PhD Thesis Review

Review of the Hao Jingrao's PhD Thesis on the *Molecular Mechanisms of Pesticides Action on the Photosynthetic Apparatus of Higher Plants*

This dissertation provides a comprehensive examination of the effects of the neonicotinoid insecticides thiamethoxam (*TMX*) and its primary metabolite, clothianidin (*CL*), on the photosynthetic apparatus of higher plants. The topic is highly relevant, as neonicotinoids are widely employed for pest control in modern agriculture, yet their potential impact on plant metabolism has been subject to conflicting reports. The author's research seeks to elucidate the molecular underpinnings of these effects, thereby contributing to a more informed utilization of neonicotinoids and to plant breeding strategies aimed at enhancing crop resilience.

This study employs a comprehensive methodological approach, utilizing a combination of Raman and infrared spectroscopy, electron paramagnetic resonance (*EPR*), variable chlorophyll fluorescence ("*JIP test*"), and atomic force microscopy (*AFM*) to provide robust, multifaceted evidence of how the neonicotinoid insecticides thiamethoxam and clothianidin affect photosynthetic pigments, electron transport, and chloroplast morphology.

Notably, in studies using two genotypes of corn—an inbred line (*zppl 225*) and a hybrid (*zp 341*)—the dissertation demonstrates that pesticide treatment can lower the efficiency of the photosystem II electron transport chain, primarily by interfering with electron flow between QA and QB. Further, the evidence indicates that such interference leads to enhanced production of reactive oxygen species, alterations in the shape of chloroplasts, and reduced membrane viscosity, implying structural reorganization of the thylakoid system.

The findings presented in the Thesis are scientifically significant and practically relevant. The research highlights genetic variations in plants' susceptibility to neonicotinoid insecticides, providing novel insights into how these compounds may disrupt core photosynthetic mechanisms. The clear evidence of induced oxidative stress raises concerns about the broader ecological and agronomic implications of widespread neonicotinoid application. Ultimately, the Thesis conclusions suggest promising directions for future investigations into the assessment of pesticide impacts and the development of screening methods for cultivars with enhanced stress resistance.

Overall, this work advances our understanding of the molecular mechanisms underlying pesticide effects on plant photosynthesis, providing insights that can inform crop improvement strategies and the judicious use of these agricultural chemicals. The Thesis itself is estimated as thorough, methodologically sound, and it addresses a pressing concern in contemporary agriculture. Its results will be valuable for researchers in plant physiology and biophysics, as well as for agronomists seeking to optimize pesticide application and enhance crop productivity.

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Grigorev G.V., PhD (Tsinghua – UC Berkeley Shenzhen Institute, Tsinghua University),
researcher of Tsinghua Shenzhen International Graduate School, Shenzhen, China;
professor of Department of Cyberphysical Systems of Cherepovets State University, Cherepovets, Russia.

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