

MINISTERIO DE DESARROLLO AGROPECUARIO DIRECCION NACIONAL DE SANIDAD VEGETAL

CIPAC SYMPOSIUM

Presence of carcinogenic pesticide residues in three important river basins of the Republic of Panama

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OBJECTIVES

- **To make known the list of pesticide active ingredients detected in three important watersheds of the country, namely: La Villa river, Chico river and Santamaría river, paying special attention to those that are now considered as potential carcinogenic agents.**

INTRODUCTION

- The role played by synthetic pesticides in Panamanian agriculture for zoo and phytosanitary protection against various pests is indisputable.
- The last official report indicated that in the 2005-2008 period, a little more than 6 million kilograms had entered the country, a high figure if we compare it with our population growth and area sown.
- Pesticides have different physicochemical properties and a defined toxicology. Therefore, the suffering of chronic diseases, particularly cancer, can be caused by the consumption of food and water sources contaminated by agro-toxins.
- In Panama, according to the latest report released by the Ministry of Health in February 2018, cancer is the second leading cause of death in the country (831 are due to prostate cancer, 695 breast, 600 skin, among others).

CANCER AND PESTICIDES

- It can be stated (review by Zahm and Ward's, 1998) that there is an association between exposure to pesticides and cancer in children. However, the specific relationship with an active ingredient was not demonstrated.
- In another study (systematic review by Bassil KL., Vakil C, et al.) A positive association was shown between exposure to pesticides and non-Hodgkin lymphoma, leukemia, prostate cancer, brain cancer, breast cancer. Research work in other countries also associates agricultural and livestock practices with a high incidence of cancer cases (López-Abente G., 1991, Motta, J., et al., 2008).
- In Costa Rica (SALTRA of Central America, 2009) reports that workers of banana plantations have high incidences of cervical cancer and leukemia.

MATERIALS AND METHODS

The organophosphorus, organochlorine and pyrethroid residues were extracted using ethyl acetate and then injected to a GC / MS gas chromatograph with a triple quadrupole analyzer and limit of quantification of $0.11 \mu\text{g} / \text{L}$.

For the carbamates, triazines, neonicotinoids and other families the ONLINE enrichment system was used, detection and quantification was performed by means of liquid chromatography, LC-MS / MS with a triple quadrupole analyzer.

Similarly, by means of a precolumn derivatization, we worked with the herbicide glyphosate and its main metabolite AMPA (aminomethylphosphonic acid). The limit of quantification for the last two methods is $0.1 \mu\text{g} / \text{L}$ and $10 \mu\text{g} / \text{L}$, respectively.

MATERIALS AND METHODS

- The sample collections were carried out quarterly by certified officials of the National Directorate of Plant Health, in previously established sites.
- The results expressed in micrograms per liter of water were compared with the guide values or maximum limits of pesticide residues (MRLs), established by WHO and US-EPA. For carcinogenic pesticides we will start from the criterion that there is no maximum limit or a guide value, any concentration, however minimal, can cause cancer.
- The association of pesticides and cancer are analyzed: from the perspective of the International Agency for Research on Cancer (IARC) and the US-EPA. The IARC is an intergovernmental agency, part of the WHO.

