

**MOULDS OCCURRENCE IN MAIZE (*Zea Mays L.*)  
GRAINS AND FLOURS SOLD IN THE MARKETS OF  
ADAMAOUA PROVINCE IN CAMEROON**

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# INTRODUCTION

- Importance of maize consumption in africa:

- ✓ Staple food for populations
- ✓ Weaning food

- Health threat due to maize contamination by moulds producing mycotoxins

- ✓ Carcinogen
- ✓ Decreased immune response
- ✓ Impaired child growth

(Bankole et Adebajo, 2003., Gong *et al*, 2003., Bittencourt et al 2005., Turner et al, 2005., Tardieu et al, 2005., Fandohan et al 2005 )



- Evaluate the risk of exposition to the threat by means of maize consumption
- Understand moulds behavior during maize processing leading to foods products
- Experiment detoxification method proposed by researchers



Moulds, aflatoxin B1, fumonisin B1 in maize grains and maize based-flour: Occurrence and biological fight

# OBJECTIVES

- Stages:

- ✓ Evaluate the contamination levels of maize grains and flours
- ✓ Understand some bacteria behaviour related to mycotoxin fate during production of flours: fermentation
- ✓ Experiment biological detoxification during fermentation

- Principal objectif

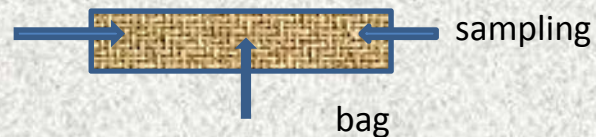
Determine the contamination level by moulds in maize grains and flours sold in Adamaoua Province of Cameroon

- Specific objectives

- ✓ Establish an overview of geographical origins of maize grains sold in Adamaoua
- ✓ Determine some physico-chemical properties of maize grains and flours
- ✓ Describe contamination levels of maize grains and flours

# METHODOLOGY

- Survey
  - ✓ A questionnaire was managed to each wholesaler in every market of the town
  - ✓ maize origins
- Sampling
  - ✓ In each store, a sample of around 500 g was removed from at 3 bags :



- Physico-chemical properties: moisture content
  - ✓ Temperature and relative humidity in each of the three portions of each bag
  - ✓ Water activity
  - ✓ Water content
- Mycological analysis
  - ✓ Total fungi
  - ✓ Principal gender
  - ✓ species

