# Cell Wall Modifying Gene expression during banana fruit ripening and in relationship with finger drop

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## Introduction and Objectives

▪ Finger drop is one of the main features closely associated with the banana ripening process.

▪ This process implies physiological and biochemical changes leading to peel softening and weakening, thus causing individual fruit in a hand to separate from the crown (see below).

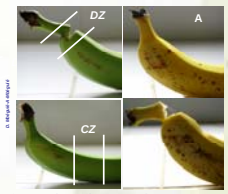
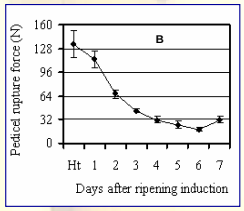



*Fig 1: Cavendish banana fruit taken at green and ripe stages. Peel tissue of control (CZ) and drop (DZ) zones used in this study are indicated in panel A. Typical evolution of finger drop observed during fruit ripening measured throughout the pedicel rupture force was indicated in panel B.*




▪ Therefore the finger drop process reduces the commercial quality and economic value of bananas as hands with fingers missing or fingers without pedicels cannot be sold to consumers.

▪Although this, few studies have been devoted on finger drop process and only at physicochemical and biochemical levels (Paull, 1996; Imsabai *et al.,* 2006; Sengpook *et al.,* 2007).

▪In the prospect of improvement of banana fruit quality throughout conventional breeding and marker assisted selection, getting major or candidate gene(s) putatively involved on finger drop process is an essential step for identification of related marker (s).

▪ In order to identify these candidate genes, we examined here expression of Cell Wall Modifying Genes (CWMGs) in peel tissue at median area (CZ) and compared to that in the pedicel rupture area (DZ).

## Materials and Methods

▪Studies were performed on peel of Cavendish banana fruit ripen in air at 20°C after azethyl (95% N + 5% C2H4) treatment (1000ppm / 24 h / 20°C).

▪ As CWMGs, we examined those involved in metabolism of cell wall component including pectin (PME, PEL and PG) and xyloglucan (XTH) and those involved in physical properties of cell wall (EXP).

▪CWMGs were isolated by RACE-PCR (XTHs), Musa sequence data mining (PME) or systematic searches in GenBank database (PEL, PG and EXP).

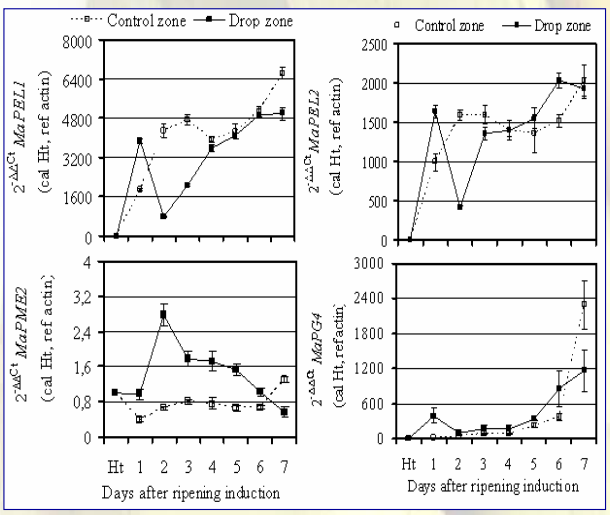
▪CWMGs expression was performed throughout real-time quantitative PCR comparatively at control and drop zones.

PEL= pectate lyase
PG= polygalacturonase
PME= pectin methylesterase
XTH= xyloglucan transglycosylase hydrolase
EXP= expansin

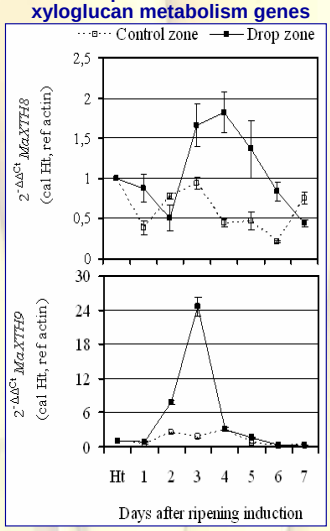
*Method used to measure pedicel rupture force (Chillet et al., 2008)*

## Results

### Expression of four pectolytic genes




### Expression of two xyloglucan metabolism genes




### Expression of four cell wall loosening genes

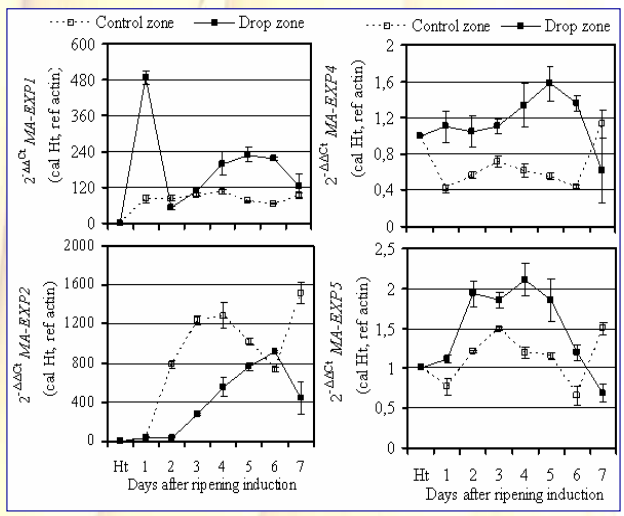



*Fig 2: Expression of CWMGs during in peel tissue and during ripening of Cavendish banana fruit. CWMGs expression was performed daily since the harvest time (Ht) d from 7 days after ripening induction in peel tissue taken at median (control zone) and pedicel rupture area (drop zone) .*

## Discussions and Perspectives

▪ Finger drop phenomenon implies changes in CWMGs expression involved in metabolism of cell wall components (pectin and xyloglucan) and in physical properties of cell wall.

▪ Theses changes occur mainly 1-4 days after ripening induction. Based on CWMGs genes, the sequence of events begins with changes in pectolitic component following and physical properties of Cell wall following by xyloglucan metabolism.

▪ Contrary to *MaEXP2*, *MaPME2*, *MaPEL1* and *2*, *MaPG4*, *MaXTH8* and *9*, *MaEXP1*, *4* and *5* of which mRNA accumulated highly in the drop zone appeared as good candidates.

▪ The next step of this study will be the identification, for breeding program, of molecular marker related from each candidate CWMG. To this end, the biodiversity among banana species will exploited to investigate the relationship between structural variability of allelic form of each CWMG – its expression – phenotype (finger drop).

## References

Chillet M, De Lapeyre De Bellaire L, Hubert O, Mbéguié-A-Mbéguié D. 2008. Mechanical characterization of banana fruits. *Fruits* 63, 51–52; Imsabai W, Ketsa S, van Doorn W. 2006. physiological and biochemical changes during banana ripening and finger drop. *Postharvest Biology and Technology* 39, 211-216. Paull RE. 1996. Ethylene, storage and ripening temperatures affect Dwarf Brazilian banana finger drop. *Postharvest Biology and Technology* 8, 65-74; Saengpook C, Ketsa S, van Doorn W. 2007. Effects of relative humidity on banana finger drop. *Postharvest Biology and Technology* 45, 151-154.