Can amino acid also be developed as pesticide against plant viruses?

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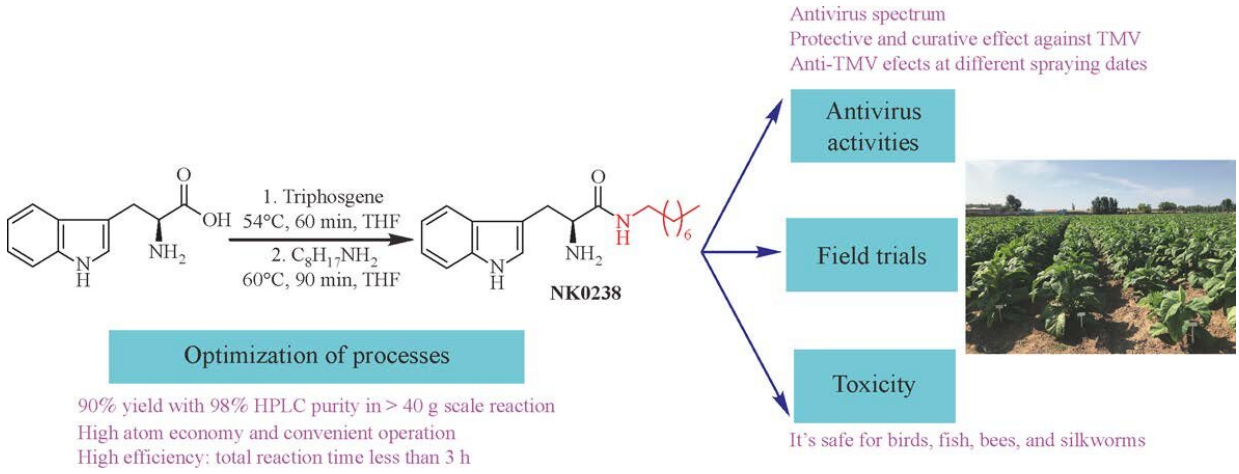

Credit: Hongjian Song, Qingmin Wang

Plant viruses create a great variety of harm. Virus disease pandemics and epidemics are estimated to have a global economic impact in the tens of billions of dollars. At present, there are not many effective and satisfactory varieties of anti-plant virus agents in practical use, and especially few therapeutic agents.

In the face of the harm viruses cause to agricultural production, it is necessary to develop environmentally friendly anti-plant virus drugs. It is increasingly important, and a growing research focus, to find drug candidates from natural products. Natural products possess many of the

properties that can make them useful drug candidates, including structural diversity, specificity and novel modes of action. However, natural products also have some disadvantages, such as limited compound availability, high structural complexity and poor drug-likeness. Therefore, pesticide creation based on natural products has become an important direction of green pesticide creation.

Tryptophan is one of the essential amino acids and the biosynthetic precursor of many alkaloids. Prof. Qingmin Wang and Dr. Hongjian Song from Nankai University previously found that tryptophan, the biosynthesis precursor of Peganum harmala alkaloids, and its derivatives have anti-TMV activity both in vitro and in vivo. Further exploration of this led to the identification of NK0238 as a highly effective agent for the prevention and control of diseases caused by plant viruses, but the existing routes are unsuitable for its large-scale synthesis.

They optimized a route for two-step synthesis of this virucide candidate. The optimized route provides a solid foundation for its large-scale synthesis and subsequent efficacy and toxicity studies. Field experiment results showed that it had good effect on multiple plant viruses. The oral toxicity in rats was mild, and it had no effect on the safety of birds, fish or bees. The study entitled "Route development, antiviral studies, field evaluation and toxicity of an antiviral plant protectant NK0238" is published on the Journal of *Frontiers of Agricultural Science and Engineering* in 2022.

In this study, a two-step synthetic route for the antiviral plant protectant, NK0238, was developed. By this route, NK0238 can be obtained in 94% yield and nearly 97% HPLC purity. Compared with the previously reported routes, this route has the advantages of high atom economy, high yield and operational simplicity. In addition, it can be used for the preparation of more than 40 g of NK0238 in a single batch. After completing the process optimization, an in-depth study of antiviral

activity in greenhouse and field experiments and toxicity tests were conducted. NK0238 exhibited a broad antiviral spectrum, in field experiments, the activities of NK0238 against TMV, pepper virus, panax notoginseng virus Y, gladiolus mosaic virus, banana bunchy top virus were equal to or higher than amino-oligosaccharins and moroxydine hydrochloride-copper acetate. The results of ecotoxicological testing showed that the compound was not harmful to birds, fish, bees and silkworms, its excellent activity and safety make NK0238 a promising drug candidate for further development.

More information: Wentao Xu et al, Route Development, Antiviral Studies, Field Evaluation And Toxicity Of An Antiviral Plant Protectant Nk0238, *Frontiers of Agricultural Science and Engineering* (2021). DOI: 10.15302/J-FASE-2021390

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