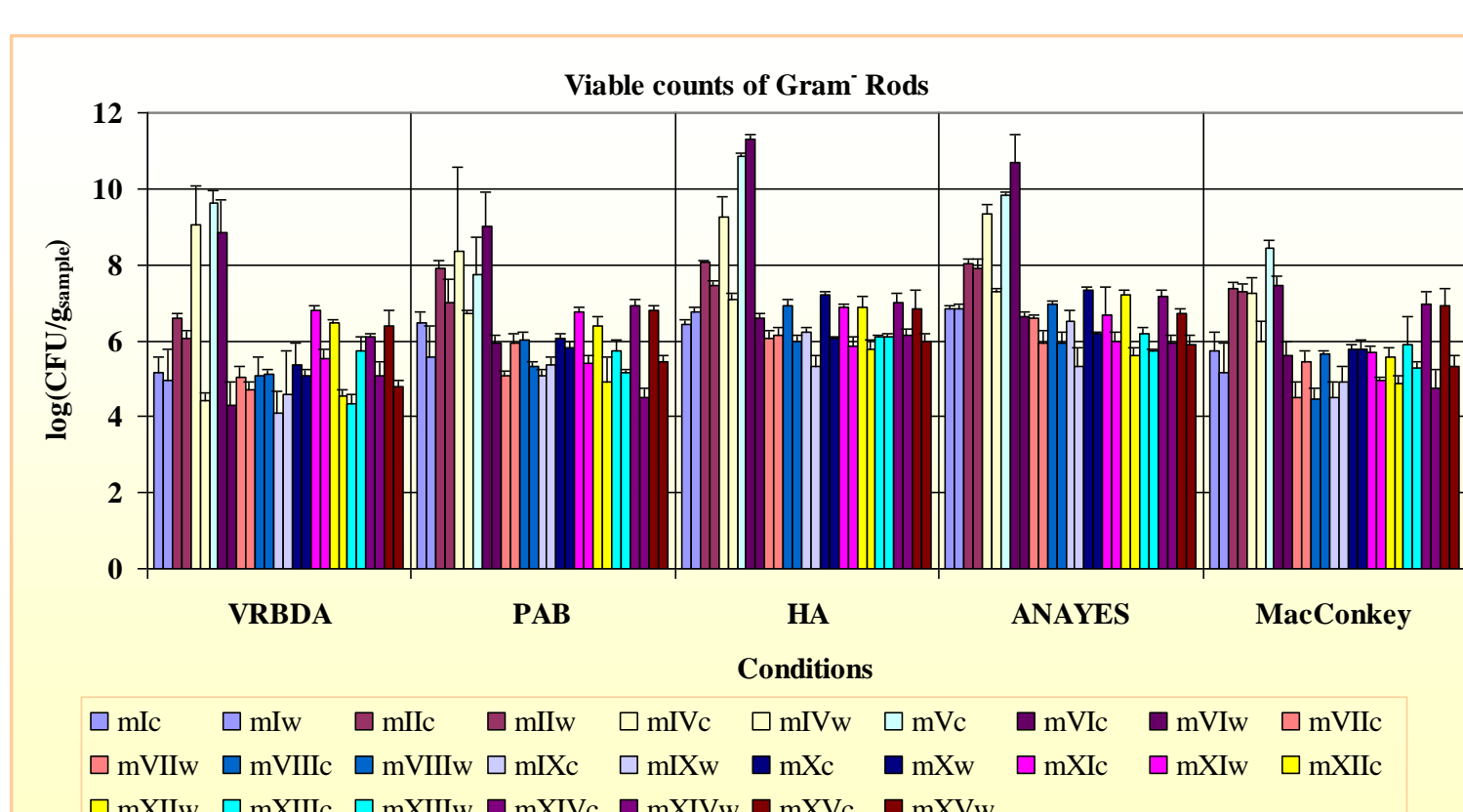
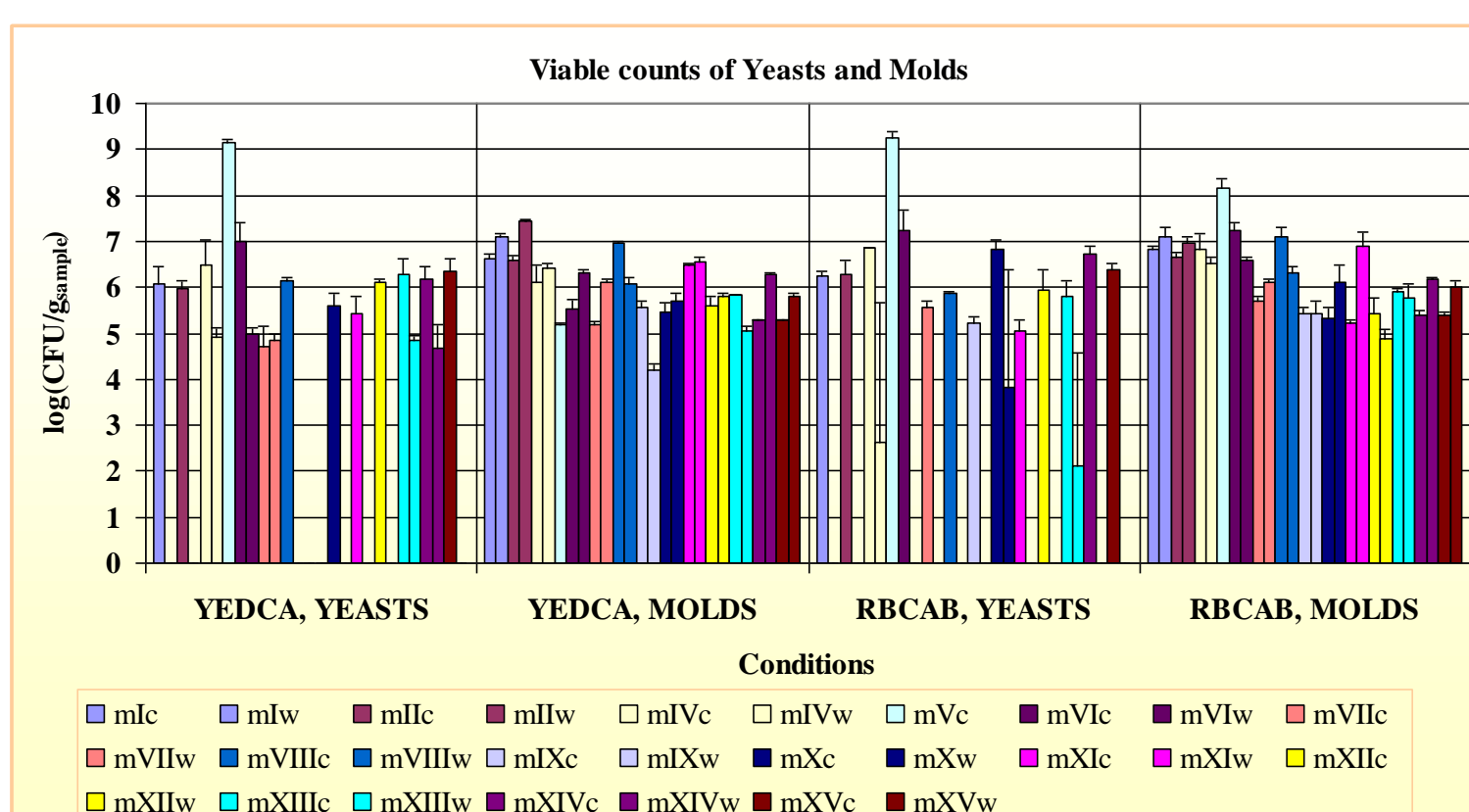
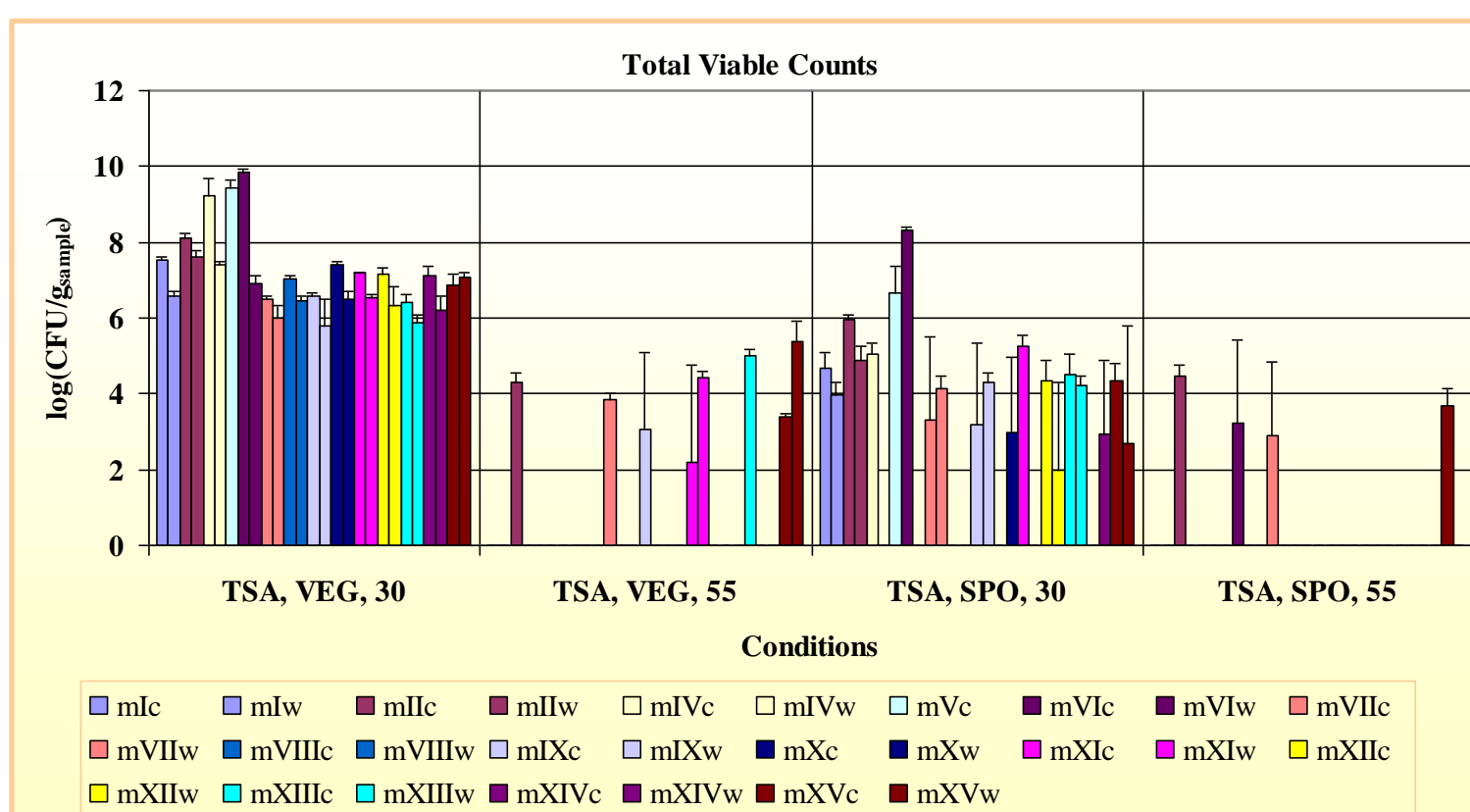


In order to check for the existence of a wide diversity of microorganisms, a large number of culture media and incubation conditions were selected, according to the schematic procedure showed below:

