Isolation, identification and nematicidal activity of secondary metabolites produced by the entomopathogenic bacterium Photorhabdus l. sonorensis (Enterobacteriaceae) against the root knot nematode, Meloidogyne incognita (Tylenchidae)

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The banning of several chemical nematicides has prompted the need for new and environmentally-friendly methods to enhance current management of plant parasitic nematodes. Insect pathogenic Photorhabdus bacteria, the natural symbionts of Heterorhabditis entomopathogenic nematodes, are considered a goldmine for the discovery and application of biologically active secondary metabolites (SMs) with antibacterial, antifungal, insecticidal, and nematicidal activities. In this study, we evaluated three metabolites that were isolated and purified from culture filtrates of P. l. sonorensis (strain Caborca). The chemical identification of active SMs was done by bioassay-guided fractionation. Spectral analyses identified two of these compounds as phenylpropanoids (AK1 and AK2) and one alkaloid (AK3). In vitro assays were carried out to assess the nematicidal activity of these SMs on the infective stage (second-juvenile stage or J2) of the root-knot nematode, Meloidogyne incognita. The activity of these SMs was also tested on four non-target nematode species: Caenorhabditis elegans (free-living bacterivore) and three entomopathogenic species, Steinernema carpocapsae, H. bacteriophora, and H. sonorensis. These compounds revealed different inhibitory activity ranging from a transient paralysis to death. AK1 and AK2 exhibited nematicidal activity to M. incognita. The LC$_{50}$ for AK1 was 64 µg/ml and 45 µg/ml for AK2. AK3 showed nematicidal activity to M. incognita and C. elegans at the two highest concentrations tested (300 and 400 µg/ml). At 60 to 200 µg/ml, AK3 induced reversible paralysis in both nematodes species. All entomopathogenic species tested were resistant to AK3. This work sheds light on ascertaining the potency of the Photorhabdus-derived SMs as nematicides.