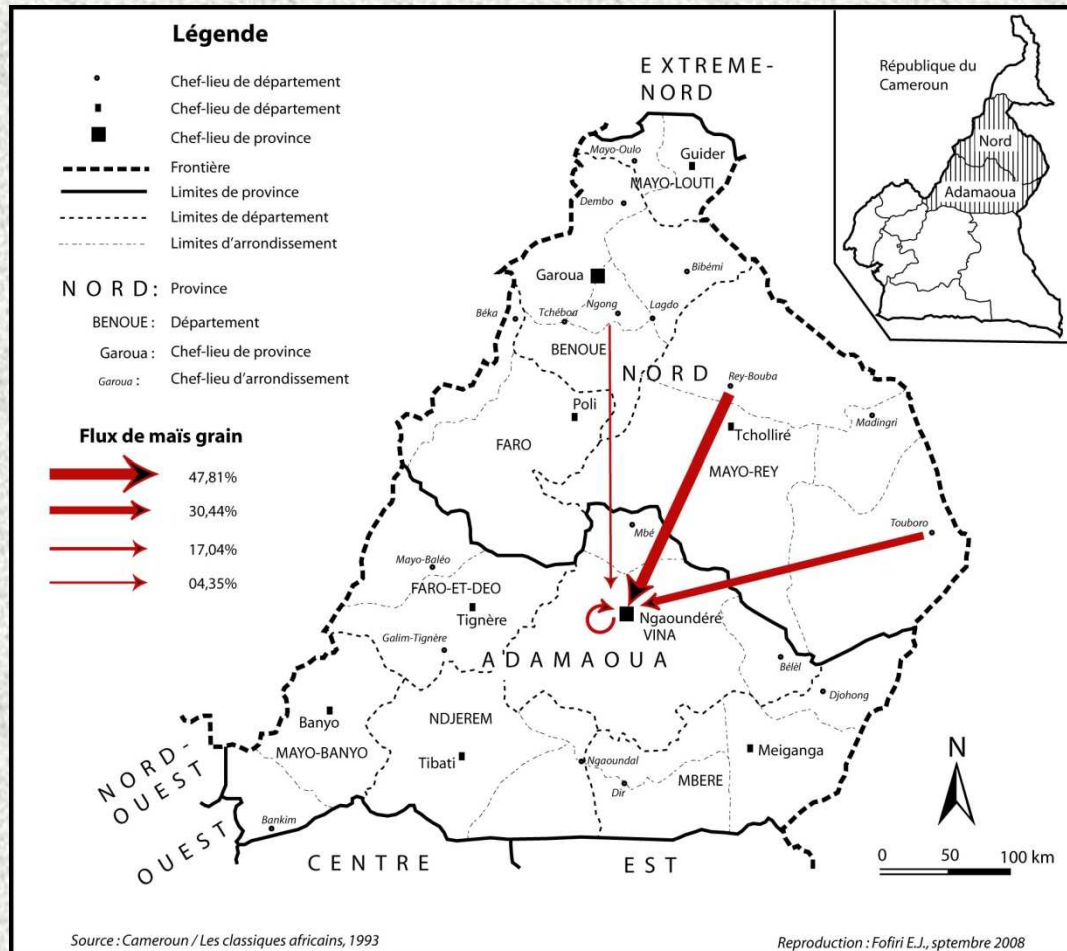
expressed in

→

  - ✓ percentage of samples contaminated
  - ✓ Percentage of grain contaminated
  - ✓ Colony forming unit (CFU)

# RESULTS AND DISCUSSION

- Geographical map of maize grain origins



- Maize grains samples are mainly from the maize fields area located in the north province
- It has been shown that those fied areas are the main providers of maize grain in all the northern part of the country (AGRI STAT 2007)
- So, the difference could be due to travel conditions and storage conditions in stores.

Figure 1: Overview of geographical maize grains origins

## RESULT AND DISCUSSION

- Moisture properties of samples

Table 1: Moisture properties of samples

Samples	parameters			
	Reative humidity	Temperature	Water activity	Moisture content
Grain	39% ± 11%	35°C ± 2°C	0,44 ± 0,04	8,40% ± 0,7%
Flour	48% ± 7%	32,12 ± 3°C	0,74 ± 0,12	15,37% ± 4,5%

- Relative humidity and water activity were the limiting factor for the growth of mould in grains and flours .
- Temperature was favourable for insect attacks and growth in grains
- More than 70% of fours samples presented water activity values higher than 0,65 favourable for the growth of mould

(Samson at al, 2002)



Contamination come from:

- the field and transport conditions and insects attacks (grain);
- water activity and temperature (flour)

