Tropical Ecotoxicology in Central America: Risk factors and challenges for the near future

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INTRODUCTION

Pesticides are heavily used in the Central American Region and studies carried out, mostly in Costa Rica, indicate widespread pollution of different aquatic and terrestrial ecosystems. Environmental effects such as toxic effects to organisms and significant changes in community composition after pesticide applications have been documented. However the data gaps are considerable and in order to allow the use of valuable tools such as environmental risk analysis, there is a need to evaluate risk factors in the tropics.

Table 1: Fish Kill events in intensive agriculture areas

YEAR	LOCATION	SAMPLE	PESTICIDES FOUND
2003	Canal Salado, Matina	water	ethoprofos: 0,4 µg/L propiconazol: 0,2 µg/L difenoconazol: traces
2003	Laguna Madre de Dios y Caño Santa Marta	fish	ethoprofos: 0,1 µg/g ww terbufos: 0,2 µg/g ww*
2004	R. Aguas Zarcas,Siquirres	water	ethoprofos: 0,4 µg/L
2004	Río Madre de Dios	water	ethoprofos: 2,9 µg/L chlorotalonil: 15 µg/L difenoconazol: 0,1µg/L
		fish	ethoprofos: 0,07 µg/g ww
2004	Canal de Batán	fish	terbufos: 0,2 µg/g ww
2005	Laguna Madre de Dios	water	bromacil: 0,7 µg/L chlorotalonil: 0,4 µg/L fenamifos : 1 µg/L
2006	Río de Estrella, Limón Estero Negro	water	difenoconazol: 0,4-0,8 µg/L terbufos: 0,2 µg/L
		fish	terbufos: 0,3 µg/g ww
2006	Río de Westfalia, Limón	water	chlorothalonil: 3,8 µg/L fenamifos: 1,3-1,8 µg/L
2007	Río de Suerte	water	bromacil: 3,5 µg/L diazinon: trazas - 0,3 µg/L difenoconazol: 0,4 µg/L ethoprofos: trazas terbufos: 0,2 µg/L
		fish	terbufos: 0,1 µg/g ww
2008	Río Madre de Dios	water	amethryn: 0,1-0,2 µg/L bromacil: 0,4 - 0,6 µg/L diazinon: 0,2 - 1, 4 µg/L diuron: trazas ethoprofos: 0,1 µg/L propiconazol: trazas
		fish	terbufos: 0,2 µg/L

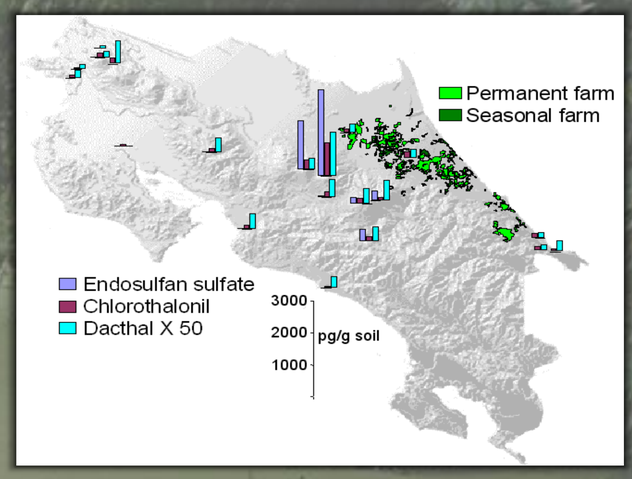

Fig.1: Concentrations of pesticides in soil and location of banana plantations (Daly *et al*., 2007)

