Effect of Essential Oils on the *in vitro* growth of *Penicillium digitatum* and *Penicillium italicum* infecting citrus and *Colletotrichum musea* infecting banana.

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Figure 1 : Blue mold (P. italicum)

Figure 2 : Green mold (*P.digitatum*)

Backgrounds and objectives

Citrus and bananas represent the two economically important fruit crops worldwide [1]. The most important causes of post-harvest losses of these fruits are blue mold caused by *Penicillium italicum* (fig 1) and green mold caused by *Penicillium digitatum* (fig 2) for citrus, and anthracnose disease caused by *Colletotrichum musea* (fig 3) for bananas. To cope with these diseases, treatment with chemical fungicides during the conditioning process has long been used. Nowadays, such a treatment is challenged because of the following reasons:

- ✓High level of chemical fungicide residues in food products
- ✓Chemical fungicides toxicity and risk for human health and for the environment,
- ✓Development of pathogens populations resistant to chemical fungicides,
- ✓Restriction or ban on use of a number of chemical fungicides by the legislation.

This has motivated the search for alternative approaches. Essential Oils (EOs) extracted from aromatic plants are known for their antifungal effects and could thus be used against plant pests.
The present work was therefore undertaken to study the effect of ten Eos on the *in vitro* growth of *P. italicum*, *P. digitatum* and *C. musea.*

Figure 3 : Anthracnose (C. musea)

Material and methods

Table 1 shows essential oils [2] tested in the present work. Their effect on the growth of *P. italicum*, *P. digitatum* and *C. musea* was evaluated *in vitro* at 25°C for light days using microplate Elisa. For each pathogen, growth was followed by recording each day the optical density at 490 nm of a solution of 200 µl containing:

- ✓Diluted (10 times) orange (*P. italicum* and *P. digitatum*) or banana (*C .musea*) juice.
- ✓10^4 spores/ml
- ✓0,5% methanol
- ✓0,1% essential oil

The detailed experimental design is show in figure 4. for each pathogen two independent experiments were performed with 8 replicates per essential oil.

Table 1: Essential oils

Major constituents	Essential Oils*	Origin	Part of the plant	Chemotype
Terpenes	EO_1	Brazil	Fruit zest	Limonene
Alcohols	EO_2	Egypt	Terminal flower	Terpinene 1,4
	EO_3	France	Vegetative part	Menthol
	EO_4	India	Vegetative part	Geraniol
Aldehydes	EO_5	Guatemala	Vegetative part	Citral
Ketones	EO_6	Morocco	Vegetative part	Pulegone
Phenols	EO_7	Madagascar	Flowering bud	Eugenol
	EO_8	India	fruit	Thymol
Esters	EO_9	France	Terminal flower	Acetate de lin
Ether-oxides	EO_{10}	hungary	fruit	Trans - aneth

* Obtained from Pranarôm International S.A.

Figure 4: Experimental plan

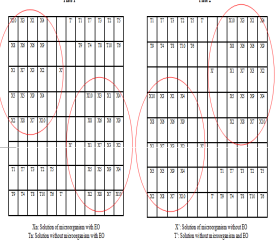
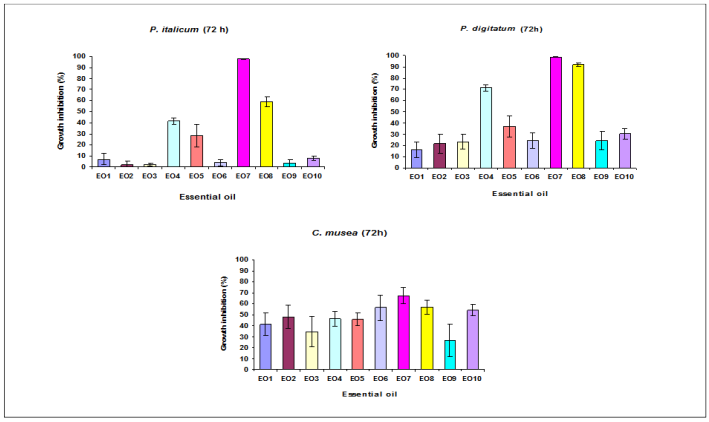


Figure 5: Percent mean growth inhibition of Essential oils against P. italicum, P. digitatum and C. musea



Results

❖Only growth data recorded after 72 h of incubation are shown on figure 5.

❖Whatever the essential oil tested, there was a growth inhibition regardless of the pathogen.

❖Among the essential oil, EO4 (41-71%), EO8 (57-92%) and specially EO7 (67-99%) have presented the most important growth inhibition effect.

❖*C. musea* seems to be more sensitive than the penicillium.

Conclusion

The present preliminary work shows that essential oils are able to inhibit, and even avoid, the growth of the tested pathogens.
This suggests that essential oils could be used as an alternative to chemical fungicides.

Acknowledgements and references

K. H. S. Kouassi is grateful to Agence Universitaire de la Francophonie (AUF) for its financial support.

[1] Groupe international sur la banane et les fruits tropicaux 2005.

[2] Pranarôm International S.A, expert en aromathérapie scientifique et médicale, Tarif export 2008.