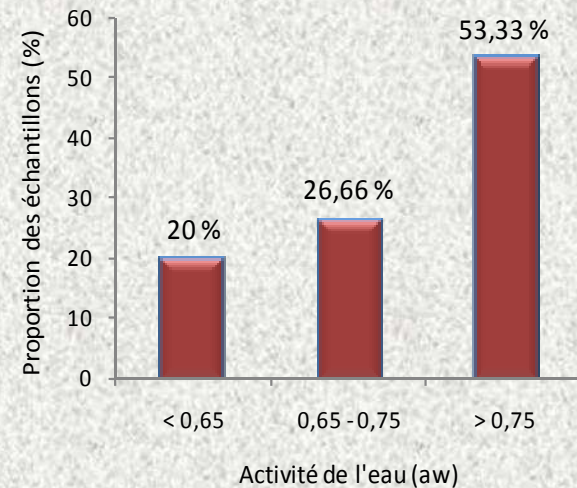


Fig 2 : Distribution of samples according to water activities

## RESULT AND DISCUSSION

- Contamination Levels of maize grains and fours

- ✓ Total Moulds content

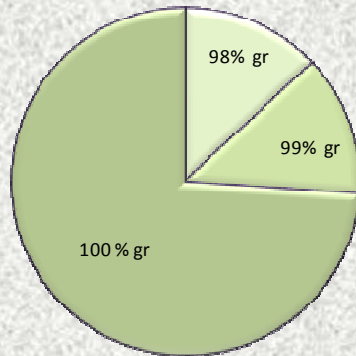


Figure 3a: grain samples distribution according to contamination levels

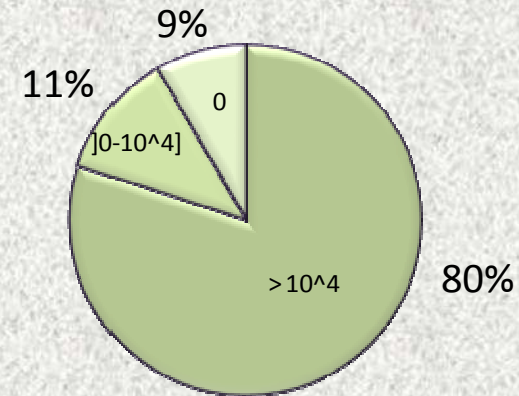
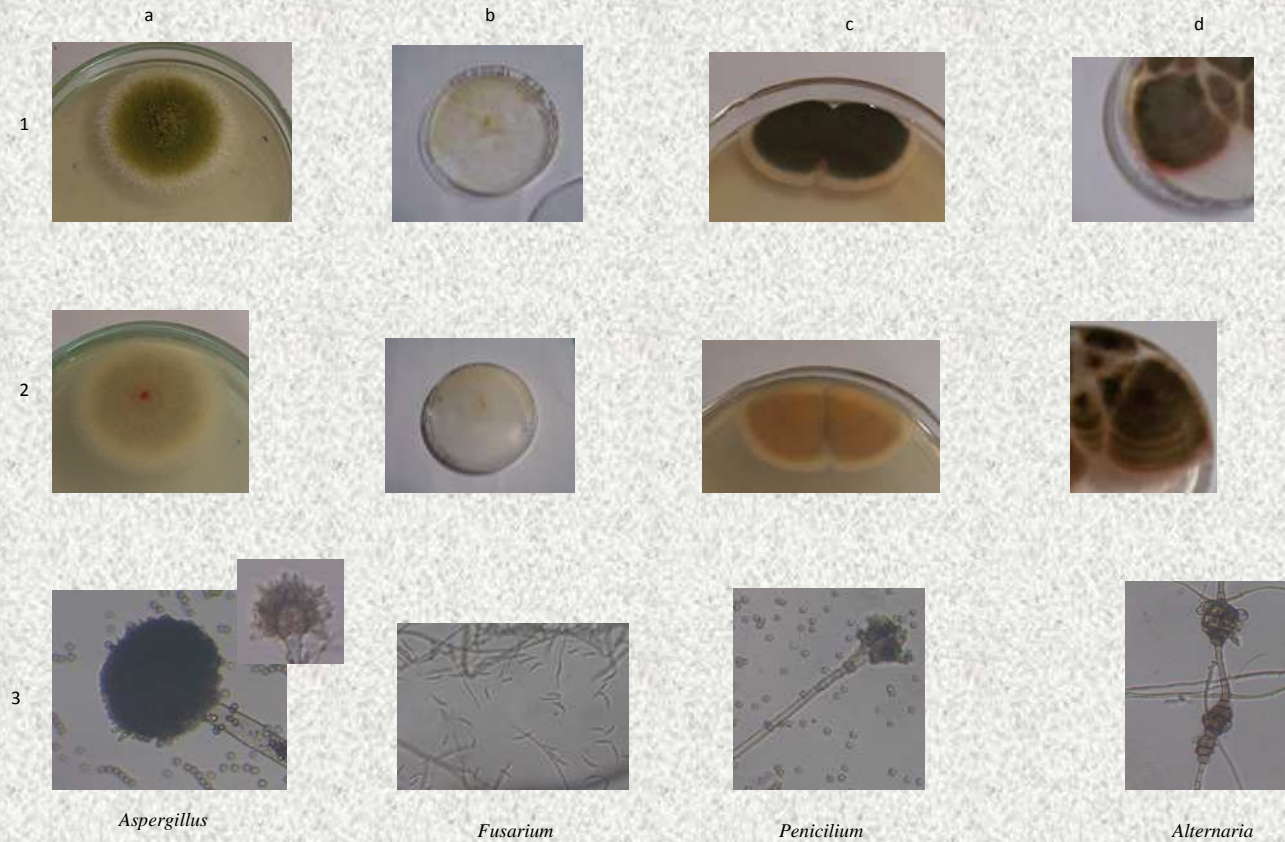