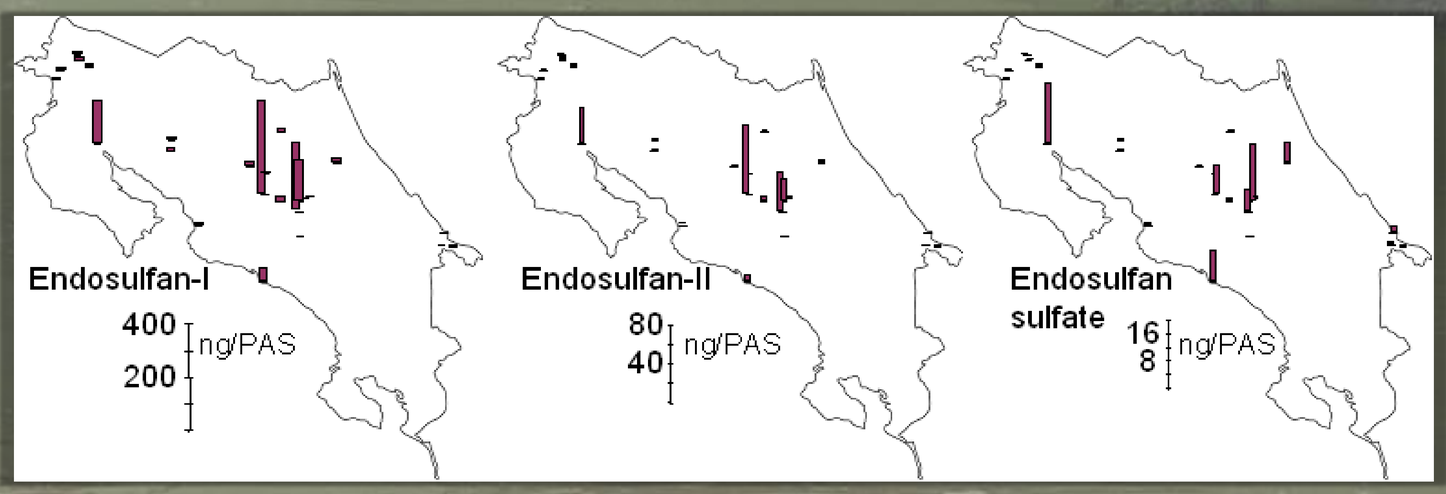

Fig 2: Concentrations of endosulfan related compound in passive air samplers 2004-2005 (ng/sampler), (Daly *et al*., 2007)

MACROINVERTEBRATE SENSITIVE SPECIES

Vertiente Pacífica
Efemerópteros: *Caenis* sp.,*Baetis sp.*
Tricópteros: *Smiridea sp.*
Diptera: *Pentaneura* sp. (tolerant)
Gastropoda: *Pisidium* sp. (tolerant)

Vertiente Caribe
Efemerópteros: *Caenis* sp, *Tricotythodes* sp.
Tricópteros: *Smicridea sp., Heterelmis sp.*
Gastropoda: *Bythinella* sp

SPECIAL CONSIDERATION IN TROPICAL AREAS

- **Extensive use of pesticides and safety measures to minimize impact are not applied.**
- **Rainy conditions and frequent practices such as the cultivation and use of pesticides in slopes, the lack of buffer zones to protect streams and rivers and the extensive drainage systems in several crops, can increase pesticide runoff.**
- **The higher temperatures can increase degradation and toxicity, and decrease DO, making aquatic species more susceptible to toxic compounds.**
- **High biodiversity and the occurrence of species that are more sensitive (?).**
- **Vulnerability of tropical ecosystems (coastal lagoons, mangroves and coral reefs) is poorly known.**
- **Hydrodynamics of the coastal tropical ecosystems (can trap pollutants, increasing their residence time, which in turn can increase exposure times for organisms living in those systems).**
- **Climate change can be an additional stress to these ecosystems and increase their vulnerability to toxic compounds.**

CHALLENGES

- **Enhancement of clean technologies in agriculture is a key issue in the reduction of pesticide loads.**
- **Ecotoxicological studies can play a key role providing relevant data on environmental exposure and effects, as well as tools for control of pesticide use and for measuring health of ecosystems.**
- **Consumers and scientist in developed countries appear as key partners!**

SUMMARY OF FINDINGS

- **Studies indicate widespread pollution including aquatic ecosystems, coastal areas, montane forest, and ground waters.**
- **Some studies report toxic effects to organisms and significant changes in community composition after pesticide applications.**
- **Data gaps in the Region are considerable and need reliable inventories of sources, monitoring of emissions and surveillance of environmental and health exposure and effects.**