ANALYSIS OF THE RESULTS



HYDROGRAPHIC BASINS IN STUDY



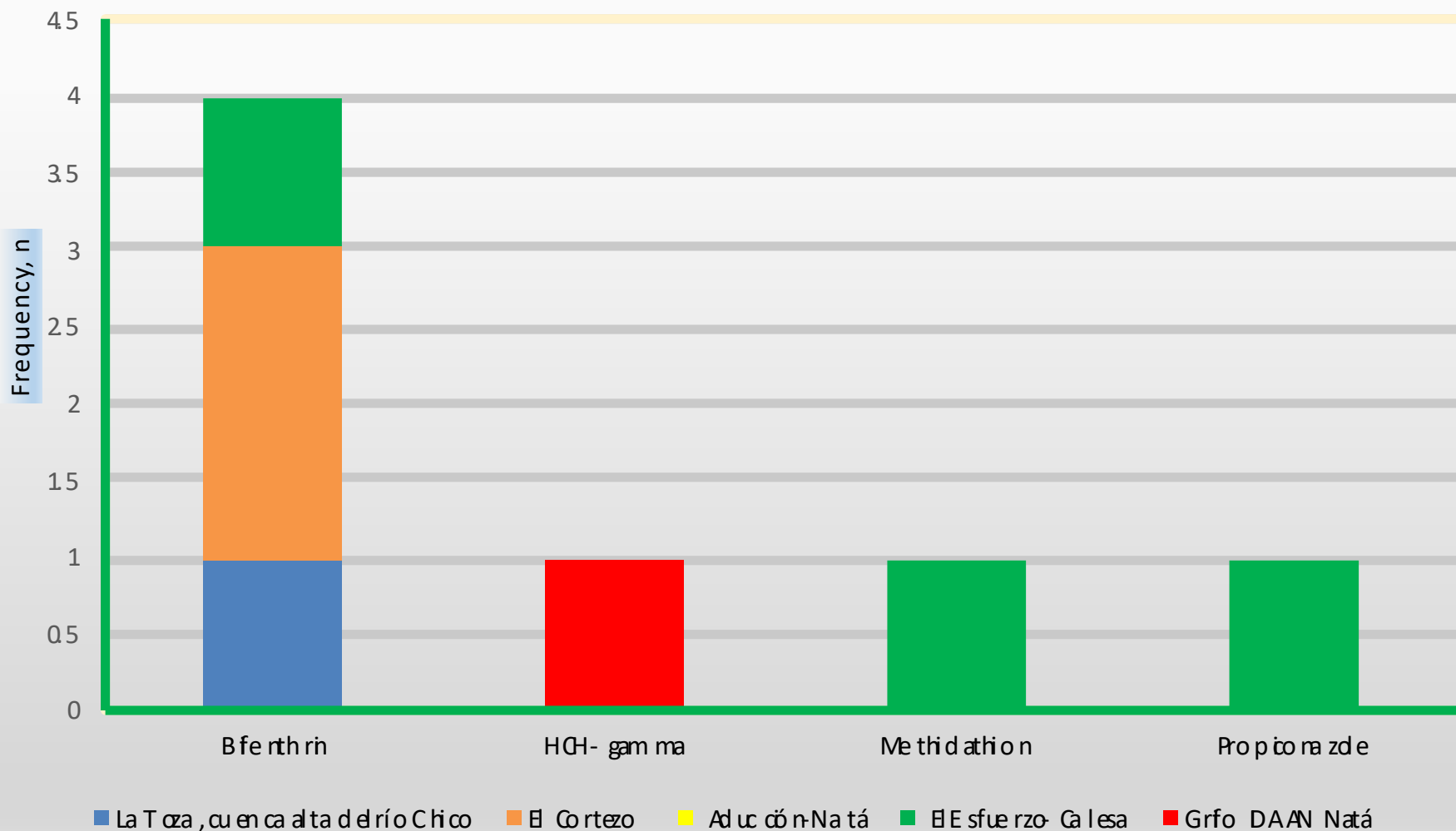
CONTAMINATION OF THE CHICO RIVER FOR PESTICIDE RESIDUES, $\mu\text{g} / \text{L}$

PLACE	01.10.2015	12.04.2016		07.09.2016			16.12.2016	17.03.2017	17.06.2017	17.09.2017				17.12.2017
	Iprobenfos	Bifenthrin	Propiconazole	HCH-gamma	Cadusafos	Acetochlor	ND	ND	ND	Atrazine	Bifenthrin	Cadusafos	Methidathion	Bifenthrin
La Toza, cuenca alta del río Chico					0,12	0,27					0,41			
El Cortezo										7,39	<0.11	<0.11		0,14
Toma de agua IDAAN-Natá														
El Esfuerzo- Calesa	<0.11	<0.11	0,14										0,4	
Grifo IDAAN Natá				0,58										



Detected eight I.A., which do not exceed the guide values given by WHO and US-EPA. However, half of them according to US-EPA and IARC are carcinogenic.