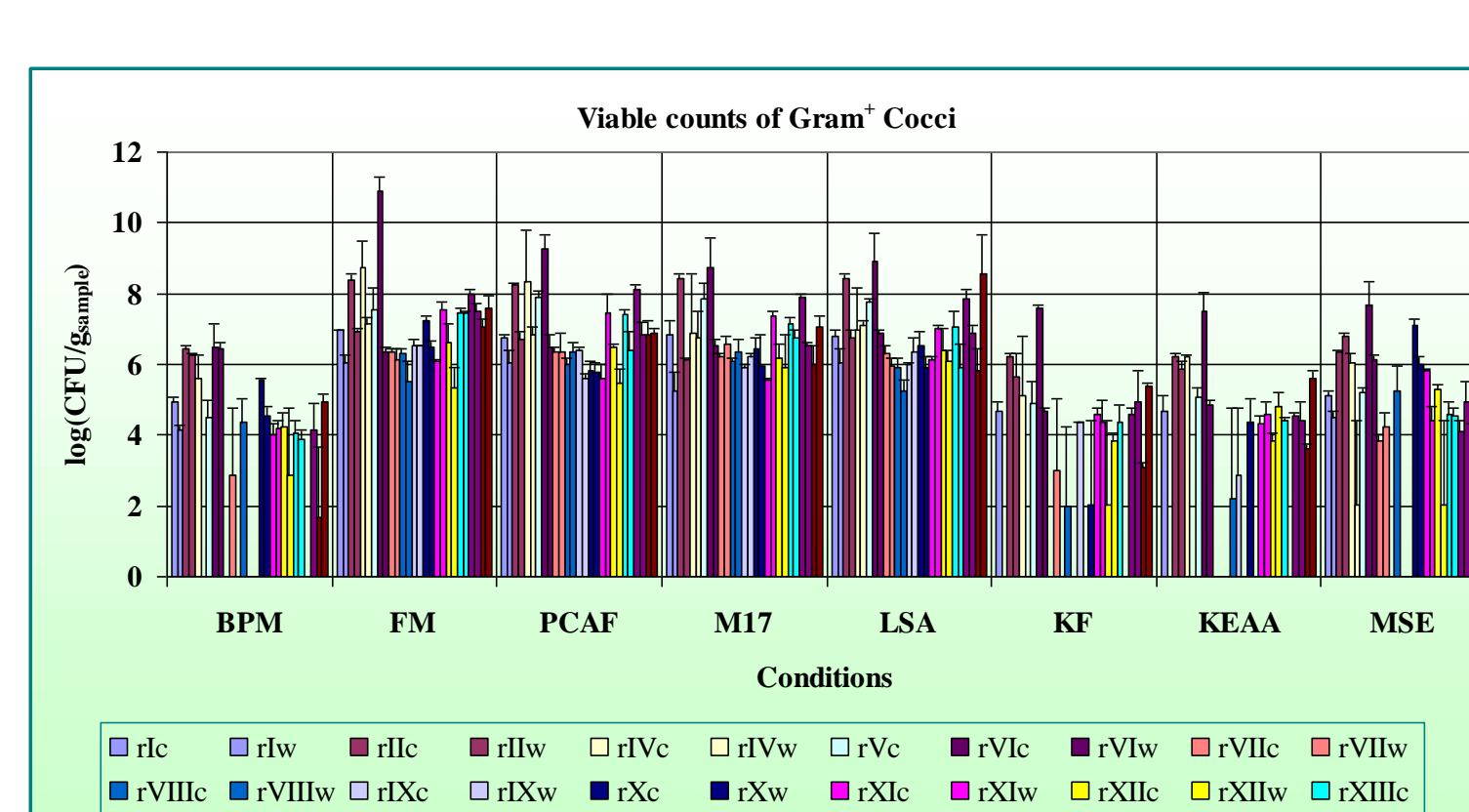
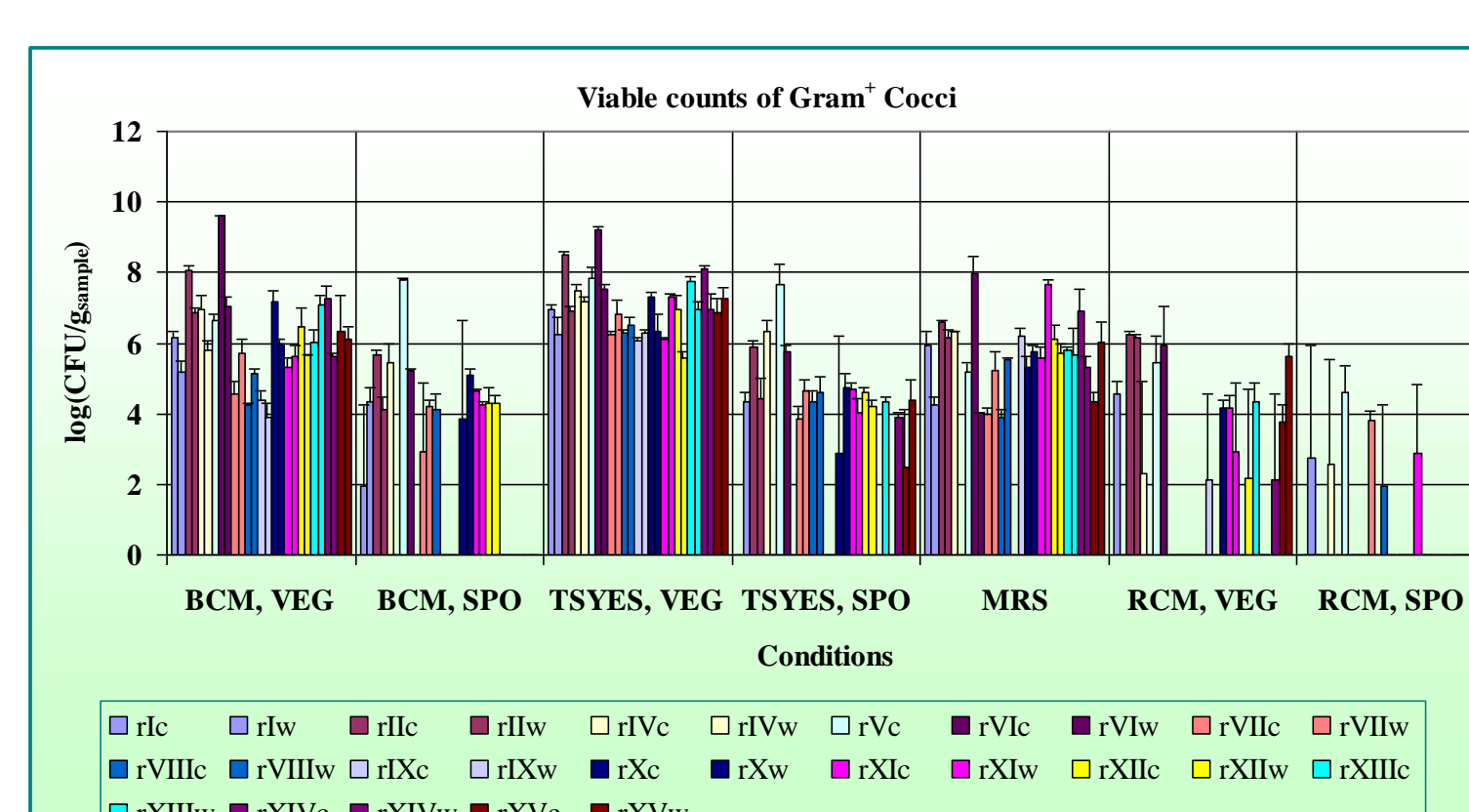
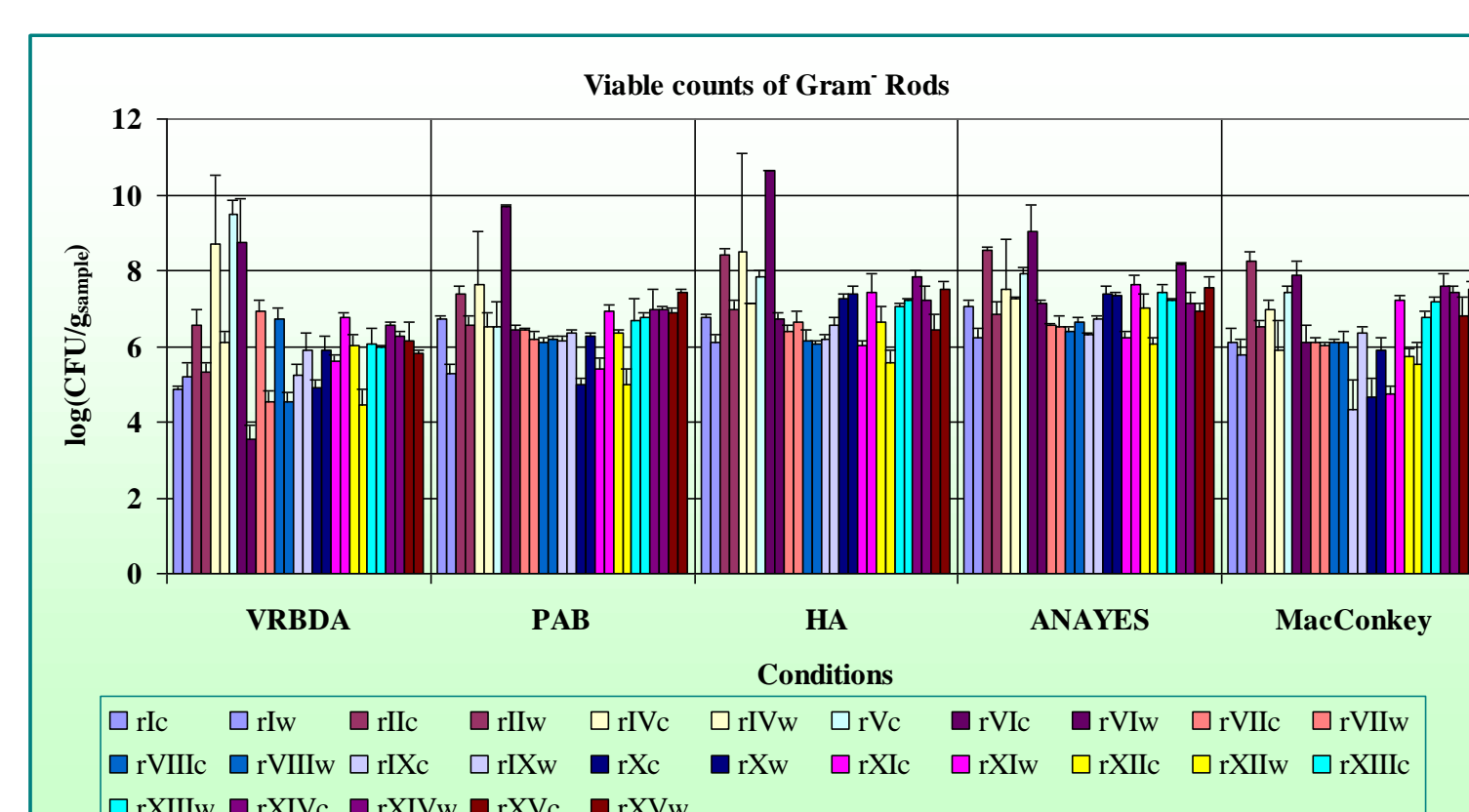
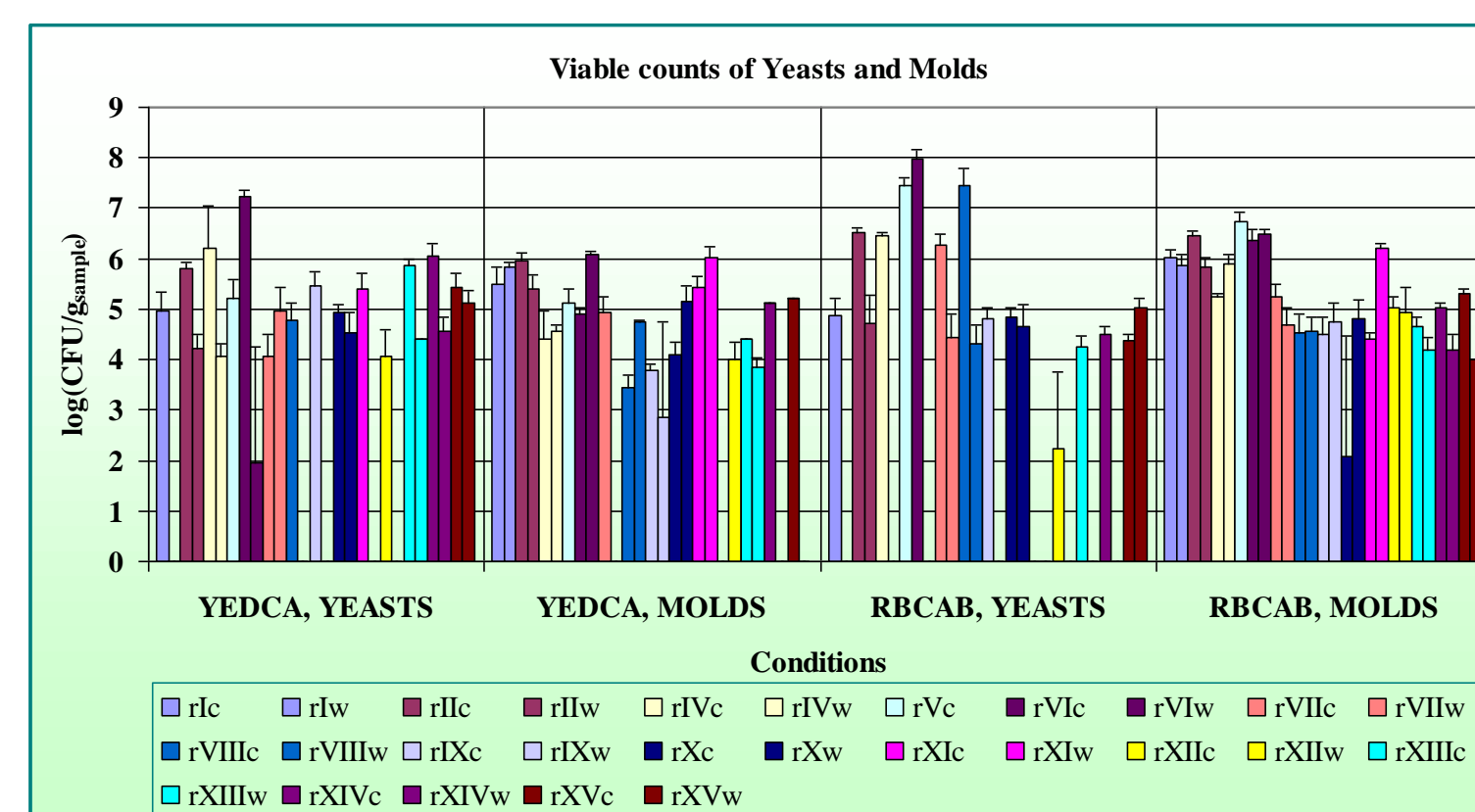
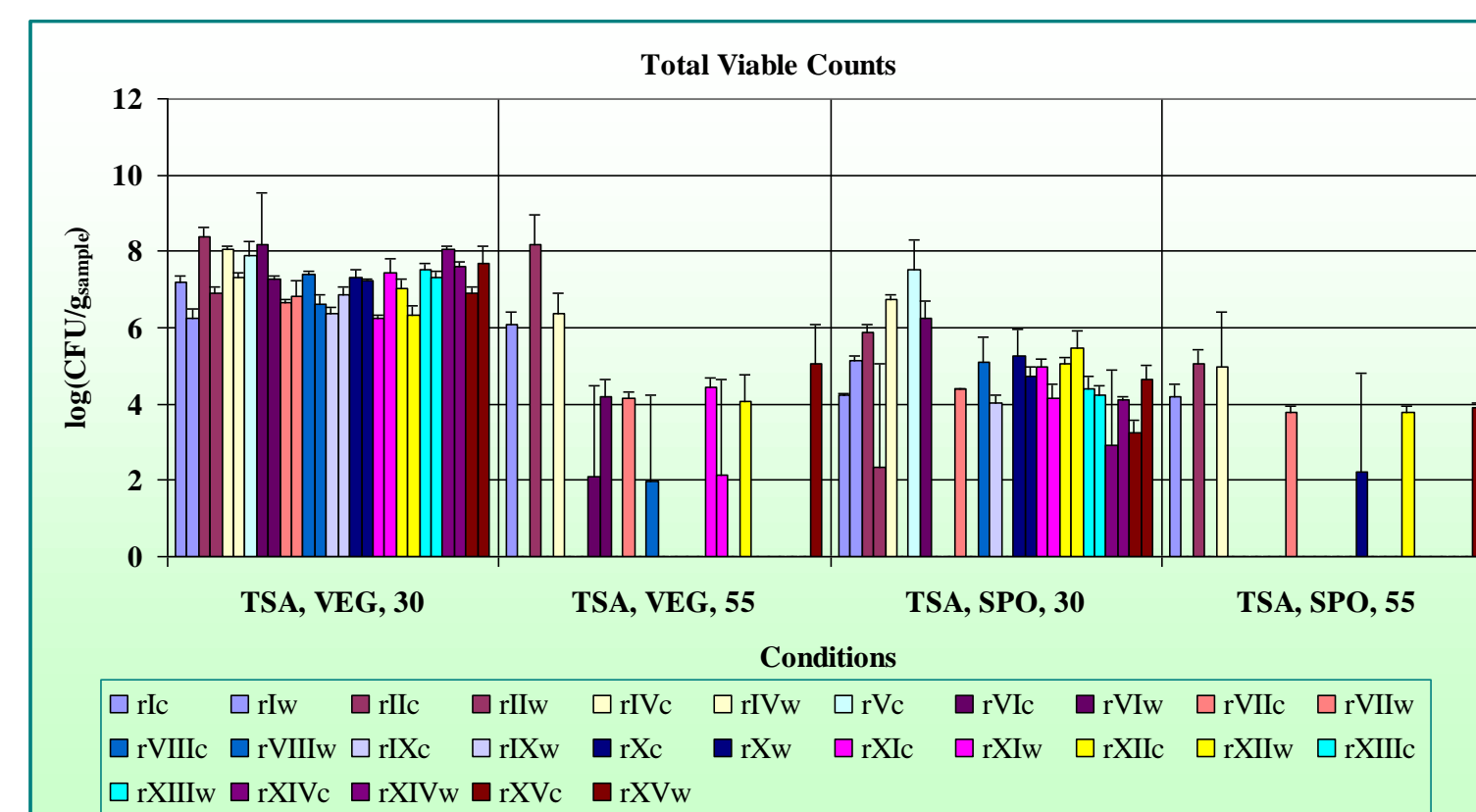


## RESULTS and DISCUSSION

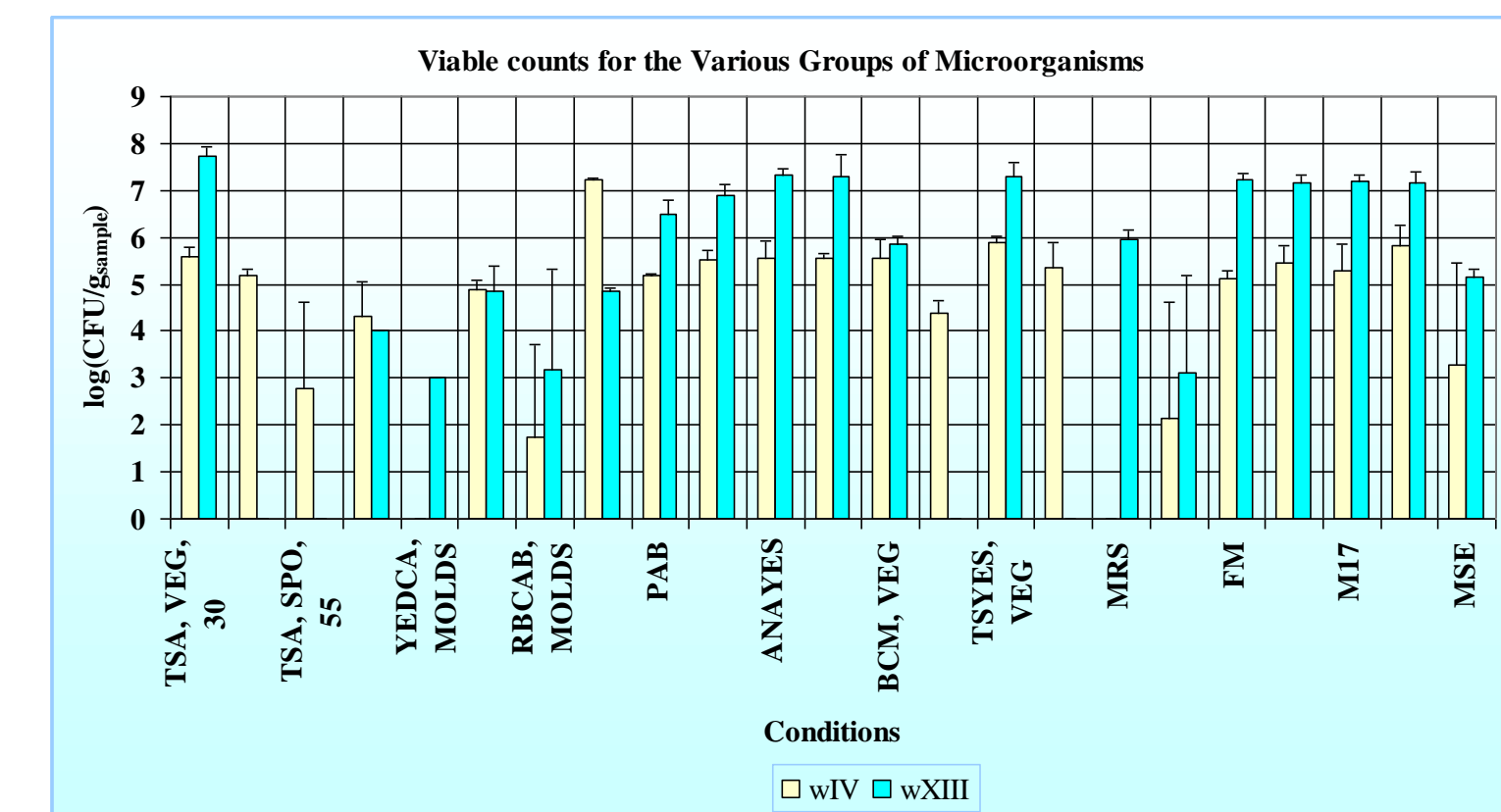
