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SHAANXI INSTITUTE OF MICROBIOLOGY

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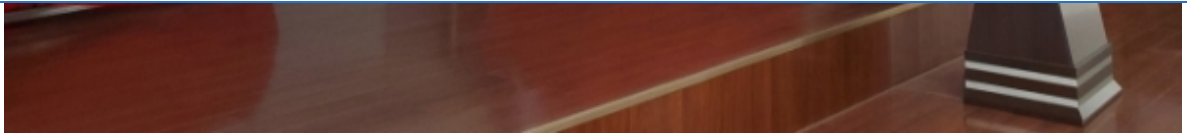
## 科研动态

### 陕西省微生物研究所召开“低剂量敌百虫胁迫对中国林蛙的肝细胞毒性与分子响应”学术报告交流会

发布时间：2023-02-28

2022年2月24日下午，我所组织举办了学术交流会，微生物技术研究中心马瑜博士做了题为“低剂量敌百虫胁迫对中国林蛙的肝细胞毒性与分子响应”的学术报告。所内三十余名科研人员聆听了本次报告。





因具有广谱、高效、残留期短、使用成本低的特点，有机磷类杀虫剂（organophosphate insecticides, OPs）成为继有机氯类被禁用后应用最为广泛的一类药剂，占全球杀虫剂使用总量的70%以上。但OPs广泛应用的同时也已在水域中残留、蓄积，造成水域环境污染，严重威胁水体质量，对水生动物的神经功能以及行为、氧化应激效应及其导致的组织损伤、基因损伤和遗传毒性、免疫功能、内分泌、生殖和发育等多方面产生毒性效应，已成为威胁水生生态环境安全的巨大隐患。敌百虫（trichlorphon），化学名O,O-二甲基-(2,2,2-三氯-1-羟基乙基)磷酸酯（C<sub>4</sub>H<sub>8</sub>O<sub>4</sub>Cl<sub>3</sub>P），是一种最常见的有机磷农药，被广泛用于害虫防治以及养殖动物体内外寄生虫的杀灭。与大多数OPs不同，敌百虫易溶于水。且由于其对靶标和非靶标动物的生长发育和内分泌活动均具有一定的负面干扰，敌百虫已被列为环境内分泌干扰物。

水体中有毒物质很容易影响两栖动物的胚胎及幼体的发育，因此，两栖动物可作为检测水域化学污染效力的理想材料之一，其生态分布也可作为环境污染程度的指示种群。中国林蛙(*Rana chensinensis*)分布广泛，易饲养，幼体对污染敏感。马瑜博士通过低剂量敌百虫对中国林蛙幼体和成体的水体暴露，从对幼体生长发育、肝组织的细胞和亚细胞结构、代谢相关酶的活性以及基因差异表达变化等多层次检测敌百虫对于非靶标动物产生的毒理效应，以期为两栖动物生殖环境的保护、水产养殖、资源保护及水源涵养地水域污染的治理提供科学依据。相关科学研究成果已在 *Environmental Toxicology*、*Journal of Environmental Science and Health*, Pangt B、*Ecotoxicology and Environmental Safety*、*生态毒理学报*、*农药学学报*、*生物技术进展*等学术期刊上发表。



### 有机磷杀虫剂对非靶标水生动物的毒性机制研究进展

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**摘 要:** 有机磷杀虫剂对非靶标水生动物造成的危害日益严重, 但其毒性作用机制尚不明确。本文综述了有机磷杀虫剂对非靶标水生动物毒性的作用机制, 包括对水生动物神经系统的毒性作用, 以及对水生动物生殖系统的毒性作用。文章指出, 有机磷杀虫剂可以通过抑制乙酰胆碱酯酶的活性, 导致神经递质乙酰胆碱在突触处积累, 从而引起水生动物神经系统的中毒。此外, 有机磷杀虫剂还可以通过抑制水生动物的生殖系统, 导致水生动物生殖能力的下降。文章最后指出, 有机磷杀虫剂对非靶标水生动物毒性的作用机制是一个复杂的过程, 需要进一步的研究。