Figure 3b: flour samples distribution according to contamination levels

- All the grain samples was contaminated by moulds at higher levels
- 80% of flour was contaminated by moulds at a level beyond the one above which the product is considered as safe for human consumption (Adebanjo et Diyaolu, 2003).

## RESULT AND DISCUSSION

- Contamination Levels of maize grains and fours
- ✓ The most observed mould Genus



**Figure 4** : Macroscopic and microscopic observations of the principal observed moulds genus after one week of culture on PDA

1 : macroscopic observations of colonies ; 2 : macroscopic observations of the reverse phase of colonies; 3 : microscopic observation of swelling cells.

## RESULT AND DISCUSSION

### ✓ Distribution of contaminated Samples according to the genus

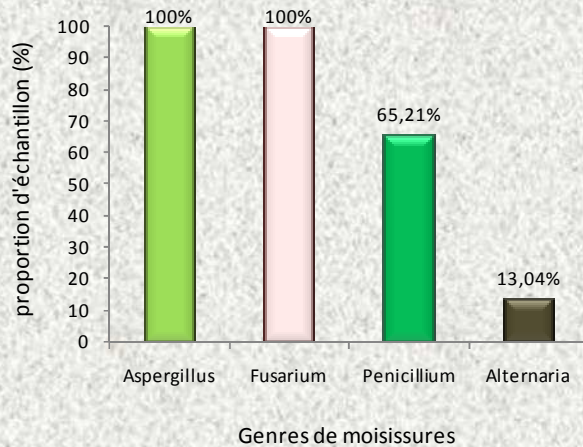


Figure 5a: Distribution of contaminated maize grains according to the genus

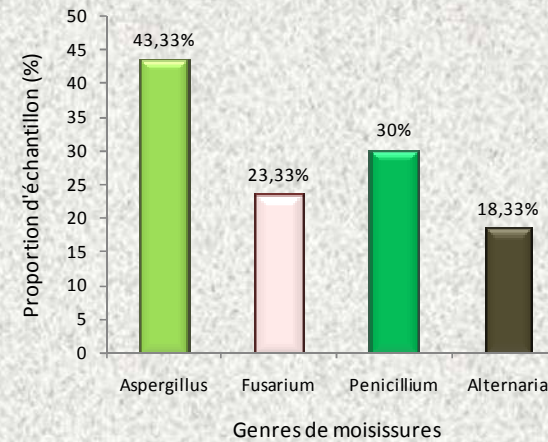


Figure 5b: Distribution of contaminated maize flours according to the genus

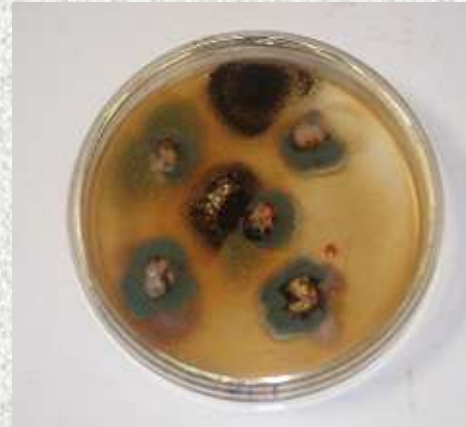
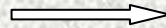
- Aspergillus and fusarium were the prevailing moulds and contaminated all maize grains samples
- Aspergillus the most important mould in maize flours, followed by Penicillium
- From maize grain to maize flour contamination by fusarium decrease

## RESULT AND DISCUSSION

- ✓ Distribution of contaminated Samples according to the genus



Before crushing and winnowing



After crushing and winnowing

Figure 6: Macroscopic observations of colonies contaminating maize grain before and after dehulling