### Maize Flour



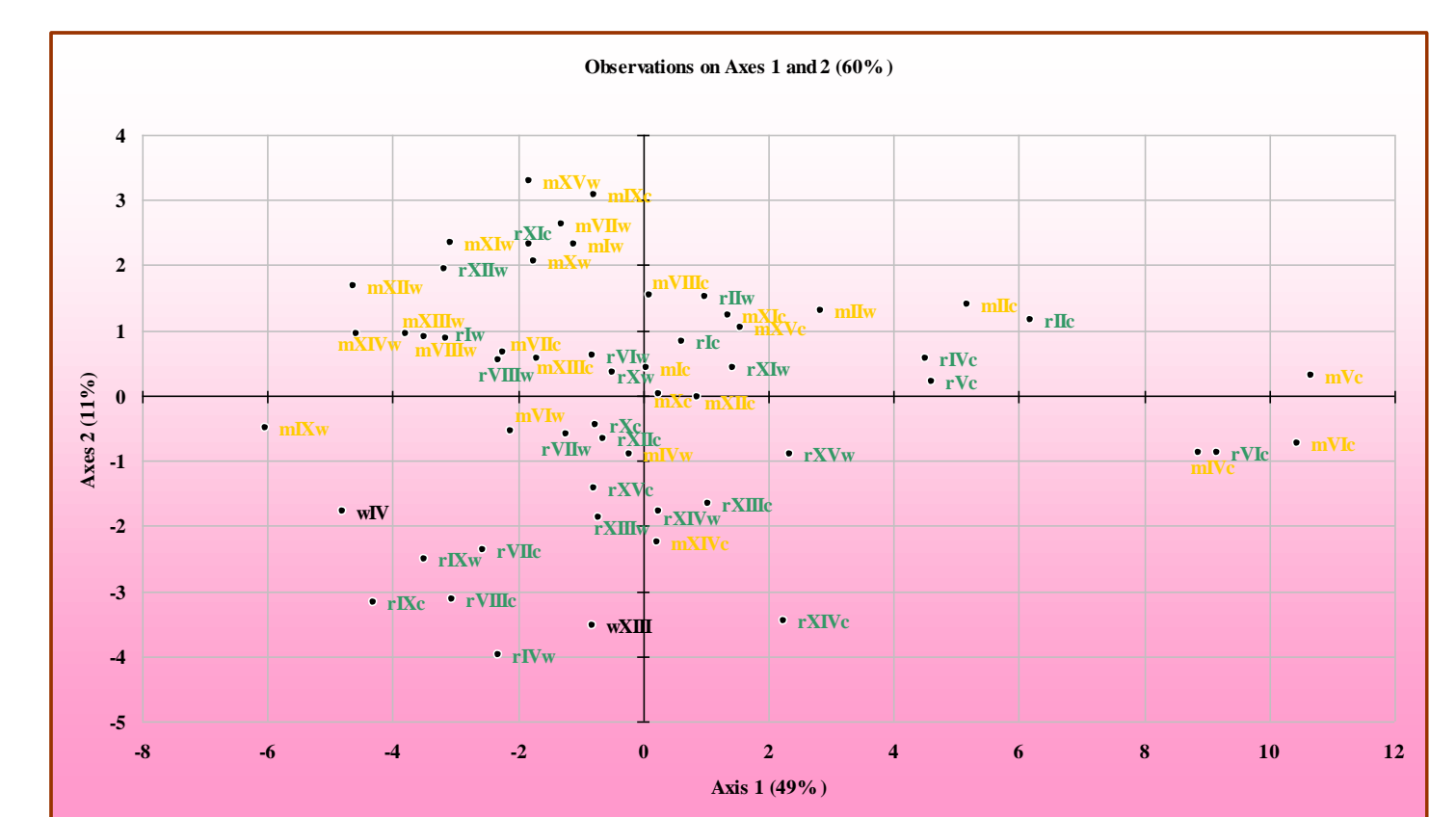
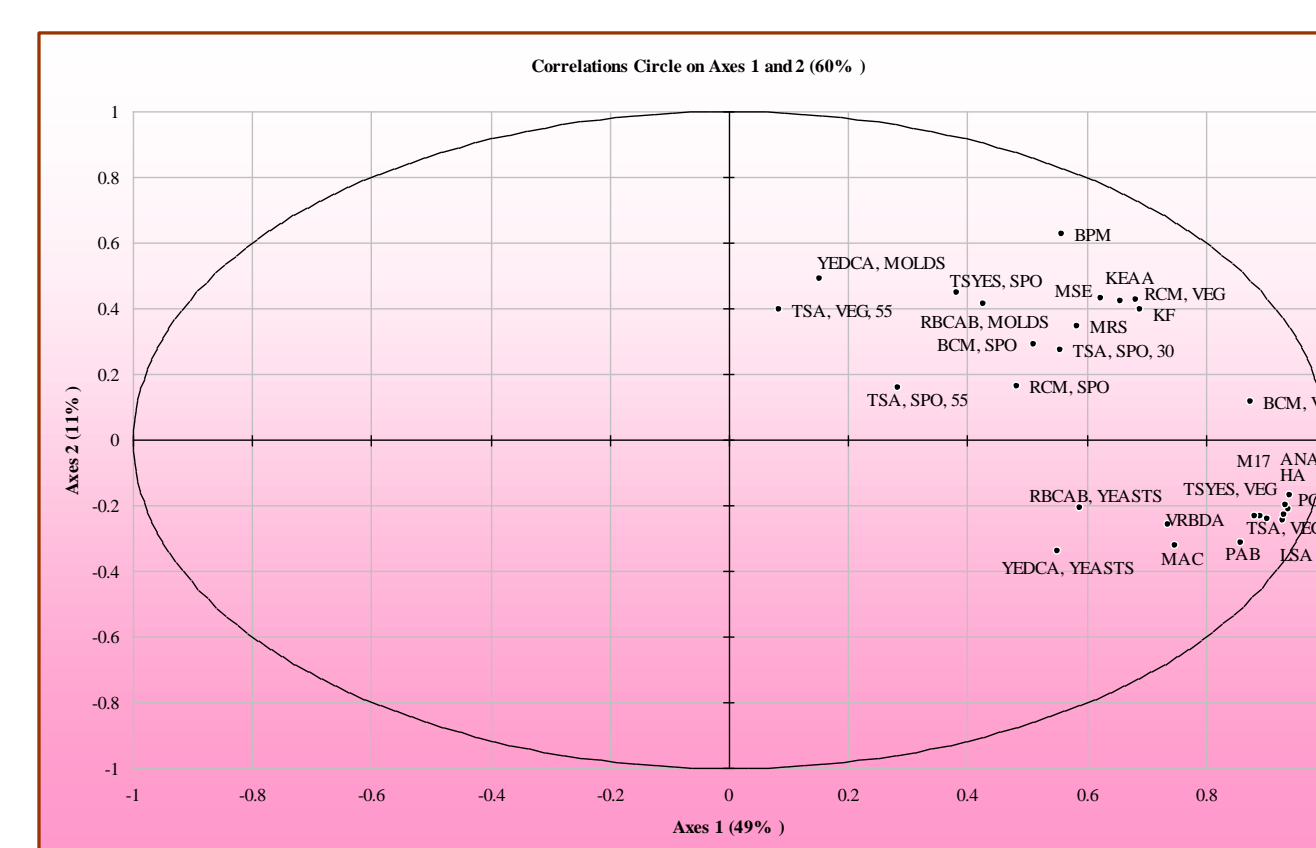
### Rye Flour



### Wheat Flour



### Principal Component Analysis



- It can be concluded that samples of maize flour are mostly located in the 2<sup>nd</sup> quadrant, and rye flour in the 3<sup>rd</sup> quadrant
