




WORKSHOP: VALORISATION OF TRADITIONAL PROCESSING OF INDIGENOUS AND UNDERUTILISED FRUITS
 Institute of Technology of Cambodia, Phnom Penh, Cambodia, Jan. 14-16, 2013.
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VALORISATION OF THE VEGETAL BIODIVERSITY FOR FOOD SAFETY: CHARACTERISATION OF ANTIMICROBIAL PLANT EXTRACTS

Sarter S., Nguyen H.V. and Chu-Ky S.
 CIRAD-Hanoi University of Science and Technology

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Outline

- Antibiotic resistance (literature data)
- Antimicrobial essential oils: Alternatives to antibiotics in Aquaculture?
- Biodiversity screening in Vietnam
- Projects and Network
- Conclusion

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Antibiotic resistance

- Resistant *Salmonella* spp. to antibiotics in animal products: 17-68% Vietnam, 41-92% Thaïlande and 22-49% Malaysia (Thi Thu Hao Van et al. 2012)
- Resistance up to 97% *Campylobacter jejuni* in poultry products in Cambodia (Kruv Sun Lay et al. 2011)
- Multiresistance of strains of *Salmonella* spp. between 6 and 13 antibiotics (Benacer et al. 2010)

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Antibiotic resistance


- Aquaculture:
 - 90% tetracycline, 76% ampicillin, 100% chloramphenicol, 65% nitrofurantoin and 89% trimethoprim-sulfamethoxazol (Phuong et al. 2005)
 - Chloramphenicol-resistant *E. coli*: 58.3% Vietnam, 25% Malaysia, 31.8% Thaïland (Huys et al. 2007)
 - Multiresistance in fish bacteria in Mekong Delta between 66 and 90% of isolates (Sarter et al. 2007)

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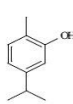
Antibiotic resistance

- Health Risks
 - Animal diseases
 - Spread of resistance genes to other pathogens of diverse origins
 - Zoonoses (*Salmonella*, *Campylobacter*)

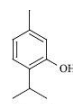
**Implications on animal and human health:
Global issue**

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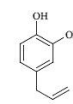
Antimicrobial Essential Oils



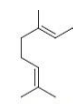
Carvacrol



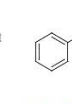
Thymol



Eugenol




Géraniol



Cinnamaldéhyde

- Secondary metabolites
- Plant defense mechanisms against predation by microorganisms, insects and herbivores

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Antimicrobial Essential Oils

- *Cinnamosma fragrans*
 - Chemical composition
 - Antimicrobial activity
 - Assays in shrimp hatchery



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Antimicrobial Essential Oils

Major composition of the essential oils of 68 samples of *Cinnamosma fragrans* harvested in Tsaramandroso (n=30) and Mariarano (n=38).

	Tsaramandroso		Mariarano	
	% area (n=30)	B8	% area (n=38)	B143
Monoterpenes hydrocarbons		1.5		13.7
α-pinene	1.0 ± 1.3	0.1	3.5 ± 1.5	1.1
camphene	1.1 ± 1.6	0.1	4.8 ± 2.2	1.2
β-pinene	0.9 ± 1.0	0.1	8.0 ± 3.8	2.1
sabinene	0.9 ± 1.0	0.2	1.8 ± 0.9	3.2
α-phellandrene	0.2 ± 0.2	tr	0.4 ± 0.7	2.1
myrcene	0.2 ± 0.4	0.2	0.6 ± 1.0	1.2
Oxygenated monoterpenes		97.5		81.1
1,8-cineole	0.5 ± 0.9	0.4	47.3 ± 10.2	71.6
linalool	72.5 ± 23.3	95.8	1.1 ± 1.5	2.9
terpinen-4-ol	1.5 ± 2.3	0.3	2.2 ± 2.0	2.5
l-terpineol	1.2 ± 1.4	0.2	4.2 ± 3.0	2.1
Sesquiterpene hydrocarbons		0.2		2.9
Oxygenated sesquiterpenes		0.2		1.7
Others		0.3		10.0

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Antimicrobial Essential Oils

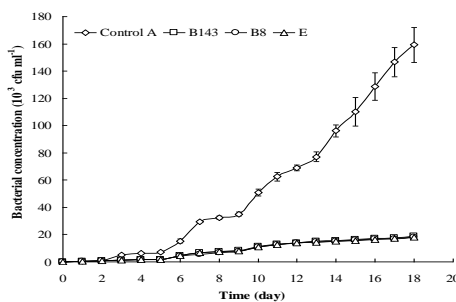
- Reference strains
 - *S. aureus*
 - *S. Typhimurium*
 - *Escherichia coli*
 - *Vibrio parvaecidae*
 - *Vibrio fischeri*
 - *Vibrio anguillarum*
 - *Vibrio harveyi*
 - *Vibrio alginolyticus*
 - *Vibrio splendidus*
- Farm isolates
 - *Bacillus subtilis*
 - *Bacillus cereus*
 - *Bacillus pumilus*
 - *Vibrio hollisae*
 - *Vibrio alginolyticus*
 - *V. parahaemolyticus*
 - *Vibrio vulnificus*
 - *P. damsela*

