

# Chloride tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]-cobalt(III) as a stimulator of the total antioxidant status of *Apis Mellifera*.

Olga Garbuz\*<sup>1</sup>, Vasilii Graur<sup>2</sup>, Victor Tsapkov<sup>2</sup>, Nadejda Railean<sup>1</sup>, Ion Toderas<sup>1</sup>, Aurelian Gulea\*<sup>2</sup>

<sup>1</sup> Laboratory of Systematics and Molecular Phylogenetics, Institute of Zoology, Moldova State University, 1 Academiei Street, MD-2028 Chisinau, Moldova

<sup>2</sup> Laboratory of Advanced Materials in Biopharmaceutics and Technics, Institute of Chemistry, Moldova State University, 60 Mateevici Street, MD-2009 Chisinau, Moldova

## INTRODUCTION

Oxidative stress is a major factor in the development of diseases in *Apis Mellifera*. To assess the functionality of the antioxidant system in bees and their larvae, total antioxidant status (TAS) serves as a critical indicator. Commonly, Vitamin C is used to enhance TAS, yet its effectiveness is limited by its relatively low antioxidant activity. In this study, we synthesized tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]cobalt(III) chloride, offering a novel alternative to Vitamin C for TAS enhancement. Notably, previous research has not explored coordination compounds with thiosemicarbazides for this purpose in bees.

## AIM

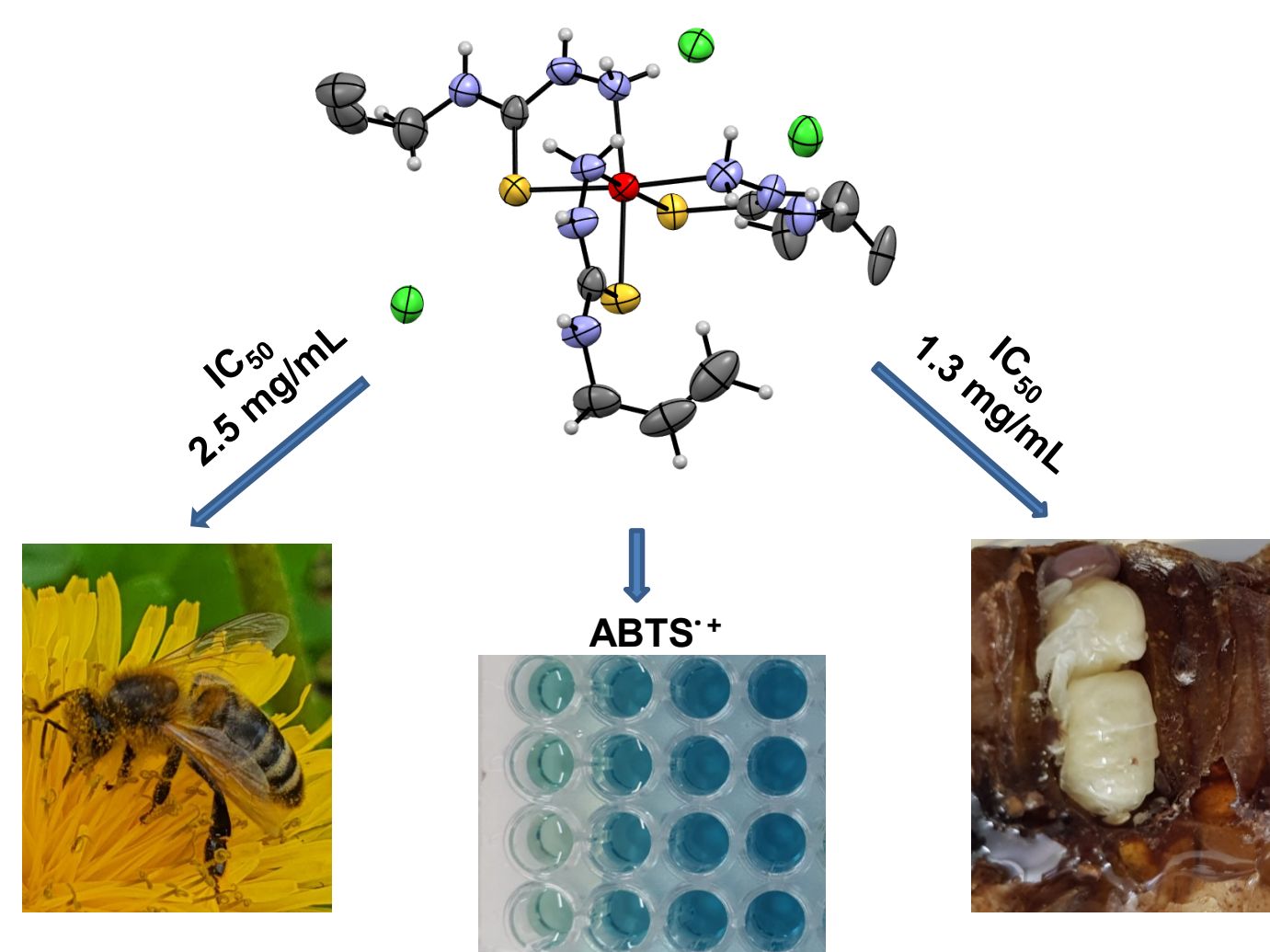
Chemical synthesis, characterization of new synthetic stimulator of the total antioxidant status of the bee and larval hemolymph that may find application in apiculture.