RESIDUES OF CARCINOGENIC PESTICIDES PRESENT IN THE CHICO RIVER, BY PLACE OF COLLECTION AND FREQUENCY OF DETECTION (2015-2017)



CONTAMINATION OF THE RIVER SANTAMARÍA FOR RESIDUES OF PESTICIDES, $\mu\text{g} / \text{L}$

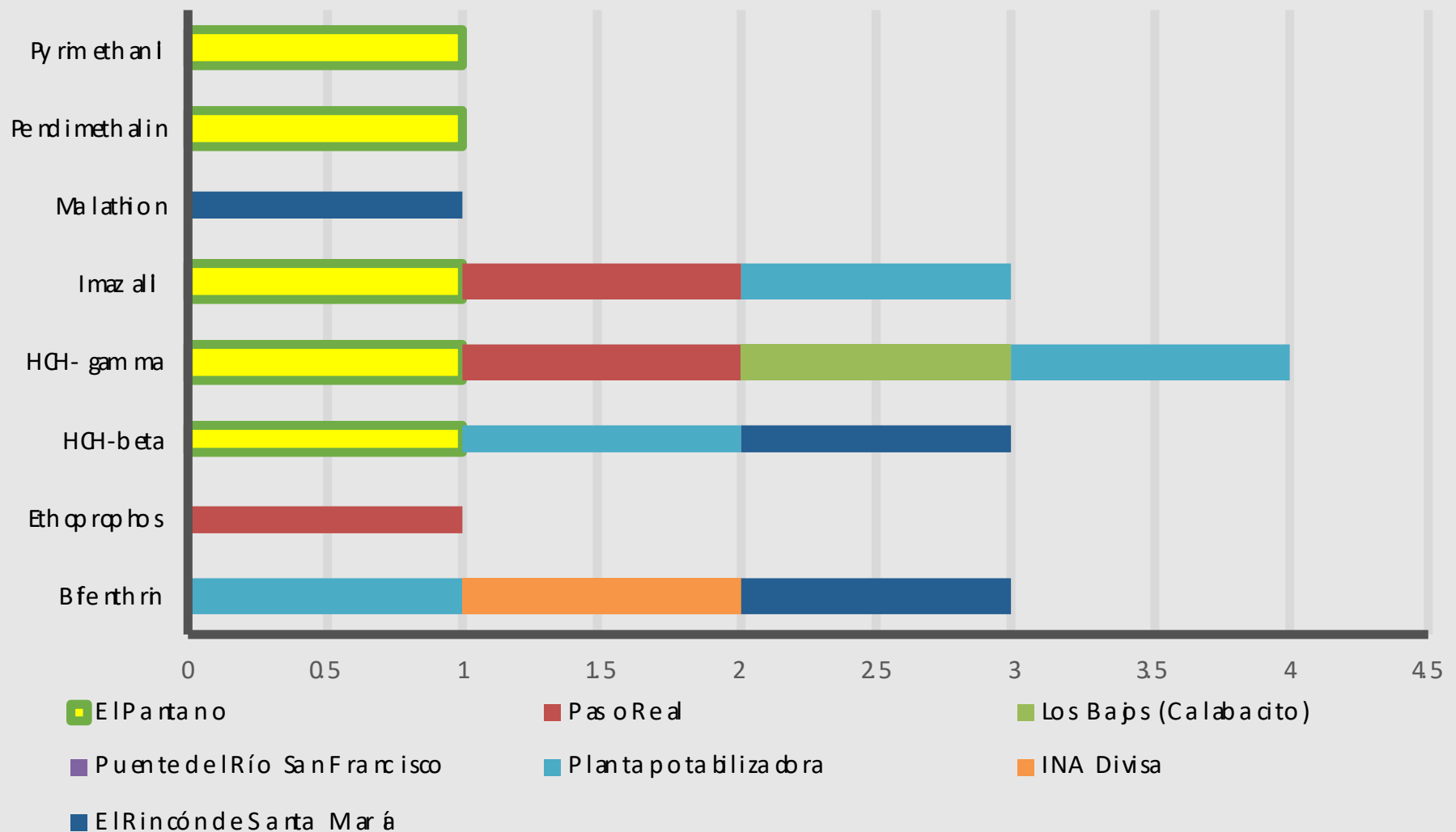
PLACE	01.10.2015		11.04.2016												
	λ Cyhalothrin	Iprobenfos	Aldrin	Bifenthrin	HCH-beta	Imazalil	Endosulfan-beta	Endosulfan-Sulfato	Fipronil	HCH- gamma	Cadusafos	Spinosad	Anilofos	Profenofos	Malathion
El Pantano					<0.11	<0.10	0,14			<0.11	<0.11	<0.10			
Paso Real						<0.10	0,14			<0.11					
Los Bajos (Calabacito)		<0.11					0,14	0,14	0,32	<0.11			0,18		
Puente del Río San Francisco	0,11	<0.11													
Planta potabilizadora			<0.11	<0.11	<0.11	<0.10	0,14	0,22		<0.11					
INA Divisa				<0.11			0,54					<0.10	0,18	0,25	
El Rincón de Santa María				<0.11	<0.11										0,38