**关键词:** 有机磷杀虫剂; 非靶标水生动物; 毒性作用; 作用机制

中图分类号: S475.1; X913.1 文献标识码: A 文章编号: 1001-6872(2018)12-2615-08

### Review on toxic mechanisms of organophosphate on invertebrate non-target aquatic

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**Abstract:** Organophosphate insecticides (OPs) on aquatic non-targeted organisms have become a threat to aquatic non-targeted organisms. OPs compounds have a general acute structure, causing their toxic effects primarily on the inhibition of acetylcholinesterase (AChE). However, only the neurotoxic mechanism (cholinergic over-stimulation) cannot explain the wide-spectrum adverse consequences caused by OPs exposure. The inhibition of cholinergic transmission plays a key role in the toxicity of OPs, which is associated with neurotoxicological abnormality. Furthermore, an reproductive disruption, OPs not only induced changes in endocrine systems, but also caused changes in the reproductive system and endocrine disruption. Disasters in nature induced by the OPs exposure could lead to genetic effects and

**Keywords:** organophosphate insecticides; non-targeted organisms; toxicity; mechanism

**Subject terms:** organophosphate insecticides; non-targeted organisms; toxicity; mechanism

**Classification:** S475.1; X913.1; Literature Code: A; Article ID: 1001-6872(2018)12-2615-08

**Indexing:** Environmental Science; Environmental Science; Environmental Science

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### 敌百虫对中国林蛙蝌蚪生长发育的毒性效应

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**摘要:** 敌百虫是一种广谱杀虫剂, 对水生动物具有毒性。本文研究了敌百虫对中国林蛙蝌蚪生长发育的毒性效应。实验结果表明, 敌百虫对林蛙蝌蚪的生长发育具有明显的抑制作用, 表现为蝌蚪体长、体重的降低, 以及变态发育的延迟。此外, 敌百虫还对林蛙蝌蚪的生理生化指标产生了影响, 如血清中丙氨酸氨基转移酶(ALT)和天门冬氨酸氨基转移酶(AST)活性的升高。这些结果表明, 敌百虫对林蛙蝌蚪的生长发育具有显著的毒性效应, 需要引起重视。

**关键词:** 敌百虫; 中国林蛙; 蝌蚪; 生长发育; 毒性效应

中图分类号: S475.1; X913.1 文献标识码: A

### Toxicity Effect of Trichlorfon on the Growth and Development of Tadpoles *Rana chensiensis*

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**Abstract:** Trichlorfon is a broad-spectrum insecticide with acute toxicity to aquatic organisms. This study investigated the toxicity effect of Trichlorfon on the growth and development of tadpoles of *Rana chensiensis*. The results showed that Trichlorfon had a significant inhibitory effect on the growth and development of tadpoles, manifested as the decrease of tadpole body length and weight, and the delay of metamorphosis. In addition, Trichlorfon also affected the physiological and biochemical indicators of tadpoles, such as the increase of serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activity. These results indicate that Trichlorfon has a significant toxic effect on the growth and development of tadpoles of *Rana chensiensis*, which needs to be paid attention to.

**Keywords:** Trichlorfon; *Rana chensiensis*; tadpoles; growth and development; toxicity effect

**Classification:** S475.1; X913.1; Literature Code: A

**Indexing:** Environmental Science; Environmental Science; Environmental Science

**Address:** College of Life Science, Hunan Normal University, Changsha 410012, China

### Qualitative stress and hepatotoxicity in the frog, *Rana chensiensis*, when exposed to low-doses of trichlorfon

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**Abstract:** Trichlorfon is an organophosphate insecticide that is widely used to eradicate and suppress aquatic pests. However, it has been reported to be toxic to non-target organisms. To evaluate the effects of low doses of trichlorfon on the qualitative stress and hepatotoxicity of aquatic organisms, tadpoles of *Rana chensiensis* were exposed to concentrations of 0.01, 0.1, 1, and 10 mg/L for 14 days. The qualitative stress response (QSR) and hepatotoxicity (HT) were assessed using the qualitative stress response (QSR) and hepatotoxicity (HT) indices. The results showed that the QSR and HT indices increased significantly with increasing trichlorfon concentrations. The QSR index increased from 0.01 to 10 mg/L, and the HT index increased from 0.01 to 10 mg/L. The results also showed that the QSR and HT indices were significantly correlated with the trichlorfon concentration. These results suggest that low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis*.

