

## Bioassay and sexual competitiveness test as methods for quality assurance of ingredients for mass rearing of fruit flies: Case of the larval food yeast

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**PALABRAS CLAVE:** Larval diet, Control Quality, Sterile Insect Technique, Protein Source, Quality Parameters.



### Introduction

The mass-rearing facilities of fruit flies produce millions of flies using artificial food prepared with raw ingredients of undetermined composition, which present high variability in quality and its impossible known the effect on production. In this study we assumed that the variability of the yeast used as a protein source can be partially uncontrolled, then, how do you determine its efficiency for mass rearing of fruit flies? The aim of this study was to determine if the current physicochemical and microbiological parameters allow determining the efficacy of the yeasts; or performing a bioassay is required.

### Results

The current physicochemical and microbiological analysis, including the vitamins and amino-acid content do not allow discriminate between efficient vs inefficient yeast. The bioassay at experimental and semi-massive level and sexual competitiveness test were the only test which allowed discriminate between different types of yeast. It means that we need develop and implement of new laboratory techniques to determine real parameters to ensure the quality of the ingredients for mass rearing fruit flies larvae for SIT, or optimize the bioassay including sexual competitiveness for males in field cages.



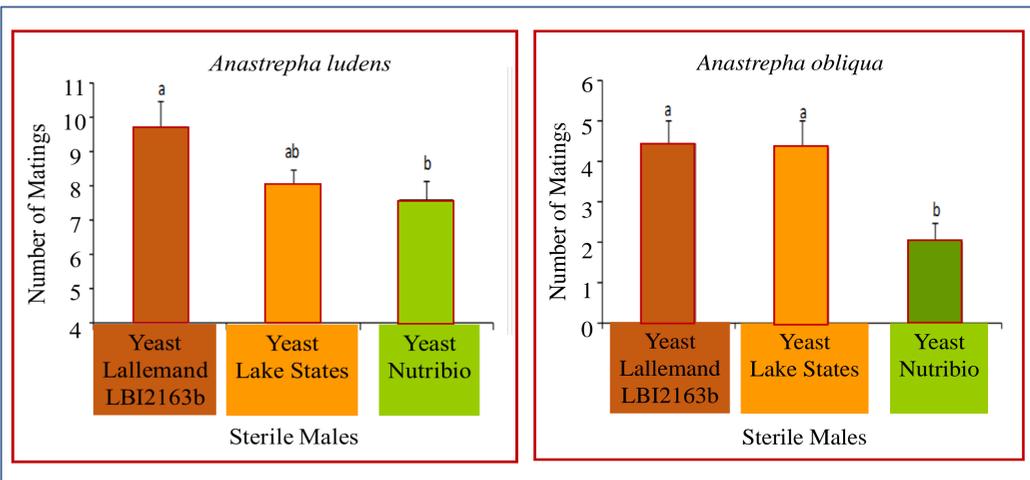
### Materials and Methods

The efficacy of the yeasts for larval food was determined in three experiments:

- 1) Physicochemical and microbiological characterization of each sample yeast.
- 2) Experimental bioassay used a random one-way design where the treatments corresponded to six commercial yeast: Borregard, Lallemand-LBI2240-25, Lallemand-LBI2163b, Lake States, Nutribio-SAFMEX and Nupro-Alltech for mass-rearing larvae of *Anastrepha ludens*, *A. obliqua* and *Ceratitis capitata*.
- 3) Semi-massive level-test including sexual competitiveness for males in field cages.

Physicochemical analysis consisted to determine the moisture, pH, acidity, solubility, density and protein content. Microbiological characterization consisted to determine the total count of unit forming colonies, molds, yeasts and coliforms. In addition, we determined the vitamins and amino-acid content for samples evaluated at semi-massive level.

PHYSICAL SPECIFICATIONS	
Humidity (%)	5 -7
Ph (UI)	5 -7
Acidity (%)	0.018 - 0.304
Solubilidad (%)	>30
Density (g/cc)	>0.65
Protein (%)	45 - 55
MICROBIOLOGICAL SPECIFICATIONS	
Cuenta total (UFC/g)	7,000
Hongos (UFC/g)	<10
Levaduras (UFC/g)	<10
Coliformes (NMP/g)	<3
Actividad	Negativo



### Efficacy of the yeasts for larval food for *Ceratitis capitata*: Semi-massive confirmatory test.

Yeast type	Larval recovery from egg (%)	Yield (No. of larvae/g diet)	Larval weight (mg)	Pupa weight (mg)	Adult eclosion (%)	Flyers (%)	Mortality
Lake	15.62±0.99a	12.03±0.77a	10.15±0.17a	7.70±0.09a	88.83±9.86a	85.52±0.99b	14.30±2.02a
Nupro	11.31±1.33a	8.89±1.01 a	10.00±0.16ab	7.54±0.16b	89.77±0.87a	88.47±0.22a	11.25±2.06a
Lallemand BI 2163 b	13.75±1.85a	10.59±1.42a	9.48±0.14b	6.94±0.12b	91.52±0.60a	88.96±0.70a	16.32±2.20a

### Efficacy of the yeast for larval food for *Anastrepha ludens* and *Anastrepha obliqua* : Semi-massive confirmatory test.

Yeast type	Larval recovery from eggs (%)	Yield (No. of larvae/g diet)	Larval weight (mg)	Pupariation at 24 h (%)	Pupa weight (mg)	Adult eclosion (%)	Pre-irradiation flyers (%)
<i>Anastrepha ludens</i>							
Nutribio	77.53 ± 0.85 b	3.56 ± 0.01 a	23.29 ± 0.29 b	51.28 ± 0.11 c	17.40 ± 0.14 b	94.22 ± 1.03 b	93.05 ± 1.12 a
Lake	78.57 ± 0.04 ab	3.55 ± 0.01 a	23.89 ± 0.07 b	87.20 ± 1.67 a	18.03 ± 0.13 a	97.00 ± 0.39 ab	96.44 ± 0.38 a
Lallemand BI 2163 b	80.66 ± 0.01 a	3.50 ± 0.03 a	24.51 ± 0.50 a	64.53 ± 0.99 b	18.49 ± 0.13 a	97.39 ± 0.29 a	96.05 ± 0.67 a
<i>Anastrepha obliqua</i>							
Nutribio	85.33 ± 1.12 b	4.33 ± 0.01 b	18.26 ± 0.03 b	81.75 ± 2.64 b	13.50 ± 0.01 a	86.56 ± 0.78 a	81.73 ± 0.99 a
Lake	90.96 ± 0.72 a	4.46 ± 0.03 a	18.67 ± 0.08 a	96.28 ± 0.61 a	13.32 ± 0.06 a	89.20 ± 1.15 a	84.44 ± 1.60 a
Lallemand LBI 2163 b	90.33 ± 1.75 a	4.34 ± 0.02 b	18.73 ± 0.20 a	94.25 ± 1.01 a	13.49 ± 0.05 a	89.79 ± 0.42 a	84.83 ± 0.74 a

### CONCLUSION

The most significant contribution of this work was to determine that the bioassay at experimental and semi-massive level were the only assessments to discriminate between different types of yeast; and that any evaluation of yeasts for larval development must include evidence of sexual competition for the sterile males.

### REFERENCIAS

FAO/IAEA/USDA. 2014. *Product Quality Control for Sterile Mass-Reared and Released Tephritid Fruit Flies*. Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture. Manual Version 6.0. IAEA, Vienna, Austria. 164 pp. Available at: <http://www-naweb.iaea.org/nafa/ipc/public/sterile-mass-reared-v6.pdf>