07.09.2016			16.12.2016	17.03.2017	17.06.2017	17.09.2017	17.12.2017
Ethoprophos	Pyrimethanil	Pendimethalin	N/D	ND	ND	Atrazine	Iprobenfos
	0,47	0,47	ND	ND	ND		
0,25			ND	ND	ND		
			ND	ND	ND		
			ND	ND	ND		0,25
			ND	ND	ND		
			ND	ND	ND		
			ND	ND	ND	7,44	

We determined 17 different I.A., their levels did not exceed the MRLs according to WHO and US-EPA. According to IARC and US-EPA, 8 of them are classified as carcinogenic.



RESIDUES OF CARCINOGENIC PESTICIDES PRESENT IN THE SANTAMARÍA RIVER, BY PLACE OF COLLECTION AND FREQUENCY OF DETECTION (2015-2017)



POLLUTION OF THE LA VILLA RIVER FOR RESIDUES OF PESTICIDES, $\mu\text{g} / \text{L}$

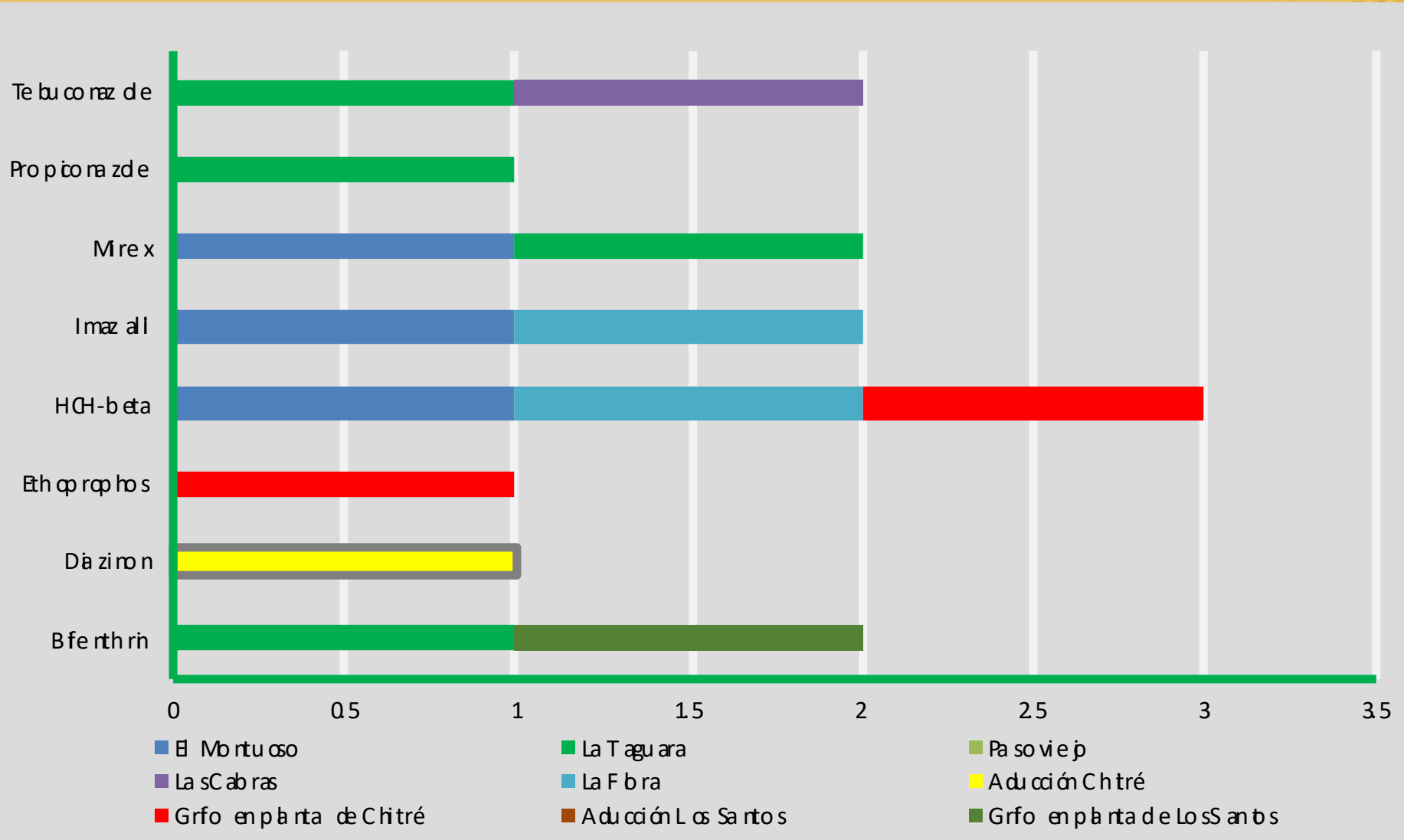
PLACE	2015 (01/10)			11.04.16							07.09.16		
	Atrazine	Chlorpyrifos	Terbufos	Atrazine	Aldrin	Bifenthrin	HCH-beta	Imazalil	Propiconazole	Endosulfan- alfa	Atrazine	Acetochlor	Ethoprophos
El Montuoso	0	0	0				<0.11	<0.10					
La Taguara									0,13				
Paso viejo	No	existía	este punto		<0.11								
Las Cabras		<0.11										0,26	
La Flora	0,28						<0.11	<0.10					
Toma de agua de Chitré	0,41		<0.11	<0.10								0,25	
Grifo cerca Toma de agua de Chitré	No	existía	este punto				<0.11				<0.10		0,26
Toma de agua de Los Santos	0	0	0		<0.11								
Grifo cerca Toma de agua Los Santos	No	existía	este punto			<0.11					<0.10		
Puente sobre río	0,42									<0.11			