- Aspergillus and Penicillium seems to be brought by the crushing machine
- It is not advised to store maize grains after the crushing stage
- Subsequent production of aflatoxin can occur when storage conditions become favorable (temperature and humidity increase)

## RESULT AND DISCUSSION

### ✓ Contamination degrees of Samples

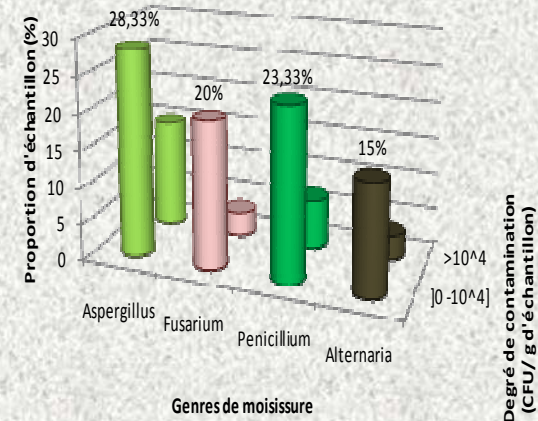
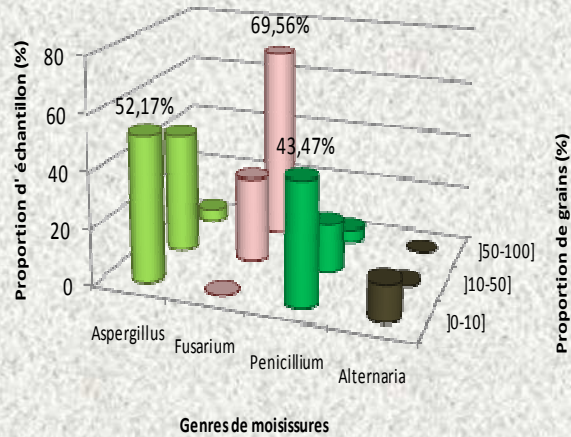


Figure 7a: Distribution of contaminated maize grains according to genus and contamination degrees

Figure 7b: Distribution of contaminated maize flours according to genus and contamination degrees

- Fusarium contaminated maize grain at higher levels according to both percentage of samples and percentage of grains
- Aspergillus was found in maize flours at the highest level but at a degree below the value to the top of which the product is considered as safe
- In general, all genus contaminated flour at safe level

## RESULT AND DISCUSSION

### ✓ Contamination degrees Samples by some identified and non identified species

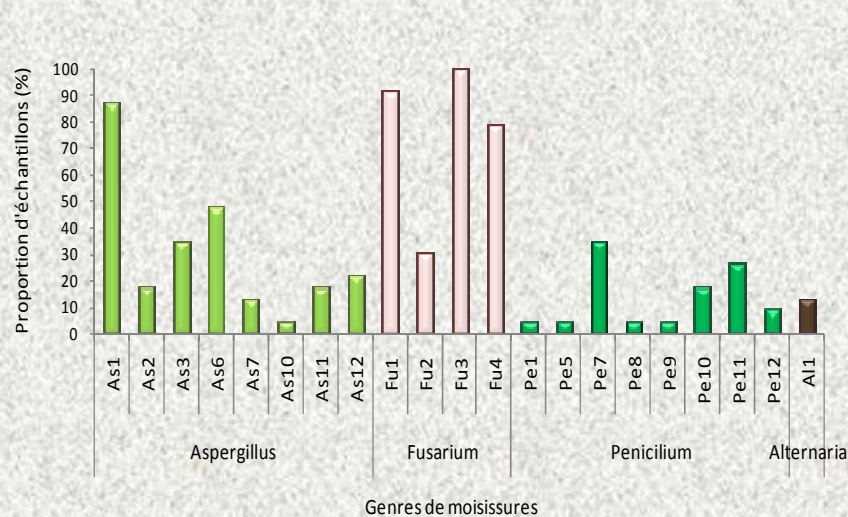


Figure 8a: Distribution of contaminated maize grains according to species.