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Vibrio concentration of *Penaeus monodon* larvae

(Source: Randrianarivelo et al. 2010)

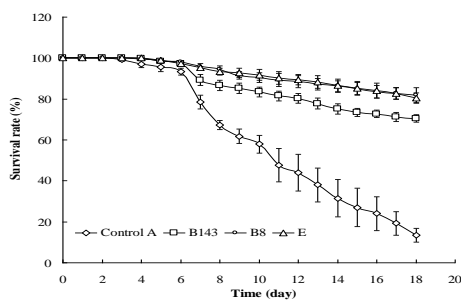


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Survival rate of *Penaeus monodon* larvae

(Source: Randrianarivelo et al. 2010)

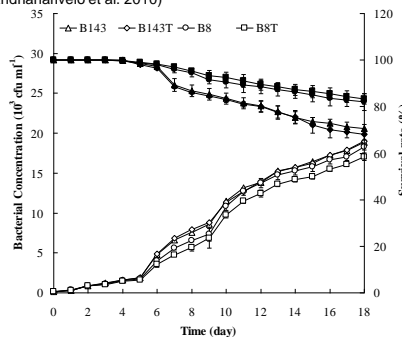


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Assays with and without Tween 80

(Source: Randrianarivelo et al. 2010)



Alternatives to antibiotics?

- Low Minimum Inhibitory Concentration *in vitro* against *Vibrio* spp.
- Decrease microbial load in culture assays
- Negative correlation between the bacterial concentration and larval survival
- Valorisation of local biodiversity

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Biodiversity screening

- Local EOs from Vietnam
 - *Ocimum gratissimum*, *Melaleuca leucadendron*, *Cinnamomum loureiri*, *Zanthoxylum rhesta*, *Artemisia annua*, *Litsea cubeba*, *Ocimum basilicum*, *Chenopodium ambrosoides*, *Mentha arvensis*

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Biodiversity screening

	<i>O. gratissimum</i>		<i>C. loureiri</i>		<i>L. cubeba</i>		<i>C. ambrosoides</i>		<i>M. arvensis</i>	
	µl EO/mL	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC
<i>S. Typhimurium</i>		3,13	0,39	6,25	3,13	25				
		6,25	0,39	6,25	3,13	12,5				
		6,25			3,13	25				
<i>E. coli</i>		6,25	0,78	6,25	6,25	6,25				
		3,13	1,56	6,25	6,25	6,25				
		6,25	0,78							
<i>S. aureus</i>		12,5	6,25	6,25	6,25	12,5				
		12,5	6,25	6,25	6,25	12,5				
		6,25								
<i>A. hydrophila</i>		12,5	0,78	12,5	6,25	25				
		6,25	0,78	6,25	12,5	25				
		6,25	0,39	12,5	6,25					
<i>V. parahaemolyticus</i>		6,25	0,78	6,25	12,5	6,25				
		6,25	0,78	6,25	12,5	6,25				

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Perspectives

- Antimicrobial activities (harmonisation)
- Mode of action (bacterial models)
- Chemical composition/variability
- Toxicity tests
- Assays in food preservation and aquaculture

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Projects and Network

- BioAsia Project (2013-2015)
 - Ethnobotany for Sustainable Therapy in Aquaculture and Food Safety
 - Partners: France, Indonesia, Vietnam
 - Coordination: IRD Indonesia
 - Budget: 40,000 euros

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Projects and Network

- **Objectives**
 - Develop an ecofriendly pharmacopeia for aquaculture
 - Validate the use of plants or extracts such as preservatives for fishery products.
 - Create a scientific network working on medicinal plants in the region

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Projects and Network

- 1st Workshop organised by IRD-CIRAD on December 3, 2012 in Hanoi, Vietnam:
 - HERBAL THERAPY IN FISH FARMING : FROM ETHNOBOTANY TO SUSTAINABLE AQUACULTURE AND FOOD SAFETY
 - 42 participants (France, Thaïlande, Vietnam, Laos, Philippines)

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Projects and Network

- Scientific Interuniversity Pre-project (PCSI) (AUF 2013)
 - Exploring the vegetal and microbial diversity and technological innovations to improve food quality and safety
 - Partners: France, Vietnam (6), China
 - Coordination: HUST Vietnam
 - Budget: 15,000 euros

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Projects and Network

- **Objectives**
 - Support network meeting and exchange to prepare and submit collaboration projects
 - Support scientists exchange and mobility
 - Plants extracts and microbial activities

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Conclusion

- Characterisation of the rich biodiversity of South East Asia region
- Strengthen cooperation via regional collaboration projects
- Valorisation of local resources for food production and processing
- Develop ecofriendly innovations to improve food safety and reduce chemicals

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