PLACE	16.12.16			17.03.17	17.06.17	17.09.17			17.12.17
	Cadusafos	Mirex	Chlorpyrifos	ND	ND	Atrazine	Bifenthrin	Tebuconazole	Diazinon
El Montuoso		<0,11		ND	ND				
La Taguara		<0,11		ND	ND		0,42	9,94	
Paso viejo				ND	ND				
Las Cabras				ND	ND	8,32		9,18	
La Flora				ND	ND	8,96			
Toma de agua de Chitré				ND	ND	9,48			<0.11
Grifo cerca Toma de agua de Chitré				ND	ND	9,03			
Toma de agua de Los Santos				ND	ND	9,3			
Grifo cerca Toma de agua Los Santos				ND	ND				
Puente sobre río	<0.11		<0,11	ND	ND	9,86			

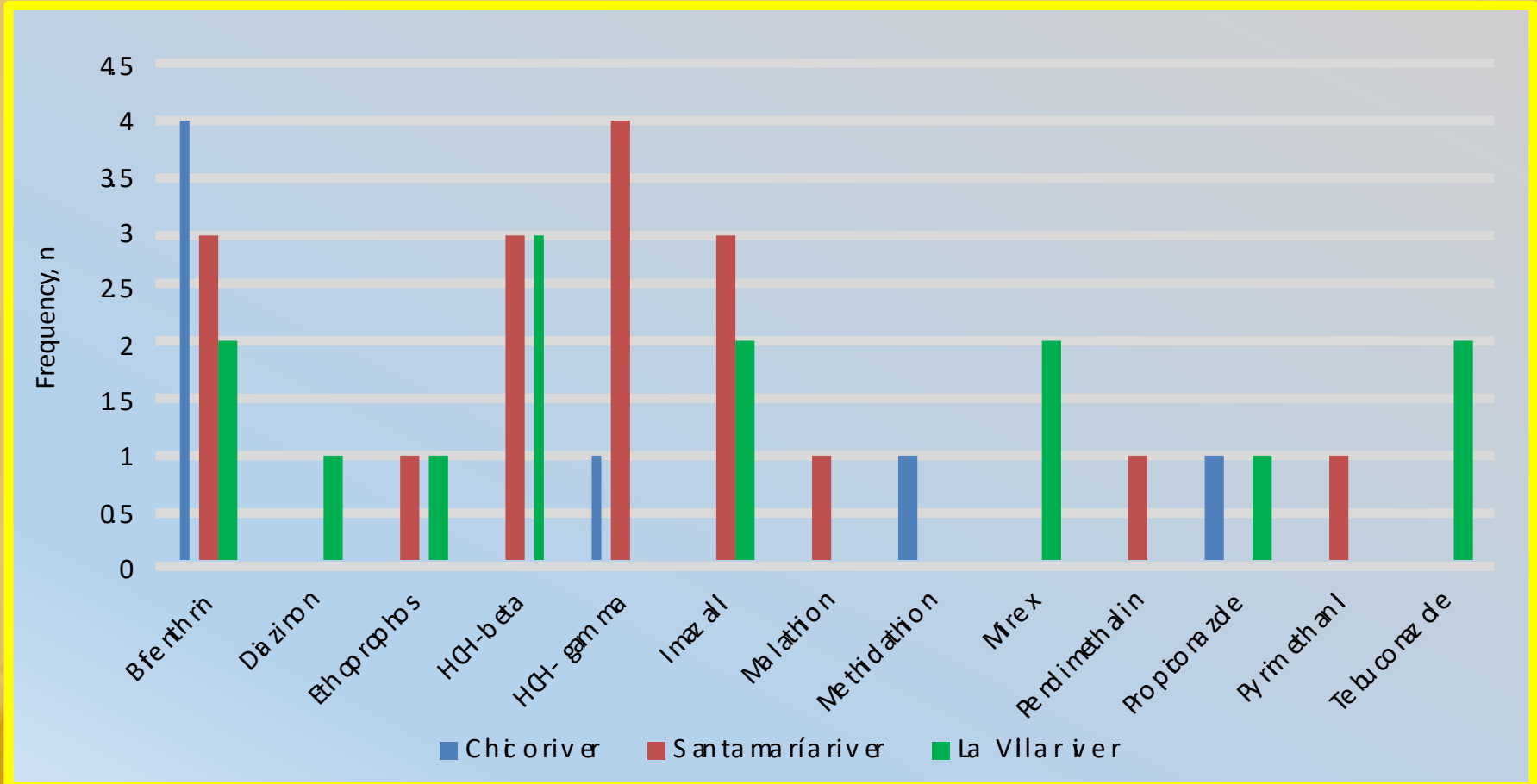
15 Miscellaneous I.A. detected.

Maximum concentration for tebuconazole and atrazine, but they do not exceed the MRLs. 8 I.A. included as carcinogenic.

WASTE OF CARCINOGENIC PESTICIDES PRESENT IN THE RIVER LA VILLA, BY PLACE OF COLLECTION AND FREQUENCY OF DETECTION (2015-2017)



OCCURRENCE IN THE DETECTION OF CARCINOGENIC PESTICIDES IN THREE IMPORTANT HYDROGRAPHIC BASINS OF THE COUNTRY. PERIOD 2015-2017.



The basin most contaminated by carcinogenic, according to sampling sites, is that of the Santamaría River. Bifenthrin (23.7 %), HCH-isomers (29 %) and imazalil (13.2 %) are I.A. most detected.

CONCLUSIONS

- In the three basins, residues of 24 different pesticides are detected and quantified, with the basins of the Santamaría and La Villa rivers being the most contaminated with 17 and 15 active ingredients, respectively.
- According to the criteria of the IARC and US-EPA, approximately 50 % of the pesticides detected in each of the basins are classified as carcinogenic.
- The I.A. Most quantified in the three river basins were: bifenthrin - 23.7 %, HCH-isomers (hexachlorocyclohexane) – 29 % and imazalil - 13.2 %.
- The presence of Aldrin, Mirex and HCH-isomers in the basins is worthy of analysis because: 1) they do not have a registry in Panama and were prohibited according to Resolved MIDA 074 of 1997; 2) are more persistent in water than estimated.

THANK YOU VERY MUCH