## RESULTS & DISCUSSION

The cobalt(III) complex was synthesized through the reaction of cobalt(II) hexahydrate with *N*-(prop-2-en-1-yl)hydrazinecarbothioamide in ethanol and hydrochloric acid. The characterization techniques included single crystal X-ray diffraction, FT-IR, <sup>1</sup>H NMR, <sup>13</sup>C NMR, elemental analysis, and molar conductivity. Antioxidant activity was assessed via ABTS, DPPH, and ORAC assays, while in vivo toxicity was evaluated using *Daphnia magna*. The complex demonstrated significant antioxidant activity, with an IC<sub>50</sub> of 7.3±0.3µM and lower toxicity than expected with an LC<sub>50</sub> of 56.3±3.1µM.

Experimental results revealed that tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]cobalt(III) chloride increased TAS in the hemolymph of bees and larvae by up to 5 and 8 times, respectively. The IC<sub>50</sub> values were recorded at 2.5mg/mL for bee hemolymph and 1.3mg/mL for larval hemolymph, compared to control values of 13.6mg/mL and 10.0mg/mL, respectively.

The stimulatory effect of the tested compound on TAS surpassed the activity of Vitamin C by up to 5 times.



The IC<sub>50</sub> (mg/mL) values of hemolymph towards ABTS<sup>+</sup>

Compound	Bee's hemolymph	Bee larval hemolymph
Control	13.56	9.95
Vitamin C (prototype)	13.14	6.31
Cobalt(III) coordination compound	2.48	1.26

These findings suggest that increasing TAS levels in bees could enhance their immune systems, highlighting the potential of tris[*N*-(prop-2-en-1-yl)hydrazinecarbothioamide]cobalt(III) chloride as a beneficial additive in apicultural health practices.

CONFLICTS OF INTEREST: The authors declare no conflicts of interest.

FUNDING: This research was funded by the subprograms 010602, 010701 of the Institutional Project.

References: Słowińska, M.; Nynca, J.; Wilde, J.; Bąk, B.; Siuda, M.; Cierieszko, A. Total antioxidant capacity of honeybee haemolymph in relation to age and exposure to pesticide, and comparison to antioxidant capacity of seminal plasma. *Apidologie* (2016) 47:227–236. INRA, DIB and Springer-Verlag France, DOI: 10.1007/s13592-015-0391-9.