- It is easy to observe that:
  - o the majority of maize flours have the highest values for microorganism growth on culture media located in the 1<sup>st</sup> quadrant (in the correlations circle); and
  - o rye flours have the highest values for microorganism growth on culture media located in the 4<sup>th</sup> quadrant
- Comparing both flours, maize can be distinguished by highest number of Colony-Forming Units (CFU) for molds and sporulated viable forms, and rye by highest number of CFU Gram rods and some Micrococcaceae genera
- Samples of maize and rye flours cannot be distinctly separated by region or by producer, in terms of microbiological profiles (both quantitative and qualitative)
- There are slight differences when samples from different periods are analysed
- It can be concluded that flours constitute the main source of the diverse microflora found in the dough for *BROA*

## ACKNOWLEDGEMENTS

The authors are grateful to several members of the Regional Directorate of Agriculture of Entre Douro e Minho (DRAEDM) and several local farmers for cooperation within the experimental program described. Financial support for author J. M. R. was provided by a Ph.D. fellowship within program PRAXIS XXI administered by the Foundation for Science and Technology (FCT, Portugal). Partial financial support was received from PAMAF – IED (Ministry of Agriculture, Portugal) through a research grant entitled “Pão de milho: caracterização do processo tradicional de produção e melhoria tecnológica”.