### Introduction

Recently, a marked decline in amphibian populations has been observed globally and continues to be the greatest concern worldwide. This decline is attributed to a variety of factors, including habitat loss, pollution, and climate change. Organophosphate insecticides (OPs) are widely used in agriculture and forestry, and their use has been associated with the decline of amphibian populations. OPs are known to be toxic to aquatic organisms, and their use in agriculture and forestry has been associated with the decline of amphibian populations. This study aims to evaluate the qualitative stress and hepatotoxicity of *Rana chensiensis* tadpoles exposed to low doses of trichlorfon.

Trichlorfon is a widely used organophosphate insecticide that is effective against a variety of aquatic pests. However, it has been reported to be toxic to non-target organisms. This study aims to evaluate the qualitative stress and hepatotoxicity of *Rana chensiensis* tadpoles exposed to low doses of trichlorfon. The results showed that the QSR and HT indices increased significantly with increasing trichlorfon concentrations. The QSR index increased from 0.01 to 10 mg/L, and the HT index increased from 0.01 to 10 mg/L. The results also showed that the QSR and HT indices were significantly correlated with the trichlorfon concentration. These results suggest that low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis*.

### Materials and Methods

**2.1. Tadpoles:** Tadpoles of *Rana chensiensis* were collected from a natural pond in Changsha, Hunan Province, China. The tadpoles were reared in filtered water at 20°C. The tadpoles were divided into five groups: control, 0.01 mg/L, 0.1 mg/L, 1 mg/L, and 10 mg/L. The tadpoles were exposed to trichlorfon for 14 days.

### Transcriptome analysis of *Rana chensiensis* liver under trichlorfon stress

Ma Yu<sup>1</sup>, Li Yu<sup>1</sup>, Yang Ke<sup>2</sup>, Yang Xue<sup>2</sup>, and Yu Zhang<sup>1</sup>

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### ARTICLE INFO

**Introduction:** Trichlorfon is a widely used organophosphate insecticide that is effective against a variety of aquatic pests. However, it has been reported to be toxic to non-target organisms. This study aims to evaluate the qualitative stress and hepatotoxicity of *Rana chensiensis* tadpoles exposed to low doses of trichlorfon. The results showed that the QSR and HT indices increased significantly with increasing trichlorfon concentrations. The QSR index increased from 0.01 to 10 mg/L, and the HT index increased from 0.01 to 10 mg/L. The results also showed that the QSR and HT indices were significantly correlated with the trichlorfon concentration. These results suggest that low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis*.

### 1. Introduction

Organophosphate insecticides have been used as insecticides, acaricides and herbicides for several decades. They are highly effective against a wide range of pests and diseases. However, they are also toxic to non-target organisms. This study aims to evaluate the qualitative stress and hepatotoxicity of *Rana chensiensis* tadpoles exposed to low doses of trichlorfon. The results showed that the QSR and HT indices increased significantly with increasing trichlorfon concentrations. The QSR index increased from 0.01 to 10 mg/L, and the HT index increased from 0.01 to 10 mg/L. The results also showed that the QSR and HT indices were significantly correlated with the trichlorfon concentration. These results suggest that low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis*.

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**2.1. Tadpoles:** Tadpoles of *Rana chensiensis* were collected from a natural pond in Changsha, Hunan Province, China. The tadpoles were reared in filtered water at 20°C. The tadpoles were divided into five groups: control, 0.01 mg/L, 0.1 mg/L, 1 mg/L, and 10 mg/L. The tadpoles were exposed to trichlorfon for 14 days.

### RNA-seq 技术在水生生物生态毒理学中的应用进展

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**摘要:** RNA-seq 技术是一种高通量的测序技术, 可以同时对水生生物基因组进行大规模测序。本文综述了 RNA-seq 技术在水生生物生态毒理学中的应用进展, 包括对水生生物基因组结构的解析, 以及对水生生物基因表达谱的分析。文章指出, RNA-seq 技术可以用于水生生物基因组的测序, 以及水生生物基因表达谱的分析。此外, RNA-seq 技术还可以用于水生生物基因组的注释, 以及水生生物基因表达谱的分析。文章最后指出, RNA-seq 技术在水生生物生态毒理学中的应用前景广阔, 需要进一步的研究。

