

Nicotinamide and Structurally Related Compounds Show Halting Activity against Zoospores of the Phytopathogenic Fungus *Aphanomyces cochlioides*

Takashi Shimai^a, Md. Tofazzal Islam^a, Yukiharu Fukushi^a, Yasuyuki Hashidoko^a, Ryozo Yokosawa^b and Satoshi Tahara^{a,*}

^a Division of Applied Bioscience, Graduate School of Agriculture, Hokkaido University, Kita-ku, Sapporo 060-8589, Japan.

Fax: +81-11-706-4182. E-mail: tahara@abs.agr.hokudai.ac.jp

^b Faculty of Pharmaceutical Sciences, Health Science University of Hokkaido, Tohbetu, Hokkaido 061-0293, Japan

* Author for correspondence and reprint requests

Z. Naturforsch. **57c**, 323–331 (2002); received November 11/December 3, 2001

Fungal Zoospore, Motility Inhibition, Nicotinamide

In a survey of plant secondary metabolites regulating the behavior of phytopathogenic *Aphanomyces cochlioides* zoospores, we found that leaf extracts of *Amaranthus gangeticus* and cotyledon extracts of pea (*Pisum sativum*) remarkably halted the motility of zoospores. Bioassay-directed fractionation of *A. gangeticus* and pea constituents revealed that the halting activity was dependent on a single chemical factor (halting factor). The active principle was identified as nicotinamide (**1**) by comparing its biological activity and spectroscopic properties with those of the authentic compound. Nicotinamide (**1**) showed potent halting activity toward the zoospores of *A. cochlioides* and *A. euteiches*, but it exhibited very less activity against other Oomycetes, *Pythium aphanidermatum* and *Phytophthora infestans* zoospores. Interestingly, the zoospores halted by nicotinamide (**1**) encysted within 10–15 min and then the resulting cystospores regenerated zoospores instead of germination. Nicotinamide (**1**) and related compounds were subjected to the halting activity bioassay to elucidate the structure-activity relationships. These bioassays revealed that part structures of (A) the aromatic ring containing at least one nitrogen atom, (B) carbonyl-like group adjacent to the aromatic ring and (C) hydrogen atoms on the amide group are responsible for the strong activity. So far, this is the first report of halting activity of nicotinamide (**1**) against fungal zoospores.