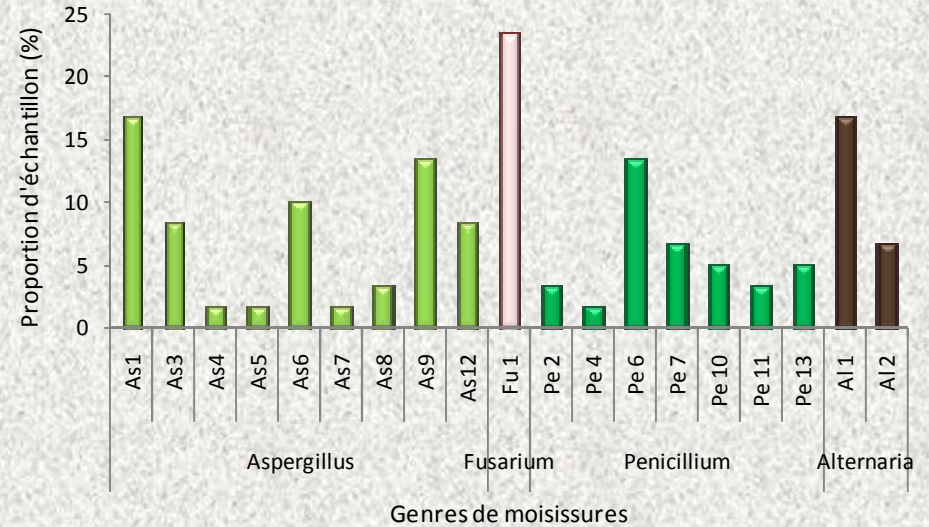


Figure 8b: Distribution of contaminated maize flours according to species

- Aspergillus niger prevailed within the samples contaminated by Aspergillus genus
- Fusarium verticillioides was the dominant mould and contaminated all grain samples
- Flour samples contaminated by Aspergillus flavus were low

# CONCLUSION

According to:

- The High level of contamination by Fusarium and aspergillus genus suggesting a possibility of the presence of Aflatoxins and fumonisin;
- The fact that Humidity could not contribute to justify observed contamination in maize grain
- Contamination is probably mainly due to field, harvest and travels conditions (for grains); and crushing or milling stages very difficult to control;



It 's crucial to carry up detoxification experiences to reduce mycotoxins contamination



## Danish Development Research Network

*Bringing together knowledge and development*



<http://www.ddrn.dk>

- Network linking research-based knowledge within the sectors of environment, agriculture and governance.
- Settle in Denmark
- Members primarily in Denmark and developing countries
- drawn from research community, private sectors, NGOs, development organisations
- Contribute to the inclusion of research and research-based knowledge in development assistance and in partner countries' development activities.

## OBJECTIVES

- Dissemination and exchange of information between the development programmes and research community within their areas of interest
- Fostering an engaged and committed network of members.
- Promotion of production and exchange of research-based knowledge relevant to their areas of interest
  - Thematic platforms
  - North-south partnerships
  - Establishment of links at national, regional and international levels.

## ACTIVITIES

- Policy contribution
- Research overview
- Funding opportunities

- ✓ Workshop and seminars

The target group must represent more than one single stakeholder and danish partners must be included

- ✓ Participation in meetings and conferences

The target group can be a member an this one must play an active role in the meeting or conference.

- ✓ Other activities

- Publication of brief
- Activities to disseminate research results: joinalistic assistance
- Development of new methodologies, tools and or guidelines

## WORKING GROUPS, THEMATIC NEWS AND LINKS

- Working groups
  - ✓ gather researchers and practitioners who share an interest in a specific capacity
  - ✓ are expected to contribute with an out come: workshop or conference; publication or research brief
- Thematic news
  - ✓ General issues; livelihoods and social development; **Agricultural production**; natural resource management and biodiversity; urban and industrial management; public administration and pubic policy; democracy and human rights and state building; trade, private sector and economic development.
  - ✓ Events, research paper and policy document, funding opportunities for each thematic area
- Links
  - ✓ Knowledge centres
  - ✓ Research institutions
  - ✓ Organizations

At national, regional and international levels



Young Professional's Platform for Agricultural  
Research for Development  
(<http://www.ypard.org/ypard/>)

Facilitate access to resources and capacity building opportunities

**THANK YOU FOR YOUR ATTENTION**