### Application Progress of RNA-seq Technology in Ecotoxicology of Aquatic Organisms

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**Abstract:** RNA-seq technology is a high-throughput sequencing technology that can simultaneously sequence the genomes of aquatic organisms. This study reviews the application progress of RNA-seq technology in the ecotoxicology of aquatic organisms, including the analysis of aquatic organism genomes and the analysis of aquatic organism gene expression profiles. The results show that RNA-seq technology can be used to analyze the genomes of aquatic organisms and to analyze the gene expression profiles of aquatic organisms. Additionally, RNA-seq technology can be used to analyze the genomes of aquatic organisms and to analyze the gene expression profiles of aquatic organisms. These results suggest that RNA-seq technology has a wide range of applications in the ecotoxicology of aquatic organisms.

**Keywords:** RNA-seq; aquatic organisms; ecotoxicology

**Subject terms:** RNA-seq; aquatic organisms; ecotoxicology

**Classification:** S475.1; X913.1; Literature Code: A

**Indexing:** Environmental Science; Environmental Science; Environmental Science

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### RESEARCH ARTICLE

### Effects of low doses Trichlorfon exposure on *Rana chensiensis* tadpoles

Ma Yu<sup>1</sup>, Li Yu<sup>1</sup>, Yang Ke<sup>2</sup>, and Yu Zhang<sup>1</sup>

1. College of Life Science, Hunan Normal University, Changsha 410012, China; 2. College of Environment, Hunan Normal University, Changsha 410012, China

**Introduction:** Trichlorfon is a widely used organophosphate insecticide that is effective against a variety of aquatic pests. However, it has been reported to be toxic to non-target organisms. This study aims to evaluate the qualitative stress and hepatotoxicity of *Rana chensiensis* tadpoles exposed to low doses of trichlorfon. The results showed that the QSR and HT indices increased significantly with increasing trichlorfon concentrations. The QSR index increased from 0.01 to 10 mg/L, and the HT index increased from 0.01 to 10 mg/L. The results also showed that the QSR and HT indices were significantly correlated with the trichlorfon concentration. These results suggest that low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis*.

**Keywords:** Trichlorfon; *Rana chensiensis*; tadpoles; growth and development; toxicity effect

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### 2. Materials and Methods

**2.1. Tadpoles:** Tadpoles of *Rana chensiensis* were collected from a natural pond in Changsha, Hunan Province, China. The tadpoles were reared in filtered water at 20°C. The tadpoles were divided into five groups: control, 0.01 mg/L, 0.1 mg/L, 1 mg/L, and 10 mg/L. The tadpoles were exposed to trichlorfon for 14 days.

### 3. Results and Discussion

The results showed that the QSR and HT indices increased significantly with increasing trichlorfon concentrations. The QSR index increased from 0.01 to 10 mg/L, and the HT index increased from 0.01 to 10 mg/L. The results also showed that the QSR and HT indices were significantly correlated with the trichlorfon concentration. These results suggest that low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis*.

### 4. Conclusion

Low doses of trichlorfon can cause qualitative stress and hepatotoxicity in *Rana chensiensis* tadpoles.

### 5. Acknowledgements

This work was supported by the National Natural Science Foundation of China [Grant Number 81573100].

### 6. References

1. Zhang Y, Ma Y, Li Y. (2018) Qualitative stress and hepatotoxicity in the frog, *Rana chensiensis*, when exposed to low-doses of trichlorfon. *Environmental Science*, 39(12), 2615-2622.

### 7. Author Biographies

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报告结束后, 马瑜博士与科研人员在湖南师范大学林蛙实验室饲养条件与方法、林蛙蝌蚪解剖方法、敌百虫针对不同靶标生物的使用浓度、鱼类与林蛙耐毒性比较等方面进行了学术交流与探讨。通过此次学术报告, 与会科研人员在有机磷杀虫剂对非靶标水生动物的毒性机制方面有了新认识 and 了解, 促进不同研究领域的学术交流, 开阔了科研人员的学术视野。







下一篇：我所薛文娇研究员在“一带一路”生物健康农业国际研讨会做主旨报告



陕西省科学院

☑ 违纪违法举报



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